Matthews E.G. 1972 A revision of the Scarabaeine dung beetles of Australia I tribe Onthophagini
Australian Journal of zoology. Supplementary Series. Melbourne 9:1-330

AUSTRALIAN JOURNAL
OF ZOOLOGY

SUPPLEMENTARY SERIES

*SUPPLEMENT NUMBER 9*

# A REVISION OF THE SCARABAEINE DUNG BEETLES OF AUSTRALIA

## I. TRIBE ONTHOPHAGINI

*E. G. Matthews*

25 February 1972

# A REVISION OF THE SCARABAEINE DUNG BEETLES OF AUSTRALIA

## I. TRIBE ONTHOPHAGINI

By E. G. MATTHEWS*

[Manuscript received 28 June 1971]

*Abstract*

The first part of this revision covers the tribe Onthophagini, comprising only the cosmopolitan genus *Onthophagus* Latreille. The generic name *Macropocopris* Arrow is synonymized under *Onthophagus*. Distribution patterns of the species in Australia are outlined in general terms, as are feeding habits and behaviour, where known. Ecological preferences, particularly as regards vegetation cover and soil type, are briefly outlined for about two-thirds of the species. The distribution of each species is plotted on maps.

The genus is divided into 24 species-groups and 165 species in Australia. Keys are provided for the species-groups and, within these, for the included species. Forty-six new names are proposed, as follows: *alquirta*, *apterus*, *arrilla*, *bambra*, *bornemisszai*, *bornemisszanus*, *brooksi*, *bunamin*, *chepara*, *dandalu*, *darlingtoni*, *dummal*, *endota*, *ferrari*, *gandju*, *gangulu*, *gidju*, *gulmarri*, *jalamari*, *jangga*, *kokereka*, *kumbaingeri*, *lamgalio*, *manya*, *millamilla*, *monteithi*, *mundill*, *nammuldi*, *nurubuan*, *ouratita*, *paluma*, *parrumbal*, *pillara*, *togeman*, *tuckonie*, *turrbal*, *wagamen*, *wakelbura*, *waminda*, *wigmungan*, *wilgi*, *wombalano*, *yeyeko*, *yiryoront*, *yungaburra*, and *yunkara*.

Five names previously regarded as synonyms are revalidated, as follows: *duboulayi* Waterhouse, *fuliginosus* Erichson, *mniszechi* Harold, *propinquus* Macleay, and *quinquetuberculatus* Macleay.

Forty-two names are newly synonymized, as follows (the synonym first): *acuticeps* Macleay = *propinquus* Macleay; *aureoviridanus* Blackburn = *geelongensis* Blackburn; *bipustulatus* Fabricius = *quadripustulatus* Fabricius; *chillagoensis* Paulian = *glabratus* Hope; *conspicuoformis* Paulian = *tricavicollis* Lea; *cowleyi* Blackburn = *laminatus* Macleay; *cupreopunctatus* Lea = *evanidus* Harold; *darwini* Paulian = *fissiceps* Macleay, *decurio* Lansberge = *rubrimaculatus* Macleay; *dumbrelli* Blackburn = *dunningi* Harold; *emarginatus* Macleay = *rubrimaculatus* Macleay; *fitzroyensis* Blackburn = *queenslandicus* Blackburn; *granicollis* Lea = *rupicapra* Waterhouse; *hackeri* Paulian = *tabellicornis* Macleay; *helmsi* Blackburn = *propinquus* Macleay; *hornianus* Paulian = *blackburni* Shipp; *howitti* Blackburn = *desectus* Macleay; *humeralis* Macleay = *fabricii* Waterhouse; *imponderosus* Lea = *rubescens* Macleay; *integriceps* Macleay = *fissiceps* Macleay; *kingi* Harold = *muticus* Macleay; *leaniensis* Paulian = *incanus* Macleay; *lucidicollis* Boheman = *auritus* Hope; *microtrichius* Lea = *vilis* Harold; *minusculus* Macleay = *quadripustulatus* Fabricius; *monticola* Paulian = *sydneyensis* Blackburn; *negatorius* Blackburn = *evanidus* Harold; *opacipennis* Lea = *pugnax* Harold; *pauperculus* Frey = *bicarinaticeps* Lea; *pontilis* Blackburn = *blackwoodensis* Blackburn; *postcornutus* Frey = *peramelinus* Lea; *promptus* Harold = *discolor* Hope; *pseudoemarginatus* Goidanich = *rubrimaculatus* Macleay; *quadrinodicollis* Lea = *erichsoni* Hope; *semihirtus* Frey = *incornutus* Macleay; *semirugosus* Gillet = *fissiceps* Macleay; *spissicollis* Lea = *duboulayi* Waterhouse; *strabonis* Lea = *fabricii* Waterhouse; *subocelliger* Blackburn = *waterhousei* Boucomont and Gillet; *sutilistriatus* Lea = *thoreyi* Harold; *sydneyicus* Paulian = *dunningi* Harold; *zietzi* Blackburn = *blackburni* Shipp.

Two names, *crotchi* Harold and *granum* Lansberge, are treated as *nomina inquirenda*.

* Division of Entomology, CSIRO, Canberra; present address: South Australian Museum, Adelaide, S.A. 5000.

## INTRODUCTION

The present work is the first comprehensive revision of the Australian species of the subfamily Scarabaeinae (Coprinae). The first part deals with the tribe Onthophagini, comprising only the genus *Onthophagus* (including the former genus *Macropocopris*). Subsequent parts will deal with the tribes Scarabaeini and Coprini. The higher classification used is that of Janssens (1949).

Four previous synoptic works have dealt with Australian *Onthophagus*. Harold (1869) described and keyed the 30 species known to him at that time. Blackburn (1903) reviewed the genus and presented keys to species, but 37 previously described species were unknown to him *in natura* and were treated on the basis of the original descriptions only. Lea (1923) listed all the Australian species of the subfamily, but did not give a key or description of previously named species. He presented notes on 26 previously known *Onthophagus* and *Macropocopris* and described 25 new ones. The absence of any complete survey of the entire genus as a whole has led subsequent workers (Paulian 1937; Frey 1959, 1963), while attempting to describe new species, to introduce a large proportion of synonyms into the literature.

The last complete list of Australian Onthophagini is that of Boucomont and Gillet (1927), in the Coleopterorum Catalogus. They list 130 valid names and 37 synonyms for *Onthophagus* and six valid names and three synonyms for *Macropocopris*. Subsequently, Gillet (1927) proposed three new names, Paulian (1937) proposed ten, and Frey (1959, 1962, 1963, 1970) nine, all in the genus *Onthophagus*. At the time the present revision was begun, therefore, there were 158 names considered valid in the Australian Onthophagini. The present work synonymizes 42 of these names and treats two as *nomina inquirenda*, which cannot be ascribed to any known species at present. Five previous synonyms are revalidated and 46 new names are proposed, bringing the total to 165. The generic name *Macropocopris* is merged with *Onthophagus* for reasons explained later.

There are, in addition, 12 undescribed species of *Onthophagus* labelled from Australia in collections. These are not described at the present time because of insufficient material, the species being represented only by unique specimens of either sex, or old specimens of doubtful authenticity. No new species in the present work is described from a single specimen with the exception of *apterus*, which is of special interest because of its flightless condition.

If all of the undescribed species mentioned above are indeed valid, the known number of Australian *Onthophagus* is 177. It is difficult to estimate the degree of completeness of our knowledge of the fauna. In spite of extensive collecting in recent years, it is likely that a substantial number of species remains undiscovered. These probably reside in the already investigated, wetter areas of Queensland and New South Wales and consist of the "rare" species which normally elude even the most specialized collecting techniques if these are not applied in a continuous and repeated fashion. Although large areas of Australia have not been explored at all with the express purpose of collecting dung beetles, these are largely dry areas in the centre and west which are not expected to yield many new species.

Exotic species being introduced under the buffalo fly and bushfly control programme of CSIRO (see below) are not included in the present work.

The major problem encountered in the course of the revision was the multiplicity of names available for Australian *Onthophagus* and the need to examine holotypes of

as many as possible. No previous worker had been able to see the types in both Europe and Australia – one of the major reasons for the existence of 73 synonyms in this group. The author examined types in London, Oxford, Paris, Adelaide, Melbourne, Sydney, and Brisbane and had types sent to him from Berlin and Stockholm. In this way the holotypes of 164 of the 198 available names could be examined. Of the remainder, 10 names have no type specimens since they were proposed to replace homonyms, and the rest are either lost or could not be examined for various reasons.

The first part of this revision is based on the examination of 19,363 specimens, the great majority of which are in the Australian National Insect Collection (ANIC) in Canberra and are the result of systematic collecting by Dr. G. F. Bornemissza and the author. The remaining specimens are scattered throughout the world collections listed below. Most of the holotypes and paratypes of new names are deposited in ANIC, and paratypes of many new names are deposited in BMNH, CNC, MGF, and SAM.

The following institutions are those which contributed material for this revision. The curator named is the one with whom the author dealt directly and whom he wishes to thank. Henceforth throughout the present work these institutions will be referred to only by the corresponding initials appearing in the left-hand column.

| | |
|---|---|
| AM | The Australian Museum, Sydney. Mr. G. Holloway. |
| ANIC | The Australian National Insect Collection, Canberra. Dr. E. B. Britton. |
| BMNH | The British Museum (Natural History), London. Mr. R. D. Pope. Specimens designated BMNH(Banks) are in the Banks Collection of this museum. |
| BPBM | The Bernice P. Bishop Museum, Honolulu. Dr. J. L. Gressitt. |
| CNC | The Canadian National Collection, Ottawa. Dr. H. F. Howden. |
| DEI | Deutsche Entomologische Institut, Eberswalde. Mr. Dieckmann. |
| GB | Collection of Mr. G. Brooks, Cairns. |
| HM | The Hope Museum, Oxford. Mr. E. Taylor. |
| ISZ | Institut für spezielle Zoologie und zoologischen Museum der Humboldt-Universität, Berlin. Dr. F. Hieke. |
| MCZ | The Museum of Comparative Zoology, Cambridge, Mass. Dr. J. F. Lawrence. |
| MGF | Museum G. Frey, Tützing-bei-München. Dr. G. Frey. |
| MM | The Macleay Museum, Sydney. Dr. P. J. Stanbury. (Types from this museum are now on permanent loan to ANIC.) |
| MNHN | Muséum National d'Histoire Naturelle, Paris. Mr. A. Descarpentries. Also referred to as the Paris Museum. The particular collection in which a specimen is found is designated by letters in parentheses, thus: (Bouc) = Boucomont Collection, (Gen) = General Collection, (Ob) = René Oberthür Collection. |
| NMV | The National Museum of Victoria, Melbourne. Mr. A. Neboiss. |
| NRM | Naturhistoriska Riksmuseet, Stockholm. Mr. T. Nyholm. |
| QM | The Queensland Museum, Brisbane. Mr. E. C. Dahms. |
| SAM | The South Australian Museum, Adelaide. Mr. G. F. Gross. |
| UNE | The University of New England, Armidale. Mr. C. W. Frazier. |
| UQ | The Department of Entomology, University of Queensland, St. Lucia. Mr. G. B. Monteith. |
| WADA | The Western Australia Department of Agriculture, Perth and Kununurra. Mr. D. Hardy. |
| WAM | The Western Australian Museum, Perth. Mr. L. E. Koch. |

## METHODS

### *Collection*

While much valuable material can be accumulated in the course of general collecting over many years, an attempt at a revision of dung beetles is not justified until there has also been extensive specialized collecting specifically aimed at them, in the region under study. This collecting must be done with baited pit traps, a method which, while very old, has been extensively developed by dung-beetle specialists over the last 10 or 15 years to become the principal collecting method for Scarabaeinae all over the world, but particularly in the Americas (and now Australia). Much flexibility is allowable regarding the type of container used and the bait, but the essential elements are a glass, plastic, metal, or waxed-paper container sunk into the ground up to the rim, with a quantity of bait placed in the bottom, with or without a layer of sand beneath it, and the whole covered with an elevated roof to keep out rain. The author used waxed-paper cups with a hole cut into the lid, instead of the glass jars previously used. They had the advantage of being easily packed into a small space, particularly when travelling by air. They had the occasional disadvantage of being penetrated at the bottom by powerful beetles.

The most effective bait used was marsupial entrails. These were removed from animals found dead on the roads, and remained effective for several days. Also effective were sheep entrails obtained from abattoirs, and to a lesser extent those of monitors, *Varanus* spp., and skinks, *Trachydosaurus* spp. Entrails of snakes and birds were not effective. In a second order of effectiveness was human excrement, used when entrails could not be found. In the absence of human excrement, cow dung was used, with minimal results. Other baits used successfully by Dr. Bornemissza and Mr. Brooks are rabbit entrails, fish bones, and chicken bones. The author has also used parts of dead reptiles (other than the entrails) and squashed snails to test for necrophagy, and mushrooms, fruit, and fermenting malt to test for other specialized food habits. These baits are generally not successful in Australia.

The reasons behind the effectiveness, or lack of it, of baits have not been investigated. It may be surmised that the beetles respond most strongly to complex organic molecules of elaborate structure, and least strongly to simple decomposition products such as scatole or propionic acid. Excrement while still in the intestine has undergone least decomposition and therefore contains the highest proportion of complex molecules. The adaptive significance of this response is obvious, as it enables the beetles to locate the food with the highest energy content. For this reason, it is impossible to substitute any artificial baits for excrement or entrails, as the complex substances needed, even if they could easily be obtained, would decompose too rapidly.

The regions of Australia which have been specifically surveyed for dung beetles by the trapping method are as follows: by Dr. Bornemissza and his assistants: southern Gippsland, Vic., southern New South Wales primarily east of the divide, the area of the McPherson Range on the New South Wales–Queensland border, south-eastern Queensland inland along the divide to Carnarvon Gorge, coastal Queensland from Rockhampton north to Daintree, and the Atherton Tableland; by the author: the Victoria–New South Wales border region near the coast, the eastern escarpment both south and north of Sydney with special emphasis on wet sclerophyll or rain forest areas, the McPherson Range and the Brisbane area, and the montane rain forests of eastern Queensland from Mt. Glorious to Mossman Gorge; also, in the Northern Territory, the Darwin–Katherine region, Melville I., and Yirrkala in Arnhem Land; in Western Australia the Kimberleys around Kununurra and Derby, and the south-west coast from Hamelin Pool to Hopetoun; by Mr. Monteith: the Iron Range and Lockerbie areas of Cape York; by Mr. Brooks: Paluma and the Atherton area of north Queensland.

Traps were set by the author along motor roads at regular intervals, with a special effort to include all vegetational and soil types that could be seen in an area. Traps were left in place for 24 hr to collect both diurnal and nocturnal species. In some cases, traps were left for several days (a maximum of four), but this is not recommended because of the death of the beetles and the increased risk of interference with the traps by large animals or man.

It must be pointed out that trapping will not collect all the species of Scarabaeinae in an area. A number of species will unaccountably come only to light and ignore baited traps set in the same area, and several *Onthophagus* are known only from specimens collected at light by lepidopterists. Also, mushroom-feeding species will often not come to traps even when these are baited with mushrooms, and must be sought by looking for the fresh mushrooms themselves.

Finally, herbivore dung such as marsupial pellets and occasionally cow dung was found to yield species which did not come to traps baited with entrails or human faeces. Whenever possible, caves, vertebrate nests, and ant nests should be checked for inquiline species, but the author in general was not successful in finding these habitats.

### *Presentation*

The collected material was examined by traditional taxonomic procedures. Characters needed to separate one taxon from another are sought after the limits of taxa have been predetermined by visual observation. Characters are weighed as to their probable taxonomic significance. The descriptions are limited to diagnostic characters and are not intended to be complete descriptions of the species. Infraspecific variation is described where the material warrants it, but no formal (subspecific) names are used. The use of subspecific names requires a more complete knowledge of the populations and their distribution than is available for Australian Scarabaeinae, and in any case the advantage of using such names is questionable.

The species are arranged into what the author believes intuitively to be natural groups, which are characterized by exclusive combinations of characters, rather than by any particular single character. The arrangement of species-groups in the work is not meant to be phylogenetic, as no basis exists for the establishment of a phylogeny in this genus. Within the species-groups of *Onthophagus* the species are further arranged into groupings (or subgroups) which are believed to be natural. The presumed relationships and characteristics of these subgroups are expressed by the species position in the keys and text, usually without any further comment.

Under each species, a section headed "Distribution" discusses the geographical and ecological distribution of the species, using the word in its broadest possible sense of environmental, seasonal, diurnal, and food-spectrum distribution, where known. It should be understood that all data are derived from trapping results only and have not been verified in any controlled manner.

Under "Material Examined" the locality data are presented. Where a species is known from 20 or more localities, the name of the locality alone is given, the date and collector being omitted. For species with less than 20 localities ("rare" species), and for all new species, the complete collection data are given for each specimen. In the keys, the approximate distribution of species is given by standard abbreviations for States and for compass points, with the addition of "C" for "central"; thus "SE. S.A." means "the south-east of South Australia", "N. N.T." the north of the Northern Territory, "C. Qld.", central Queensland, etc.

New species are given Australian aboriginal names with few exceptions. In each case, an effort was made to give the species an appropriate name in a language spoken more or less in the same area as that where the species occurs, or to use the name of the tribe occurring in that area. Words were selected from Reed and Reed (1965) and the original spelling was retained except for the combinations "ee" and "oo", which were substituted by "i" and "u" respectively. Names of tribes and the location of their territories were obtained from Berndt and Berndt (1964). The names of aboriginal origin are to be considered nouns in apposition.

## DISTRIBUTION

The known distribution of the genus *Onthophagus* in Australia is given in Figure 12, which shows by dots the sum total of all localities on the continent in which specimens have been collected. These dots may show the distribution of the human population as much as they do that of the beetles, but there is an indication that the genus becomes markedly thinned out in areas of less than 15 in. of annual rainfall. In areas of less than 8 in. rainfall there are almost no records.* It will further be noted that almost no *Onthophagus* have been collected south of the 28th parallel in a large region starting east of the 15-in. isohyet in south Western Australia (Esperance

*The isohyets and isotherms on all the maps in the present work are taken from Watt (1960). They should not be considered absolutely accurate, particularly with regard to lines in the centre of the continent.

being the easternmost record) as far east as the western shore of Spencer Gulf in South Australia. Areas of Queensland and New South Wales west of the 15-in. isohyet are also largely blank. With regard to Queensland this may be due to lack of collecting, but the south-western New South Wales (Broken Hill) region was the subject of a special search for dung beetles by Dr. Bornemissza's assistants, in November 1969 under seemingly favourable conditions, and not a single specimen was found.

The records below the 15-in. isohyet can all be accounted for by only eight species: *alquirta*, *blackburni*, *consentaneus*, *declivis*, *jubatus*, *mjobergi*, *murchisoni*, and *sloanei*. Of these, only *sloanei* and possibly *alquirta* can be considered specialist desert forms (see Fig. 10), because only these occupy the central regions as the main part of their ranges.

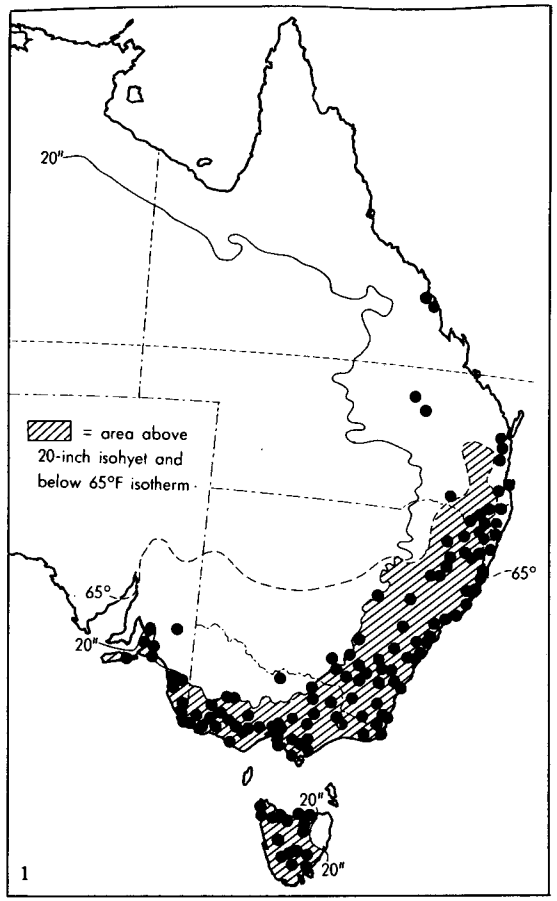
The distributions of the 165 described species have been combined by the author into 11 distribution patterns, which are shown in Figures 1–11. These patterns were prepared by plotting the individual species distributions on transparent paper on a uniform scale and overlaying the resulting sheets in combinations which more or less overlapped. The overlap is seldom complete between one species and another, and no individual species should be assumed to occupy all of the area shown. In general, a mutual two-thirds overlap of ranges was considered sufficient to unite two species into one pattern. By the same token, the patterns are not mutually exclusive and often overlap broadly. They are based on the centres, rather than the peripheries, or boundaries, of distributions.

The resulting divisions represent very broad distribution zones which could be subdivided further along ecological lines. To have done so would have unduly complicated the present analysis, which is not intended to be anything more than an aid to identification. By consulting the maps and lists of species below, the reader can reduce the number of possible names to which he need refer in order to identify a specimen from any particular locality, by restricting his search to those species seen to occur in the zone which includes that locality.

For each of the 11 patterns, the isotherms and isohyets which appear to be relevant in fixing the limits of distributions are indicated, and the climatic zone contained within them is shaded. The inclusion of species within the same broad pattern does not necessarily imply similar ecological requirements. On the contrary, it is quite likely that the geographically sympatric species involved differ in their requirements as to vegetation cover, soil type, moisture, altitude, etc. and this cannot be indicated on maps of this scale.

The patterns and their included species are listed below, together with a mention of the climate and vegetation types to be found in each. Names of vegetation zones are taken from Chapter 6 of "The Australian Environment" (3rd edition, 1960) (CSIRO and Melbourne University Press), to which the reader should refer for explanation. Where possible, the present patterns are correlated with the classic biogeographic zones of Spencer and Tate, but these are only partly relevant because of their emphasis on fixed boundaries.

(1) *The South-eastern Coastal and Montane Pattern* (Fig. 1).–This includes the southernmost species which occupy the coastal habitats, tablelands, and mountains in a broad band on the wet side of the 20-in. isohyet from Adelaide to the McPherson Range on the New South Wales–Queensland border. A few species extend to just



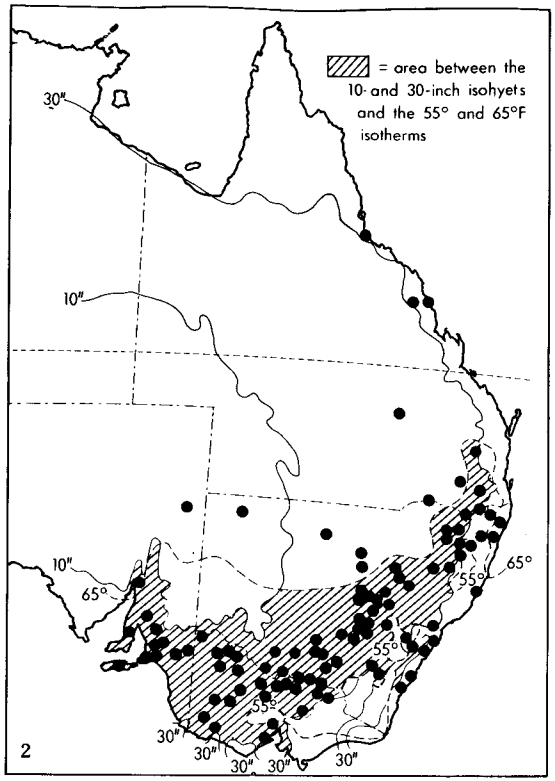
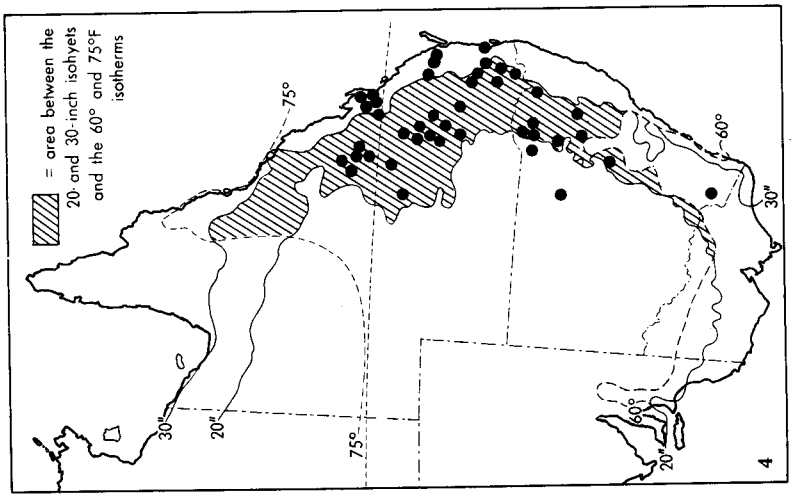




Fig. 1.–South-eastern coastal and montane distribution pattern, shown by 26 species.
Fig. 2.–South-eastern inland distribution pattern, shown by nine species.



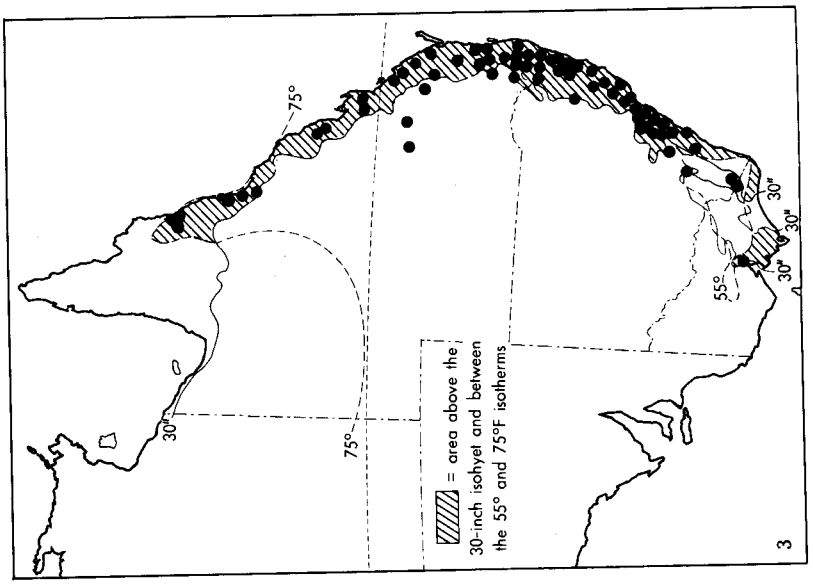
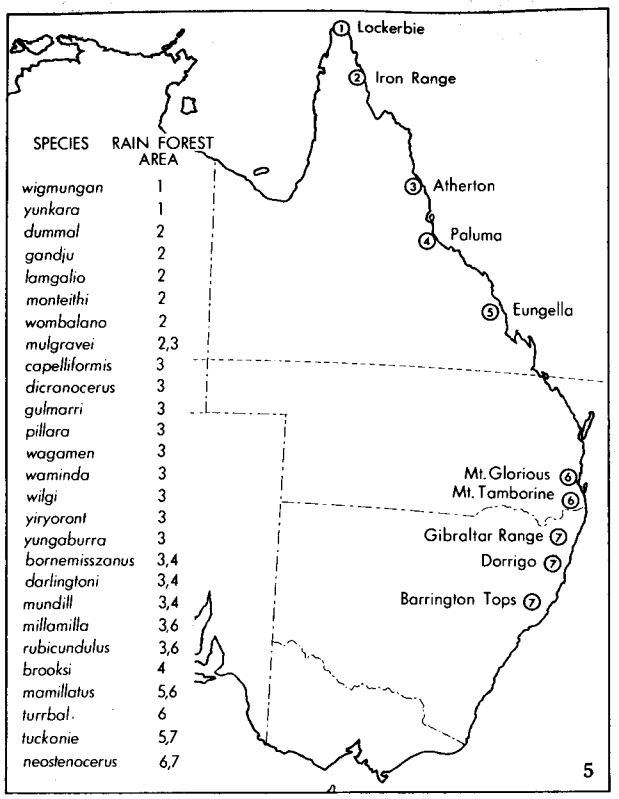




Fig. 3.—Eastern coastal distribution pattern, shown by 11 species.
Fig. 4.—Eastern inland distribution pattern, shown by six species.



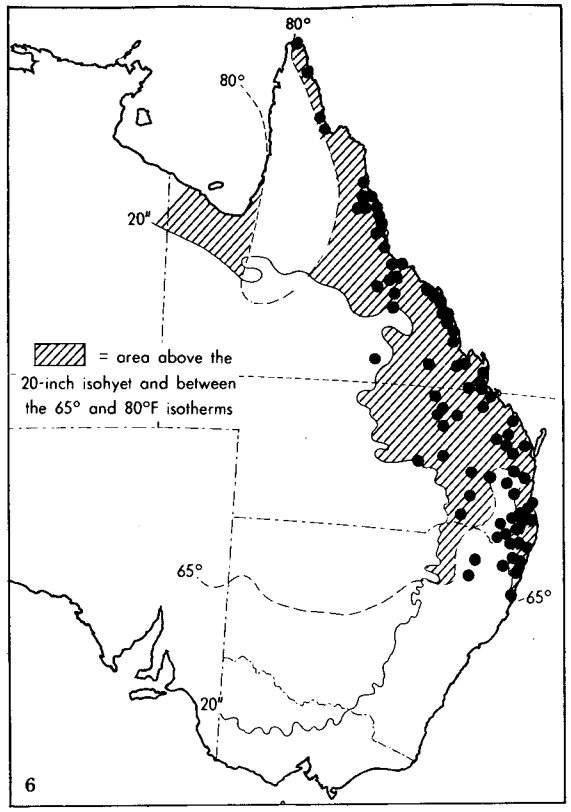
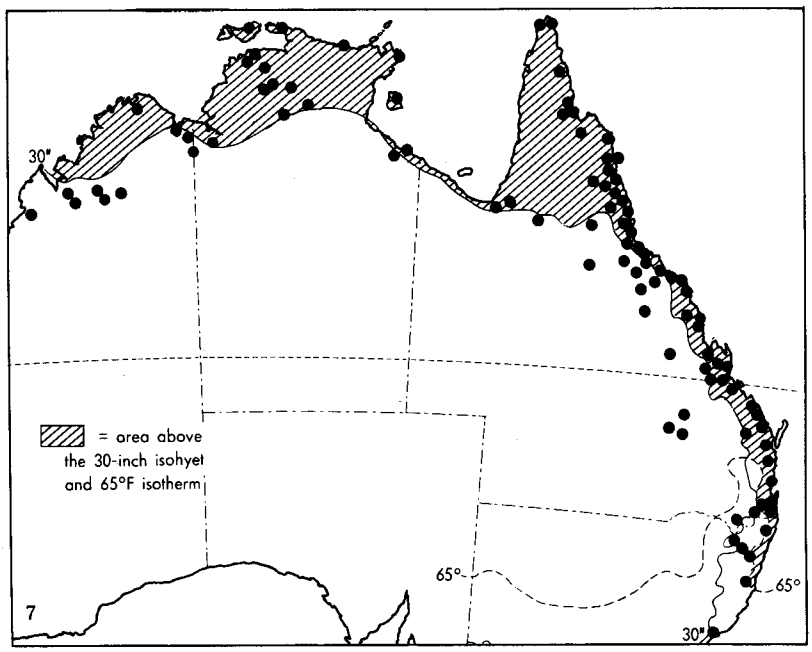




Fig. 5.–Rain forest distribution pattern, shown by the 27 species listed at the left, together with the rain forest areas which each occupies.

Fig. 6.–Queensland savannah–woodland distribution pattern, shown by 25 species.



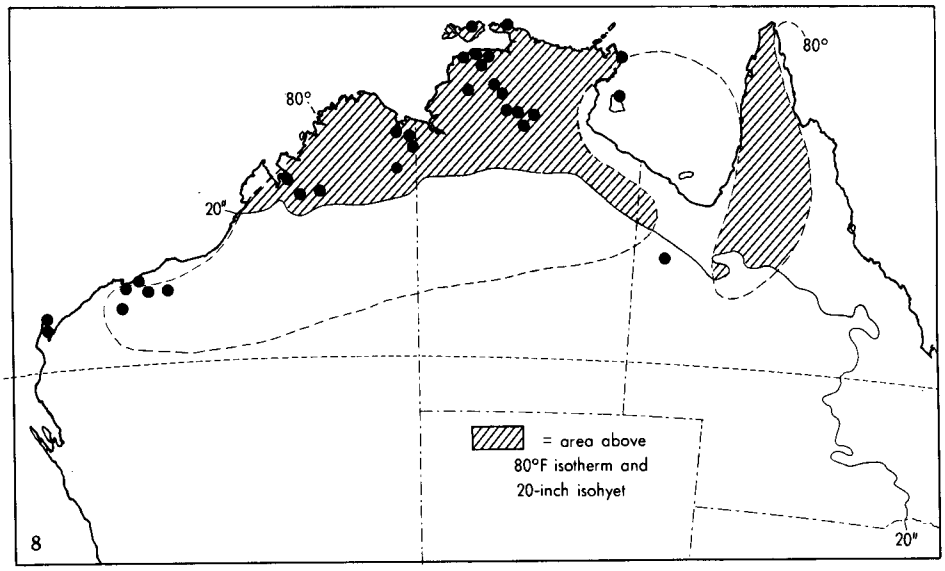
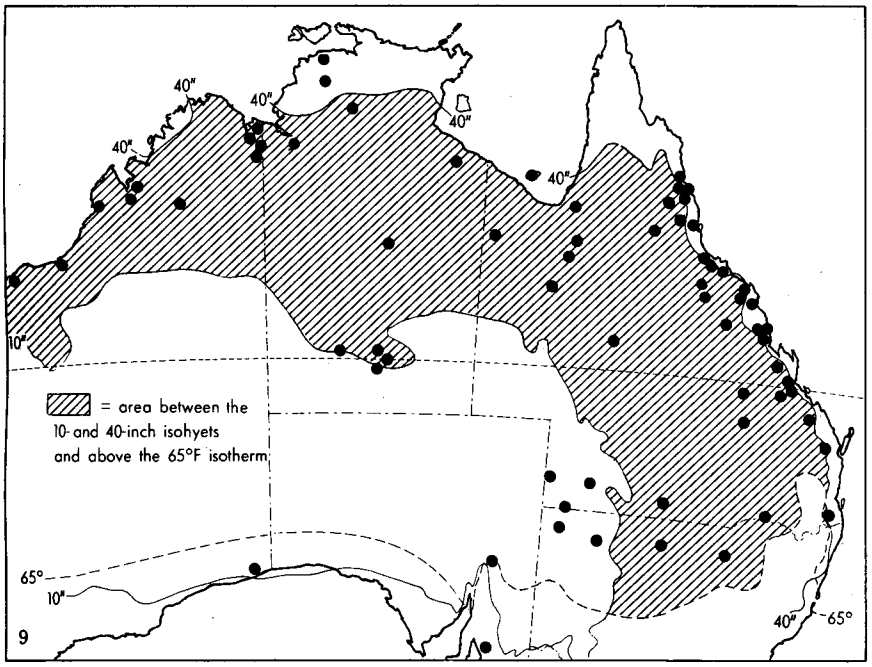




Fig. 7.—Northern savannah–woodland distribution pattern, shown by 27 species.
Fig. 8.—North-western savannah–woodland distribution pattern, shown by 16 species.



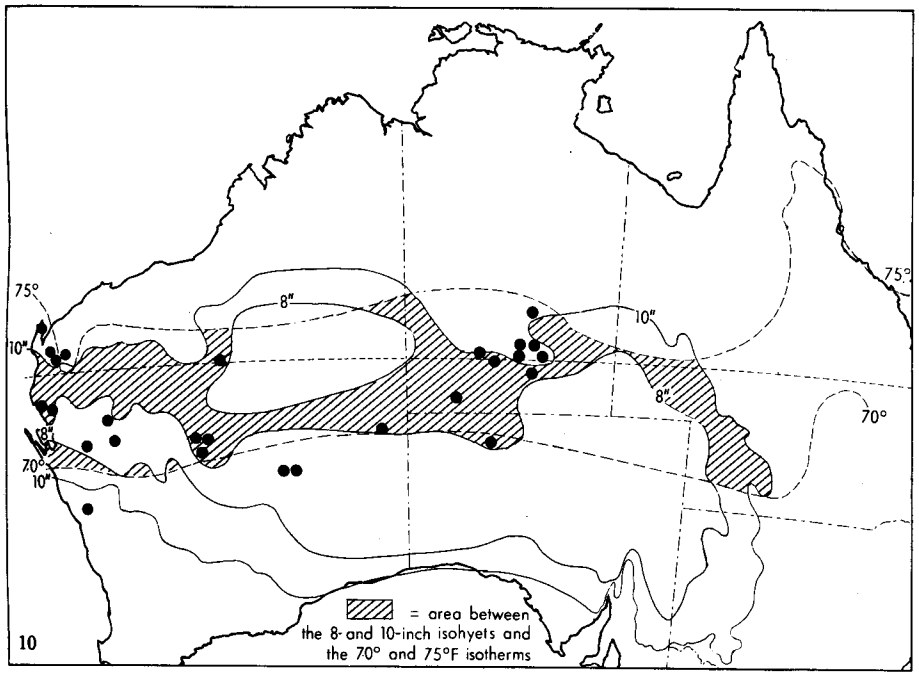
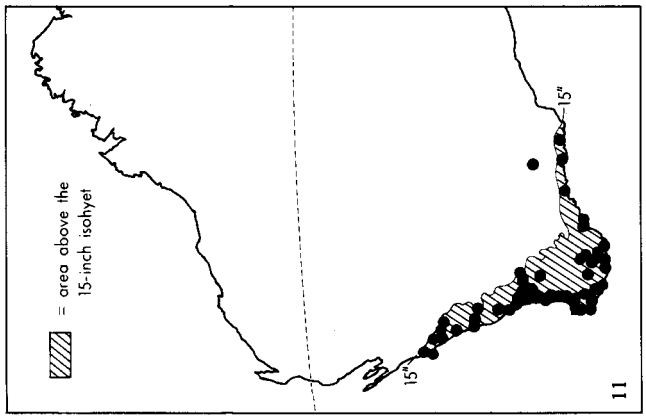




Fig. 9.–Northern grassland distribution pattern, shown by five species.
Fig. 10.–Desert distribution pattern, shown by two species.



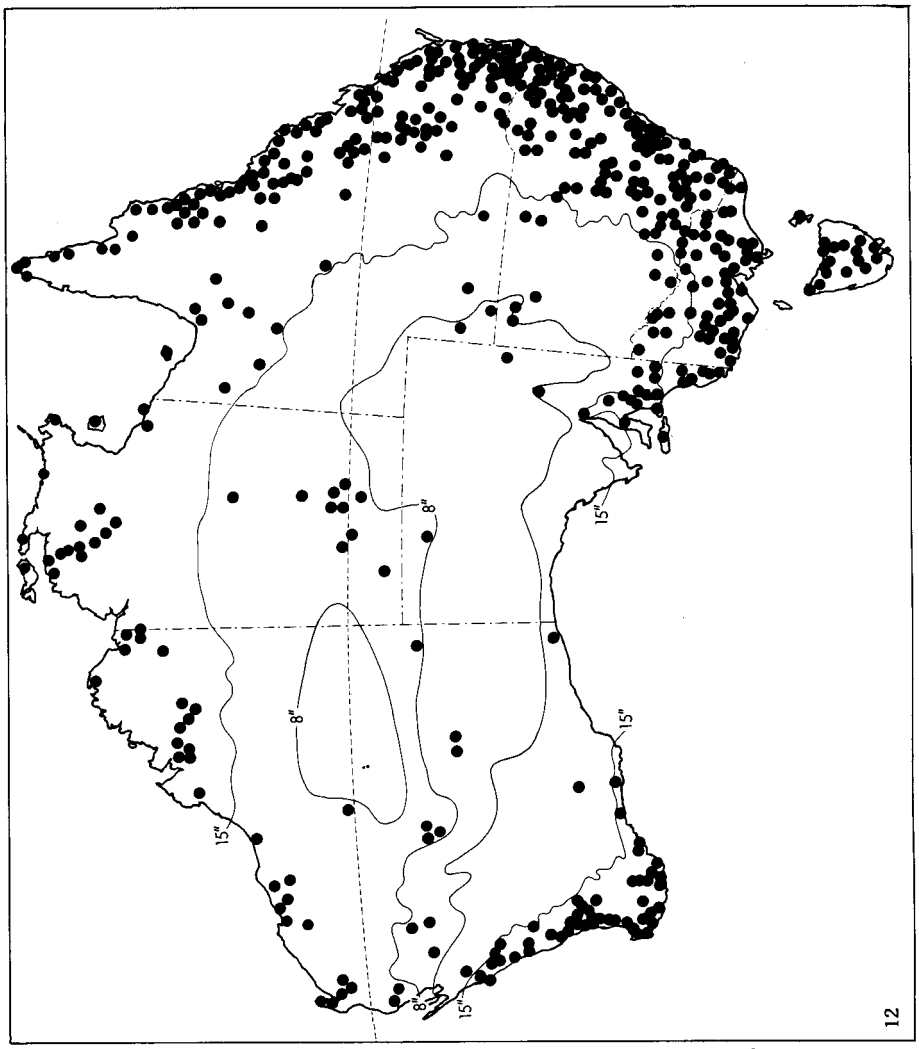




Fig. 11.—South-western distribution pattern, shown by seven species.
Fig. 12.—Known distribution of the genus *Onthophagus* in Australia.

north of Brisbane and to Carnarvon Gorge near Rolleston, Qld., and one (*granulatus*) as far as Mackay. Eight occur in Tasmania (*anisocerus*, *auritus*, *australis*, *fuliginosus*, *mutatus*, *posticus*, *pronus*, and *tabellifer*), only one of which (*anisocerus*) is endemic to Tasmania. Annual rainfall is 20–60 in., heavier in the winter months, and annual mean temperatures from 50 to 65°F. The vegetation is dominated by wet and dry sclerophyll forest, tall and low woodland, and moist temperate perennial grass pastures. The area corresponds to most of the Bassian biogeographic zone. Twenty-six species: *anchommatus*, *anisocerus*, *auritus*, *australis*, *bornemisszai*, *compositus*, *frenchi*, *fuliginosus*, *granulatus*, *hoplocerus*, *kumbaingeri*, *leai*, *longipes*, *macrocephalus*, *mniszechi*, *mutatus*, *nammuldi*, *nurubuan*, *pexatus*, *posticus*, *pronus*, *pugnax*, *squalidus*, *sydneyensis*, *tabellifer*, and *tenebrosus*.

(2) *The South-eastern Inland Pattern* (Fig. 2).–Species which occur inland from those of pattern 1, generally west of the Great Dividing Range and as far as the 10-in. isohyet. Several may extend the peripheries of their ranges to the coasts of South Australia, western Victoria, and New South Wales. Annual rainfall is 10–30 in., mostly in winter, and annual mean temperatures from 55 to 65°F. Dominant vegetation is sclerophyll shrub woodland, mallee, and temperate short grass pastures. The area corresponds to the rest of the eastern Bassian zone. Nine species: *adelaidae*, *blackburni*, *blackwoodensis*, *dandalu*, *declivis*, *geelongensis*, *pentacanthus*, *victoriensis*, and *waterhousei*.

(3) *The Eastern Coastal Pattern* (Fig. 3).–The essential feature of this pattern is a centre at the McPherson Range on the New South Wales–Queensland border east of the 30-in. isohyet. Several species occur only in this area, the rest extend equally to the north and south of it. There is, of course, broad overlap with patterns 1 and 6. Annual rainfall is from 30 to 70 in. throughout the year, annual mean temperatures from 55 to 75°F. Dominant vegetation is wet and dry sclerophyll forest and pastures of moist temperate perennial grass and bunch spear grass. This area and the next overlap parts of the Bassian and Torresian biogeographic zones. Eleven species: *arrilla*, *capella*, *chepara*, *dunningi*, *incornutus*, *kokereka*, *leanus*, *macleayi*, *ouratita*, *peramelinus*, and *tweedensis*.

(4) *The Eastern Inland Pattern* (Fig. 4).–Species which occur inland from those of pattern 3, bearing the same relationship to this pattern as does pattern 2 to 1, generally between the 20 and 30-in. isohyets, but, as before, with several species able to reach the coast. Annual rainfall is 20–30 in. throughout the year, annual mean temperatures 60–75°F. Dominant vegetation is low-layered forest (brigalow), tree savannah, and brigalow pasture. Six species: *fletcheri*, *gangulu*, *perpilosus*, *quinquetuberculatus*, *tamworthi*, and *wakelbura*.

(5) *The Rain Forest Pattern* (Fig. 5).–Species restricted to the tropical or subtropical rain forest ("Papuan" forest) of eastern Australia. This forest type is fragmented into small enclaves scattered about the mountain ranges from Cape York to a highly diluted element at Barrington Tops, N.S.W. As may be expected from the disjunct nature of the habitat, the resident species are highly endemic and generally restricted to one or two areas. The Atherton Tableland forests are the richest, with nine endemic species and five additional ones shared with one more area (usually Paluma). A few of the species also invade wet sclerophyll forest, and most seem to require heavy clay soils. Rain forest conditions prevail, with continuous annual rainfall

of up to 160 in. and a relatively stable temperature regime. This is part of the Torresian biogeographic zone. Twenty-seven species, 22 of them new: *bornemisszanus*, *brooksi*, *capelliformis*, *darlingtoni*, *dicranocerus*, *dummal*, *gandju*, *gulmarri*, *lamgalio*, *mamillatus*, *millamilla*, *monteithi*, *mulgravei*, *mundill*, *neostenocerus*, *pillara*, *rubicundulus*, *tuckonie*, *turrbal*, *wagamen*, *waminda*, *wigmungan*, *wilgi*, *wombalano*, *yiryoront*, *yungaburra*, and *yunkara*. *O. wigmungan* and *yunkara* are only tentatively ascribed to this pattern, as their ecological distribution is unknown.

(6) *The Queensland Savannah-Woodland Pattern* (Fig. 6).—Species occurring in open or semi-open areas of eastern Queensland and northern New South Wales, with a few inhabiting denser woodland and dry sclerophyll forest. Annual rainfall is from 20 to 80 in. or more, concentrated in the summer months, annual mean temperature from 65 to 80°F. Vegetation is predominantly savannah woodland cleared in places to bunch spear grass and tropical tall grass pastures. This and the following three patterns belong to the Torresian biogeographic zone. Twenty-four species: *asper*, *atrox*, *bunamin*, *capellinus*, *comperei*, *conspicuus*, *cuniculus*, *ferrari*, *furcaticeps*, *jangga*, *manya*, *ocelliger*, *paluma*, *parallelicornis*, *planicollis*, *pugnacior*, *purpureicollis*, *semimetallicus*, *signaticollis*, *tabellicornis*, *thoreyi*, *tricavicollis*, *vilis*, and *walteri*. *O. pugnacior* also occurs in the Hammersley district of Western Australia, forming a pattern unique among Australian *Onthophagus*.

(7) *The Northern Savannah-Woodland Pattern* (Fig. 7).—With regard to the biome-type inhabited, this pattern is much the same as the previous one and overlaps it completely, but geographically the species extend westward across northern Australia, usually to the Kimberleys. Climatic and vegetational features as for pattern 6, but with somewhat higher rainfall and temperatures. Twenty-seven species: *bicarinaticeps*, *bicavicollis*, *bicornis*, *capitosus*, *clypealis*, *demarzi*, *desectus*, *discolor*, *fabricii*, *gidju*, *glabratus*, *incanus*, *kingi*, *koebelei*, *laminatus*, *latro*, *nodulifer*, *parrumbal*, *parvus*, *propinquus*, *quadripustulatus*, *rubescens*, *rubrimaculatus*, *rufosignatus*, *symbioticus*, *varianus*, and *yeyeko*.

(8) *The North-western Savannah-Woodland Pattern* (Fig. 8).—Once again species of savannah woodland or savannah, but restricted geographically to the north of the Northern Territory, the Kimberley district, or both, but with one species (*mjobergi*) extending to the North West Cape on the one hand and to western Queensland on the other. This area possesses a monsoon climate, with 20–60 in. of rainfall a year concentrated in the summer (December to April), and annual mean temperatures of 80–85°F. Vegetation is savannah woodland (multistoreyed near the coast), shrub savannah, and tropical tall grass pastures, with small patches of monsoon forest (depauperate rain forest) along the coast. Sixteen species: *bambra*, *devexus*, *endota*, *erichsoni*, *fissiceps*, *jalamari*, *margaretensis*, *mjobergi*, *neboissi*, *picipennis*, *rugosicollis*, *salebrosus*, *solidus*, *togeman*, *variolicollis*, and *villosus*.

(9) *The Northern Grassland Pattern* (Fig. 9).—A special category for northern species which are highly xerophilic and able to extend from the northern coasts southward to central Australia, northern New South Wales, and South Australia (*cruciger*, *jubatus*). This area is largely occupied by the ubiquitous *consentaneus*. Annual rainfall is erratic, from 10 to 40 in., and mean annual temperatures from 65 to 80°F. Dominant vegetation is tree savannah (this has fewer trees than savannah woodland), tussock grassland (Mitchell grass), and hummock grassland (spinifex). Five species: *consentaneus*, *cruciger*, *jubatus*, *murchisoni*, and *queenslandicus*.

(10) *The Desert Pattern* (Fig. 10).–Species able to withstand desert conditions of less than 10 in. annual rainfall in Western and central Australia. *O. sloanei* occupies most of this region and is therefore a true desert form, while *alquirta* is unique in being restricted to the area of the Musgrave or Everard Ranges. Central Australia contains, beside the two species in this pattern, *consentaneus* and *murchisoni* of pattern 9, and *ferox* of pattern 11. Annual rainfall is 8–10 in. and erratic, mean annual temperatures 70–75°F. Dominant vegetation is hummock grassland, shrub savannah, and mulga scrub. The region corresponds to the Eyrean biogeographic zone. Two species: *alquirta* and *sloanei.*

(11) *The South-western Pattern* (Fig. 11).–Species of the south-west corner of Australia, all largely confined by the 15-in. isohyet and all endemic to the area except *ferox*, which unexpectedly reappears in the Alice Springs region. Most species in this pattern have close relatives in the eastern part of the Bassian zone, but no species is common to both areas. Annual rainfall is 15–60 in., concentrated in the winter months, and annual mean temperatures 55–65°F (Mediterranean climate). Dominant vegetation is wet and dry sclerophyll forest, heath, and winter annual pastures. The area corresponds to the southern part of the western Bassian biogeographic zone, formerly called the Autochthonian. Seven species: *duboulayi*, *evanidus*, *ferox*, *flavoapicalis*, *haagi*, *rupicapra*, and *vermiculatus.*

Species not mentioned above have an unknown distribution, and one (*depressus*) is not native to Australia.

## FOOD HABITS

Detailed studies of the food requirements, particularly with regard to brood rearing, have been made for only two species of Australian *Onthophagus* (*compositus* and *dunningi*), studied by Bornemissza (1971*a*, 1971*b*). For the remainder, the only information available is that resulting from general collecting and trapping with baits. Such information can be misleading, as, for instance, with *dunningi*, shown by Bornemissza (1971*b*) to use mushrooms for brood rearing, perhaps exclusively, but which nevertheless comes frequently to human excrement bait. The method of collecting is specified for each species in the taxonomic section, and in all cases what is known regarding the food habits refers only to the sorts of baits or naturally occurring food to which the beetles were attracted. In no case has it been demonstrated that this particular food is in fact that preferred by the species or that used for brood rearing (with the exception of the two species mentioned above). In very few cases were the beetles offered a simultaneous choice of different foods, but in some cases species were collected at one type of food in an area and not at another type.

Since the sort of information gleaned from collecting data, however inadequate it may be, is the only one we are likely to have for the vast majority of species, it is worth summarizing, and it is presented here with the reservations mentioned above. The following categories are noted:

(1) Species collected only at light or for which the collecting method is not specified: 35 species. These are not included in the total for calculating the percentages mentioned below.

(2) Species collected at excrement or entrails, but not at carrion or mushrooms (coprophagous species): 113 species, or 86%. This category can be further

broken down into 13 species collected only at herbivore dung, usually marsupial pellets but also cow dung, 55 collected only at human excrement or entrails, and 45 collected at both herbivore and human excrement or entrails. These figures are probably not too meaningful, as the species were usually not offered a direct choice of baits.

(3) Species collected at both excrement and carrion (the latter is defined as the whole animal, or parts not including the entrails) (copro-necrophagous species): six species, or 5% (*discolor*, *haagi*, *incanus*, *ocelliger*, *rubrimaculatus*, and *villosus*). *O. villosus* was collected predominantly at carrion, while the rest were collected predominantly at excrement.

(4) Species collected in or under mushrooms (mycetophagous species): 10 species, or 8% (*anchommatus*, *bambra*, *dunningi*, *endota*, *gidju*, *kumbaingeri*, *latro*, *parrumbal*, *varianus*, and *walteri*). Of these, *dunningi*, *endota*, *parrumbal*, and *walteri* were also collected at excrement bait, while the rest were collected only at mushrooms (where the collecting method is known).

(5) Species collected at excrement, carrion, and mushrooms (omnivorous species): 1 species or $<1\%$ (*consentaneus*).

Particularly noteworthy in comparison with other faunas is the high proportion of mycetophagous species. Only seven other species of *Onthophagus* have been collected at fungi in the entire world (Halffter and Matthews 1966, p. 40), and of these, only one has been collected exclusively at fungi (*O. agaricophilus* Arrow of India). It is quite possible that all the species in category 4 above are true mycetophages using mushrooms as larval food, as was shown for *dunningi* by Bornemissza (1971*b*). Furthermore, four additional species which are taxonomically very close to the mycetophagous ones, and for which no data are available, are suspected of being mycetophagous (see under the *dunningi* and *latro* species-groups).

Also significant is the small proportion of copro-necrophagous species and the apparent complete absence of exclusive necrophages and of carpophagous species (fruit-eaters) of any description. It appears that the only significant trophic deviation from coprophagy among Australian *Onthophagus* has been toward mycetophagy.

Also unknown are nidicolous, cavernicolous, and myrmecophilous species. While mammal nests have not been extensively investigated for included fauna, some work has been done on the marsupial nest fauna of northern New South Wales by Mr. J. H. Calaby, without uncovering any scarabs.

On the other hand, an extremely interesting adaptation for clinging to the fur of macropods is seen in six species of Australian *Onthophagus*. These merit a section to themselves.

## The Former Genus *Macropocopris*

In 1920 Arrow erected the genus *Macropocopris* to receive three species previously in *Onthophagus* (*parvus*, *muticus*, and *carmodensis*) and two new species (*symbioticus* and *prehensilis*), all of which possess claws modified for grasping the fur of mammals. The form of the claws, the accompanying enlargement of the last tarsal segment, and the unarmed head and thorax, are the features on which Arrow based the genus. Subsequently, Lea (1923) described another species with prehensile claws, *M. peramelinus*, but in this species the male bears a prominent median horn on the pronotum.

An examination, by the present author, of the six species with prehensile claws disclosed some surprising facts. In the first place, the tarsal structure of *symbioticus* is quite different from that of the other five species, although the claw itself is much the same. The last tarsal segment of *symbioticus* bears a double row of stiff bristles on the lower surface (Fig. 13). These bristles act in apposition to the claws to hold on to the host's hair. Furthermore, *symbioticus* has a distinct pulvillus [Arrow (1920) claimed that the pulvillus is absent in *Macropocopris*]. Taxonomically, *symbioticus* is quite close to *koebelei* and is put in the *rubescens* group in the present revision.

The other five species do not have any bristles on the last tarsal segment below. Instead, a prolongation of the edge of the segment projects between the bases of the claws and acts in apposition to these (Fig. 13, spur). In these species, the pulvillus is indeed absent or greatly reduced. The prolongation or spur, as well as the reduction of the pulvillus, are also seen in five other species with perfectly normal claws, such as *glabratus* (Fig. 13). Another feature shared between these 10 species (five with prehensile and five with normal claws) is the arrangement of bristles on the outer part of the distal edge of the hind tibia (see key to species-groups). All three of these features (the tarsal spur, the reduced pulvillus, and the tibial bristles) are unique among Australian *Onthophagus* and are used here to separate the *glabratus* group. Superficially, all the species of this group are very similar (with the exception of *variolicollis*), and it is possible to trace an evolutionary sequence in the development of the claws from *glabratus* or another normal-clawed species, through *muticus*, *prehensilis*, or *carmodensis*, with moderately enlarged claws, to *parvus* or *peramelinus*, which have strongly developed claws. Furthermore, it is possible to arrange six of the species in the *glabratus* group by closely related pairs of very similar appearance, one member of which has normal claws, the other prehensile claws. These pairs are *murchisoni–carmodensis*, *glabratus–prehensilis*, and *chepara–muticus*. Only the strongly modified *parvus* and *peramelinus* cannot be matched with a normal-clawed species and probably evolved from *muticus* or some other prehensile form.

The conclusions to be drawn from these observations are clear. The prehensile-clawed condition was evolved entirely independently in two unrelated groups of Australian *Onthophagus*, the *rubescens* and *glabratus* groups, each arriving at a different tarsal structure to achieve the same grasping effect. While the *rubescens* group produced only one prehensile species, the *glabratus* group produced five. Evidently, the species of the latter group have a general predisposition to evolve prehensile claws, probably because of the presence of the tarsal "spur". It is not known what purpose is served by this spur in normal-clawed species, as none has ever been collected on a mammal host. The existence of the matched pairs mentioned above suggests that even within the *glabratus* group the prehensile claws were evolved at least three times independently.

It remains to be mentioned only that an individual of a normal-clawed species in yet a third group, *incornutus* in the *posticus* group, was found clinging to the fur of a striped wallaby, *Macropus dorsalis* Gray, by Mr. J. H. Calaby, and that Roberts (1931) reports an *Onthophagus*, possibly *granulatus*, clinging to the anus of horses. This shows that even unmodified species of *Onthophagus* may adopt this habit under certain circumstances.

The "genus" *Macropocopris*, therefore, is not a monophyletic group but a collection of species which have evolved a similar adaptation at least twice and perhaps four times independently, and it obviously cannot be maintained as a taxonomic unit.

## BIOLOGY OF THE PREHENSILE SPECIES

What little is known at present regarding the behaviour and ecology of the prehensile species of *Onthophagus* will be presented in a separate paper now in preparation, by Mr. B. L. Bolton and the author, hence only a few comments will be made here and under the species involved.

Most of the available data result from the investigations of Mr. Bolton in the vicinity of Darwin. In the course of a study of the agile wallaby, *Macropus agilis* Gould, about 200 of these animals were being shot four times a year, in January, April, July, and October, at which times the beetle infestation of some of the wallabies was recorded.

As many as 175 beetles may occur on a single host, with the highest average number per infested host being in December and January (about 37 beetles). The average infestation then declines, being about 11 in April, and one to three in July, rising again to about nine in October. The percentage of wallabies infested declined from a high of nearly 100% (after last light) in January, to lower figures for the rest of the year. The species composition of the beetles also changes seasonally, most of the *symbioticus* occurring in January and April and accounting for most of the heavy infestation during the wet season. The two species *muticus* and *parvus* make up the rest of the beetle collections, being distributed throughout the year, the former always less abundant.

In northern New South Wales, J. H. Calaby (1962) has investigated the ectoparasite fauna of various marsupials, finding *muticus* on the red-necked wallaby, *Macropus rufogrisea* Desmarest, and *peramelinus* on the large rat-kangaroo, *Aepyprymnus rufescens* Gray. The latter scarab species does not occur on bandicoots or in their nests (see under 10. *peramelinus* in the taxonomic section). Mr. Calaby also found a specimen of the non-prehensile *incornutus* (XIX. *posticus* group) on a striped wallaby, as previously mentioned.

The only other precise records of marsupial hosts for *Onthophagus* are the northern nail-tailed wallaby, *Onychogalea unguifer* Gould, and the spectacled hare-wallaby, *Lagorchestes conspicillatus* Gould, on which *parvus* has been found at Kalumburu and Barrow Island, W.A., respectively, by Mr. W. H. Butler. All confirmed marsupial hosts of *Onthophagus* are macropods, which possess a very fine silky fur to which the beetles can cling easily. All are medium- to small-sized, the large kangaroos or small rat-kangaroos not harbouring beetles, as far as we know (although Mr. W. Arndt noted an infestation of a pet red kangaroo near Katherine).

Mr. Arndt and Mr. L. J. Phillips (personal communication) have seen beetles clinging to the fur of goats near Katherine, N.T., this being the only reliable record of a host other than a macropod known so far.

The only observations that have been made on the behaviour of the beetles while on the hosts are due to Mr. W. Arndt (personal communication). He observed that the beetles may occur on any part of the body of wallabies and goats, although they congregate about the anal or cloacal openings. During defaecation, beetles converge on the emerging pellet and two or three get a grip on the pellet and drop with it to the ground. There is no evidence that the beetles feed on skin or fur or derive nourishment or mucus directly from the opening.

Once on the ground with the pellet, the beetles engage in a "lively tussle" for possession of it, and one individual emerges as victor. This beetle may roll the pellet

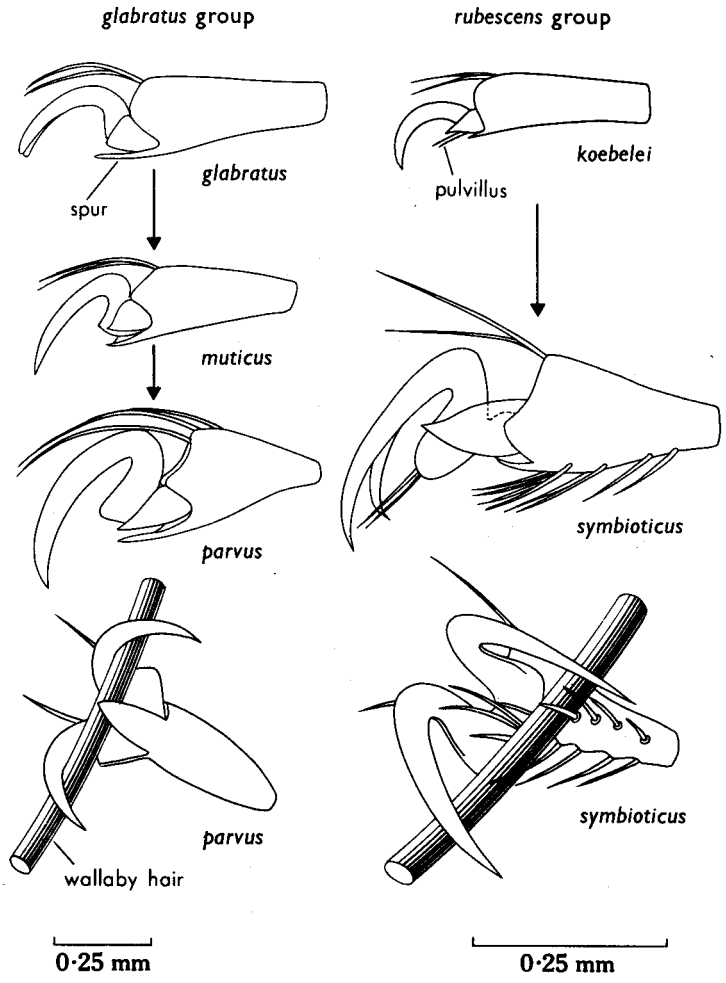
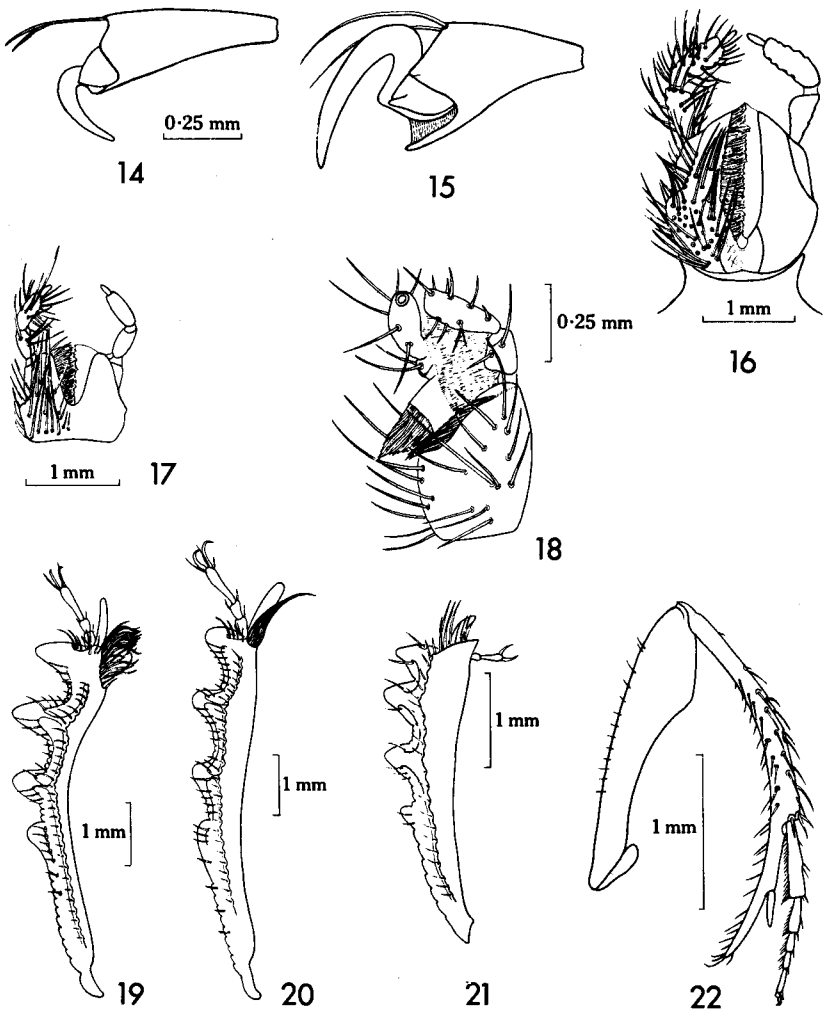



Fig. 13.–Postulated convergent evolution of prehensile claws in two different groups of Australian *Onthophagus*, as reconstructed from existing species. The lower diagrams show the different clinging mechanism of the two types, the apposing function being performed by a spur in *parvus*, by stout bristles in *symbioticus*.




Figs. 14–22.–*Onthophagus* spp.: *14*, *15*, tarsus and claw: *14*, *O. prehensilis*; *15*, *O. peramelinus*; *16–18*, labium: *16*, *O. ferox*, showing split condition; *17*, *O. capella*, normal condition in genus; *18*, *O. wombalano*, with perpendicular fringe setae; *19–21*, left fore tibia: *19*, *O. tenebrosus*; *20*, *O. jalamari*; *21*, *O. kumbaingeri*; *22*, right hind leg, major male of *O. tuckonie*.

as much as a foot by placing its clypeus under the edge of the pellet and lifting its head while pushing forward.* The beetle then buries itself and the pellet "by spading the soil away from under the pellet which settles into the excavation to a depth approaching 1.5 in." (Arndt).

Some of the pellets were unearthed after 24 hr and kept in moist soil. After 10 days the pellets were found to be unaltered externally but to be completely filled by a single larva, leaving only a fibrous outer wall 1 mm thick.

These interesting observations by Mr. Arndt indicate that the clinging adaptation of some Australian *Onthophagus* is specifically aimed at providing the beetles and their larvae with fresh food. The small pellets of wallabies are subject to rapid desiccation in the fiercely hot climate of northern Australia, and would be lost to the coprophages if not exploited immediately. Particularly important among Mr. Arndt's observations is the fact that the beetle buries the entire pellet intact, instead of dividing it into "armfuls" as in those species adapted to large-animal faeces.

The fact that a single beetle takes possession of a brood (i.e. larval) pellet indicates that the beetles involved are females and that copulation has already occurred, presumably on the mammal host.

## Faunistics of Australian *Onthophagus*

The 177 known species of Australian *Onthophagus* (12 undescribed) comprise about 12% of the world fauna of approximately 1500 species of this nearly cosmopolitan genus. This compares with 37 species known from the United States (Howden and Cartwright 1963) and 85 listed from Europe by Boucomont and Gillet (1927), both areas comparable in size to Australia and with wetter climates. The genus may have originated in Africa, which has some 800 species, and spread throughout the world to become the largest genus of organisms. Its earliest arrival in Australia cannot be dated, but extensive autochthonous speciation suggests long residence by some elements. However, it is still the newest part of the Australian scarabaeine fauna, the remaining genera being largely or entirely endemic at the genus level.

Five Australian species of *Onthophagus* also occur in New Guinea, four from the northern savannah-woodland pattern (*laminatus*, *quadripustulatus*, *rufosignatus*, and *symbioticus*) and one from the northern grasslands pattern (*consentaneus*), the latter being known to reach the Celebes. Otherwise, all Australian *Onthophagus* are endemic.

*Onthophagus* is a genus with notable over-water dispersal ability, often being the only representative of the subfamily on islands, and it can be imagined to have arrived in Australia by a steady, but slow, sweepstakes movement from the north continuing up to the present time. The preponderance of species of the "fugitive" genus *Onthophagus*, which make up well over half the total scarabaeine fauna of Australia, combined with highly endemic and probably archaic groups (to be treated later), gives this fauna a strongly insular aspect, unlike that of any other region of comparable size but reminiscent of that of some continental islands.

If the species-groups in the present work are accepted as natural, then each may represent an original invasion by one ancestral species, the remaining species in the group being autochthonous. This suggests 34 original invasions (23 formal groups and

* This was also observed by Mr. Bolton. While this method of transporting food is known for several genera of Scarabaeinae, it has not been observed in *Onthophagus* before. (See Halffter and Matthews 1966, pp. 96–99.)

11 groupings within the ungrouped species), or probably fewer, as several of the groups are linked to one another by intermediate species.

## TAXONOMY

The genus *Onthophagus*, established by Latreille in 1802, has generally defied successful fragmentation in spite of its size, its world-wide distribution, and many superficially very different species. The difficulty lies largely in the fact that no one person has been able to consider *Onthophagus* on a world-wide basis. The large size of the genus suggests that it has hit upon a particular formula for success (or at least successful speciation) which combines factors at which we can only guess at present. The important elements may be an abundant food supply, relatively rapid development, a safe but not overly complicated nesting procedure, high mobility, and an unexplained ability to compartmentalize the total environment in such a way as to enable many congeneric species to coexist.

*Onthophagus* may be recognized by the beginner as a scarabaeid by the lamellate antennae and fossorial legs, and as a scarabaeine (= coprine*) by the semicircular head with fused clypeus covering membranous mouthparts, and the exposed pygidium. Within the Scarabaeinae it can be distinguished by the combination of characters listed below under "Diagnosis". A key to the tribes and subtribes of Australian Scarabaeinae will not be given at this time because the author has not yet studied the other groups.

## Genus ONTHOPHAGUS Latreille

*Onthophagus* Latreille, 1802, p. 141. Type species *Scarabaeus taurus* Schreber, 1759.

*Monapus* Erichson, 1848, p. 763. Type species unnamed, probably *Onthophagus mniszechi* Harold, 1869.

*Psilax* Erichson, 1848, p. 763. Type species *Onthophagus pronus* Erichson, 1842.

*Macropocopris* Arrow, 1920, p. 434. Type species *Macropocopris prehensilis* Arrow, 1920. New synonymy.

### *Diagnosis*

Second segment of labial palpus a little larger than first, 3rd segment minute, glabrous, sometimes invisible. Antennae 9-segmented. Scutellum absent. Elytra with 8 striae, without intercalary striae. Apical tooth of fore tibia oblique, not forming a right angle with inner edge. Fore tibia with 4 outer teeth. Middle and hind tibiae strongly dilated apically, without transverse carina in middle of outer face. Tarsi with 5 segments, all tarsi and claws present, hind metatarsus elongated, linear.

The reasons for synonymizing *Marcopocopris* have been presented earlier in this work.

* The earliest use of a family-group name based on *Scarabaeus* appears to be Scarabaeides Latreille, 1802, whereas the first use of a family-group name based on *Copris* is Copridae Leach, 1815. Scarabaeidae therefore has priority as the family name. According to Article 39 of the International Code of Nomenclature, if "Scarabaeidae" is established, based on the type genus *Scarabaeus*, it automatically makes available the subfamily name Scarabaeinae (as from 1802) and Scarabaeini (also from 1802). Coprinae as a subfamily name is therefore not valid, although there can of course be a tribe Coprini (type genus *Copris*) separate but equal in rank with Scarabaeini. I am indebted to Dr. E. B. Britton for pointing this out.

The 165 described species are arranged in 23 species-groups and one assemblage of 13 "ungrouped" species. Six of the latter can be grouped into three pairs, each of which is equivalent to a species-group, but it was decided not to erect a formal group for less than three species. Each of the groups has a key to included species based on both sexes (except for occasional couplets). The species-groups, in turn, are keyed below. Since the groups are sometimes rather loose assemblages, with some species only doubtfully belonging, it proved impossible to construct a key which would place every species in its proper group and at the same time remain practicable. For this reason several individual species are also keyed out in the key to groups, and again under their respective groups.

It also proved impossible to include females in the key to groups, as this would have made the key too cumbersome, and in any case many of the group characteristics are seen only in the male. It will not be possible, therefore, to identify any series which does not include a male except by the hit-or-miss method of consulting illustrations, maps, and descriptions, or trying several keys in likely species groups.

The sex of all specimens of *Onthophagus* may easily be determined by examining the last abdominal sternite. In the female this is of equal length throughout, while in the male it is more or less shortened (narrowed) medially. The pygidium of the male is correspondingly a little larger (very much so in the *planicollis* group). Other male secondary sexual characters, which are not always present, are an effaced frontoclypeal suture, an elongation of the fore tibia with smaller teeth, a more angular inner apex or a brush of setae at the end of this tibia, or both, and different cephalic and pronotal armament (if any). Some species have dimorphic characters peculiar to themselves, as for instance the nearly atrophied front tibiae of male *planicollis* or the prolonged hind tibia of male *tuckonie*.

The following is a list of the species-groups and included species in the "natural" order adopted in the present work, together with a matrix showing which of the 11 distribution patterns (see section on distribution above) each species falls into. At the end of the work is an alphabetical list of species and their synonyms together with the number given to each species here. This will serve partly as an index to enable the reader to locate any particular named species in the work by number.

| Species-group and Species | Distribution Pattern No.* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| I. *glabratus* group | | | | | | | | | | | |
| 1. *variolicollis* Lea | | | | | | | | + | | | |
| 2. *neboissi* Frey | | | | | | | | + | | | |
| 3. *murchisoni* Blackburn | | | | | | | | | + | | |
| 4. *carmodensis* Blackburn | | | | | | | | + | | | |
| 5. *glabratus* Hope | | | | | | | + | | | | |
| 6. *prehensilis* Arrow | | | | | | + | | | | | |
| 7. *chepara*, sp. nov. | | | + | | | | | | | | |
| 8. *muticus* Macleay | | | | | | | + | | | | |
| 9. *parvus* Harold | | | | | | | + | | | | |
| 10. *peramelinus* Lea | | | + | | | | | | | | |

* Numbers 1–11 refer to the distribution patterns described on pp. 8–17 and illustrated in Figures 1–11 respectively.

| Species-group and Species | Distribution Pattern No. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| II. *atrox* group | | | | | | | | | | | |
| 11. *solidus* Gillet | | | | | | | | + | | | |
| 12. *leai* Blackburn | + | | | | | | | | | | |
| 13. *pentacanthus* Harold | | + | | | | | | | | | |
| 14. *mniszechi* Harold | + | | | | | | | | | | |
| 15. *ferox* Harold | | | | | | | | | | | + |
| 16. *sloanei* Blackburn | | | | | | | | | | + | |
| 17. *mjobergi* Gillet | | | | | | | | + | | | |
| 18. *quinquetuberculatus* Macleay | | | | + | | | | | | | |
| 19. *pugnacior* Blackburn | | | | | | + | | | | | |
| 20. *atrox* Harold | | | | | | + | | | | | |
| 21. *capitosus* Harold | | | | | | | + | | | | |
| 22. *laminatus* Macleay | | | | | | | + | | | | |
| 23. *demarzi* Frey | | | | | | | + | | | | |
| III. *conspicuus* group | | | | | | | | | | | |
| 24. *salebrosus* Macleay | | | | | | | | + | | | |
| 25. *tenebrosus* Harold | + | | | | | | | | | | |
| 26. *jalamari*, sp. nov. | | | | | | | | + | | | |
| 27. *fissiceps* Macleay | | | | | | | | + | | | |
| 28. *rugosicollis* Gillet | | | | | | | | + | | | |
| 29. *tricavicollis* Lea | | | | | | + | | | | | |
| 30. *conspicuus* Macleay | | | | | | + | | | | | |
| 31. *bicavicollis* Lea | | | | | | | + | | | | |
| IV. *pronus* group | | | | | | | | | | | |
| 32. *pronus* Erichson | + | | | | | | | | | | |
| 33. *leanus* Goidanich | | | + | | | | | | | | |
| 34. *bornemisszanus*, sp. nov. | | | | | + | | | | | | |
| V. *declivis* group | | | | | | | | | | | |
| 35. *declivis* Harold | | + | | | | | | | | | |
| 36. *desectus* Macleay | | | | | | | + | | | | |
| 37. *alquirta*, sp. nov. | | | | | | | | | | + | |
| 38. *devexus* Macleay | | | | | | | | + | | | |
| 39. *apterus*, sp. nov. | | | | | | + | | | | | |
| VI. *capella* group | | | | | | | | | | | |
| 40. *nodulifer* Harold | | | | | | | + | | | | |
| 41. *dicranocerus* Gillet | | | | | + | | | | | | |
| 42. *neostenocerus* Goidanich | | | | | + | | | | | | |
| 43. *queenslandicus* Blackburn | | | | | | | | | + | | |
| 44. *comperei* Blackburn | | | | | | + | | | | | |
| 45. *ferrari*, sp. nov. | | | | | | + | | | | | |
| 46. *capelliformis* Gillet | | | | | + | | | | | | |
| 47. *capella* Kirby | | | + | | | | | | | | |
| 48. *pugnax* Harold | + | | | | | | | | | | |
| 49. *tabellifer* Gillet | + | | | | | | | | | | |
| 50. *ouratita*, sp. nov. | | | + | | | | | | | | |
| 51. *macrocephalus* Kirby | + | | | | | | | | | | |
| 52. *mamillatus* Lea | | | | | + | | | | | | |
| 53. *mundill*, sp. nov. | | | | | + | | | | | | |
| 54. *darlingtoni*, sp. nov. | | | | | + | | | | | | |
| VII. *erichsoni* group | | | | | | | | | | | |
| 55. *bicornis* Macleay | | | | | | | + | | | | |
| 56. *tabellicornis* Macleay | | | | | | + | | | | | |

| Species-group and Species | Distribution Pattern No. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 57. *erichsoni* Hope | | | | | | | | + | | | |
| 58. *wigmungan*, sp. nov. | | | | | + | | | | | | |
| 59. *picipennis* Hope | | | | | | | | + | | | |
| 60. *capellinus* Frey | | | | | | + | | | | | |
| VIII. *dunningi* group | | | | | | | | | | | |
| 61. *anchommatus* Lea | + | | | | | | | | | | |
| 62. *kumbaingeri*, sp. nov. | + | | | | | | | | | | |
| 63. *dunningi* Harold | | | + | | | | | | | | |
| 64. *brooksi*, sp. nov. | | | | | + | | | | | | |
| IX. *australis* group | | | | | | | | | | | |
| 65. *hoplocerus* Lea | + | | | | | | | | | | |
| 66. *fuliginosus* Erichson | + | | | | | | | | | | |
| 67. *anisocerus* Erichson | + | | | | | | | | | | |
| 68. *australis* Guérin | + | | | | | | | | | | |
| 69. *nurubuan*, sp. nov. | + | | | | | | | | | | |
| 70. *paluma*, sp. nov. | | | | | | + | | | | | |
| 71. *tweedensis* Blackburn | | | + | | | | | | | | |
| 72. *thoreyi* Harold | | | | | | + | | | | | |
| 73. *parallelicornis* Macleay | | | | | | + | | | | | |
| X. *auritus* group | | | | | | | | | | | |
| 74. *discolor* Hope | | | | | | | + | | | | |
| 75. *purpureicollis* Lea | | | | | | + | | | | | |
| 76. *auritus* Erichson | + | | | | | | | | | | |
| 77. *furcaticeps* Masters | | | | | | + | | | | | |
| 78. *cuniculus* Macleay | | | | | | + | | | | | |
| 79. *dandalu*, sp. nov. | | + | | | | | | | | | |
| 80. *walteri* Macleay | | | | | | + | | | | | |
| 81. *rufosignatus* Macleay | | | | | | | + | | | | |
| XI. *latro* group | | | | | | | | | | | |
| 82. *latro* Harold | | | | | | | + | | | | |
| 83. *signaticollis* Frey | | | | | | + | | | | | |
| 84. *endota*, sp. nov. | | | | | | | | + | | | |
| 85. *bambra*, sp. nov. | | | | | | | | + | | | |
| 86. *varianus* Lea | | | | | | | + | | | | |
| 87. *margaretensis* Blackburn | | | | | | | | + | | | |
| XII. *vilis* group | | | | | | | | | | | |
| 88. *geelongensis* Blackburn | | + | | | | | | | | | |
| 89. *yiryoront*, sp. nov. | | | | | + | | | | | | |
| 90. *vilis* Harold | | | | | | + | | | | | |
| XIII. *adelaidae* group | | | | | | | | | | | |
| 91. *rupicapra* Waterhouse | | | | | | | | | | | + |
| 92. *adelaidae* Harold | | + | | | | | | | | | |
| 93. *phoenicocerus* Lea | | | | + | | | | | | | |
| 94. *duboulayi* Waterhouse | | | | | | | | | | | + |
| 95. *jubatus* Harold | | | | | | | | | + | | |
| 96. *vermiculatus* Frey | | | | | | | | | | | + |
| 97. *haagi* Harold | | | | | | | | | | | + |
| XIV. *perpilosus* group | | | | | | | | | | | |
| 98. *incanus* Macleay | | | | | | | + | | | | |
| 99. *perpilosus* Macleay | | | | + | | | | | | | |
| 100. *tamworthi* Blackburn | | | | + | | | | | | | |
| 101. *gangulu*, sp. nov. | | | | + | | | | | | | |

| Species-group and Species | Distribution Pattern No. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 102. *villosus* Macleay | | | | | | | | + | | | |
| 103. *wakelbura*, sp. nov. | | | | + | | | | | | | |
| 104. *fletcheri* Blackburn | | | | + | | | | | | | |
| XV. *pexatus* group | | | | | | | | | | | |
| 105. *nammuldi*, sp. nov. | + | | | | | | | | | | |
| 106. *pexatus* Harold | + | | | | | | | | | | |
| 107. *squalidus* Lea | + | | | | | | | | | | |
| 108. *longipes* Paulian | + | | | | | | | | | | |
| XVI. *quadripustulatus* group | | | | | | | | | | | |
| 109. *evanidus* Harold | | | | | | | | | | | + |
| 110. *fabricii* Waterhouse | | | | | | | + | | | | |
| 111. *waterhousei* Boucomont & Gillet | | + | | | | | | | | | |
| 112. *quadripustulatus* Fabricius | | | | | | | + | | | | |
| 113. *kokereka*, sp. nov. | | | + | | | | | | | | |
| 114. *blackburni* Shipp | | + | | | | | | | | | |
| 115. *cruciger* Macleay | | | | | | | | | + | | |
| XVII. *propinquus* group | | | | | | | | | | | |
| 116. *propinquus* Macleay | | | | | | | + | | | | |
| 117. *monteithi*, sp. nov. | | | | | + | | | | | | |
| 118. *semimetallicus* Lea | | | | | | + | | | | | |
| 119. *wagamen*, sp. nov. | | | | | + | | | | | | |
| XVIII. *mutatus* group | | | | | | | | | | | |
| 120. *compositus* Lea | + | | | | | | | | | | |
| 121. *togeman*, sp. nov. | | | | | | | | + | | | |
| 122. *frenchi* Blackburn | + | | | | | | | | | | |
| 123. *jangga*, sp. nov. | | | | | | + | | | | | |
| 124. *mutatus* Harold | + | | | | | | | | | | |
| 125. *sydneyensis* Macleay | + | | | | | | | | | | |
| 126. *yungaburra*, sp. nov. | | | | | + | | | | | | |
| XIX. *posticus* Erichson | | | | | | | | | | | |
| 127. *arrilla*, sp. nov. | | | + | | | | | | | | |
| 128. *posticus* Erichson | + | | | | | | | | | | |
| 129. *incornutus* Macleay | | | + | | | | | | | | |
| 130. *mulgravei* Paulian | | | | | + | | | | | | |
| 131. *millamilla*, sp. nov. | | | | | + | | | | | | |
| 132. *turrbal*, sp. nov. | | | | | + | | | | | | |
| XX. *rubescens* group | | | | | | | | | | | |
| 133. *rubescens* Macleay | | | | | | | + | | | | |
| 134. *koebelei* Blackburn | | | | | | | + | | | | |
| 135. *symbioticus* Arrow | | | | | | | + | | | | |
| 136. *waminda*, sp. nov. | | | | | + | | | | | | |
| 137. *parrumbal*, sp. nov. | | | | | | | + | | | | |
| 138. *manya*, sp. nov. | | | | | | + | | | | | |
| 139. *tuckonie*, sp. nov. | | | | | + | | | | | | |
| 140. *wilgi*, sp. nov. | | | | | + | | | | | | |
| XXI. *asper* group | | | | | | | | | | | |
| 141. *rubicundulus* Macleay | | | | | + | | | | | | |
| 142. *ocelliger* Harold | | | | | | + | | | | | |
| 143. *asper* Macleay | | | | | | + | | | | | |
| XXII. *bicarinaticeps* group | | | | | | | | | | | |
| 144. *bicarinaticeps* Lea | | | | | | | + | | | | |
| 145. *gidju*, sp. nov. | | | | | | | + | | | | |

| Species-group and Species | Distribution Pattern No. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 146. *dummal*, sp. nov. | | | | | + | | | | | | |
| 147. *yeyeko*, sp. nov. | | | | | | | + | | | | |
| 148. *lamgalio*, sp. nov. | | | | | + | | | | | | |
| XXIII. *planicollis* group | | | | | | | | | | | |
| 149. *clypealis* Lea | | | | | | | + | | | | |
| 150. *yunkara*, sp. nov. | | | | | + | | | | | | |
| 151. *planicollis* Harold | | | | | | + | | | | | |
| 152. *macleayi* Blackburn | | | + | | | | | | | | |
| XXIV. Ungrouped species | | | | | | | | | | | |
| 153. *wombalano*, sp. nov. | | | | | + | | | | | | |
| 154. *pillara*, sp. nov. | | | | | + | | | | | | |
| 155. *gulmarri*, sp. nov. | | | | | + | | | | | | |
| 156. *granulatus* Boheman | + | | | | | | | | | | |
| 157. *bornemisszai*, sp. nov. | + | | | | | | | | | | |
| 158. *rubrimaculatus* Macleay | | | | | | | + | | | | |
| 159. *bunamin*, sp. nov. | | | | | | + | | | | | |
| 160. *consentaneus* Harold | | | | | | | | | + | | |
| 161. *gandju*, sp. nov. | | | | | + | | | | | | |
| 162. *victoriensis* Blackburn | | + | | | | | | | | | |
| 163. *blackwoodensis* Blackburn | | + | | | | | | | | | |
| 164. *flavoapicalis* Lea | | | | | | | | | | | + |
| 165. *depressus* Harold | + | | | | | | | | | | |

## KEY TO SPECIES-GROUPS OF AUSTRALIAN *ONTHOPHAGUS*

1. Distal segment of tarsus with a distinct lobe or spur projecting between claws and longer than base of claws (Fig. 13); if only as long, then claws are hypertrophied; pulvillus small, hidden; distal edge of hind tibia outwardly with short stout bristles only, or with only 1 or 2 longer bristles as well; head unarmed, or if horns are present these are strongly geniculate (Fig. 25); pronotum unarmed or, if armed, then only with a single median posterior horn directed forward (Fig. 44) ..... I. *glabratus* group

   Distal segment of tarsus with a shorter lobe beneath claws, not longer than base of claws, with a prominent pulvillus; distal edge of hind tibia outwardly with alternating short stout bristles and long slender ones; head horns, if present, not geniculate; pronotum, if armed, not as above ..... 2

2(1). Labium excised nearly to base, usually split into 2 movable lobes, the basal portion between lobes membranous and deeply sunken (Fig. 16) ..... 3

   Labium more shallowly excised, usually only about halfway to base or less, basal portion not membranous medially, not sunken ..... 4

3(2). Eyes with more than 20 rows of facets across widest point; lenses of ommatidia fused to form a single, smooth transparent pane over eye; fore tibia of male may be elongated or not, but never with a distal brush or tuft of long setae; colour black; large beetles, usually 15–23 mm in total length ..... II. *atrox* group

   Eyes with fewer than 18 rows of facets across widest point; lenses of ommatidia discrete, forming granular surface over eye; fore tibia of major male elongated and with a distal brush or tuft of long setae (Figs. 19, 20); colour black or green; total length 8–15 mm ..... III. *conspicuus* group

4(2). Abdominal sternites of male greatly foreshortened, first 5 sternites combined little longer than 6th; tarsi very slender, the segments cylindrical ..... XXIII. *planicollis* group

   Abdominal sternites of male not or little foreshortened, first 5 sternites combined very much longer than 6th ..... 5

5(4). Pronotum of both sexes with 3 tubercles in a transverse row; vertex with a pair of transverse ridges or elevated angles in male; dorsal surfaces at least partly setose, pygidium densely setose ..... XI. *latro* group

Pronotum variable, but never with 3 tubercles; vertex and surfaces variable ..... 6

6(5). Pronotum green, violet, coppery, or partly red, very smooth, nitid, glabrous, very finely punctate at least on base; pygidium usually with long pale pilosity; elytra nitid; total length 6–11 mm ..... X. *auritus* group

Pronotum black or rufous or, if the above colours, then surface is sericeous, rugulose, or setose, or specimen otherwise differs from above ..... 7

7(6). Pygidium with shallow ocellate punctures; major male with clypeal margin medially a little produced and reflexed; total length 5–7 mm ..... XVII. *propinquus* group

Pygidium with simple punctures; if clypeal margin of male is produced, then total length is more than 7 mm ..... 8

8(7). Pygidium and dorsal surfaces entirely glabrous, devoid even of microtrichia (at 40 X), and total length at least 10 mm ..... 9

Either pygidium with at least a few setae, or total length less than 9 mm, or both; dorsal surfaces variable ..... 11

9(8). Male with frontoclypeal suture effaced and head in both sexes devoid of any horns or crests; eyes large, with 25–28 facet rows across widest point, separated by 4–5 times width of 1 eye; pronotum unarmed or with single median prong issuing from front edge ..... IV. *pronus* group

Male with frontoclypeal suture carinate, with or without horns or crests; eyes smaller or, if equally large, then head is armed in male ..... 10

10(9). Head of male devoid of any horns or crests; pronotum of male with a median flattened or depressed area which is posteriorly acuminate and produced in major individuals; pronotum of female usually with a trace of this flattened area, or with median longitudinal raised line anteriorly ..... V. *declivis* group

Head of male with horns or crest on frons or vertex, or with backwardly prolonged lamina; pronotum of male, if armed, not as above (specimens of *australis* group with setae worn off pygidium will arrive here) ..... VI. *capella* group

11(8). First 6 elytral intervals with at least a few setae (visible at 10 X at least as stubble); sides of elytra, pronotum, or head, or all three, usually with numerous setae ..... 12

First 6 elytral intervals glabrous or with microtrichia only (not visible except at 25 X or more), occasionally with 1 or 2 setae; sides of pronotum and head with few setae or none, sides of elytra may or may not have numerous setae ..... 22

12(11). Head of male entirely devoid of frontoclypeal or frontal carinae or horns, although there may be 2 low transverse ridges on vertex; fore tibia of major male elongated and with a distal brush of long setae ..... 13

Head of male with either a carinate frontoclypeal suture or with a frontal or vertical carina or horns, or both; fore tibia of male variable ..... 14

13(12). Colour dull grey, usually with a bronze sheen; pronotum entirely unsculptured ..... XIV. *pexatus* group

Colour brown and green; pronotum of male with 4 tubercles or small longitudinal ridges anteriorly. Proceed to couplet 6 of key to ..... XXIV. Ungrouped species

14(12). Total length 2–5 mm; eyes with 3–7 facet rows across widest point ..... 15

Total length 4–10 mm; eyes with 5–9 facet rows across widest point ..... 17

15(14). Male with frontoclypeal suture fully carinate, without horns or tubercles on frons (except in 146. *dummal*); pronotum with simple punctures; eyes with 4–7 facet rows across widest point ..... XXII. *bicarinaticeps* group

Male with frontoclypeal suture carinate only medially or entirely effaced, with a pair of tubercles or short horns on frons; pronotum usually with ocellate punctures; eyes very narrow, with only 3–4 facet rows across widest point ..... 16

16(15). Very densely setose, setae stout, curved; pronotum with ocellate punctures ..... XXI. *asper* group

Sparsely setose, setae fine, straight; pronotum with simple punctures. Specimens less than 5 mm long of 95. *jubatus* in ..... XIII. *adelaidae* group

17(14). Disc of pronotum rugose, reticulate, or granulate; elytra granulate, asperate, or costate, or with uneven surface; if surfaces are relatively smooth, then male has a pair of frontal horns not joined by any carina ..... 18

Surfaces smooth between punctures; without horns, or with short erect horns issuing from a transverse frontal carina ..... 20

18(17). Clypeus not bidentate; surfaces usually greenish and very densely pilose. 98. *incanus* in ..... XIV. *perpilosus* group

Clypeus bidentate; not greenish or, if so, then setae are sparse and short ..... 19

19(18). Setae very stout, blunt, and short; punctures of pronotum shaped like horseshoes; without horns. 165. *depressus* in ..... XXIV. Ungrouped species

Setae finer; punctures of pronotum normal; male armed with 1 or 2 horns ..... XIII. *adelaidae* group

20(17). Major male with fore tibia elongated, with inner apical angle prolonged into a point as long as fore spur; vertex with a single transverse lamina raised into a pair of angles or low points; pronotum of both sexes frequently with a median transverse fold near anterior margin ..... XIV. *perpilosus* group

Fore tibia not elongated, without inner apical point; frons and vertex with a simple transverse carina in both sexes, or 2 separate elevated ridges; pronotum variable, but without a single median fold near margin ..... 21

21(20). Sparsely covered with short setae, usually absent from pronotal disc at least; frontal carina of male divided into 2 elevated ridges. 121. *togeman* in ..... XVIII. *mutatus* group

Very densely and uniformly covered with short cilia or longer pilosity over dorsal surfaces; frontal or vertical carina of male continuous ..... XII. *vilis* group

22(11). Clypeal margin of major male produced into a lobe or long process; pronotum armed with distinct projections or carinae; colour piceous ..... 23

Clypeal margin of male not produced, or if somewhat lobate then pronotum is unarmed; colour may not be uniformly piceous ..... 25

23(22). Eyes moderate, with 6–12 facet rows across widest point; clypeal margin of major male with very prominent lobe or process, pronotum with a single large tapering median projection directed forward ..... VIII. *dunningi* group

Eyes large, with 12–22 facet rows across widest point; clypeal margin of major male less produced medially, head usually subtriangular in outline ..... 24

24(23). Male with frontoclypeal suture effaced; eyes very large, separated by less than 3 times width of 1 eye; total length less than 8 mm. 155. *gulmarri* in ..... XXIV. Ungrouped species

Male with frontoclypeal suture carinate; eyes smaller, separated by at least 4 times width of 1 eye; total length more than 8 mm ..... VII. *erichsoni* group

25(22). Total length 8–12 mm ..... 26

Total length 2.5–8 mm ..... 29

26(25). Head of male without any horns, crests, or laminae, nearly circular in outline. Proceed to couplet 9 in key to ..... XXIV. Ungrouped species

Head of male armed with horns or laminae, not circular in outline ..... 27

27(26). Vertex of male with a broad bilobate lamina terminating in a pair of unbranched flattened horns, often with an additional smaller median lobe ..... IX. *australis* group

Male with a pair of compound (branched or toothed) cephalic horns ..... 28

28(27). Clypeus very strongly bidentate; pronotum coarsely punctate and laterally setose. 162. *victoriensis* in ..... XXIV. Ungrouped species

Clypeus not bidentate; pronotum finely punctate and glabrous. 44. *comperei* in ..... VI. *capella* group

29(25). Male with fore tibia elongated, with apical brush of long setae ..... 30
Male with fore tibia not elongate, without brush ..... 31

30(29). Total length 4–8 mm; eyes with 5–9 facet rows across widest point; head of male either unarmed, or with a pair of widely separated tubercles on vertex, or a simple carina across frons; surfaces often sericeous or alutaceous ..... XIX. *posticus* group
Total length 2.5–5 mm; eyes with 3–5 facet rows across widest point; male with carina across base of head more or less elevated into 2 angles or low points; surfaces usually nitid ..... XVI. *quadripustulatus* group

31(29). Not more than 5 mm in total length; male without horns, at most with single transverse frontal carina ..... XX. *rubescens* group
More than 5 mm long or, if less, then male has a pair of short erect conical horns on frons ..... 32

32(31). Male with a pair of erect subparallel conical horns or transverse tubercles on frons near inner edge of eyes ..... XVIII. *mutatus* group
Male otherwise armed, or unarmed; if with subparallel horns, then these are inclined to plane of head and not perpendicular; not agreeing with any of above alternatives ..... XXIV. Ungrouped species

## I. *The* GLABRATUS *Group*

Eyes moderate to wide, with 13–19 facet rows across widest point, separated by 6–8 widths, canthus complete. Labium excised halfway to two-thirds of way to base. Pronotum glabrous or with short stubble. Elytra glabrous or with microtrichia on disc or short setae laterally. Pygidium glabrous or with short setae. Colour entirely black. Total length 5.5–12 mm. Tarsi with pulvillus hidden or absent, lower edge of last tarsal segment produced into a flattened spur usually longer than base of claws (Figs. 13–15). Claws hypertrophied in 5 species. Fringe of bristles on distal edge of hind tibia outwardly nearly all short, usually with only 1 long seta, sometimes 3.

Male with frontoclypeal suture effaced (except in *neboissi*), vertex unarmed (except in *variolicollis*, which has sharply bent horns), pronotum unarmed (except in *peramelinus*, which has a single median horn). Fore tibiae not elongated and without brush of long setae, although an inner apical projection may be present. Female unarmed.

Ten species: 1. *variolicollis* Lea; 2. *neboissi* Frey; 3. *murchisoni* Blackburn; 4. *carmodensis* Blackburn; 5. *glabratus* Hope; 6. *prehensilis* Arrow; 7. *chepara* sp. nov., 8. *muticus* Macleay; 9. *parvus* Blanchard; 10. *peramelinus* Lea.

This group contains five of the six species with prehensile claws formerly in the genus *Macropocopris* (see discussion in Introduction), plus five species with normal claws. However, all members of the group share the unique structure of the last tarsal segment described above. *O. chepara*, of northern New South Wales, has normal claws but is otherwise very similar to both *muticus* and *parvus* and has been confused with them in collections. *O. muticus* and *prehensilis*, both prehensile species, have only moderately developed claws (Figs. 13, 14) and could form evolutionary links between *chepara* and *glabratus*, and the highly modified *parvus* and *peramelinus*. The ultimate in claw development is achieved by *peramelinus*, in which the claws slide vertically between a high central keel, emerging from the tarsal spur, and the expanded lateral edges of the tarsal segment, which together permit no lateral movement of the claws (Fig. 15).

Among the remaining species, *glabratus*, *prehensilis*, *murchisoni*, and *carmodensis* form two natural subgroups, while *neboissi* shares certain features (in couplet 1 of the key) with the highly ornate *variolicollis*.

Worthy of note is the high degree of sympatry between the two prehensile species *muticus* and *parvus*. They are collected together simultaneously with a greater frequency than can be accounted for by chance alone (see discussion under the species concerned), which suggests a form of loose symbiotic association between them.

All the species of this group are open savannah or savannah-woodland species except possibly *peramelinus* and *chepara*, which may be woodland forms. A number (*murchisoni*, *parvus*, and to a less extent *muticus*) are exceptionally xerophylic.

## KEY TO SPECIES OF THE *GLABRATUS* GROUP

1. Labium deeply excised, about two-thirds of way to base; pronotum with large shallow punctures bearing very short setae; elytra entirely covered with very short setae ..... 2
   Labium excised only about halfway to base; pronotum with smaller punctures, glabrous; elytra glabrous on disc at least ..... 3

2(1). Elytra with strongly asperate punctures, appearing as granules; pronotum with large shallow ocellate punctures; edges of pronotum concave and explanate; head of major male with a pair of strongly bent horns expanded at the bend, with frontoclypeal suture effaced. N. W.A. ..... 1. *variolicollis* Lea
   Elytra smooth; pronotal punctures not ocellate; edges of pronotum normal; head of male unarmed, with feebly carinate frontoclypeal suture. N. N.T. ..... 2. *neboissi* Frey

3(1). Clypeal margin bidentate; anterior angles of pronotum acute, the apices projecting and a little turned out ..... 4
   Clypeal margin rounded or feebly bilobate; anterior angles of pronotum subquadrate, the apices not projecting ..... 5

4(3). Claws normal; eyes with about 14 facet rows across widest point. W.A., N.T., N. Qld. ..... 3. *murchisoni* Blackburn
   Claws prehensile; eyes with about 19 facet rows across widest point. N. W.A. ..... 4. *carmodensis* Blackburn

5(3). Dorsal surfaces sericeous; clypeal surface entirely rugose in both sexes ..... 6
   Dorsal surfaces more or less nitid, may be sericeous on elytra only; clypeal surface smooth at least at base ..... 7

6(5). Claws normal. N. W.A., N. N.T., N. Qld. ..... 5. *glabratus* Hope
   Claws prehensile. N. Qld. ..... 6. *prehensilis* Arrow

7(5). Edges of elytra and pygidium with short setae; elytral intervals convex, the striae impressed and strongly punctate; claws strongly prehensile. W.A., N. N.T., Qld., N. N.S.W. ..... 9. *parvus* Blanchard
   Elytra and pygidium entirely glabrous; elytral intervals flat or nearly so, striae shallow and with very small punctures; claws variable ..... 8

8(7). Posterior part of middle of metasternum with large setigerous punctures; depth at distal edge of last tarsal segment about equal to length, claw greatly enlarged; male with a horn or tubercle on midline of pronotum. S. Qld., N. N.S.W. ..... 10. *peramelinus* Lea
   Posterior part of middle of metasternum with very small punctures or none, glabrous; depth at distal end of last tarsal segment contained 2 or 3 times in length, claw not greatly enlarged; male unarmed ..... 9

9(8). Claws moderately prehensile; elytral intervals sericeous, striae superficial. N. W.A., N. N.T., N. Qld., N. N.S.W. ..... 8. *muticus* Macleay
   Claws not prehensile; elytral intervals nitid, striae impressed. N. N.S.W. ... 7. *chepara*, sp. nov.

## 1. ONTHOPHAGUS VARIOLICOLLIS Lea

(Figs. 25-27, 459, 460)

*Onthophagus variolicollis* Lea, 1923, p. 382; Boucomont and Gillet, 1927, p. 216.

Black, rufopiceous around edges and on legs, antennal clubs fulvous. Total length 9-10 mm.

*Male*

*Head.*—Very broad, two-thirds as wide as pronotum, clypeal margin medially bidentate, almost straight to genal angles, which are angulate and prominent. Clypeal suture with frontal section effaced, genal sections indistinct, not carinate. Vertex with a pair of horns which are strongly divergent at base, then abruptly bent inwards and strongly expanded into an angular lamina at outer edge of bend. Minor male unknown. Eyes moderate, with about 15 facet rows across widest point, separated by 6 widths, canthus complete. Densely covered with granules, coarsest on clypeus, smallest on frons and horns, a very short bristle arising behind each granule. Vertex smooth, shagreened. Labium deeply excised, almost to base as in *atrox* group. *Pronotum.*—Flattened, unsculptured. Anterior angles concave above, subquadrate, with the apices broadly rounded. Hind edge unmargined. Fairly densely punctate with very large shallow ocellate punctures separated by 1-2 diameters, each puncture with a very short bristle. Surface shagreened, matt. *Elytra.*—Intervals convex, shagreened, matt, with 2 irregular rows of shallow asperate punctures (1 only on 1st and 6th intervals) each bearing a very short bristle. Striae superficial, indistinct, geminate, crenulate, impunctate. *Legs.*—Fore tibia slender with long teeth, inner apical angle produced into a small point. Spur long, sickle-shaped, shorter middle spur and hind spur somewhat falciform. Claws normal. *Abdomen.*—Pygidium shagreened, with numerous large shallow transverse ocellate punctures bearing very short bristles. Parameres of aedeagus elongated, the points blunt.

*Female*

Clypeal margin more strongly bidentate. Clypeal suture with frontal section present, finely carinate, angled upward in middle, joining genal sections very far from margin. Inner margin of eyes with short incurved ridges, vertex with ocellate punctures. Fore tibia with inner apical angle not produced. Otherwise like male.

*Type*

Holotype ♂, Wyndham, W.A., J. Clark from W. Crawshaw, SAM I.15420. Seen by the author.

*Distribution* (Fig. 23)

Known only from the vicinity of the Ord River in north Western Australia. Collected by the author in open savannah woodland with sandy soil at human excrement bait.

*Material Examined*

The holotype and two specimens. WESTERN AUSTRALIA: Kununurra, 20.ii.1968, E. G. Matthews, ANIC, 2.

## 2. ONTHOPHAGUS NEBOISSI Frey

(Figs. 28, 29, 461)

*Onthophagus neboissi* Frey, 1970, p. 151.

Rufopiceous to piceous, antennal clubs flavous. Total length 7–10 mm.

*Male*

*Head.*—Clypeal margin medially slightly emarginate, rest of head margin evenly curved to genal angles, which are angulated and a little advanced. Clypeal suture with frontal section feebly carinate, straight, meeting genal sections at an obtuse angle far from margins. Frons with the continuation of genal sutures feebly carinate, forming a pair of strongly oblique ridges. Eyes moderate, with 13 facet rows across widest point, separated by 7.5 widths, canthus complete. Densely punctate on centre of head, more sparsely punctate toward base, strongly irregularly rugose on genae and most of clypeus, punctures on genae and sides of clypeus with short setae (often worn down). Labium deeply excised, about two-thirds of way to base. *Pronotum.*—Strongly convex, unsculptured. Anterior angles subacute, the apices rounded. Hind edge unmargined. Moderately densely punctate with large shallow punctures, those on disc sparsest, those toward anterior angles densest, each puncture with a very short seta (not always visible on disc), surface shagreened, sericeous. *Elytra.*—Intervals flat, smooth, shagreened, sericeous, with numerous extremely small punctures bearing microtrichia, more visible on sides. Striae superficial, subgeminate, shiny, impunctate or with extremely small and shallow punctures. *Legs.*—Fore tibiae with inner apical angle produced. Spur large. Claws normal, large. *Abdomen.*—Pygidium shagreened, moderately punctate with small punctures, with very short, downwardly directed setae. Parameres of aedeagus normal.

*Female*

Clypeus more distinctly bilobate, margin wider. Frontoclypeal suture more strongly carinate. Pronotum less convex, more densely and coarsely punctate. Otherwise like male.

*Type*

Holotype ♂, Yardie Ck., Carnarvon, W.A., 12.v.1958, A. Snell, NMV. Although the label is written this way, Yardie Creek is actually on the North West Cape.

*Distribution* (Fig. 23)

Known from the vicinity of Katherine, N.T., and the North West Cape, W.A.; collected at light.

*Material Examined*

The type and 17 specimens. NORTHERN TERRITORY: Flora R., Prof. Spencer, NMV, 1; Tindal 14°31′S., 132°22′E., 1–20.xii.1967, W. J. M. Vestjens, ANIC, 11. WESTERN AUSTRALIA: Yardie Ck., N.W. Cape, 12.v.1958, A. Snell, NMV, 5.

## 3. ONTHOPHAGUS MURCHISONI Blackburn

(Figs. 30-32, 462)

*Onthophagus murchisoni* Blackburn, 1892, p. 25; Blackburn, 1903, p. 269; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214.

Rufopiceous, antennal clubs fulvous or flavous. Total length 8-10 mm.

*Male*

*Head.*—Clypeal margin medially strongly excised in a rounded V, a little expanded on either side into a pair of rounded teeth, rest of margin evenly arcuate to genal angles, which are subangulate and a little advanced. Clypeal suture with frontal section entirely effaced. Frons and vertex unarmed. Eyes moderate, with 14 facet rows across widest point, separated by 8 widths, canthus complete. Strongly, irregularly rugose on clypeus and genae, becoming less strongly rugose on frons, smooth and finely punctate on base of head, glabrous. Labium excised about halfway to base. *Pronotum.*—Moderately convex, unsculptured. Anterior angles acute, the apices projecting and a little turned out. Hind edge unmargined. Evenly punctate with extremely small punctures, appearing impunctate, glabrous. Surface very finely shagreened, sericeous. *Elytra.*—Intervals very feebly convex, smooth, sericeous, impunctate, glabrous or with very short setae under the humeri and along lateral and apical edges of elytra. Striae very shallow, narrowly geminate, impunctate or with very small, shallow punctures. *Legs.*—Fore tibiae unmodified, spur normal. Claws normal, pulvillus present, very small. *Abdomen.*—Pygidium shagreened, with numerous small punctures with short, downwardly directed setae. Parameres of aedeagus tapering, the tips transversely expanded.

*Female*

Clypeus more distinctly bidentate (strongly excised between teeth in Northern Territory specimen in Figure 31). Frontoclypeal suture usually effaced, but may be carinate on sides only or be completely but feebly carinate. Otherwise like male.

*Type*

Holotype ♂, Murchison District, W.A., Jan. 1892, Helms, SAM. Seen by the author.

*Remarks*

The female from Townsville has a complete, though feeble, frontoclypeal carina, apparently paralleling the situation in *glabratus*, where the Queensland females also have a frontoclypeal carina. The female of *murchisoni* from Camballin, W.A., has a partial carina, effaced in the middle. The female from Areyonga, N.T. (central Australia), has a very deeply excised clypeal margin and proportionally small eyes (Fig. 31). There is slight variation also among populations in the degree of punctuation and extent of dorsal setae. Nevertheless, there is as yet no convincing evidence that more than one species is involved.

*Distribution* (Fig. 23)

An extraordinarily extensive distribution across Australia consistent with adaptation to very dry climates. The few available records suggest a general, but very spotty,

occurrence in areas with 10–20 in. of annual rainfall, occasionally in wetter areas in Western and northern Australia. It is one of five species known to occur in central Australia.

*Material Examined*

The type and 17 specimens. QUEENSLAND: Townsville, F. H. Taylor, ANIC 1. NORTHERN TERRITORY: Areyonga, 8.iii.1958, A. G. Woolcock, SAM, 2; Port Darwin, NMV, 1. WESTERN AUSTRALIA: Barrow I., 5, 26.v.1964, W. H. Butler, WAM, 8; Camballin, 29.ii.1968, J. A. L. Watson, ANIC, 1; Derby, Dec. 1947, F. H. Uther Baker, WAM, 2; Murchison District, Jan. 1892, Helms, SAM, 2.

## 4. ONTHOPHAGUS CARMODENSIS Blackburn

(Figs. 33, 463)

*Onthophagus carmodensis* Blackburn, 1907, p. 233.

*Macropocopris carmodensis*, Arrow, 1920, p. 436; Lea, 1923, p. 353; Boucomont and Gillett, 1927, p. 217.

Rufopiceous, antennal clubs fulvous. Total length 9–10 mm. The male is unknown.

*Female*

*Head.*—Clypeal margin medially bidentate, margin between teeth excised in a rounded V. Rest of margin feebly arcuate to genal angles, which are subangulate. Clypeal suture with frontal section largely effaced, present as indistinct ridges at sides only. Frons and vertex unarmed. Eyes moderately wide, with about 19 facet rows across widest point, separated by about 7 widths, canthus complete. Rugose and subasperate on clypeus and genae, becoming less so on frons; base of head smooth, sericeous, impunctate. Glabrous. Labium excised a little more than halfway to base. *Pronotum.*—Moderately convex, unsculptured. Anterior angles subquadrate, the apices angulate, a little turned out at angle. Hind edge unmargined. Evenly punctate with extremely small punctures, appearing impunctate, smooth, sericeous, glabrous. *Elytra.*—Intervals feebly convex, smooth, sericeous, impunctate, glabrous or with very short setae below humeri. Striae very shallow, geminate, with very small, shallow punctures. *Legs.*—Claws prehensile, last tarsal segment not very deep, no pulvillus. *Abdomen.*—Pygidium shagreened, smooth, with numerous punctures bearing very short setae.

*Type*

Holotype ♀, Carmod Bay, north W.A., Mr. French, BMNH. Seen by the author.

*Remarks*

This species is very close to *murchisoni*, from which it differs only in the slightly larger eyes and prehensile claws.

*Distribution* (Fig. 23)

The Kimberley District of Western Australia and Darwin, N.T. Only a few specimens have ever been collected.

*Material Examined*

The type and two specimens. WESTERN AUSTRALIA: West Kimberley, 29.iv.1946, P. J. Barwire, WAM, 1. NORTHERN TERRITORY: Port Darwin, H. J. Carter Coll., NMV, 1.

## 5. ONTHOPHAGUS GLABRATUS Hope

(Figs. 13, 34-36, 464)

*Onthophagus glabratus* Hope, 1841, p. 44; Hope, 1842, p. 424; Blackburn, 1903, p. 284; Boucomont and Gillett, 1927, p. 212.

*Onthophagus chillagoensis* Paulian, 1937, p. 344. New synonymy.

Rufopiceous to piceous, antennal clubs fuscous. Total length 7-12 mm.

*Male*

*Head.*—Clypeal margin broadly rounded, very slightly expanded in middle to a barely visible truncate lobe, not at all excised. Genal angles subangulate, not advanced, the margin behind them a little concave. Clypeal suture with frontal section effaced, sometimes with a trace of a transverse ridge. Frons and vertex unarmed, smooth. Eyes fairly large, with 19 facet rows across widest point, separated by 7 widths, canthus complete. Clypeus and anterior part of genae strongly transversely rugose, becoming more feebly rugose posteriorly, base of head smooth, very finely punctate. Head glabrous. Labium excised a little more than halfway to base. *Pronotum.*—Moderately convex, unsculptured. Anterior angles subquadrate, the apices rounded. Hind edge unmargined, may be finely margined laterally. Evenly and extremely finely punctate, appearing impunctate, glabrous, surface sericeous. *Elytra.*—Intervals very feebly convex, sericeous, impunctate, glabrous (Queensland specimens may have a very few short setae below humeri). Striae very shallow, geminate, with very small shallow punctures or impunctate. *Legs.*—Fore tibia unmodified, spur normal. Claws normal, large, bent at right angle (Fig. 13), no pulvillus. *Abdomen.*—Pygidium shagreened, with extremely small punctures, usually appearing impunctate, glabrous (Queensland specimens may have a few to many short bristles on pygidium). Parameres of aedeagus tapering, the tips transversely expanded.

*Female*

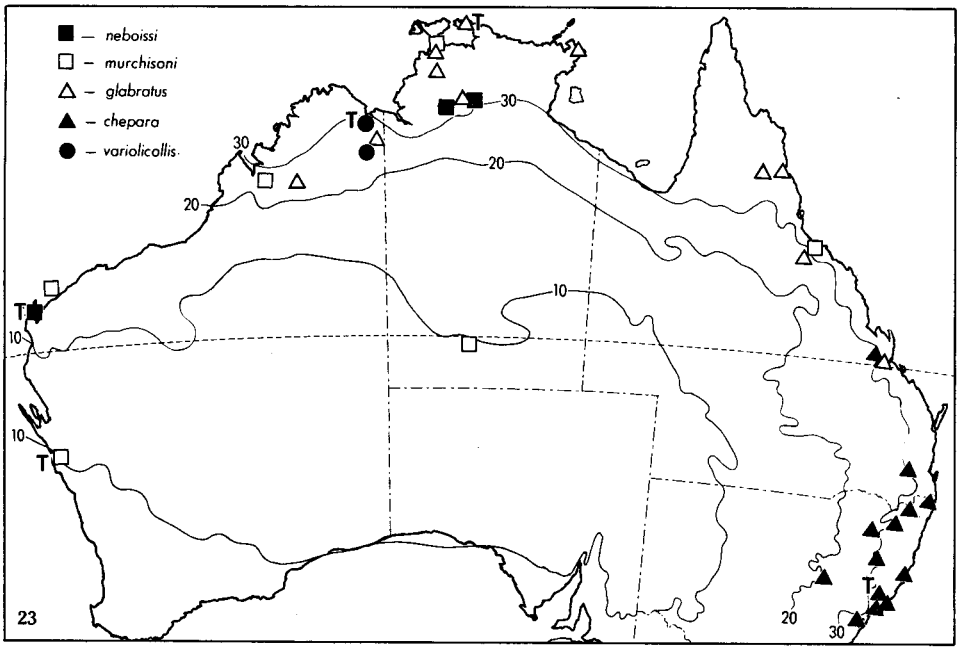
Western Australian and most Northern Territory females do not differ from the male except for a slightly wider and feebly bilobate clypeal margin. Some Northern Territory and all Queensland females differ from the male in possessing a complete frontoclypeal carina across head.

*Types*

Lectotype of *glabratus*: ♀, Port Essington, N.T., HM 464 1/3.
Holotype of *chillagoensis*: ♀, Chillagoe, Qld., Hacker, DEI.
Both seen by the author.

*Remarks*

Queensland specimens have a complete frontoclypeal carina in the female and usually bear setae on the pygidium and occasionally on the elytra below the humeri. One Northern Territory female (Tindal) also has a frontoclypeal carina but has a glabrous pygidium, as do some of the Queensland specimens. These differences are apparently infraspecific. The type of *chillagoensis* is a small female *glabratus*. A small male of this species in SAM from north Western Australia is a cotype of *fitzroyensis* Blackburn, who believed it to be the female of that species.



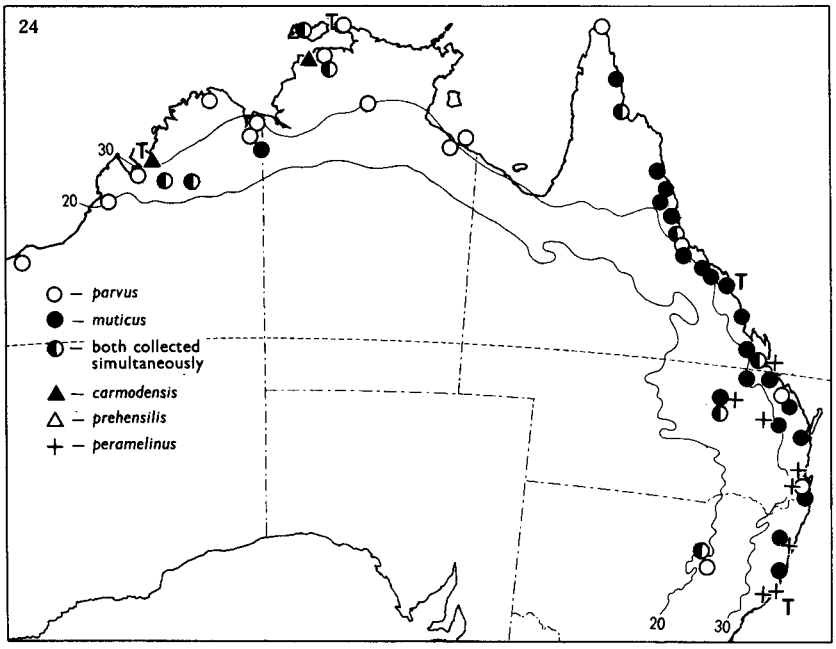
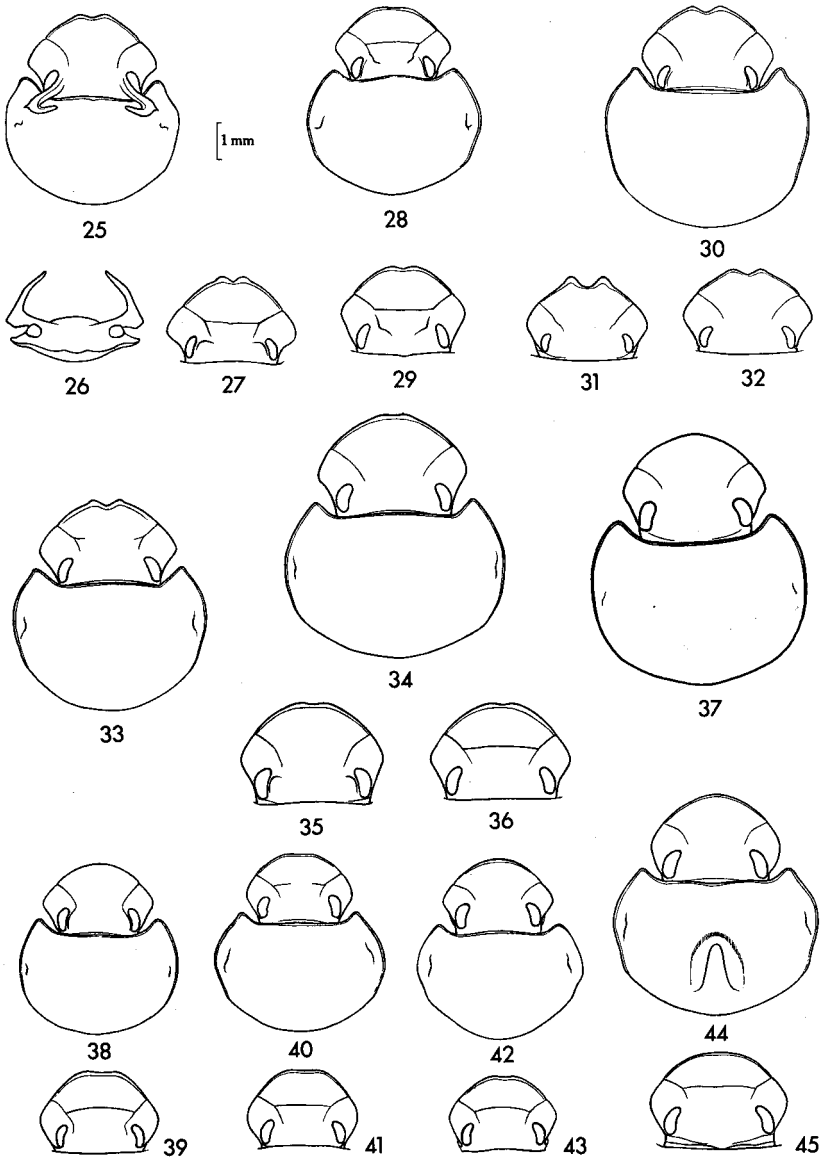




Fig. 23.–Known distribution of part of the *glabratus* group in relation to annual rainfall (in.). *T* next to a symbol points out the type locality of the corresponding species on all maps in the present work.

Fig. 24.–Known distribution of the rest of the *glabratus* group in relation to annual rainfall (in.).




Figs. 25–45.–*Onthophagus* spp.: *25–27*, *O. variolicollis*: *25*, male fore body; *26*, male head, front view; *27*, female head, dorsal view; *28*, *29*, *O. neboissi*: *28*, male fore body; *29*, female head; *30–32*, *O. murchisoni*: *30*, male fore body; *31*, female head, central Australia; *32*, female head, Kimberleys; *33*, *O. carmodensis*, female fore body; *34–36*, *O. glabratus*: *34*, male fore body; *35*, female head, Northern Territory; *36*, female head, Queensland; *37*, *O. prehensilis*, holotype male, fore body; *38*, *39*, *O. chepara*: *38*, male fore body; *39*, female head; *40*, *41*, *O. muticus*: *40*, male fore body; *41*, female head; *42*, *43*, *O. parvus*: *42*, male fore body; *43*, female head; *44*, *45*, *O. peramelinus*: *44*, male fore body; *45*, female head.

*Distribution* (Fig. 23)

The Kimberley District of Western Australia, the north of the Northern Territory, and north Queensland to the tropic, in regions of 30–50 in. of annual rainfall. At the time of the author's collecting in the Northern Territory, in January and February (months of heavy rainfall), *glabratus* was the most abundant species of *Onthophagus* in the region from Darwin to Adelaide River, in savannah woodland with sandy soil. In drier areas (with less than 50 in. annual rainfall), it still occurred, but more rarely and was replaced as the most abundant species by *consentaneus*. Trapped with human excrement bait. Nocturnal.

*Material Examined*

The types and 213 specimens. QUEENSLAND: Chillagoe, Clark, ANIC, 1; Helenslee Station homestead (20°32′S., 145°43′E.), 16.iii.1969, J. A. L. Watson, ANIC, 2; Ingham, Forrest Beach, 1.v.1964, G. F. Bornemissza, ANIC, 1; Mingela, 21.iv.1955, K. R. Norris and I. F. B. Common ANIC, 4; Mourangie near Edungalba, 50 miles SW. of Rockhampton, 26.xi.1968, Britton and Misko, ANIC, 1; Townsville, F. H. Taylor, ANIC, 8. NORTHERN TERRITORY: 1–17 miles N. of Adelaide River, 12.ii.1968, E. G. Matthews, ANIC, 82; 15–27 miles S. of Darwin, 29.i.1968, E. G. Matthews, ANIC, 46; Darwin, Lee Point, 28.i.1968, E. G. Matthews, ANIC, 25; Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 14; 2–4 miles E. of Katherine, 8.ii.1968, E. G. Matthews, ANIC, 8; Tindal (14°31′S., 132°22′E.), 1–20.xii.1967, W. J. M. Vestjens, ANIC, 10; Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 3; no exact data, SAM, 2. WESTERN AUSTRALIA: 37–59 miles W. of Fitzroy Crossing, 26.ii.1968, E. G. Matthews, ANIC, 4; K. R. S., Wyndham, Feb. 1954, WADA, 2; no exact data, SAM, 1.

## 6. ONTHOPHAGUS PREHENSILIS (Arrow), new combination

(Figs. 14, 37)

*Macropocopris prehensilis* Arrow, 1920, p. 436; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 218.

Piceous, antennal clubs fulvous. Total length 10.5 mm. The female is unknown.

*Male*

*Head.*–Clypeal margin broadly rounded, genal angles subangulate, not advanced, the margin behind them a little concave. Clypeal suture with frontal section completely effaced. Frons and vertex unarmed, smooth. Eyes fairly large, with about 20 facet rows, separated by about 7.5 widths, canthus complete. Clypeus and anterior part of genae transversely rugose, becoming more feebly rugose posteriorly, base of head smooth, finely punctate, head glabrous. Labium excised halfway to base. *Pronotum.*–Moderately convex, unsculptured. Anterior angles subquadrate, the apices rounded. Hind edge unmargined. Impunctate, glabrous, surface sericeous. *Elytra.*–Intervals flat, sericeous, impunctate. Striae very shallow, simple, impunctate. *Legs.*–Fore tibiae unmodified. Claws prehensile, bent at an acute angle, no pulvillus, tarsal spur long (Fig. 14). Apical tarsal segment normal, not very deep. *Abdomen.*–Pygidium shagreened, impunctate, glabrous. Aedeagus not examined.

*Type*

Holotype ♂, Kuranda, Qld., 19.ii.1909, G. E. Bryant, BMNH. Unique. Seen by the author.

*Remarks*

Except for the more sharply bent claws and a somewhat more obsolete striation and punctuation (possibly due to heavy wear), *prehensilis* is identical to *glabratus* and could even be a morph of the latter species.

*Distribution* (Fig. 24)

Known only from the type locality at Kuranda, on the Atherton Tableland, Qld.

### 7. ONTHOPHAGUS CHEPARA, sp. nov.

(Figs. 38, 39, 465)

Black, legs rufopiceous, antennal clubs flavous to fuscous. Total length 6.5–10 mm.

*Male*

*Head.*–Margin evenly rounded, slightly straightened at middle, reflexed, genal angles obtusely angulate. Clypeal suture with frontal section entirely effaced. Frons and vertex unarmed, flat. Eyes moderately large, with 14 facet rows across widest point, separated by 8 widths, canthus complete. Densely punctate with very small punctures, edges of head rugose, rest smooth to feebly rugulose, base smooth, surface alutaceous, glabrous. Labium excised a little more than halfway to base. *Pronotum.*–Moderately convex, unsculptured. Anterior angles subacute, the points rounded. Sides not strongly convex. Hind edge unmargined. Densely and extremely finely punctate, glabrous, surface nitid on disc, becoming sericeous toward anterior angles. *Elytra.*–Intervals flat, nitid, impunctate, glabrous. Striae impressed, simple, with small deep punctures a little wider than stria, not crenulating edges of intervals. *Metasternum.*–Posterior part of middle impunctate. *Legs.*–Fore tibiae unmodified. Spur large, tapering, curved out. Claws normal, pulvillus not visible. Bristles on outer edge of end of hind tibia with several longer ones. *Abdomen.*–Pygidium shagreened, with numerous small shallow punctures, glabrous. Parameres of aedeagus with points prolonged, transversely expanded.

*Female*

Clypeal surface more strongly rugose, frontoclypeal suture completely but feebly carinate. Otherwise like male.

*Type*

Holotype ♂, Gallagher's Camp, N.S.W., 14.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC.

*Distribution* (Fig. 24)

Northern New South Wales north from Sydney (Fairfield, Quaker's Hill) to west of Brisbane, being most frequently collected in the Barrington Tops area and the New England Tableland. Also, a few quite typical specimens were collected near Rockhampton and Proserpine, Qld., indicating a subcontinuous distribution up the eastern coast. A specimen in BMNH (lot 1947–431) is labelled as from Adelaide, a record which needs confirmation.

Probably a woodland species, collected at human excrement and at light. October–April.

*Material Examined*

The type and 72 specimens. NEW SOUTH WALES: Acacia Plateau, H. Davidson, ANIC, 2, Acacia Plateau via Legume, 9.i.1967, B. Cantrell, UQ, 5; Armidale, 1.xi.1959, C. W. Frazier, UNE, 2; Armidale, 2, 12.xii.1962, R. L. Davidson, ANIC, 2; Barrington House via Salisbury, 7.i.1967, G. Monteith, UQ, 8; Barrington Tops via Salisbury, 9.ii.1965, G. Monteith, CNC, 1; Bolivia, 13.iv.1965, G. F. Bornemissza, ANIC, 3; Branxton, 27.x.1960, P. B. Carne, ANIC, 1; Chiswick Experiment Station, near Armidale, 21.i.1968, ANIC, 1; Cumberland, BMNH, 1; 13 miles N. of Dunedoo, 23.iii.1963, R.B., NMV, 4; Fairfield (33°52′S., 150°57′E.), 1.iii.1960, M. I. Nikitin, BMNH, 1; Gallagher's Camp, 14.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 2; Hastings River, Paxton, ANIC, 1; Hastings River, 1935, H. Davidson, ANIC, 1; Lower Acacia Creek, 7.xii.1965, G. A. Yapp, ANIC, 2; McCoys Crossing near Kempsey, 4.i.1963, P. Aitken, SAM, 2; Noonameena Station, 28 miles SE. of Bingara, 7.i.1952, A. L. Dyce, ANIC, 12; Quaker's Hill, H. Davidson, ANIC, 2; 8 miles NW. of Stroud, 3.xii.1948, P. Carne and E. Britton, ANIC, 1; Tamworth, 17.i.1960, F. L. Edwards, BMNH, 2; Tamworth, 2.xii.1960, M. Edwards, CNC, 6, Tenterfield, Dec. 1943, G. Brooks, GB, 2; 1 mile W. of Uralla, 10.i.1967, B. Cantrell, UQ, 2; 4 miles W. of Woodenbong, 9.xii.1967, E. G. Matthews, ANIC, 1. QUEENSLAND: 6 miles W. of Gogango, 6.iv.1957, E. F. Riek, ANIC, 2; Greta Creek, 20 miles N. of Proserpine, 1.i.1965, G. Monteith, UQ, 1; Ravensbourne, 23.ii.1963, G. Monteith, UQ, 1.

## 8. ONTHOPHAGUS MUTICUS Macleay

(Figs. 13, 40, 41, 466)

*Onthophagus muticus* Macleay, 1864, p. 124; Blackburn, 1903, p. 295.

*Onthophagus kingi* Harold, 1869, p. 87.

*Macropocopris kingi*, Arrow, 1920, p. 436; Lea, 1923, pp. 353, 393; Boucomont and Gillet, 1927, p. 217.

Rufopiceous to black, antennal clubs fulvous. Total length 6–9 mm.

*Male*

*Head.*—Margin evenly rounded, slightly straightened at middle, reflexed, genal angles obtusely subangulate. Clypeal suture with frontal section entirely effaced. Frons and vertex unarmed, flat. Eyes large, with 17 facet rows across widest point, separated by 7 widths, canthus complete. Densely punctate with very small punctures, edges of head rugose, rest smooth to feebly rugulose, base smooth. Surface finely shagreened, alutaceous, glabrous. Labium excised more than halfway. *Pronotum.*—Moderately convex, unsculptured. Anterior angles subacute, the apices rounded. Sides not strongly convex. Hind edge unmargined. Densely and extremely finely punctate, glabrous, surface nitid on disc, becoming sericeous toward anterior angles. *Elytra.*—Intervals flat, sericeous, very finely punctate, glabrous. Striae very shallow, simple, with indistinct shallow punctures a little wider than stria, not crenulating edges of intervals. *Metasternum.*—Posterior part of middle glabrous. *Legs.*—Fore tibiae unmodified, spur acute, curved out. Claws moderately prehensile, pulvillus not visible. *Abdomen.*—Pygidium shagreened, with numerous very small shallow punctures, glabrous. Parameres of aedeagus with points prolonged, strongly transversely expanded.

*Female*

Clypeal surface more strongly rugose, frontoclypeal suture fully carinate. Otherwise like male.

*Types*

Holotype of *muticus*: ♀, Port Denison (Bowen), Qld., MM.

Holotype of *kingi*: ♂, Rockhampton, Qld., MNHN. Both seen by the author.

*Distribution* (Fig. 24)

This species and *parvus* have very much the same distribution across northern Australia in open sclerophyll forests and savannah woodlands, and eight different collection series across the continent contain the two species together (i.e. collected in the same place at the same time). Mr. Bolton found both species together throughout the year on agile wallabies near Darwin, often on the same host animal. This degree of sympatry between two closely related species is not known elsewhere in the genus. There is, however, some indication that the two species are active at somewhat different times of year (see Introduction).

At the extremes of the ranges the overlap with *parvus* is not complete. In northern New South Wales, *muticus* occurs nearer the coast (Jackadgery, Coff's Harbour), whereas *parvus* is apparently confined to drier inland areas. At the other end of the ranges, *muticus* was not found very far west of Fitzroy Crossing, W.A., whereas *parvus* extends to Derby, Broome, and Port Hedland. There is also a difference in the relative abundance of the two species (at least when occurring together) in east and west, as mentioned below under *parvus*. Like *parvus*, this species is found under excrement as well as attached to macropods. Dr. J. L. Gressitt records finding a specimen under kelp on a beach.

The macropods to which this species is recorded to have been attached are: red-necked wallaby, *Macropus rufogrisea* Desmarest (J. H. Calaby, Logan Village, Qld.) and agile wallaby, *Macropus agilis* Gould (B. L. Bolton, Tortilla Flats, N.T.).

Specimens have been collected in all months of the year except June, with most records falling in December and March.

*Material Examined*

The types and 244 specimens. NEW SOUTH WALES: Bowraville; Coff's Harbour; Collector (30°55'S., 149°26'E.); Jackadgery; Macleay River. QUEENSLAND: 40 miles S. of Ayr, Belmont, 8 miles NW. of Rockhampton; Bowen; 10 miles N. of Bowen; 35 miles NW. of Bowen; Brisbane; Byfield; Cairns; Canungra; Carnarvon Gorge; Cardwell Range; Clump Point; Edge Hill; Eidsvold; Finch Hatton; Gayndah; Gillie's Highway; Ingham; 30 miles N. of Injune; Iron Range; Logan Village; Lotus Creek, Sarina; Mackay; 3.5 miles S. of Marmor; Marlborough; Maryborough; Millstream Falls, Ravenshoe; 21 miles S. of Miriam Vale; Mt. Crosby; Mourangee, Edungalba; 10 miles S. of Mossman; Proserpine; Ravenshoe; Rodds Bay; Sarina; Silver Plains; Sunday Creek; Townsville; Woodford; Woodstock. NORTHERN TERRITORY: 70 miles S. of Darwin; Snake Bay, Melville I.; Tortilla Flats, 60 miles S. of Darwin. WESTERN AUSTRALIA: Fitzroy Crossing; 37–59 miles W. of Fitzroy Crossing; Kimberley Research Station, Kununurra.

## 9. ONTHOPHAGUS PARVUS Blanchard

(Figs. 13, 42, 43, 467)

*Onthophagus parvus* Blanchard, 1853, p. 101; Harold, 1869, p. 86; Blackburn, 1903, pp. 269, 286.

*Macropocopris parvus*, Arrow, 1920, p. 436; Lea, 1923, p. 393; Boucomont and Gillet, 1927, p. 217.

*Onthophagus inermis* Macleay, 1871, p. 183; Blackburn, 1903, pp. 282, 295 (syn.).

*Onthophagus submuticus* Blackburn, 1903, p. 294; Arrow, 1920, p. 435 (syn.).

Black, legs rufopiceous, antennal clubs fulvous. Total length 5.5-9.0 mm.

*Male*

*Head.*—Margin rounded, reflexed, barely emarginate in middle, genal angles rounded. Clypeal suture with frontal section entirely effaced or present laterally as an indistinct ridge. Frons and vertex unarmed, flat. Eyes large, with 18 facet rows across widest point, separated by 6 widths, canthus complete. Densely punctate with small punctures, edges of head feebly rugulose, rest smooth, surface nitid, glabrous. Labium excised about halfway to base. *Pronotum.*—Moderately convex and unsculptured. Anterior angles quadrate, the apices rounded. Lateral margins strongly rounded and prominent in major male. Hind edge unmargined. Densely, evenly punctate with extremely small punctures, glabrous, surface smooth, very nitid. *Elytra.*—Intervals moderately convex, nitid, very finely punctate, glabrous except for last interval, which has a group of short setae below humerus and a single row of short setae along epipleural edge to apex. Striae impressed, finely geminate, with deep punctures a little wider than stria and slightly crenulating edges of intervals. *Metasternum.*—Posterior part of middle with setigerous punctures. *Legs.*—Fore tibia with inner apical angle produced into a short tooth, spur acute, bent out. Claws strongly prehensile, pulvillus present, distinct but reduced. *Abdomen.*—Pygidium finely shagreened, alutaceous to nitid, densely punctate with small deep punctures, laterally with groups of short setae. Parameres of aedeagus with points elongated, strongly transversely expanded.

*Female*

Clypeal surface strongly rugose, frontoclypeal suture entirely carinate, or briefly interrupted in middle. Sides of prothorax not strongly rounded. Fore tibia with inner apical angle not produced. Otherwise like male.

*Types*

Holotype of *parvus*: probably ♂, Raffles Bay, N.T., MNHN, not found.

Holotype of *inermis*: ♂, Gayndah, Qld., MM.

Holotype of *submuticus*: ♂, north Queensland, BMNH. The two latter seen by the author.

*Distribution* (Fig. 24)

From the interior of New South Wales in the Pilliga Scrub area along eastern Queensland to Cape York, westward across northern Australia as far as Port Hedland, W.A., in areas of about 15 to about 50 in. of annual rainfall. While almost completely sympatric with *muticus* (q.v.), it appears to be more abundant in drier areas than the latter species. In the eight areas where both species appeared in the same collection series (see map), the average ratio of *parvus* to *muticus* in the series was about 4 : 1 in western localities (Western Australia and Northern Territory), while it was 1 : 2 in Queensland localities. At Fitzroy Crossing, W.A., in February 1968, *parvus* outnumbered *muticus* by about 13 to 1, while in the Derby area *muticus* did not occur at all. In the latter region *parvus* was very abundant, matching *consentaneus* in this respect.

While *parvus* is one of the prehensile species, it is most frequently encountered in and under macropod droppings in open dry scrubland or savannah. Near Derby it

was abundant also in cow dung in open woodland. It is nocturnal and frequently caught at light.

The macropod species to which it has been reported clinging are: agile wallaby, *Macropus agilis* Gould (B. L. Bolton, Tortilla Flats, N.T.), northern nail-tail wallaby, *Onychogalea unguifer* Gould (W. H. Baker, Kalumburu, W.A.), and spectacled hare-wallaby, *Lagorchestes conspicillatus* Gould (W. H. Butler, Barrow I., W.A.).

Specimens have been collected in all months of the year except June, August, and November, with a peak in January.

*Material Examined*

The types and 286 specimens. NEW SOUTH WALES: Collector, 30°55′S., 149°26′E.; Pilliga. QUEENSLAND: Belmont, 8 miles NW. of Rockhampton; Brisbane; Coen; Crystal Ck., 23 miles SSE. of Ingham; 48 miles N. of Goondiwindi; Ingham; 20 miles N. of Injune; Jardine River; Lockerbie; 10 miles S. of Miriam Vale; 2 miles ENE. of Rollingstone; Silver Plains; 14 miles N. of Tamborine; Yeppoon. NORTHERN TERRITORY: Borroloola; 70 miles S. of Darwin, Howard Springs; Katherine; Sir Edward Pellew Group; Snake Bay, Melville I.; Tortilla Flats, 60 miles S. of Darwin. WESTERN AUSTRALIA: Barrow I.; Broome; Camballin; Derby; 8–35 miles S. of Derby; Fitzroy Crossing; 37–59 miles W. of Fitzroy Crossing; Kalumburu; Kununurra; 60 miles NW. of Kununurra; Port Hedland; Roebuck Bay.

## 10. ONTHOPHAGUS PERAMELINUS (Lea), new combination

(Figs. 15, 44, 45, 468)

*Macropocopris peramelinus* Lea, 1923, p. 393; Boucomont and Gillet, 1927, p. 218.
*Onthophagus postcornutus* Frey, 1963, p. 539. New synonymy.

Rufopiceous to piceous, antennal clubs flavous. Total length 8–11 mm.

*Male*

*Head.*—Margin evenly rounded, reflexed, very slightly produced medially in major male, genal angles rounded. Clypeal suture with frontal section entirely effaced. Frons and vertex unarmed, flat. Eyes large, with 14 facet rows across widest point, separated by 6.5 widths, canthus complete. Densely punctate with very small punctures, smooth, becoming feebly rugulose along edges, surface nitid, glabrous. Labium excised halfway to base. *Pronotum.*—Strongly convex, in minor male with a slight tumescence on midline in front of middle, with more development this tumescence moves backward and becomes conical with a depression just before it. In major male a long, forwardly inclined, flattened horn arising from near hind edge of pronotum, preceded by a depression. Anterior angles acute, the apices rounded. Hind edge unmargined. Appearing impunctate, surface smooth, alutaceous, glabrous. *Elytra.*—Intervals flat on disc, very slightly convex laterally, smooth, impunctate, alutaceous, glabrous. Striae shallow, simple, with numerous impressed transverse punctures not crenulating edges of intervals. *Metasternum.*—Posterior part of middle with several large setigerous punctures. *Legs.*—Fore tibia unmodified, spur large. Claws strongly prehensile, tarsal spur keeled (Fig. 15), pulvillus absent. *Abdomen.*—Pygidium shagreened, densely punctate with deep, medium-sized punctures, glabrous. Parameres of aedeagus normal.

*Female*

Clypeal surface entirely transversely rugose, frontoclypeal suture carinate, pronotum devoid of tumescence or horn. Otherwise like male.

*Types*

Holotype of *peramelinus*: ♂, Wingham, N.S.W., W. du Boulay, SAM I 15396. Seen by the author.

Holotype of *postcornutus*: ♂, Manango, Qld., 25.xi.1962, H. Demarz. Not seen.

*Remarks*

The description and figure of *postcornutus* are unmistakeably those of this species. Although Frey did not notice the claws, the artist clearly drew an enlarged front tarsus and claw in the figure (Frey 1963, p. 539, fig. 2).

*Distribution* (Fig. 24)

Southern Queensland and northern New South Wales between the tropic and Wingham, mostly in montane areas. The type was supposedly collected in a nest of bandicoot, *Perameles nasuta* Geoffroy, but no mammal was found in this nest and Mr. J. H. Calaby believes this record is erroneous and that the nest was one of a rat-kangaroo, *Aepyprymnus rufescens* Grey, which builds similar nests. The fur of the bandicoot is short and coarse and it is unlikely that the beetles could cling to it (Calaby 1962), while on the other hand Mr. Calaby collected three specimens of *peramelinus* clinging to a rat-kangaroo near Tooloom, N.S.W. This is the only verified mammal host for this beetle. Two specimens have been collected at human excrement and the collecting method for the remainder is not specified. The few available records are from December to April.

*Material Examined*

The holotype and 17 specimens. NEW SOUTH WALES: Glenugie, 15 miles S. of Grafton, 10.xii.1965, G. Yapp, ANIC, 1; Inverell, J. Stephen, NMV, 1; Tooloom, 14.ii.1961, J. H. Calaby, ANIC, 3; Upper Yarraman, 7.xii.1966, S. D. Clydsdale, ANIC, 1. QUEENSLAND: Bulimba, UQ, 1; Camboon, Mar. 1939, K. Jackson, QM, 7; Carnarvon Gorge, 9.iv.1965, G. F. Bornemissza and G. Yapp, ANIC, 1; Cawarral, NMV, 1; Mt. Mee, d'Aguilar Range, 30.iii.1962, G. Monteith, UQ, 1.

## II. *The* ATROX *Group*

Eyes wide, with 22–36 facet rows across widest point, the lenses apparently fused to form a nearly smooth transparent pane over eye, eyes separated by 8–10 widths, canthus complete. Labium excised nearly to base, the excision parallel-sided and densely fringed with setae (Fig. 16), middle of base of labium at end of excision membranous, flexible, and deeply concave. Pronotum either glabrous or with setae on anterior declivities. Elytra glabrous or with short setae along basal edges. Pygidium with short setae. Colour entirely black. Total length 10–23 mm, usually 15–20 mm.

Male with frontoclypeal suture carinate, head usually armed, pronotum ornately sculptured or armed. Fore tibia elongated or not, but always without a distal brush of long setae. Female sculptured on both head and pronotum.

Thirteen species: 11, *solidus* Gillet; 12. *leai* Blackburn; 13. *pentacanthus* Harold; 14. *mniszechi* Harold; 15. *ferox* Harold; 16. *sloanei* Blackburn; 17. *mjobergi* Gillet; 18. *quinquetuberculatus* Macleay; 19. *pugnacior* Blackburn; 20. *atrox* Harold; 21. *capitosus* Harold; 22. *laminatus* Macleay; 23. *demarzi* Frey.

The species making up this group are usually recognizable by their size alone. The split labium appears to serve as a supplementary pair of maxillae, as the two halves

are slightly movable in dead specimens. This labial structure is also seen in the following group (III. *conspicuus*). Erichson (1848) proposed a separate genus, which he named *Monapus*, for species with the labium divided to the base. This genus was based on an unnamed Australian species which from its description was either *mniszechi* or *ferox*, named later by Harold (1869).

This labial structure is certainly striking and might merit generic separation for the 21 species which possess it (the *atrox* and *conspicuus* groups), were it not for the facts that there is no other character which correlates completely with the labial structure, and that some species in the *conspicuus* group have somewhat less deeply incised labia merging with the condition seen in other *Onthophagus*. Furthermore, it is not known to what extent other species of the genus, outside Australia, also have this condition. In general among Australian species of *Onthophagus*, the larger the beetle the more deeply split is the labium. The *atrox* group of species, in accordance with their size, have carried this trend to its extreme.

There are no strictly woodland or forest forms in this group, although a few occur in shaded savannah woodland situations. A number are found in xeric habitats, at least in part (*demarzi*, *ferox*, *laminatus*, *mjobergi*, and *pentacanthus*), while *sloanei* is a true desert form.

## KEY TO SPECIES OF THE *ATROX* GROUP

1. Both sexes with a single erect frontal horn or a strong erect, 3-pointed, 5-pointed, or quadrate transverse frontal crest; both sexes with similar ornamentation, with median pronotal prominences acute, laminate, or corniform in major individuals, quadrate and pyramidal in minor ones; fore tibiae of male not much slenderer or more bent than those of female. Southern species (except *solidus*) ..... 2

   Frons never with a single horn or pointed crest; sexes differing in their pronotal and cephalic ornamentation, median pronotal prominences not corniform or acute; fore tibiae of male markedly slenderer than those of female. Central and northern species ..... 6

2(1). Frons with a strong erect transverse carina; median pronotal prominences laminate or pyramidal, lateral ones tuberculiform, indistinct ..... 3

   Frons with a conical horn; lateral pronotal prominences, if present, not tuberculiform ..... 4

3(2). Frontal carina with 3 points or angles in minor male and female, 5 points in major male; median pronotal prominences pyramidal. N. N.T. ..... 11. *solidus* Gillet

   Frontal carina quadrate in minor individuals, with 3 points in major ones; median pronotal prominences laminate. E. N.S.W. ..... 12. *leai* Blackburn

4(2). Lateral pronotal prominences acute, prominent, laminate, resembling median ones. SE. S.A., C. N.S.W. ..... 13. *pentacanthus* Harold

   Lateral pronotal prominences absent or, if present, carinate, much smaller than median ones ..... 5

5(4). Median pronotal prominences flattened, basally widened, concavities flanking them margined externally by a pointed carina in major male; front of head horn rugose; lateral pronotal angles rounded. SE. S.A., S. Vic. ..... 14. *mniszechi* Harold

   Median pronotal prominences conical, slenderer, concavities flanking them not externally margined; front of head horn smooth; lateral pronotal angles angular. S. W.A., S. N.T. ..... 15. *ferox* Harold

6(1). Anterior surface of pronotum with at least a few setae (reduced to stubble in worn individuals; examine in oblique light) ..... 7

   Entire surface of pronotum without any trace of setae ..... 8

7(6). Front of pronotum very sparsely setose, the setae usually short; male with median tubercle or raised area on frontoclypeal suture; median pronotal prominences somewhat like inverted W, the median points and ends angular and tuberculate in major male, rounded and not tuberculate in minor ones; median points distinctly separated; female with median pronotal prominence distinctly concave in middle; clypeal margin strongly bilobate; both female and minor male with frontal carina raised to 2 lateral points. N. W.A., S. N.T. ..... 16. *sloanei* Blackburn

Front of pronotum more densely setose, the setae usually long; frontoclypeal suture of male without median tubercle, median pronotal prominences like inverted V or U, with the apex bi- or unituberculate; female with median pronotal carina straight or evenly procurved; clypeal margin feebly bilobate or medially truncate; only females with frontal carina raised to lateral points. N. W.A., N. N.T. ..... 17. *mjobergi* Gillet

8(6). Clypeal suture strongly angulate, with frontal section more strongly raised than genal sections; male with frontal carina inclined backward into a strong, bifurcate lamina covering base of head ..... 9

Clypeal suture not strongly angulate, the frontal section not more raised; male without a lamina over base of head ..... 10

9(8). Clypeal suture with the angles raised into a pair of transverse processes in front of eyes in both sexes; male with frontal lamina terminating in 4 points, the outer ones much longer, the margin between inner points excised in a U; median pronotal carina straight, more or less interrupted in middle. N. W.A., N. N.T. ..... 23. *demarzi* Frey

Clypeal suture not raised at angles; male with frontal lamina terminating in 2 upraised lateral points, the margin between these points excised in a V in major male, or nearly straight in minor male; median pronotal carina semicircular, uninterrupted. N. Qld., N. N.T., N. W.A. ..... 22. *laminatus* Macleay

10(8). Genae with depressed smooth area just before eyes; male with median pronotal prominence an inverted V, the apex bituberculate and the ends each with 1 tubercle; female and minor male with frontal carina raised laterally into a pair of points set close to eyes. C. Qld. ..... 18. *quinquetuberculatus* Macleay

Genae without depressed smooth area; male with median pronotal prominences not V-shaped; if frontal carina is raised to 2 points, these are not very close to eyes..... 11

11(10). Clypeal suture interrupted into 2 distinct lateral parts and 1 indistinct middle part, the sections between these effaced; middle part set well behind lateral parts because of strong backward curve of middle section of suture; clypeal margin distinctly bilobate, especially in female; frontal carina not strongly raised in either sex; female median pronotal carina indistinct or absent. N. Qld., N. N.T. ..... 21. *capitosus* Harold

Clypeal suture entirely distinct, not strongly curved back in middle; clypeal margin bilobate or not; female frontal carina strongly raised, with median pronotal carina distinct ..... 12

12(11). Frontoclypeal suture usually with a median tubercle or raised section; anterior declivities of pronotum densely punctate; male with clypeal margin truncate; frontal carina nearly straight, largely paralleling occipital margin, median pronotal prominences biarcuate; distance between points on frontal carina of female much more than one-third interocular distance. N. N.S.W., Qld. ..... 20. *atrox* Harold

Frontoclypeal suture without median tubercle; anterior declivities of pronotum densely but very finely asperate or granulate; male with clypeal margin bilobate, produced, frontal carina evenly procurved, median pronotal prominences tending to be angulate; distance between points on frontal carina of female about one-third interocular distance. C. Qld., N. W.A. ..... 19. *pugnacior* Blackburn

## 11. ONTHOPHAGUS SOLIDUS Gillet

(Figs. 50, 51, 469)

*Onthophagus solidus* Gillet, 1927, p. 257.

Black, antennal clubs rufous or flavous. Total length 17–18 mm.

*Male*

*Head.*—Anterior margin of clypeus not produced, very slightly truncate. Clypeal suture somewhat sinuate, without median tubercle, genal sections joining frontal very near margin. A low tubercle on genal sutures behind clypeal carina. Carina on vertex very strongly raised into 1 long median point and 2 lateral teeth on each side; the margin between these also raised into a lobe on each side, giving carina a total of 5 prominences in major male. In minor male these reduced to 3 angles, the middle one highest. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths. Clypeal surface densely, finely transversely rugose, rest of head except back of vertical carina finely punctate and rugose, back of vertical carina smooth, finely shagreened. Labium split nearly to base. *Pronotum.*—With 2 large separated median pyramidal projections and 1 smaller tubercle on each side. Anterior angles prominent. Hind edge distinctly margined. Disc densely but finely punctate, becoming more coarsely punctate anteriorly and laterally, the punctures separated by indistinct rugae. Dorsal surfaces of median projections densely and coarsely rugose and punctate, bordered anteriorly and laterally by a distinct margin, which abruptly separates rugose dorsal surface from smooth, very finely punctate anterior declivity, which is vertical and glabrous. *Elytra.*—Intervals flat dorsally, becoming moderately convex laterally, very finely shagreened, impunctate, with very short fine setae along entire sides. Striae very fine, impunctate, distinctly but shallowly impressed. *Legs.*—Fore tibia not appreciably slender or elongated. *Abdomen.*—Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each bearing a short fine seta. Aedeagus normal.

*Female*

Like minor male, with a transverse frontal carina raised at the ends and middle into 3 distinct angles. Pronotum armed as in male and otherwise like male.

*Type*

Holotype ♂, Port Issling, BMNH. Seen by the author.

*Distribution* (Fig. 49)

The type locality of "Port Issling" could not be found on any map or in any historical account consulted. The type specimen was collected in the early part of the nineteenth century. The remaining known specimens are all from the north of the Northern Territory.

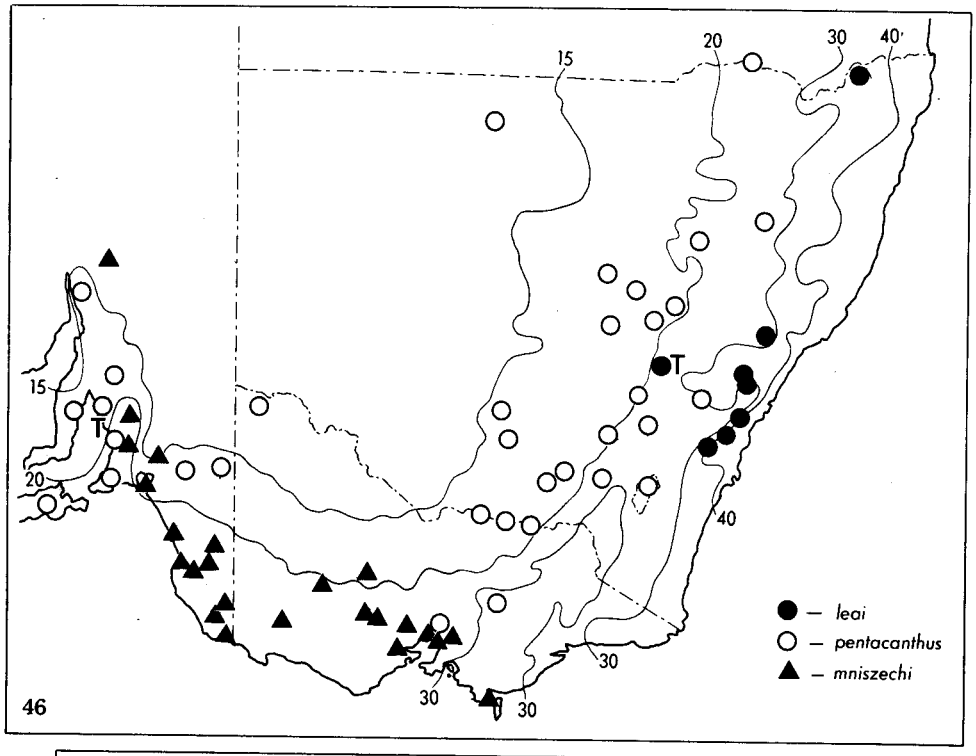
*Material Examined*

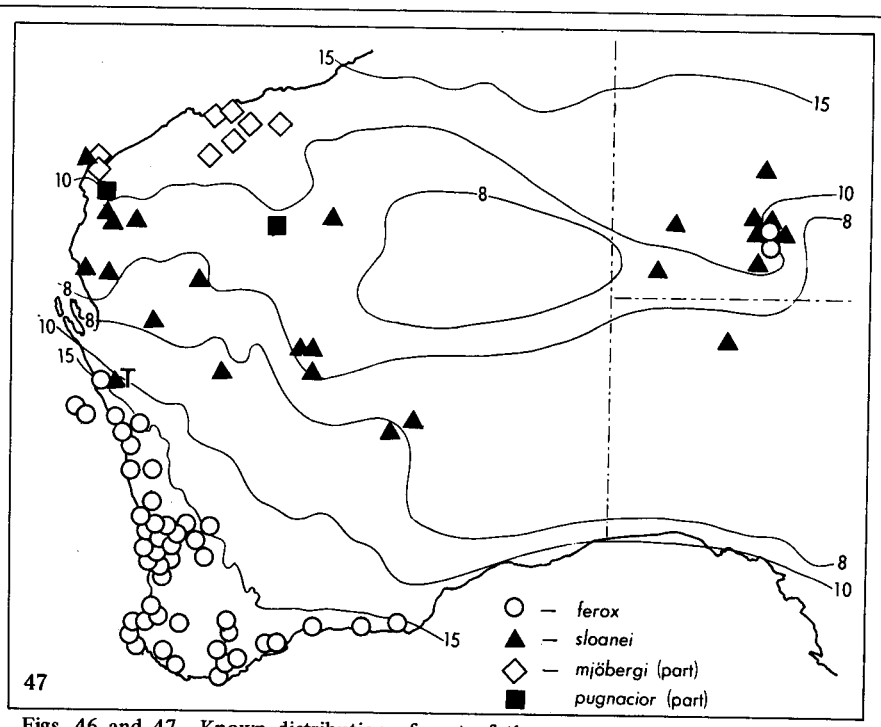
The type and six specimens. NORTHERN TERRITORY: Alligator R., 22.ix.1914, M. Cahill, NMV, 1; 70 miles S. of Darwin, Dec. 1969, B. L. Bolton, ANIC, 1; Oenpelli, Dec. 1918, P. Cahill, NMV, 2; Melville I., W. D. Dodd, SAM, 2.

## 12. ONTHOPHAGUS LEAI Blackburn

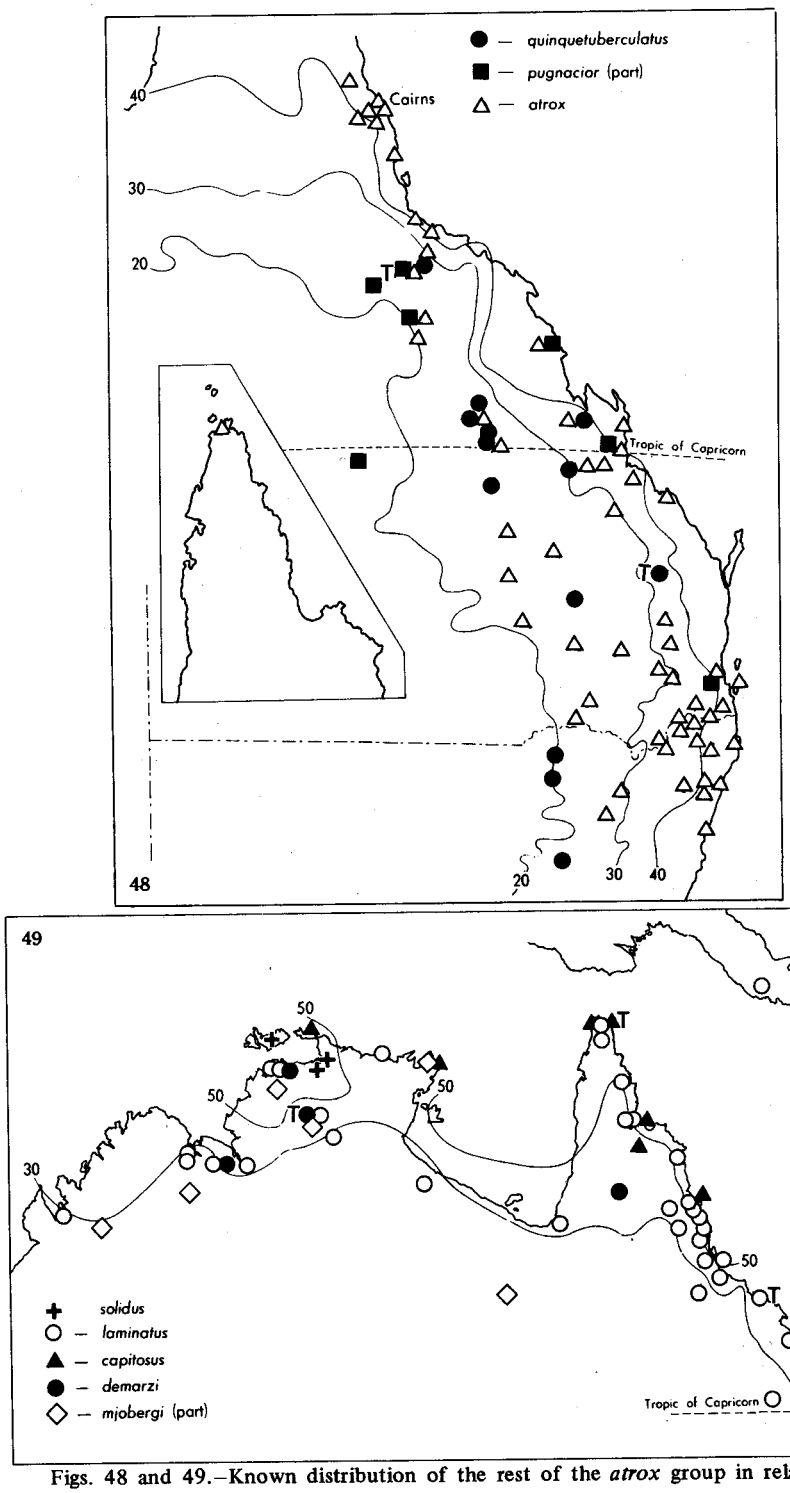
(Figs. 52–54, 470)

*Onthophagus leai* Blackburn, 1895, p. 31; Blackburn, 1903, p. 267; Lea, 1923, p. 370; Boucomont and Gillet, 1927, p. 213.




Figs. 46 and 47.—Known distribution of part of the *atrox* group in relation to annual rainfall (in.).




Figs. 48 and 49.–Known distribution of the rest of the *atrox* group in relation to annual rainfall (in.).

Entirely black, antennal clubs rufous. Total length 17–23 mm.

*Male*

*Head.*–Clypeal margin semicircular, not drawn out or strongly reflexed, very slightly truncate medially. Genal margins rounded. Frontoclypeal suture a little curved forward, the frontal section very long, meeting genal sections very near margins, without median tubercle. Frons with a very strong transverse carina running between eyes, this carina low and with perpendicular edges in minor individuals, very high (4 mm), 3-pointed, and with diverging edges in major individuals. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Entire head surface densely transversely rugose except for posterior surface of frontal carina, which is smooth. Labium split nearly to base. *Pronotum.*–With 2 large divergent flattened median laminae directed forward in major male, 2 approximated pyramidal projections in minor male. Pronotum behind eyes with a concavity, deeper in major male, flanked outwardly by a distinct tubercle. Anterior angles very broadly rounded. Hind edge strongly margined. Disc and sides coarsely longitudinally rugose, anterior declivities and cavities smooth, very finely punctate, with a few recumbent setae. *Elytra.*–Intervals flat dorsally, becoming moderately convex laterally. Striae very fine, impunctate, distinctly but shallowly impressed. Very finely shagreened, impunctate, with a few short setae along sides. *Legs.*–Fore tibiae not elongated, spur normal. *Abdomen.*–Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each bearing a short fine seta. Aedeagus normal.

*Female*

Differs from male only in the relatively shorter horns for a given size, and frontal lamina has a lower median point.

*Type*

Holotype ♂, Forest Reefs, N.S.W., BMNH. Seen by the author.

*Distribution* (Fig. 46)

This species is known from a relatively small geographical area inland from Sydney, in sandstone hills. There is also a single specimen labelled Acacia Plateau, near the Queensland border. It occurs in tree-shaded situations, usually under cow dung and human excrement. Most specimens were collected in March and April, and a few in July and October.

*Material Examined*

The type and 24 specimens. NEW SOUTH WALES: Acacia Plateau, July 1947, GB, 1; Caddy Park, near Cattai, 4.iv.1968, E. B. Britton and L. Mound, ANIC, 2; Gallagher's Camp, 14.iv.1965, 14.iii.1965, G. F. Bornemissza and G. Yapp, ANIC, 6; 13 miles N. of Marulan, 4.iv.1964, 15.x.1964, G. F. Bornemissza, ANIC, 5; Mittagong, Feb. 1901, J. J. W., BMNH, 1; Mittagong, ANIC, 1; Quaker's Hill, H. Davidson, ANIC, 4; Picton, H. Davidson, ANIC, 1; Richmond, Apr. 1949, A. Dyce, ANIC, 1; Windsor, H. J. Carter, ANIC, 1.

## 13. ONTHOPHAGUS PENTACANTHUS Harold

(Figs. 55, 56, 471)

*Onthophagus pentacanthus* Harold, 1867, pp. 24, 27; Harold, 1869, pp. 80, 81, 85; Lea, 1923, p. 367; Boucomont and Gillet, 1927, p. 214.

Entirely black, antennal clubs rufous. Total length 14–20 mm.

*Male*

*Head.*—Clypeal margin not produced, semicircular, not appreciably reflexed, with 2 very small median lobes, genal angles rounded. Clypeal suture with frontal section slightly curved forward, also arched upward in major individuals, meeting genal section near margins. Frons with a single acute erect conical horn, very long (6 mm) in major individuals, short (1–2 mm) in minor ones but always present. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Densely punctate, especially on clypeus, where there is a tendency to form transverse rugosities. Entire head surface rugose in minor individuals. Area at back of horn smooth, horn sparsely setose along sides. Labium split nearly to base. *Pronotum.*—With 2 median projections, acute in major individuals and pyramidal in minor ones, separated from acute and somewhat laminate lateral projections by a depression, very deep in major individuals. All 4 projections directed upward and forward. Anterior angles rounded, the margin behind them somewhat sinuate, forming prominent lateral angles. Hind edge strongly margined. Disc and sides coarsely rugose, more so in minor individuals, anterior declivities and pits between median and lateral projections smooth, bearing moderately dense, long setae in major individuals. *Elytra.*—Intervals flat dorsally, becoming moderately convex laterally, very finely shagreened, impunctate, glabrous except for numerous short setae along sides. Striae very fine, impunctate, distinctly but shallowly impressed. *Legs.*—Fore tibiae not elongated, spur normal. *Abdomen.*—Pygidium densely clothed with long rufous hairs in fresh individuals. Aedeagus normal.

*Female*

Very similar to male, with same type of cephalic and pronotal armament, but with clypeal margin more produced, reflexed, and bilobate, with cephalic and pronotal surfaces more strongly rugose, and the horns proportionately smaller for a given individual size.

*Type*

Lectotype ♂, Adelaide, S.A. In MNHN(Ob) there are eight specimens over the label *pentacanthus*, all ex musaeo Harold, four with the additional label H. Deyr [olle], and four with the label "Adelaide". All are of the same species. One of the males bearing the Adelaide label is selected as lectotype by the author and was so marked.

*Remarks*

The specimens described as the female of *pentacanthus* by Harold (1867, p. 25) may actually have been *atrox*, as stated by Harold himself later (1869, p. 80), but *atrox* does not occur in South Australia. Harold (1867, p. 25) was wrong in placing *quadridentatus* Hope as a synonym of *pentacanthus*. It is actually a synonym of *capitosus* Harold, as pointed out by Gillet (1925).

*Distribution* (Fig. 46)

From the east coast of Spencer Gulf, S.A., eastward through upper Victoria to the western slopes of the Great Dividing Range in New South Wales, as far as the Queensland border, occupying much of the eastern part of the Murray-Darling Basin. Throughout its range it coincides closely with the area between the 15- and 20-in.

annual isohyets and thus is typical of the south-eastern inland distribution pattern. It is nocturnal and frequently comes to light at the Black Mountain laboratory in Canberra at the eastern edge of its distribution. Collected in all months of the year, but there are few records from June–August, with apparent peaks of adult abundance in April and October.

*Material Examined*

The type and 255 specimens. SOUTH AUSTRALIA: Adelaide; Ardrossan; Blanchtown; Buccleuch; Clare, Hill R.; Hincks National Park, Kangaroo I., West Emu Bay; Mt. Compass; Mt. Remarkable; Murray Bridge; 12 miles W. of Pinnaroo; 8 miles E. of Port Augusta; 4 miles S. of Sherlock; Tepper; Wild Horse Plains. VICTORIA: Cobram; 9 miles N. of Jamieson; L. Cullulleraine; Melbourne; Rutherglen. AUSTRALIAN CAPITAL TERRITORY: Black Mountain; Canberra; Reid. NEW SOUTH WALES: Armstrong, 34°10′S., 149°58′E.; Beelbangera; 26 miles NE. of Binnaway; Bogan R.; 19 miles NE. of Boorowa; 42 miles N. of Bourke; Brommagem via Dubbo; Caldwell; Corowa; Cowra; Cucumgillica; Dubbo; Fashions Mountain via Mumbil; Finley; Grenfell; Gundagai; Howlong; Narara; Narrandera; Port Willunga; Tamworth; The Rock; Trangie; 10 miles NE. of Trangie; Wagga Wagga; 5 miles SSW. of Wallendbeen; Warrumbungle National Park; Canyon Camp; Wyaldra; Yanco. QUEENSLAND: 48 miles N. of Goondiwindi.

## 14. ONTHOPHAGUS MNISZECHI Harold

(Figs. 57, 58, 472)

*Onthophagus mniszechi* Harold, 1869, p. 80; Blackburn, 1903, p. 267.

*Onthophagus ferox* var. *mniszechi*, Lea, 1923, p. 354; Gillet, 1925, p. 7; Boucomont and Gillet, 1927, p. 211.

Entirely black, antennal clubs rufous. Total length 15–22 mm.

*Male*

*Head.*—Clypeal margin nearly semicircular, not appreciably produced or reflexed, with a very feeble truncate lobe medially, genal margins rounded. Clypeal suture with frontal section largely straight or feebly arcuate or bisinuate, meeting genal sections very near margins, without median tubercle. Frons with a single erect conical horn, long (6 mm) in major individuals, short (1–2 mm) but always present in minor ones. A trace of a carina extending from each eye to base of horn. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Clypeal surface densely and somewhat transversely rugose, genae and front of horn less densely rugose, rest of head surface smooth, glabrous except for fine setae on horn. Labium split nearly to base. *Pronotum.*—With 2 large divergent flattened median horns directed forward in major male, these horns flanked by a pair of moderate concavities which are margined externally by a vertical carina terminating in a point. No lateral tubercles. Minor male with median horns reduced to a pair of approximated pyramidal projections, the concavities flanking them very shallow and not laterally margined. Anterior angles very broadly rounded. Hind edge distinctly margined. Disc and sides coarsely longitudinally rugose, anterior declivities and cavities smooth, very finely punctate, with short fine setae. *Elytra.*—Intervals flat dorsally, becoming moderately convex laterally, very finely shagreened, impunctate, glabrous or with short setae along sides. Striae very fine, impunctate, distinctly but shallowly impressed. *Legs.*—Fore tibia not elongated, spur normal. *Abdomen.*—Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each bearing a short fine seta. Aedeagus normal.

*Female*

Very similar to male, with the same type of armament, with the horns, however, proportionately a little shorter for a given size of individual. Figure 58 shows a minor female. Major female with pronotal armament almost as developed as that of major male, but with lateral margins of concavities less sharp.

*Type*

Holotype ♂, Australia. There are 19 specimens in MNHN(Ob) over the *mniszechi* label. All are of the same species. One only is labelled *mniszechi* Harold in Harold's own handwriting and is ex musaeo Harold. This specimen is considered to be the holotype and was so marked by the author.

*Remarks*

*O. mniszechi* is listed by Lea (1923, p. 354), Gillet (1925, p. 7), and Boucomont and Gillet (1927, p. 211) as a synonym of *ferox*. In fact, the species are quite distinct (see key) and geographically separate, and are here again formally separated.

*Distribution* (Fig. 46)

The south-east of South Australia from the Flinders Ranges southward and eastward along southern Victoria to Wilsons Promontory, apparently becoming increasingly restricted to coastal habitats toward the east. Throughout most of its range its inland limits correspond closely to the 20-in. isohyet, where it is replaced to the north by the allied *pentacanthus*. Collected in open pastures primarily from August to November and again in April and May.

*Material Examined*

The type and 153 specimens. SOUTH AUSTRALIA: Adelaide; Blackwood; Blanchtown; Buckulowie Ck., Hawker; Kingston; 35 miles N. of Kingston; Lucindale; 5 miles E. of Mt. Burr; 17 miles SE. of Mt. Gambier; Mt. Lofty Range; 22 miles WSW. of Mundalla; Murray Bridge; Nangwarry; Narrung; Nuriootpa; Reedy Creek; Stoneleigh Pk.; Western Flat. VICTORIA: Aspendale; Bacchus Marsh; Ballarat; Burrumbeet; Ferntree Gully; Geelong; Glenferrie; Hall's Gap, Grampians; Melbourne; Nelson; R. Murray margin; Royal Park; 3 miles SE. of Stuart Mill; Wannon; 9 miles S. of Yanakie.

## 15. ONTHOPHAGUS FEROX Harold

(Figs. 16, 59, 60, 434, 473)

*Onthophagus ferox* Harold, 1867, p. 26; Harold, 1869, p. 81; Redtenbacher, 1868, p. 56; Blackburn, 1903, p. 267; Lea, 1923, p. 367; Boucomont and Gillet, 1927, p. 211.

Entirely black, antennal clubs rufous. Total length 12–20 mm.

*Male*

*Head.*—Clypeal margin only very slightly produced, semicircular, not appreciably reflexed, with 2 very small median lobes, genal angles rounded. Clypeal suture with frontal section largely straight, evenly raised, meeting genal sections near margins, without tubercle. Frons with an erect conical acute horn, very long (6–7 mm) in major male, short (1 mm) but always present in minor male, without transverse carina. Eyes large, with 22 facet rows across widest point, separated by about 5 widths, canthus complete. Clypeal surface transversely rugose, rest of head surface smooth and shiny,

finely punctate, except laterally on genae, which have a somewhat uneven surface. Labium split nearly to base (Fig. 16). *Pronotum.*–With 2 acute median horns, divergent and directed forward, in minor male present but quite short. No lateral tubercles. Anterior declivity with 2 pits behind eyes, very deep in major male, present as dimples in minor one. Anterior angles very prominent, the margins behind them strongly sinuate, forming prominent lateral angles. Hind edge distinctly margined. Disc and sides strongly rugose, the rugae longitudinal, impunctate, anterior declivity smooth, very shiny, very finely punctate, sparsely clothed with long fine setae extending along underside of horns. *Elytra.*–Intervals flat dorsally, becoming moderately convex laterally. Very finely shagreened, impunctate, with very short fine setae along sides. Striae very fine, impunctate, moderately impressed. *Legs.*–Fore tibiae not elongated, spur normal. *Abdomen.*–Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each with a short fine seta. Aedeagus normal (Fig. 434).

*Female*

Very similar to male, with the same type of cephalic and pronotal armament. However, for a given individual size the female horns are shorter. Frontal surface rugose, discal and lateral pronotal surfaces more strongly rugose, and the 2 depressions on pronotal declivity behind eyes are much less deep, disappearing altogether in minor female.

*Type*

Lectotype ♂, Swan River, W. A. There is a series of 32 specimens in MNHN(Ob) after the label "Swan River O. *ferox* t. Harold". All are of the same species. The male next to the label (at the head of the series) is one of three specimens which are ex musaeo Harold. The author is designating this specimen lectotype and has so marked it.

*Remarks*

In the original description, Harold (1867, p. 27) cites this species from Swan River, and from Melbourne and Port Macquarie in "South Australia". The Melbourne locality shows that he was confusing *ferox* and *mniszechi*, which he later described himself (Harold 1869) as a separate species. Later still, Lea (1923) and subsequent workers again confused *ferox* and *mniszechi* (see under the latter).

*Distribution* (Fig. 47)

The south-west of Western Australia in the area of 15–50 in. of annual rainfall. The 15-in. isohyet defines its inland limits with remarkable fidelity, and the species is therefore not as xerophilic as is *sloanei*, which replaces it north of the Murchison River. The Thomas River, 63 miles E. of Esperance, is the easternmost record of *ferox* in the south, but the species occurs as an apparently isolated population (morphologically typical) in the vicinity of Alice Springs, N.T. Both these records result from the collecting of Dr. E. B. Britton. At present it is not possible to explain how *ferox* could have reached Alice Springs.

This species is extremely abundant in south Western Australia and may be found in numbers in open or semiwooded situations under cow dung and human excrement. It occurs primarily in pure sand, but will also occupy red and black loam areas. It becomes markedly less abundant in the high-rainfall (50–60 in.) zone along the south

coast, where it tends to be replaced by *haagi*. It does not enter deep forests, where *vermiculatus* occurs. *O. ferox* is strictly coprophagous and, unlike some other species in the area, it will not be found under cadavers. Collection records indicate a time of winter-spring activity (July-November) and one of autumn activity (February-May). Nocturnal, collected most frequently at light. Snowball (1944, p. 231) briefly described the feeding burrow.

*Material Examined*

The type and 327 specimens. WESTERN AUSTRALIA: North I. and Wallabi Is., Abrolhos Group; Arumvale; Aurora; Bejoordung; Belmont; Beverley; 5 miles N. of Bindoon; 4 miles NW. of Bokal; Bremer Bay; Broke Inlet; Broomehill; Bullsbrook; Bunbury; Bushmead; Busselton; Calgardup; C. Chapman; Chidlow; Cottesloe Beach; Claremont; Cranbrook; Culham; Cunderdin; Deep Dene; Dongara; 5 miles N. of Dongara; Dwellingup; Eradu; Eridoon Lake; Esperance; Flinders Bay; Garden I.; Geraldton; Gin Gin; Guildford; Hopetoun; 7 miles E. of Hopetoun; Horrack's Beach; Hutt River; 4 miles E. and 4 miles W. of Jarrahdale; Julimar State Forest; Kalbarri; Katanning; Kukerin; Ledge Pt.; Lowden, near Donnybrook; Maclika Bay; Mammoth Cave; Margaret River; 18 miles W. of Mogumber; 24 miles W. of Moora; Mt. Barker; Mundaring; Mundijong; Murchison R.; Murrin Murrin; Nedlands; Newcastle; Northam; 43 and 73 miles N. of Northampton; North Point; Pemberton; 25 miles SE. of Perth; Pingelly; Rottnest I.; Sawyer's Valley; Seabrook; Spencers Brook; 10 miles S. of Stirling Range; Swan R.; Thomas River, 63 miles E. of Esperance; Torbay; Vasse; Vickar Harbour; Warren R.; 7 miles N. and 19 miles W. of Watheroo; Wembly Downs; Westdale; Yallingup; Yanchep; Youngs; Yuna. NORTHERN TERRITORY: Barrow Ck., Alice Springs, 13.ii.1966, Britton, Upton, and McInnes, ANIC, 3.

## 16. ONTHOPHAGUS SLOANEI Blackburn

(Figs. 61-63, 474, 475)

*Onthophagus sloanei* Blackburn, 1903, p. 276; Boucomont and Gillet, 1927, p. 216.

Black, antennal clubs rufous. Total length 13-19 mm.

*Male*

*Head.*—Front margin of clypeus produced into 2 median lobes, genal margins rounded. Clypeal suture with frontal section bent medially and with a median tubercle, sometimes feeble. Frons with a very low transverse carina more or less paralleling occipital margin medially, angularly bent back laterally. In minor male this carina is higher and drawn out into 2 high points in region of bends, as in female. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Clypeal surface coarsely, densely punctate, the punctures running together in transverse rows, rest of surface more finely punctate, area behind frontal carina impunctate. Sides of the latter setose in minor male. Labium split nearly to base. *Pronotum.*—With 2 straight oblique median carinae each raised into a point at both ends, forming 4 raised points in major male, unpointed and curved in minor male. A tubercle present on each side of these carinae. Anterior angles prominent, rounded. Hind edge distinctly margined. Disc and sides densely and very coarsely punctate, forming a sort of reticular surface, anterior declivities smooth and very indistinctly but densely punctate, bearing a few hairs especially near anterior angles, often reduced to stubble by wear. *Elytra.*—Intervals flat dorsally, becoming moderately convex laterally. Very finely shagreened, impunctate, with short dense setae along sides. Striae very fine, impunctate, moderately impressed. *Legs.*—Fore tibiae slender, elongated,

spur normal. *Abdomen.*–Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each bearing a short fine seta. Aedeagus normal.

*Female*

Clypeal margin a little less produced, truncate or slightly bilobate. Frontoclypeal and genal suture more strongly carinate, former without a median tubercle. Frontal carina much more strongly elevated, terminating laterally in 2 raised horn-like points, the outer surface of these setose. Head surface more strongly punctate and rugose. Median pronotal prominences in form of 2 well-separated rounded lobes which are anteriorly margined, flat and very coarsely reticulo-punctate above. Anterior declivity moderately punctate, smooth between punctures, a few punctures with hair, often reduced to stubble.

*Type*

Holotype ♂, N.W. Australia. Stated thus, the type locality could refer either to the Kimberley District or the region about the North West Cape. The actual specimen in BMNH bears the abbreviation "Murch.". The present author is assuming this to refer to the Murchison River north of Geraldton, and is so restricting the type locality. Type seen by the author.

*Remarks*

Minor males have the ends of the frontal carina drawn up into a pair of erect points, like the female. These are completely absent in major males.

Lea (1923) erroneously listed *sloanei* as a synonym of *atrox*. This was not accepted by Boucomont and Gillet (1927), who again separated the names. Blackburn (1903) believed *sloanei* to be "extremely like the species called *O. atrox* Har. (above)". In fact he was referring to what is now called *mjobergi*, which he believed to be *atrox*, and he was correct in stating that the two species are close.

*Distribution* (Fig. 47)

Western and central Australia in the area delimited by the 10-in. annual isohyets, that is, between the Murchison River and the North West Cape, inland as far as Alice Springs and south to the Everard Ranges of South Australia. It is evidently adapted to live primarily in climatic conditions with about 8–10 in. of annual rainfall, and is thus the most xerophilic of Australian *Onthophagus*. In the moister areas to the south of Western Australia *sloanei* is replaced by *ferox*, and to the north, along the north-west coast, by the southern populations of *mjobergi*.

Most specimens are collected at light and the species is, therefore, nocturnal. Capture records are available from February to July in about equal proportion in each month, and one record each in August and November. Nothing is known of the food preferences of this species.

*Material Examined*

The holotype and 111 specimens. WESTERN AUSTRALIA: Carnarvon; 8 miles E. of Carnarvon; Cue; Ivor Rocks; Jigalong Mission; Kathleen Valley; L. Violet; Landor Station; Lyndon; Mia Mia; Milly Milly Station; 10 miles N. of Milly Milly Station; Mt. Egerton; Mt. Morgans; Wandagee; Wiluna; Wittenoom; Yalbalgo; Yardie Creek. NORTHERN TERRITORY: Alice Springs; 4 miles SW. of Alice Springs; Amadeus Basin (Reedy Rockhole); Barrow Creek; Emily Gap; Hermannsburg; Macdonnel Ranges; 21 miles SSW. of Napperby; 15 miles NNE. of Narwietooma; Renner's Rock; 15 miles E. of Vaughan Springs; Wigley Waterhole; Yuendumu. SOUTH AUSTRALIA: Betty's Well, Everard Park Station.

## 17. ONTHOPHAGUS MJOBERGI Gillet

(Figs. 64–66, 476, 477)

*Onthophagus mjobergi* Gillet, 1925, p. 8; Boucomont and Gillet, 1927, p. 214.

Black, antennal clubs rufous. Total length 13–17 mm.

*Male*

*Head.*—Anterior margin of clypeus produced into 2 small rounded lobes, genal margins angular. Clypeal suture with frontal section raised, not carinate, either sinuate or somewhat angular, without a median tubercle. Frons with a low carina more or less paralleling occipital margin, slightly bent or curved back in middle. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Densely punctate and transversely rugose, impunctate and smooth behind frontal carina. Labium split nearly to base. *Pronotum.*—With a single inverted-V-shaped median prominence, margined along edges, apex of V bituberculate in northern specimens, with a single tubercle in southern ones. A lateral tubercle on each side. Anterior angles quadrate. Hind edge distinctly margined. Disc and sides very densely and coarsely punctate, forming a rough reticular or rugose surface. Anterior declivity smoother but fairly densely punctate medially, each puncture bearing a long stiff bristle. *Elytra.*—Intervals flat dorsally, becoming moderately convex laterally. Very finely shagreened, impunctate, last interval bearing a few rows of very small setae. Striae very fine, impunctate, moderately impressed. *Legs.*—Fore tibiae slender, elongated. *Abdomen.*—Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each with a short fine seta. Aedeagus normal.

*Female*

Clypeal margin not as strongly reflexed, very slightly bilobate or truncate. Frontal carina strongly raised into 2 lateral points, the carina between them evenly curved back. Median pronotal prominence a single transverse arcuate carina bent back and raised into rounded ridges laterally. Fore tibiae not elongated or slender.

*Type*

Holotype ♂, Kimberley District, W.A., March, Mjöberg, NRM. Seen by the author.

*Remarks*

Specimens from the North West Cape (Hammersley) area differ from those from the Kimberleys and Arnhem Land in being more strongly rugose and shagreened, especially on the anterior declivity of the pronotum and on the elytra. The males have the clypeal margin more strongly bilobate (Fig. 65) and the median pronotal carina has a single median point. A different subspecies may be involved.

*Distribution* (Figs. 47 and 49)

This species occurs from the North West Cape, W.A., to Mt. Isa, Qld., in an area of about 10 to about 50 in. of annual rainfall. In the Kimberley District, the species is apparently confined to dry grassland (spinifex) areas with hard soil, but on the Gove Peninsula it occurred inside woodland under shaded conditions, under cow dung, in heavy loam soil. Several specimens bear adhering lepidopterous scales and were therefore collected at light, indicating that the species is nocturnal. Capture data suggest an active season from February to June, with one record each in January and July.

*Material Examined*

The type and 57 specimens. WESTERN AUSTRALIA: Abydos H. S., 56 miles WSW. of Marble Bar, 6.vi.1953, J. H. Calaby, ANIC, 8; Cape Range, May 1965, A. Saar, WAM, 2; Coolawanyah H. S., NW. of Wittenoom, 21.iv.1963, L. J. Chinnick, ANIC, 1; 59 miles W. of Fitzroy Crossing, 26.ii.1968, E. G. Matthews, ANIC, 2; Learmonth, 6.vi.1957, Snell, NMV, 2; Marble Bar, Jan. 1914, WAM, 1; Meekatharra, June 1953, K. G. Buller, WAM, 4; Mt. Wynne, Dec. 1924, H. W. Talbot, WAM, 2; North West Cape, 22.vii.1964, L. E. Koch, WAM, 3; Peeawah R., 14 miles NNE. of Whin Ck., E. Roebourne, 3.vi.1953, J. H. Calaby, ANIC, 2; Shaw R., June 1955, Demarz, NMV, 1; 3 miles NW. of Sherlock H. S., E. Roebourne, 3.vi.1953, J. H. Calaby, ANIC, 2; 2 miles SW. of Turkey Ck., 18.iv.1958, L. J. and M. F. Chinnick and J. Walker, ANIC, 1; Wittenoom, 7.iv.1948, F. Lambert, WAM, 5; Yardie Ck., via Carnarvon, Apr. 1958, A. Burns, Snell, NMV, 3. NORTHERN TERRITORY: 17 miles N. of Adelaide River, 12.ii.1968, E. G. Matthews, ANIC, 1; Katherine, 7–10.ii.1968, E. G. Matthews, ANIC, 1; Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 10; Port Darwin (cotype), MNHN(Bouc), 1. QUEENSLAND: Mt. Isa, Feb. 1954, Lamberts, NMV, 1.

## 18. ONTHOPHAGUS QUINQUETUBERCULATUS Macleay

(Figs. 67–69, 478)

*Onthophagus quinquetuberculatus* Macleay, 1871, p. 182.

Black, antennal clubs rufous. Total length 15–19 mm.

*Male*

*Head.*—Anterior margin of clypeus a little reflexed and very slightly bilobate, genal margins angular. Clypeal suture with frontal section nearly straight, strongly raised but not carinate, without a median tubercle, genal sections almost in line with frontal. Frontal carina more or less paralleling occipital margin, sharply and angularly raised laterally in most males, extended into 2 points laterally in some. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Entirely densely punctate, transversely rugose between punctures except for area behind frontal carina and a space just before eyes on genae, which are smooth. Labium split nearly to base. *Pronotum.*—With an inverse-V-shaped median prominence which is margined, both ends of the 2 margins raised into low tubercles, the median 2 tubercles being very closely approximated. A lateral tubercle on each side. Front angles prominent, the apices projecting somewhat. Hind edge distinctly margined. Entirely very densely punctate, the surface not pronouncedly asperate or rugose, the punctures finer on anterior declivity. Entirely glabrous. *Elytra.*—Intervals flat above, becoming moderately convex laterally. Very finely shagreened, impunctate, entirely glabrous. Striae very fine, impunctate, shallowly impressed. *Legs.*—Fore tibiae slender, elongated. *Abdomen.*—Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each with a short fine seta. Aedeagus normal.

*Female*

Clypeal margin reflexed and very slightly truncate or evenly rounded. Genae without smooth area before eyes. Frontal carina strongly raised, with 2 prominent lateral points. Median prominences of pronotum forming a single arc, very slightly curved in at middle, strongly margined. Fore tibia not slender or elongated.

*Type*

Lectotype ♂, Gayndah, Qld., AM K 28180. A male and a female both bear a holotype label; only the female bears a Macleay label. The male is here designated lectotype. Seen by the author.

*Remarks*

Blackburn (1903) believed this species was the same as what he called *atrox*, by which he meant what is now *mjobergi*. *O. quinquetuberculatus* and *mjobergi* (and also *sloanei*) are indeed closely related, sharing the same or a similar shape of the head and pronotum in the major male. They may be distinguished by the characters given in the key, and in any case the distribution of *quinquetuberculatus*, an eastern species, is quite separate from that of the other two, which are mostly western.

Lea (1923) followed Blackburn and listed *quinquetuberculatus* as a synonym of *atrox*, as he, also, had misidentified the latter. He was again followed in this by Gillet (1925) and Boucomont and Gillet (1927), in spite of the fact that Gillet had, finally, correctly identified *atrox*. The names are here separated again.

*Distribution* (Fig. 48)

Northern New South Wales well inland on the western slopes of the Great Dividing Range, continuing the distribution of *pentacanthus* northward and replacing *atrox* inland. In Queensland, it approaches the coast more, without actually reaching it, and overlaps the inland part of the range of *atrox*, occurring as far north as Charters Towers. Collected by Dr. Bornemissza in open areas in black clay and clay pan. December–May.

*Material Examined*

The type and 30 specimens. NEW SOUTH WALES: Garah, A. W. Ferguson, ANIC, 3; Moree, Mar. 1952, A. Dyce, ANIC, 1; Mullaly, Dec. 1929, H. J. Carter, ANIC, 1; Tyrone Station, Moree, 7.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 3. QUEENSLAND: Belmont, 8 miles NW. of Rockhampton, 11.iii.1965, G. F. Bornemissza, ANIC, 2; Capella, UQ, 2; 10 miles S. of Capella, 7.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 3; Clermont, 11.xii.1929, K. K. Spence, AM, 1; 24 miles NE. of Clermont, 26.iii.1962, Chinnick and Corby, ANIC, 1; Duaringa, 1945, Smith, AM, 1; 25 miles N. of Emerald, 20.iv.1955, Norris and Common, ANIC, 1; Gayndah, AM, 2; Macrossan, 9.iii.1960, K. L. Harley, ANIC, 2; Marlborough, 27.v.1968, Bornemissza and Utech, ANIC, 3; Roma, ANIC, 1; Springsure, 19.iv.1955, Norris and Common, ANIC, 2; Wandoan, 26.ii.1958, L. Clark, UQ, 1.

## 19. ONTHOPHAGUS PUGNACIOR Blackburn

(Figs. 70, 71, 435, 479)

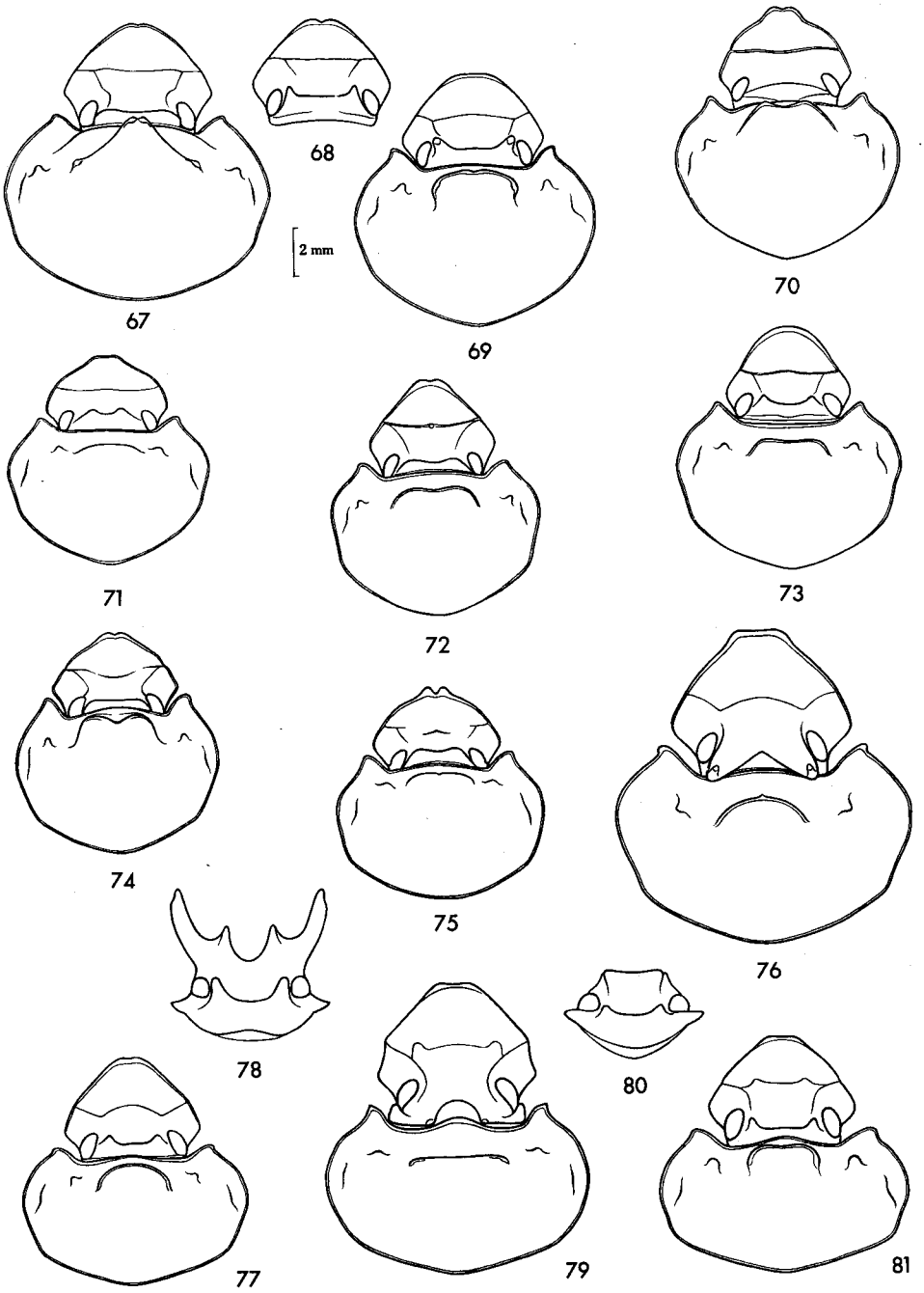
*Onthophagus pugnacior* Blackburn, 1903, p. 277; Boucomont and Gillet, 1927, p. 215.

Black, antennal clubs rufous. Total length 12–18 mm.

*Male*

*Head.*—Anterior margin of clypeus strongly produced and somewhat bilobate, genal angles angulate. Clypeal suture forming a single transverse line across head, very slightly sinuate, finely carinate, without median tubercle. Frontal carina very low, evenly curved forward into an arc. Eyes large, with 28 facet rows across widest point, separated by about 4 widths, canthus complete. Densely and fairly coarsely punctate


Figs. 50–66.–*Onthophagus* spp.: *50*, *51*, *O. solidus* male: *50*, fore body; *51*, outline of vertical crest; *52–54*, *O. leai*: *52*, male fore body; *53*, male head, front view; *54*, female fore body; *55*, *56*, *O. pentacanthus*, fore body: *55*, male; *56*, female; *57*, *58*, *O. mniszechi*, fore body: *57*, male; *58*, female; *59*, *60*, *O. ferox*, fore body: *59*, male; *60*, female; *61–63*, *O. sloanei*: *61*, minor male, head and pronotal carina; *62*, major male, fore body; *63*, female fore body; *64–66*, *O. mjobergi*: *64*, male fore body, Northern Territory; *65*, male head and pronotal carina, North West Cape region; *66*, female fore body.




Figs. 67–81.–*Onthophagus* spp.: *67–69*, *O. quinquetuberculatus*: *67*, male fore body; *68*, minor male, head; *69*, female fore body; *70*, *71*, *O. pugnacior*, fore body: *70*, male; *71*, female; *72*, *73*, *O. atrox*, fore body: *72*, male; *73*, female; *74*, *O. capitosus*, fore body: *74*, male; *75*, female; *76*, *77*, *O. laminatus*, fore body: *76*, male; *77*, female; *78–81*, *O. demarzi*: *78*, male head, front view; *79*, male fore body; *80*, female head, front view; *81*, female fore body.

except behind frontal carina, where it is impunctate. Labium split nearly to base. *Pronotum.*–With a single median prominence, angular in major male, shaped somewhat like an inverted open W, plus a small tubercle on each side. Anterior angles acute. Hind edge distinctly margined. Entire pronotum except anterior declivity densely and coarsely punctate, the punctures tending to run together into longitudinal rows, anterior declivity densely granulate or asperate, glabrous. *Elytra.*–Intervals flat, extremely finely punctate, shagreened, entirely glabrous. Striae very shallow, extremely finely punctate. *Legs.*–Fore tibiae moderately to very slender (in major male), incurved. *Abdomen.*–Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each with a short fine seta. Aedeagus with parameres more tapering than usual (Fig. 435).

*Female*

Anterior edge of clypeus only very slightly projecting, truncate. Frontal carina raised into 2 approximated points, distance between these points about one-third interocular distance. Median pronotal prominence in form of a single low arcuate ridge, lateral tubercles very low. Fore tibiae stouter. Otherwise like male.

*Type*

Holotype ♂, north Queensland, BMNH. The specimen is labelled "Ch.T.", which undoubtedly stands for Charters Towers, and the type locality is hereby so restricted. Seen by the author.

*Remarks*

The type is highly worn, which accounts for Blackburn's remarks that the clypeus is very short and wide (it would thus appear if the entire median lobe had been worn off), the tibial teeth very feeble, and the front of the pronotum subobsoletely punctulate. *O. pugnacior* is very close to *atrox* (called *pugnax* by Blackburn) and the two species are often found together. Lea (1923) has *pugnacior* as a synonym of *atrox*, in which he was not followed by Boucomont and Gillet (1927), who regarded *pugnacior* as a valid species.

*Distribution* (Figs. 47, 48)

*O. pugnacior* occupies an extensive area in central Queensland between Charters Towers and the tropic, inland at least to Barcaldine. There is also one record from the Brisbane suburb of Brookfield.

A series of six specimens in WAM was collected in 1963 at Prairie Downs Station, W.A., about 70 miles west of Mundiwindi, and another was recently (1969) collected near Marilla Station, not far from the North West Cape. These specimens are typical *pugnacior* and show that the species is definitely established on the other side of the continent from the main part of its range. No other species has quite this sort of dichotomous distribution, which suggests artificial introduction through human agency – a case akin to the inexplicable appearance of *ferox* in Alice Springs.

*O. pugnacior* has been collected in February, March, and April at human faeces and at light.

*Material Examined*

The type and 63 specimens. QUEENSLAND: Alice R., near Barcaldine, 12.x.1968, G. Monteith, UQ, 1; Belmont, 8 miles NW. of Rockhampton, 11.iii.1965, G. F. Bornemissza,

ANIC, 20; Boothill Ck., 50 miles S. of Mackay, 24.v.1968, G. Monteith, UQ, 5; Brookfield, 14.iv.1962, I. C. Cunningham, UQ, 1; Cape R., 6.iv.1965, Bornemissza and Yapp, ANIC, 3; Helenslee Station Homestead, 20°32'S., 145°43'E., 16.iii.1969, J. A. L. Watson, ANIC, 5; Lotus Ck., Sarina, 12.iii.1965, G. F. Bornemissza, ANIC, 21; Mackay, 27.ii.61, H. Demarz, MGF, 1. WESTERN AUSTRALIA: Prairie Downs Station, Jan.–Mar. 1963, C. Snell, WAM, 6; Toothawarra Ck., Marilla Station, 4.iv.1969, T. Damagh and G. Kendrich, WAM, 1.

## 20. ONTHOPHAGUS ATROX Harold

(Figs. 72, 73, 480, 481)

*Onthophagus atrox* Harold, 1867, p. 27; Harold, 1869, p. 85; Gillet, 1925, p. 9; Boucomont and Gillet, 1927, p. 209.

Black, antennal clubs rufous. Total length 12–19 mm.

*Male*

*Head.*–Anterior margin of clypeus slightly produced, truncate. Clypeal suture forming a single transverse raised ridge across head, evenly and feebly arcuate, with a median tubercle (occasionally absent). Frontal carina low to very low, more or less paralleling occipital edge of head, slightly curved back medially, the ends abruptly bent back, the bends sometimes raised into a point. Eyes large, with about 25 facet rows across widest point, separated by about 5 widths, canthus complete. Entirely densely punctate, the punctures running together to form transverse rugae, except area behind frontal carina, which is impunctate. Labium split nearly to base. *Pronotum.*–With a single margined biarcuate median prominence and a small tubercle on each side. In more developed individuals, median part of prominence extends further forward. Anterior angles quadrate. Hind edge strongly margined. Disc densely and coarsely punctate, coarsest on upper surfaces of median prominences, which are anteriorly margined. Anterior declivities densely and finely punctate, glabrous. *Elytra.*–Intervals flat, extremely finely punctate and shagreened, entirely glabrous. Striae not impressed, very indistinctly punctate. *Legs.*–Fore tibiae moderately slender and elongated, incurved. *Abdomen.*–Pygidium moderately, finely punctate, faintly rugose, shagreened, lateral punctures each bearing a short fine seta. Aedeagus normal.

*Female*

Clypeal suture more prominent, raised medially and usually with a median tubercle. Frontal carina strongly raised into 2 rounded points, the carina between these points equal to much more than one-third of interocular distance. Pronotum with median prominences similar to those of male, but less arcuate, straighter along middle. Fore tibiae stouter. Otherwise like male.

*Type*

Lectotype major ♂, Rockhampton, Qld., Harold, MNHN(Ob). There are nine specimens over the *atrox* t. Harold label in MNHN(Ob). All are of the same species. Seven bear the ex musaeo Harold label. One of these, bearing the number "90", heads the row, next to a label pinned to the bottom saying "Queensland *O. atrox* t. Harold". It is a major male and is here designated lectotype of *atrox* Harold; it was so marked. The type locality is here restricted to Rockhampton; other specimens in the series are from New South Wales and Cape York.

*Remarks*

Originally Harold (1867) believed some female specimens of *atrox* were the female of *ferox* and *pentacanthus*, while others he correctly associated with the males of *atrox*. The situation was clarified by Harold himself soon after (1869), but confusion regarding the name *atrox* has lingered to the present. Blackburn (1903, p. 274) ascribed to *atrox* the species which, from his remarks, must certainly be that later described as *mjobergi* Gillet. The true *atrox* was called *pugnax* by Blackburn, as pointed out by Gillet (1925). As for Lea (1923), it is not clear what he understood by the name *atrox*, as he places four other quite distinct species as synonyms under it (*quinquetuberculatus*, *pugnacior*, *sloanei*, and *laminatus*, cited as *palmerstoni*), while presenting a photograph labelled *atrox* (1923, pl. 7, fig. 18) which appears to be *quinquetuberculatus*. The true *atrox* he has photographed as figure 17 of the same plate as *pugnax*, thus following Blackburn in this error, but he considered *pugnax* to be a synonym of *laminatus*. Gillet (1925), having access to the types, points out the errors of Blackburn and Lea in applying the names *atrox* and *pugnax*, but he did not know that the true *pugnax* had just been redescribed by Lea (1923) as *opacipennis*. All the specimens labelled *atrox* in MNHN(Ob) are of the same species, hence there can be no doubt of the correct application of this name.

The male specimen of a series collected at Bamaga, on Cape York, by the Darlingtons is significantly different from other known *atrox* in that the eyes are smaller, having only 18 facet rows across their widest point and being separated by 10 widths. Also, the disc of the pronotum is more nitid, being impunctate at the base. The females are also smoother and more nitid, but have normal eyes. These facts suggest that the *atrox* population at the tip of Cape York is isolated from the rest of the range of the species.

*Distribution* (Fig. 48)

Widespread from northern New South Wales in the vicinity of Coff's Harbour and Glen Innes northward along the coast of Queensland, east of the Great Dividing Range, to the Cairns area, reappearing again at the tip of Cape York Peninsula (see remarks above). It has not been found in the intervening areas of Silver Plains and Iron Range, in spite of some good collections of dung beetles being available from these areas, and this species is generally not overlooked because of its large size and frequent occurrence in cow dung. It occurs in open pastures and woodland in sandy soil, and is active from September to June, with a peak in April.

*Material Examined*

The type and 338 specimens. NEW SOUTH WALES: Bonalbo; Byron Bay; Casino; Cattle Camp, 10 miles NW. of Cangai; Coff's Harbour; Grafton; Grafton–Lismore road; Inverell; Jackadgery; Lower Acacia Ck.; Maclean; Moree; Noonameena Station, 28 miles SE. of Bingara; 12 miles N. of Tenterfield; 10 miles N. of Woodenbong. QUEENSLAND: Amberley; Ballandean; Bamaga; Belmont, 8 miles NW. of Rockhampton; Bowen; Brisbane; Bundaberg; Byfield; Cairns; Canungra; Carnarvon Gorge; Cape R.; Charters Towers; Clermont; Clump Point; Curtis I.; Daandine; 25 miles N. of Emerald; Fletcher; Glenmorgan; 6 miles W. of Gogango; 48 miles N. of Goondiwindi; Gordonvale; Injune; Kalbar, Mt. French; Kingaroy; Kuranda; Lawes; Lawgi; Lockerbie; Malanda; Marlborough; 10 miles W. of Marlborough; Mingela; Mt. Carbine; Mourangee near Edungalba; Oakey; Palen Ck.; 9 miles W. of Paluma; Parada; Rodds Bay; Sarina; Stanthorpe; Stradbroke I.; Tannymorel; Taringa; 25 miles NNW. of Taroom; Thomson Ck., 120 miles N. of Clermont; Toowoomba; Townsville; Wyberba; Yarraman; Yungaburra.

## 21. ONTHOPHAGUS CAPITOSUS Harold

(Figs. 74, 75, 482, 483)

*Onthophagus quadridentatus* Hope, 1841 (non Fabricius, 1798), p. 43; Hope, 1842, p. 423; Gillet, 1925, p. 9.

*Onthophagus capitosus* Harold, 1867, p. 30 (nom. nov.); Harold, 1869, p. 84; Harold, 1877, p. 72; Blackburn, 1903, p. 280; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

Black, antennal clubs rufous. Total length 10–16 mm.

*Male*

*Head.*–Clypeal margin reflexed and produced into a bilobate process. Clypeal suture carinate only at the ends and centre; middle portion almost effaced, strongly curved back with centre only indistinctly raised into a transverse ridge. Frontal carina very low, paralleling occipital margin for most of its length. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Surface densely punctate except behind frontal carina, where it is impunctate. Labium split almost to base. *Pronotum.*–With a bilobate median prominence, strongly margined anteriorly, and a tubercle on each side, altogether absent in minor male. Anterior angles rounded. Hind edge distinctly margined. Entire surface densely punctate, the punctures coarsest on anterior part of disc, finest (nearly impunctate) on anterior declivities. *Elytra.*–Intervals flat, very finely shagreened, impunctate, a few rows of very short setae posterolaterally along epipleural edges and 8th stria, not always evident. *Legs.*–Fore tibiae slender, elongated. *Abdomen.*–Pygidium finely punctate, shagreened, lateral punctures with short setae. Aedeagus with parameres tapering.

*Female*

Clypeal margin more strongly bilobate. Centre of frontoclypeal carina sometimes raised into a tubercle. Frontal carina not raised, not forming horns. Pronotum without any prominences or carinae, only faint gibbosities anteriorly. Fore tibiae stouter. Otherwise like male.

*Types*

Lectotype of *quadridentatus*: ♂, Port Essington, N.T., HM 462½.

Lectotype of *capitosus* here designated: ♂, Cape York, Qld., Harold, MNHN(Ob) ex musaeo Harold, No. 294. (The author erroneously labelled another specimen, marked Somerset, I. 75, as lectotype. This was one of the specimens collected by d'Albertis in 1875 and could not be part of the type series. The label should be transferred to the first specimen mentioned above.) Both seen by the author.

*Distribution* (Fig. 49)

The east of the Cape York Peninsula, Qld., from Kuranda to the tip, also collected by the author on Gove Peninsula in Arnhem Land, N.T., on the other side of the Gulf of Carpentaria, and known from Port Essington on the Cobourg Peninsula, N.T. At Yirrkala on the Gove Peninsula the species occurred well inside the rather sparse woodland characteristic of the area, in sandy soil. Trapped with human excrement bait.

*Material Examined*

The types and 51 specimens. QUEENSLAND: Cape York, SAM, 3; Cape York, 1968, F. Parker, ANIC, 2; Bamaga, Jan. 1958, Darlingtons, MCZ, 1; Jardine R., 16.vi.1969, G. Monteith, UQ, 2; Kuranda, BMNH, 4; Lockerbie, 10–15.vi.1969, G. Monteith, UQ, 1; 3 miles S. of Musgrave, 14.ix.1969, R. J. Huppatz, ANIC, 8; Somerset, Jan. 1875, d'Albertis, MNHN(Ob), 12; Somerset, ANIC, 1; Station Ck., Silver Plains, Feb. 1959, J. L. Wassell, ANIC, 1. NORTHERN TERRITORY: Port Essington, HM, 2; Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 15.

## 22. ONTHOPHAGUS LAMINATUS Macleay

(Figs. 76, 77, 484, 485)

*Onthophagus laminatus* Macleay, 1864, p. 119; Blackburn, 1903, p. 268; Lea, 1923, p. 364, Gillet, 1925, pp. 10–11; Boucomont and Gillet, 1927, p. 213.

*Onthophagus cowleyi* Blackburn, 1903, p. 272; Lea, 1923, p. 364 (syn.); Gillet, 1925, p. 11; Boucomont and Gillet, 1927, p. 210.

*Onthophagus palmerstoni* Blackburn, 1903, p. 275; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210 (syn.).

Black, antennal clubs rufous. Total length 11–22 mm.

*Male*

*Head.*–Anterior margin of clypeus reflexed and prolonged into a truncate or slightly bilobate process. Clypeal suture strongly angulate, carinate only along its frontal section, genal sections indistinct. Without median tubercle or points. Carina of vertex extended backward into a lamina terminating in 2 upraised lateral points, the margin between these points deeply angularly excised in major male, nearly straight in minor one. Eyes very wide, with 27–36 facet rows across widest point, separated by about 4 widths, canthus complete. Surface impunctate, strongly transversely rugose on clypeus, becoming rugose on genae and frons in specimens from north Western Australia and the Northern Territory. Labium split nearly to base. *Pronotum.*–With a single semicircular median carina and a lateral tubercle on each side. Anterior angles with salient, laterally directed point. Hind edge distinctly margined. Disc finely punctate, nitid (coarsely punctate and rugose in north Western Australia and Northern Territory specimens), becoming coarsely punctate and rugose anteriorly and along sides, anterior declivities very finely punctate and smooth, glabrous. *Elytra.*–Intervals flat, very finely shagreened, impunctate, glabrous. Striae very fine, impunctate, shallowly impressed. *Legs.*–Fore tibiae of major male very slender and elongated. *Abdomen.*–Pygidium finely punctate, faintly rugose, lateral punctures with short fine setae. Aedeagus normal.

*Female*

Clypeal margin less prominent and reflexed, more rounded, sometimes truncate as in male. Vertical carina not laminate, consisting of a strong, backwardly curved ridge terminating laterally in 2 points which are only slightly, or not at all, raised above edge of carina. Pronotal sculpturing as in male. Fore tibiae stouter. Otherwise as in male.

*Types*

Holotype of *laminatus*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *cowleyi*: ♂, north Queensland, BMNH.
Holotype of *palmerstoni*: ♀, Palmerston (Darwin), N.T., BMNH. All three seen by the author.

*Remarks*

Blackburn (1903) based his descriptions of *cowleyi* and *palmerstoni* on characters of the punctuation of the pronotum and elytra and the number of teeth on the front tibiae. These are characters which vary individually (and according to wear), geographically, and in regard to sex. As noted in the description here, the Northern Territory and Kimberley specimens of this species are more coarsely punctate and rugose on both the head and pronotum than Queensland specimens. These differences are not in themselves sufficient even for subspecific separation, in the author's opinion. The type of *palmerstoni* is a female, a fact of which Blackburn was unaware. Lea (1923) placed *palmerstoni* as a synonym of *atrox*, incorrectly, while Boucomont and Gillet (1927) placed it correctly as synonym of *cowleyi* which, however, they listed as a valid species, evidently as an oversight, since Gillet earlier (1925) cited this name as synonym of *laminatus*. Lea (1923) placed *cowleyi* as a synonym of *laminatus* and the correct synonymization may be said to date from then.

*Distribution* (Fig. 49)

Very widespread throughout northern Australia from the tropic in Queensland north and west along the entire coast to Derby, W.A.; also occurring in New Guinea. It is apparently confined to the areas of 30 in. or more of annual rainfall, in open pastures and sparse woodlands, frequently under cow and horse droppings. Nocturnal, coming to light. Collected from November to July, with one record each in September and October.

*Material Examined*

The types and 245 specimens. · QUEENSLAND: Bamaga; Bowen; Cairns; Chillago; Coen; Cooktown; Curtis I.; 25 miles N. of Emerald; Endeavour R.; Helenslee Station Homestead; Ingham; Innisfail; Iron Range; Jardine R.; Kuranda; Lockerbie; Mackay; Mt. Bartle Frere (80 ft); 7 miles SW. of Mt. Garnet; Normanton; Palm I.; Silver Plains; Stewart; Stormy Ck.; Thirsty Sound, Plum Tree. NORTHERN TERRITORY: Auvergne Station; Borroloola; Burnside; Darwin; Humpty Doo; 2–4 miles E. of Katherine; 50 miles S. of Katherine; Lee Pt., Darwin; Milingimby; Tindal, 14°31′S., 132°22′E. WESTERN AUSTRALIA: East Kimberley; Ivanhoe; Kalumburu; King's Sound; Kimberley Research Station; 60 miles NW. of Kununurra; Wyndham. NEW GUINEA: south-east New Guinea.

## 23. ONTHOPHAGUS DEMARZI Frey

(Figs. 78–81, 486, 487)

*Onthophagus demarzi* Frey, 1959, p. 623.

Black, antennal clubs rufous. Total length 15–18 mm.

*Male*

*Head.*—Clypeal margin reflexed and prolonged into a truncate or slightly bilobate process. Clypeal suture with 2 strongly raised transverse ridges or horns in front of

eyes, the suture between them carinate, genal sections indistinct. Vertical carina strongly prolonged backward into 2 strong horns each bearing at inner base another smaller horn. Eyes large, with about 30 facet rows across widest point, separated by about 4 widths, canthus complete. Entirely finely punctate, with transverse rugosities on clypeus. Labium split nearly to base. *Pronotum.*–With single transverse median ridge more or less interrupted in middle, and a tubercle on each side. Anterior angles acute. Hind edge strongly margined. Disc and sides punctate, the punctures becoming coarser anteriorly but not forming any rugosity, anterior declivities very finely punctate and smooth, glabrous. *Elytra.*–Intervals flat, very finely shagreened, impunctate, last interval near epipleura with 1 or 2 rows of very small setae. Striae very fine, impunctate, shallowly impressed. *Legs.*–Fore tibiae moderately slender and elongated. *Abdomen.*–Pygidium finely punctate, faintly rugose, shagreened, lateral punctures with short fine setae. Aedeagus normal.

*Female*

Clypeal margin less produced, somewhat bilobate. The 2 mediolateral processes of frontoclypeal suture present but lower and more transverse. Vertical carina much less produced, somewhat quadrate with the central portion curved back, the corner only slightly raised into points. Median pronotal carina strongly curved, pronotal surface just behind it very coarsely punctate and rugose.

*Type*

Holotype ♂, Katherine, N.T., MGF. Not seen by the author.

*Distribution* (Fig. 49)

Known from the interior of the Cape York Peninsula, from Katherine and Humpty Doo, near Darwin, N.T., and from Kununurra on the Ord River, W.A. The author collected one male near Kununurra in a shaded area with sandy soil on the banks of the Ord. It came to human faeces.

*Material Examined*

Fourteen specimens. QUEENSLAND: Wrotham Park Station, Nov. 1964, P. Gillard, ANIC, 4. NORTHERN TERRITORY: Humpty Doo, 30.i.1959, ANIC, 1; Humpty Doo, Dec. 1966, E. C. Langfield, ANIC, 4. WESTERN AUSTRALIA: Ivanhoe Station, 1949, WAM, 1; Ivanhoe, 11.iv.1962, I. F. B. Common, ANIC, 1; Kimberley Research Station, 12.iv.1956, E. C. Langfield, ANIC, 1; Kimberley Research Station, 5.viii.1961, K. J. Richards, BMNH, 1; Kununurra, 15.ii.1968, E. G. Matthews, ANIC, 1.

## III. *The* CONSPICUUS *Group*

Eyes variable, with 8–17 facet rows across widest point, separated by 10–20 widths, canthus complete. Labium excised nearly to base, the excision parallel-sided or V-shaped, middle of base at end of excision concave, membranous. Pronotum usually rugose on disc, glabrous or with short setae. Elytra with short setae on sides only. Pygidium with short setae. Colour black, brown, or green. Total length 8–15 mm.

Male with frontoclypeal suture carinate, head unarmed, pronotum with a transverse row of 4 prominences. Fore tibiae elongated, slender, with a distinct brush of long setae apically. Female with head unarmed or with frontal crest; pronotum usually as in male.

Eight species: 24. *salebrosus* Macleay; 25. *tenebrosus* Harold; 26. *jalamari*, sp. nov.; 27. *fissiceps* Macleay; 28. *rugosicollis* Gillet; 29. *tricavicollis* Lea; 30. *conspicuus* Macleay; 31. *bicavicollis* Lea.

*O. jalamari* forms a link with the *atrox* group in size, colour, and appearance. The strongly rugose species *tenebrosus* and *salebrosus* appear closely related, but are very widely separated geographically, *tenebrosus* being the only non-tropical member of the group. All the species are inhabitants of savannah woodlands or other semi-open areas, as far as we know.

## KEY TO SPECIES OF THE *CONSPICUUS* GROUP

1. Both pronotum and elytra strongly and irregularly rugose ..... 2
   Only pronotum rugose or cribrate, at least on disc; elytral intervals may be coarsely punctate, but not rugose ..... 3

2(1). Frontoclypeal suture and frontal carina absent in male; hind edge of pronotum not margined; total length 8 mm. N. W.A. ..... 24. *salebrosus* Macleay
   Frontoclypeal suture and frontal carina present; hind edge of pronotum margined; total length 9–13 mm. N.S.W., S. Qld. ..... 25. *tenebrosus* Harold

3(1). Entirely black ..... 4
   Pronotum and base of head, at least, green or cupreous ..... 5

4(3). Male with genal margin convex behind genal angle; middle of frontal carina equidistant between base of head and frontoclypeal suture; lateral margin of pronotum sharply angulate in major male; median projections of pronotum not joined together by a ridge, but each so joined to lateral projections; anterior angles acute; female with head very broad, median pronotal prominences not joined by a ridge. N. N.T. ...26. *jalamari*, sp. nov.
   Male with genal margin concave behind genal angle; middle of frontal carina nearer to frontoclypeal suture than to base of head; lateral margins of pronotum rounded; median projections of pronotum joined together by a transverse ridge; anterior angles with quadrate apices in major male; female with head narrow, median pronotal prominences joined together by a transverse ridge. N. N.T., N. W.A. ..... 27. *fissiceps* Macleay

5(3). Elytra black, without trace of greenish reflections ..... 6
   Elytra green or with strong greenish reflections ..... 7

6(5). Pronotum very strongly and closely punctate, producing a cribrate (not rugose) surface; punctures on anterior part of pronotum with long setae, the rest with short stubble; elytra shagreened, matt, with dense stubble. N. N.T. ..... 28. *rugosicollis* Gillet
   Pronotum with relatively small punctures, sparse in male, the surface between them rugose, especially in minor male and female; pronotum glabrous; elytra nitid, almost glabrous. N. Qld. ..... 29. *tricavicollis* Lea

7(5). Pronotal surface feebly rugose, finely punctate, glabrous; anterior angles with prominent points in major male; elytral intervals flat, smooth, striae superficial. N. Qld. ..... 30. *conspicuus* Macleay
   Pronotal surface strongly rugose, at least on sides, coarsely punctate, with long setae anteriorly; anterior angles with the points curved outward, not prominent; elytral intervals convex, coarsely punctate, striae deep. N. Qld. ..... 31. *bicavicollis* Lea

## 24. ONTHOPHAGUS SALEBROSUS Macleay

(Figs. 83, 488)

*Onthophagus salebrosus* Macleay, 1888, p. 900; Boucomont and Gillet, 1927, p. 216.

Brown, antennal clubs fuscous. Total length 8 mm. The female is unknown.

*Male*

*Head.*–Clypeal margin feebly produced medially and reflexed, forming a broad, very short process feebly excised at a very obtuse angle, rest of head margin evenly rounded. Clypeal suture with frontal section effaced, genal sections visible only near margins. Frontal carina largely effaced, represented only by a short sharp oblique ridge near each eye. Eyes small, with 8 facet rows across widest point, separated by about 17 widths, canthus complete. Surface finely and sparsely punctate except along edges, which are coarsely and densely punctate. Labium incised nearly to base, the incision V-shaped. *Pronotum.*–Anteriorly with a prominent median projection divided into 2 by a shallow depression, with a tubercle on each side of this projection about halfway to lateral margin. Anterior angles quadrate, not projecting. Hind edge of pronotum not margined. Termination of margin at posterior end of sides marked by a slight protuberance. Surface shiny, very strongly rugose and punctate, the punctures bearing a short erect seta, except in concavities between median and lateral prominences, which are smooth and impunctate. *Elytra.*–Intervals flat, very strongly rugose with irregular raised areas, nitid, with a double row of small punctures each bearing a short erect seta. Striae superficial, geminate, transversely punctate. *Legs.*–Fore tibiae slender, with a thin brush of long setae at distal end longer than fore spur. *Abdomen.*–Pygidium rugose, shagreened, coarsely punctate, each puncture with a short seta. Aedeagus normal.

*Type*

Holotype ♂, north Western Australia, MM. Seen by the author.

*Distribution* (Fig. 82)

The Kimberley District of Western Australia. Macleay's specimen was presumably collected near Derby. The other known specimen comes from the eastern part of the district. Nothing is known of the ecology of this species.

*Material Examined*

The type and one specimen. WESTERN AUSTRALIA: Argyle Station, Kimberleys, 6.vi.1944, C.F.H.J., ANIC, 1.

## 25. ONTHOPHAGUS TENEBROSUS Harold

(Figs. 19, 86, 489)

*Onthophagus rugosus* Kirby, 1818 (non Poda, 1761), p. 398; Harold, 1869, p. 84; Blackburn, 1903, p. 270; Lea, 1923, p. 353; Boucomont and Gillet, 1927, p. 216.

*Onthophagus tenebrosus* Harold, 1871 (nom. nov.), p. 114; Boucomont and Gillet, 1927, p. 216.

Black, antennal clubs flavous, pilosity pale. Total length 9–13 mm.

*Male*

*Head.*–Clypeal margin medially produced and reflexed, truncate and feebly bilobate. Genal margins not projecting, rounded. Clypeal suture carinate, nearly straight across head in major male, more bent at junction of frontal and genal sections in minor

male. Frontal carina very low, almost or completely effaced in major male, relatively short. Eyes small, with 9–11 facet rows across widest point, separated by about 20 widths, canthus complete. Surface entirely coarsely and densely punctate (except behind frontal carina), transversely rugose on clypeus. Labium excised a little more than halfway, in a rounded V. *Pronotum.*–Anteriorly with a pair of prominent rounded or pyramidal lobes separated by a median excision and flanked by a pair of round depressions and a conical tubercle on either side about halfway to margin. Minor male with projections and depressions greatly reduced. Anterior angles quadrate, the apices produced, slightly turned out, lateral margin behind them evenly rounded. Hind edge margined. Surface extremely rugose everywhere except in 2 anterolateral depressions of major male, which are smooth and shagreened. Surface covered with very fine punctures bearing very short stubble. *Elytra.*–Intervals flat, extremely rugose, shagreened between rugae, with scattered fine punctures bearing very fine stubble. Striae superficial, geminate, with very small round punctures. *Legs.*–Fore tibiae very slender and curved inward distally in major male, with a large broad tuft of long golden setae along inner distal angle (Fig. 19). In minor male, tibia is not as curved and setae are fewer. *Abdomen.*–Pygidium shagreened, ventrally rugose, with numerous coarse punctures bearing fairly long pale setae. Aedeagus normal.

*Female*

Clypeal margin not so prominently produced, not reflexed, more feebly bilobate. Head surface more densely punctate, frontal carina more prominent but not raised into a crest. Pronotal prominences lower, without smooth depressions. Fore tibiae not slender, without tuft of long setae. Otherwise like male.

*Type*

Holotype ♂, Australasia, D. Macleay, BMNH. Seen by the author.

*Distribution* (Fig. 82)

A characteristic species of the sandstone hills in the hinterland of Sydney, extending northwards inland along the 30- and 40-in. isohyets as far as Carnarvon Gorge, Qld., and southwards through Victoria to Adelaide. Collected in sand at human excrement, from September to April.

*Material Examined*

The type and 109 specimens. SOUTH AUSTRALIA: Bellevue; Lyndoch. VICTORIA: Ballarat. NEW SOUTH WALES: Blue Mountains; Boro; Colo Heights; Glenugie, 15 miles S. of Grafton; Gosford; 13 miles N. of Marulan; Moonbi; Putty; Richmond River; Somersby; Sydney; Tabbimobile; Waterfall; Yarramalong Mountain. QUEENSLAND: Ballandean, Carnarvon Gorge; Glen Aplin; Shotover; Stanthorpe.

## 26. ONTHOPHAGUS JALAMARI, sp. nov.

(Figs. 20, 84, 85, 490, 491)

Black, antennal clubs flavous. Total length 10–15 mm.

*Male*

*Head.*–Clypeal margin medially strongly produced and reflexed in major male, forming a slightly emarginate, subquadrate lobe, this lobe reduced in minor male.

Genal margins forming a projecting lobe near clypeal suture in major male, margin behind this lobe convex. Clypeal suture sharply cariniform, the frontal section evenly procurved, forming sharp angles with genal sections. Frontal carina low, sharp, slightly angled forward, equidistant between base of head and clypeal suture, joined with sharp occipital carina to enclose a slightly depressed, transversely pentagonal area, 3 times as wide as long. Eyes moderate, oval, with 17 facet rows across widest point, separated by about 10 widths. Clypeal surface evenly and moderately densely punctate in major male, somewhat transversely rugose in minor one, genae and front half of frons finely and remotely punctate, area behind frontal carina impunctate and shagreened. Labium incised nearly to base, edges of incision parallel. *Pronotum.*–With anterior declivity nearly vertical in major male and surmounted by 4 more or less equidistant, sharp points, the middle and outer ones joined by a low recurved ridge, the 2 middle ones not so joined. Anterior angles acute, projecting, joined by an evenly concave margin to lateral angles, which are also acute and prominent in major male, but almost absent in minor one. Hind edge margined. Surface strongly rugose on disc, finely shagreened between rugae, becoming moderately punctate on sides and very finely punctate on anterior declivity, which is also rugose medially. Nitid, glabrous. *Elytra.*–Intervals flat or very feebly convex, extremely finely punctate, shagreened, glabrous. Striae moderately impressed, simple, extremely finely punctate. *Legs.*–Fore tibiae slender, not distally curved, with a brush of setae at distal end longer than fore spur. *Abdomen.*–Pygidium shagreened, with a very few scattered punctures on sides, each bearing a seta. Aedeagus normal.

*Female*

Clypeal margin not produced, not emarginate, very slightly truncate in middle. Genal margins only slightly prominent, rounded. Frons bearing a strong erect transverse crest extended into a pair of rounded points at the sides, the edges medially slightly convex in frontal view. Minor female without these points. Clypeal and part of genal surfaces strongly transversely rugose, rest of head moderately punctate. Pronotum sculptured as in male, with 4 projections, but lateral ones not joined to median ones by a carina. Median ones somewhat flattened, more rounded, the edges less sharp. Anterior angles less prominent, lateral angles absent. Pronotal surface more strongly rugose and uneven except in the concavities in anterior declivity on either side of median prominences. Fore tibiae not elongated, without seta brush. Otherwise like male.

*Type*

Holotype ♂, Humpty Doo, N.T., 28–29.i.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 82)

Known only from the type locality, where it was found under cow dung, in open woodland and sandy soil.

*Material Examined*

The type and 15 specimens. NORTHERN TERRITORY: Humpty Doo, 28–29.i.1968, E. G. Matthews, ANIC, 15.

## 27. ONTHOPHAGUS FISSICEPS Macleay

(Figs. 87, 88, 492, 493)

*Onthophagus fissiceps* Macleay, 1888, p. 899; Blackburn, 1903, p. 303; Lea, 1923, p. 365; Boucomont and Gillet, 1927, p. 212.

*Onthophagus integriceps* Macleay, 1888, p. 900; Blackburn, 1903, p. 303; Lea, 1923, p. 365; Boucomont and Gillet, 1927, p. 213. New synonymy.

*Onthophagus semirugosus* Gillet, 1927, p. 259. New synonymy.

*Onthophagus darwini* Paulian, 1937, p. 345. New synonymy.

Black, antennal clubs fulvous. Total length 10-12 mm.

*Male*

*Head.*—Clypeal margin strongly produced medially and angularly emarginate in major male, only slightly produced and feebly bilobate in minor one. Genal margins forming a projecting angular lobe behind clypeal suture, margin behind this lobe concave in major male. Minor male with a simply rounded genal margin. Clypeal suture with frontal section sharply cariniform, feebly sinuate, forming only a very feeble angle with genal sections, which are very short. Frontal carina low, sharp, strongly angled forward, joined with occipital carina to form a slightly depressed fusiform area twice as wide as long. Minor male with median part of frontal carina raised as in female, sometimes with a low median longitudinal keel crossing frontal area. Eyes moderate, oval, with 13 facet rows across widest point, separated by about 10 widths. Surface before frontal carina densely punctate, the punctures running together to form transverse grooves on clypeus and genae. Area behind frontal carina impunctate, shagreened. Labium split nearly to base. *Pronotum.*—With a median bilobate or bifurcate process, the lobes strongly divergent and apically flattened, prolonged and acute in major male, low, carinate, and obtuse in minor one. These lobes joined together by a carina which is evenly curved in major male, broadly V-shaped in minor one. Minor male with an acute conical lateral projection about halfway between median lobe and lateral margin, major male with only a very low tumosity here. Anterior angles projecting, quadrate in major male, rounded in minor one. Lateral margin evenly rounded. Surface strongly, irregularly rugose on disc and sides, smooth, finely punctate and shagreened on anterior declivity. *Elytra.*—Intervals flat, very finely shagreened, sericeous, impunctate and glabrous. Striae superficial, simple, with very small round punctures. *Legs.*—Fore tibiae slender in major male, elongated, with distal brush of long setae (Fig. 20). *Abdomen.*—Pygidium shagreened, moderately punctate, the punctures setigerous. Aedeagus normal.

*Female*

Clypeus only slightly produced, not emarginate, indistinctly truncate. Frons with an erect transverse crest extended into a pair of very low points laterally (absent in minor female), the edge medially slightly convex in front view. Head surface before this crest more coarsely punctate and rugose. Pronotum sculptured as in minor male, with a transverse row of 4 projections, the middle 2 forming a bilobate process, the lobes joined by a transverse carina which is very broadly V-shaped in major female, straight in minor one. Anterior angles as in minor male. Pronotal surface very strongly rugose except in concavities on sides of anterior declivity. Fore tibiae not elongate, without seta brush. Otherwise like male.

*Types*

Holotype of *fissiceps*: ♂, King's Sound, W.A., MM.
Holotype of *integriceps*: ♂, King's Sound, W.A., MM.
Holotype of *semirugosus*: ♂, Victoria [River, N.T. ?], BMNH.
Holotype of *darwini*: ♂, Port Darwin, N.T., DEI.
All seen by the author.

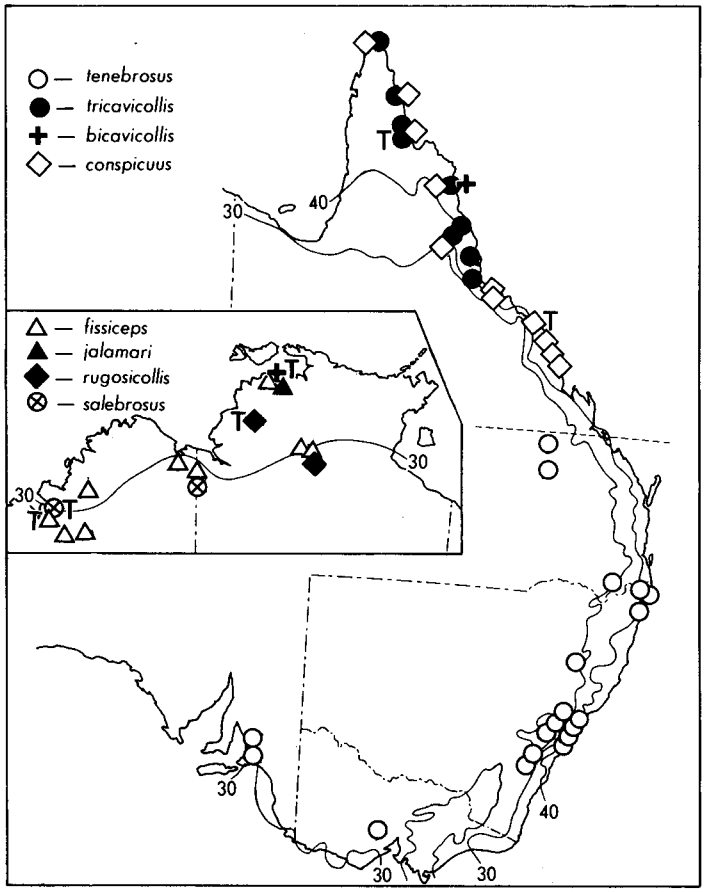
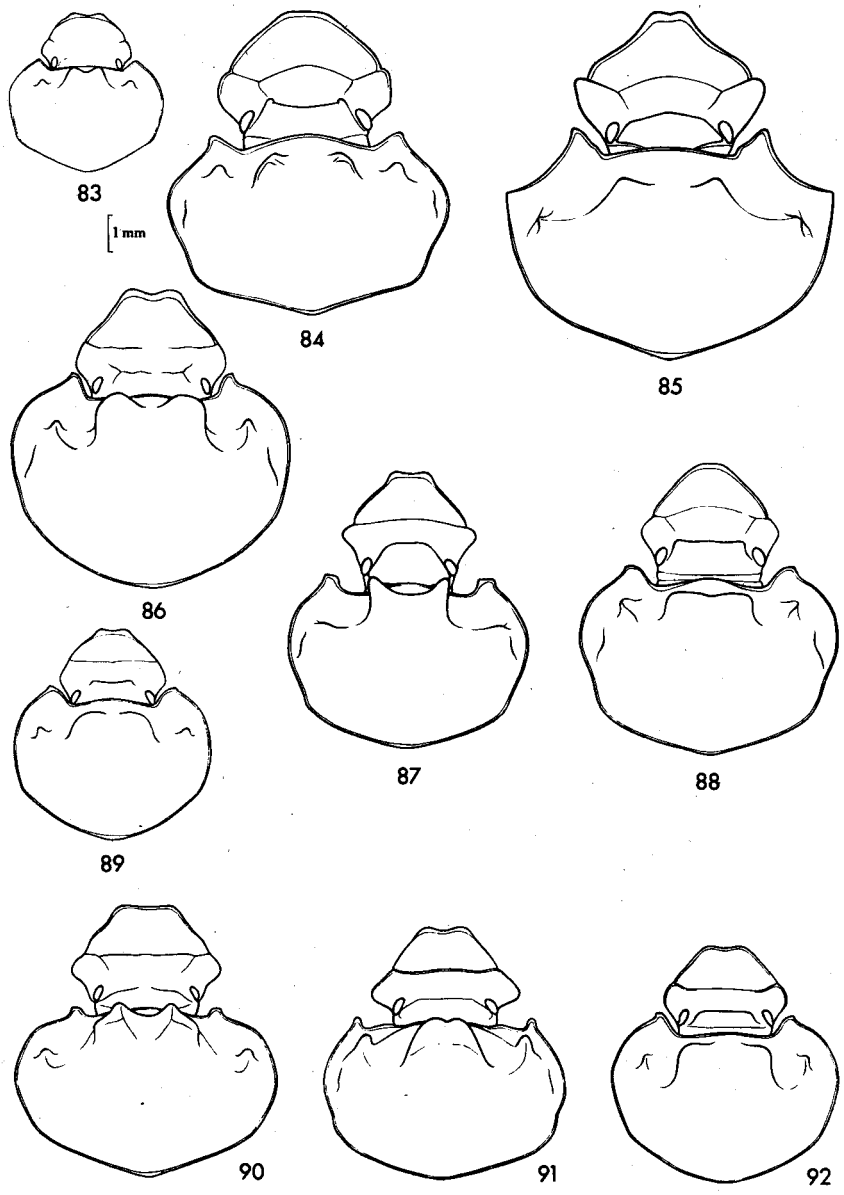



Fig. 82.–Known distribution of the *conspicuus* group in relation to annual rainfall (in.).

*Remarks*

The strongly modified major male, with its angular genae, lengthened head, produced clypeus and anterior angles, and absent lateral pronotal projections caused Macleay (1888) to believe it to be a different species from the minor male and female, which he called *integriceps*. Lea (1923) suspected this synonymy but did not go as far as formally to unite the names. The type of *darwini* is a typical male *fissiceps*, as is that of *semirugosus* Gillet. The latter author was probably misled by the label "Victoria" on the specimen. This specimen comes from the Nevinson Collection in




Figs. 83–92.–*Onthophagus* spp., fore body: *83*, *O. salebrosus*, male; *84*, *85*, *O. jalamari*: *84*, female; *85*, male; *86*, *O. tenebrosus*, male; *87*, *88*, *O. fissiceps*; *87*, male; *88*, female; *89*, *O. rugosicollis*, male; *90*, *O. tricavicollis*, male; *91*, *O. conspicuus*, male; *92*, *O. bicavicollis*, male.

BMNH and, like many others in this collection, it is from northern Australia although labelled "Victoria". Perhaps the Victoria River, N.T., is meant.

*Distribution* (Fig. 82)

The north of the Northern Territory above the 30-in. annual isohyet, and the Kimberley District of Western Australia. Found in sandy soil in open areas, including cattle pastures, in fair numbers under cow dung and wallaby droppings. It did not come to traps baited with human excrement in the same areas. Found from December to April.

*Material Examined*

The types and 62 specimens. NORTHERN TERRITORY: Collins Paddock, Burnside Station, 10.xii.1931, T. G. Campbell, ANIC, 1; Howard Springs, Darwin, 27–29.i.1968, E. G. Matthews, ANIC, 1; 2–4 miles E. of Katherine, 8.ii.1968, E. G. Matthews, ANIC, 8; 16–20 miles W. of Katherine, 9–10.ii.1968, ANIC, 3. WESTERN AUSTRALIA: Camballin, Kimberleys, 1.iii.1968, J. A. L. Watson, ANIC, 1; 37–59 miles W. of Fitzroy Crossing, 26.ii.1968, E. G. Matthews, ANIC, 1; Mt. Hart, 1–12.ii.1965, A. Douglas, WAM, 1; Kimberley, ANIC, 1; Kimberley Research Station, 22.iii.1955, E. C. B. Langfield, ANIC, 1; King's Sound, Froggatt, ANIC, 3; Kununurra, 13–22.ii.1968, E. G. Matthews, ANIC, 19; 60 miles NW. of Kununurra, 14, 18.ii.1968, E. G. Matthews, ANIC, 2; 3-mile, Wyndham, 16.iv.1930, T. G. Campbell, ANIC, 1; Wyndham, 19.iii.1930, T. G. Campbell, ANIC, 16.

## 28. ONTHOPHAGUS RUGOSICOLLIS Gillet

(Figs. 89, 494)

*Onthophagus cribricollis* Lea, 1923, p. 379 (non Horn, 1881).

*Onthophagus rugosicollis* Gillet, 1925, p. 236 (nom. nov.); Boucomont and Gillet, 1927, p. 216.

Fore body except clypeus coppery green, clypeus and rest of body and legs black, antennal clubs flavous. Total length 8–10 mm.

*Male*

*Head.*–Clypeal margin medially produced, reflexed, and feebly bilobate, rest of head margin nearly straight to genal angles, which are not advanced. Clypeal suture forming a straight transverse carina on head in major male, slightly angled forward at genae in minor one. Frons with a short transverse carina, very low in major male, more elevated in minor one, which ends laterally in slightly elevated pyramidal projections. Eyes small, with 8–10 facet rows across widest point, separated by about 14 widths, canthus complete. Surface very coarsely, deeply, and closely punctate and transversely rugose. Labium incised more than halfway to base, sides of incision parallel. *Pronotum.*–Anteriorly with a pair of procurved transverse carinae not quite joining in middle, delimiting a flat discal surface from a vertical anterior one in major male; in minor male discal surface more sloping, the carinae smaller and more remote. A tubercle on either side about halfway to margin. Anterior angles rounded, with small apices produced by a thickening of marginal beading. Hind edge margined. Surface extremely coarsely, densely, and deeply punctate on disc, surface between punctures flat, the whole having a cribrate texture. Punctures on sides contiguous, anterior declivity on either side of middle much less coarsely punctate, shagreened. Punctures each with an erect seta, those of anterior declivities with long sparse setae. *Elytra.*–Intervals convex, shagreened, the surface mildly uneven, punctate, each puncture with

a very short erect seta. Striae deep, geminate, very finely punctate, the punctures round. *Legs.*–Fore tibiae slender, in major male sharply incurved apically and bearing a loose tuft of long setae at distal end about as long as fore spur. *Abdomen.*–Pygidium shagreened, very coarsely punctate, the punctures setigerous. Aedeagus with the parameres somewhat elongated ventrally and produced outward.

*Female*

Head as in minor male, with clypeal margin medially produced, reflexed, and feebly bilobate or truncate, lateral head margin almost straight to genal angles, which are more rounded. Clypeal suture almost straight across, but frontal carina a little more elevated. Pronotum as in minor male, with 2 remote, low, curved median carinae and 2 elevated lateral tubercles. Front tibiae not elongated. Otherwise like male.

*Type*

Holotype ♂, Daly River, N.T., H. Wesselman, SAM I.15419. Seen by the author.

*Distribution* (Fig. 82)

Known only from Daly River and 28 miles south-west of Katherine, N.T. The author collected it in the latter locality in one spot which contrasted with the surrounding country of open eucalypt savannah woodland in being more densely wooded, with the ground continuously shaded by some acacias. In pure sand at human excrement bait.

*Material Examined*

The type and five specimens. NORTHERN TERRITORY: 28 miles SW. of Katherine, 10.ii.1968, E. G. Matthews, ANIC, 5.

## 29. ONTHOPHAGUS TRICAVICOLLIS Lea

(Figs. 90, 495)

*Onthophagus tricavicollis* Lea, 1923, p. 374; Boucomont and Gillet, 1927, p. 216.
*Onthophagus conspicuoformis* Paulian, 1937, p. 345. New synonymy.

Fore body (except clypeus) and pygidium green or green with cupreous reflections, clypeus and rest of body and legs black, antennal clubs fulvous. Total length 9–13 mm.

*Male*

*Head.*–Clypeal margin reflexed, broadly truncate or very slightly bilobed, rest of margin nearly straight to genal angles, which are projecting and rounded. Clypeal suture nearly straight across, forming a very feeble angle at genae near margins. Frontal carina very low, long, nearly reaching eyes, its oblique lateral sections more raised than transverse middle section in major male, entirely raised in others. Eyes small, with about 10–12 facet rows across widest point, separated by about 13 widths, canthus complete. Surface moderately punctate, glabrous. Labium split nearly to base.
*Pronotum.*–With a transverse row of 4 prominences, of which the middle 2 are much more closely approximated to each other than to lateral 2 in major male, all 4 about equidistant in minor male. Middle prominences roundly truncated, very prominent,

the truncated surfaces forming a pair of nearly vertical ridges on anterior face, separated by a rounded concavity in major male, in minor male consisting of a pair of well-separated oblique carinae. Lateral prominences small, conical. Anterior angles quadrate, not prominent, the apices slightly produced, rounded. Hind edge margined. Surface feebly rugose on disc, sides, and middle of anterior declivity, shallowly punctate, the punctures separated by about 2 diameters, anterolateral concavities of major male smooth, nitid, very finely punctate, glabrous. *Elytra.*–Intervals slightly convex, feebly rugose, nitid, with scattered fine punctures bearing barely visible stubble on sides of elytra. Striae moderately impressed, fine, with very small round punctures. *Legs.*–Fore tibiae slender, slightly curved distally in major male, bearing a tuft of setae at inner distal angles as long as fore spur. *Abdomen.*–Pygidium shagreened, moderately punctate, the punctures setigerous. Aedeagus with parameres prolonged, the apices spatulate.

*Female*

Clypeal edge rounded, not reflexed. Surface of clypeus transversely rugose. Frontal carina more prominent, but not forming a crest. Pronotum more strongly rugose, sculptured as in minor male, with middle prominences remote. Fore tibiae not slender, without seta tuft. Otherwise like male.

*Types*

Holotype of *tricavicollis*: ♂, Coen River, Qld., W. D. Dodd, SAM.
Holotype of *conspicuoformis*: ♀, Mulgrave River, Qld., Hacker, DEI.
Both seen by the author.

*Remarks*

The type of *conspicuoformis* is a typical female *tricavicollis*, probably part of the same series cited by Lea (1923, p. 375) as having been collected by Hacker on the Mulgrave River near Gordonvale.

*Distribution* (Fig. 82)

Coastal mountains and tablelands of north Queensland from Paluma (Mt. Spec) to Cape York (probably also descending to sea level north of the Atherton Tableland). Occurring in open pastures and open woodlands in sand or sandy loam. Trapped with human excrement bait from January to June.

*Material Examined*

The types and 105 specimens. QUEENSLAND: Atherton, 7.v.1964, 26.iii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 11; Bamaga, 26.iii.1964, I. F. B. Common and M. S. Upton, ANIC, 1; Big Tableland, 17 miles S. of Cooktown (2000 ft), 6.vi.1968, F. Parker, ANIC, 1; Cairns, E. Allen, A. M. Lea, W. W. Froggatt, ANIC, 4; Cardwell Range, 2.v.1964, G. F. Bornemissza, ANIC, 1; Coen R., W. D. Dodd, SAM, 2; Crystal Ck., near Paluma, 20.iii.1965, G. F. Bornemissza, ANIC, 3; Evelyn, 7 miles N. of Ravenshoe, 23.i.1968, R. J. Elder, ANIC, 2; Gillie's Highway, 20.iii.1965, 7.iv.1969, G. F. Bornemissza, ANIC, 61; Iron Range, 11–17.v.1968, G. Monteith, UQ, 8; Lankelly Ck., McIlwraith Range, June 1932, P. J. Darlington, MCZ, 1; Lockerbie, 6–10.vi.1969, G. B. Monteith, UQ, 2; Paluma, 20.iii.1965, 14.iv.1969, G. F. Bornemissza, ANIC, 4; Tableland (Atherton ?), 3.iv.1926, G. Bates, ANIC, 2; Yungaburra, 7.v.1964, 27.iii.1965, G. F. Bornemissza, ANIC, 4.

## 30. ONTHOPHAGUS CONSPICUUS Macleay

(Figs. 91, 496)

*Onthophagus conspicuus* Macleay, 1864, p. 121; Blackburn, 1903, p. 268; Lea, 1923, p. 366; Boucomont and Gillet, 1927, p. 210.

*Onthophagus bovilli* Blackburn, 1903, p. 278; Lea, 1923, p. 369 (syn.).

Green, sometimes with cupreous reflections, clypeus black, underside and legs piceous with green reflections, antennal clubs flavous. Total length 8–12 mm.

*Male*

*Head.*—Clypeal margin medially produced, reflexed, and truncate or very feebly bilobate. Rest of margin nearly straight to genal angles, which are very prominent in major male. Clypeal suture carinate, nearly straight across head, forming only very feeble angles at genae. Frontal carina very low but sharp, with a transverse median section and oblique lateral sections which are raised to sharp ridges at ends near eyes. Eyes small, with 10–12 facet rows across widest point, separated by a distance equal to about 15 widths. Clypeus strongly, densely punctate and transversely rugose, rest of head shallowly, densely, and finely punctate. Labium split nearly to base. *Pronotum.*—Anteriorly with 3 flattened lobes in a transverse row, the middle one horizontal, rounded, more or less emarginate medially, and the lateral ones vertical and laminar. Between these and middle lobe there is a small but deep concavity. In major male, a second pair of shallower concavities occurs near anterior angles. In minor male the median lobe is divided into 2 oblique, approximated but separate, rounded ridges as in female. Anterior angles obtuse, but with apices produced into prominent rounded lobes in major male only, subquadrate with apices only a little prominent in minor one. Hind edge margined. Surface feebly rugose on disc and sides, smooth and shagreened on anterior declivities and concavities, very finely punctate, glabrous. *Elytra.*—Intervals flat or very feebly convex, shagreened, impunctate on disc, very finely punctate laterally, glabrous. Striae superficial, simple, with very small round punctures. *Legs.*—Fore tibiae slender, not distally curved, with a distal tuft of only a few setae about as long as fore spur. *Abdomen.*—Pygidium shagreened, with a few punctures on sides bearing setae. Aedeagus normal.

*Female*

Clypeal margin rounded, not produced or reflexed, genal margins not prominent, forming more rounded angles. Frontal carina raised into a low crest pointed near each end, the edge evenly recurved between the points. Pronotum as in minor male, with median lobe divided into 2 oblique, slightly separated crests. Fore tibiae not elongated, without seta tuft. Otherwise like male.

*Types*

Holotype of *conspicuus*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *bovilli*: ♀, Northern Territory, SAM.
Both seen by the author.

*Distribution* (Fig. 82)

Coastal Queensland from the vicinity of Mackay north to Cape York, and apparently westward to the Northern Territory, where the type of *bovilli* comes from.

It extends much further south than the closely related *tricavicollis*, but completely overlaps the range of the latter. It does not seem to occur on the Atherton Tableland, where *tricavicollis* is common, although Dr. Darlington collected it inland from the tableland, west of Ravenshoe. The two species occur together at Iron Range on the Cape York Peninsula, where Mr. Monteith found both in open woodland, *conspicuus* being commoner there.

Found in open pastures, open woodland, in sand and loam, under bovine and marsupial dung. December to May.

*Material Examined*

The types and 52 specimens. QUEENSLAND: Bamaga, Jan. 1958, Darlingtons, MCZ, 5; Blue Water Ck., near Townsville, 17.iii.1965, G. F. Bornemissza, ANIC, 2; 10 miles N. of Bowen, 14.iii.1965, G. F. Bornemissza, ANIC, 9; Cairns district, J. A. Anderson, QM, 3; Claudie R., Dr. Macgillivray, AM, 1; Endeavour R., UQ, 1; Finch Hatton Ck., 27.iii.1968, E. G. Matthews, ANIC, 1; Silver Plains H.S., 5.i.1962, J. L. Wassell, ANIC, 1; Townsville, 10.v.1964, G. F. Bornemissza, MCZ, 1; Lockerbie, 1.iv.1964, I. F. B. Common and M. S. Upton, ANIC, 1; Mt. Garnet, Dec. 1960, N.E.U. Exp. Soc., UNE, 1; Proserpine, 13.iii.1965, G. F. Bornemissza, ANIC, 1; W. of Ravenshoe (c. 3000 ft), Feb. 1958, Darlingtons, MCZ, 6; Sarina, 12.iii.1965, G. F. Bornemissza, ANIC, 1; Silver Plains, H.S., 5.i.1962, J. L. Wassell, ANIC, 1; Townsville, 10.v.1964, G. F. Bornemissza, ANIC, 1; Townsville, UQ, 1; Woodstock, 16.iii.1965, G. F. Bornemissza, ANIC, 6.

## 31. ONTHOPHAGUS BICAVICOLLIS Lea

(Figs. 92, 497)

*Onthophagus bicavicollis* Lea, 1923, p. 375; Boucomont and Gillet, 1927, p. 209.

Fore body green except anterior part of clypeus, which is black. Elytra and pygidium dark brown with green reflections, appearing entirely green in natural light. Underside black, antennal clubs flavous. Total length 8–11 mm.

*Male*

*Head.*–Clypeal margin medially strongly produced and reflexed, truncate and very feebly emarginate, rest of margin straight to genal angles, which are rounded and moderately projecting. Clypeal suture with frontal section almost straight, forming distinct angles with genal sections. Frontal carina very low, the median section transverse, lateral sections bent back, not raised even in minor male. Eyes small, with 10–12 facet rows across widest point, separated by about 15 widths, canthus complete. Clypeus finely punctate apically, basally transversely rugose or coarsely punctate, rest of head coarsely punctate, less so behind frontal carina. Labium split nearly to base. *Pronotum.*–Anteriorly with a pair of deep concavities separated by a broad flattened lobe, sides of this lobe sharp, rounded, overhanging concavities and oblique in front view, surface between them mildly concave in dorsal view. Outer edges of concavities with a small conical projection. Anterior angles subquadrate, the apices curved outward. Hind edge margined. Surface moderately densely and very coarsely punctate on disc, the punctures separated by more than their diameter, becoming strongly rugose on sides. Surface between punctures smooth, nitid. Concavities smooth, shagreened, finely punctate. Anterior declivities and cavities with long setae. *Elytra.*–Intervals strongly convex, coarsely punctate, not shagreened, with microtrichia. Striae impressed, simple, with frequent small round punctures. *Legs.*–Fore tibiae elongate, slightly curved apically, with a thin brush of setae about as long as fore spur issuing from

apical end. *Abdomen.*–Pygidium shagreened, with numerous coarse punctures each bearing a long seta. Aedeagus normal.

*Female*

Clypeal margin feebly bilobate, clypeal surface strongly transversely rugose. Frontal carina arched forward. Pronotum with only a trace of anterior concavities, entirely coarsely punctate and rugose, anteriorly with a few long setae. Fore tibiae not elongate. Otherwise like male.

*Type*

Holotype ♂, 30 miles east of Darwin, N.T., G. F. Hill, SAM, I.15501. Seen by the author.

*Distribution* (Fig. 82)

Known only from the type locality near Darwin and from Endeavour River (Cooktown), Qld. The specimens from Queensland are all in the Paris or Macleay museums and the species has not been collected there in this century.

*Material Examined*

The type and eight specimens. QUEENSLAND: Cooktown, ex mus. van de Poll, MNHN (Bouc), 1; Endeavour R., MM, 5; no exact locality, ex mus. van Lansberge, MNHN (Gen), 1; no data, ex mus. van Lansberge, MNHN (Gen), 1.

## IV. *The* PRONUS *Group*

Eyes very wide, with 25–28 facet rows across widest point, separated by 4.5–5 widths, canthus complete. Labium excised halfway or a little more. Dorsal surfaces entirely glabrous, very finely punctate. Pygidium glabrous. Colour entirely black. Total length 8–13 mm.

Male with frontoclypeal suture effaced, without frontal carina or with 2 small transverse carinae. Pronotum unarmed or with anterior median tumescence, or with long slender prong directed forward. Fore tibiae elongated, sometimes very much so, with a distal fringe or brush of long setae. Female with frontoclypeal and frontal carinae complete, unarmed.

Three species: 32. *pronus* Erichson; 33. *leanus* Goidanich; 34. *bornemisszanus*, sp. nov.

Erichson (1848) proposed the genus *Psilax* to receive *pronus*. He was not followed in this by Lacordaire (1856) or any later workers. In spite of the unusual appearance of major male *pronus* and *bornemisszanus*, the species of this group are typical *Onthophagus*. The three species making up the group are closely related and spread over a wide geographical range, giving the impression of being separate fractions of what used to be until recently a single widespread species.

All three species are dense woodland or even rain forest forms.

KEY TO SPECIES OF THE *PRONUS* GROUP

1. Metasternum with at least a few large punctures on either side of midline near hind edge; elytral surfaces nitid, striae impressed, intervals somewhat convex; eyes with about 25 facet rows across, separated by about 5 times their width; major male with a median anterior process on pronotum which projects forward beyond pronotal margin, even when small, and does not extend much beyond clypeal margin when long. Tas., SE. S.A., Vic., N.S.W. ..... 32. *pronus* Erichson

Metasternum impunctate or with very small punctures in middle near hind edge; elytral surfaces alutaceous, striae superficial, intervals flat; eyes with 27–28 facet rows across, separated by about 4.5 times their width; pronotum either entirely devoid of any process or with one which in major male extends well beyond clypeal margin ..... 2

2(1). Pronotum of male entirely devoid of a median anterior process, at most with a swelling here which does not project beyond margin of pronotum; clypeal margin of male with a slightly projecting median lobe; pronotum of female without trace of median anterior swelling. N.S.W., S. Qld. ..... 33. *leanus* Goidanich

Pronotum of major male with a very long process usually extending well beyond edge of clypeus, probably always present to some extent; clypeal margin of male with a median emargination; pronotum of female usually with a trace of median anterior swelling. N. Qld. ..... 34. *bornemisszanus*, sp. nov.

## 32. ONTHOPHAGUS PRONUS Erichson ♂

(Figs. 94–96, 498, 499)

*Onthophagus pronus* Erichson, 1842, p. 154; Blackburn, 1903, p. 271; Lea, 1923, p. 369; Boucomont and Gillet, 1927, p. 215.

*Psilax pronus* Erichson, 1848, p. 763; Lacordaire, 1856, p. 109; Harold, 1867, p. 31; Boucomont and Gillet, 1927, p. 118. (*Onthophagus*.)

Piceous to black, antennal clubs fulvous. Total length 8–13 mm.

*Male*

*Head.*–Clypeal margin forming 3 straight sections, the middle one a little emarginate, finely margined, genal angles prominent, angulate. Clypeal suture with frontal section effaced, genal sections finely carinate, oblique, prolonged backward on to frons. Frons and vertex flat, with the sides forming a fine raised ridge alongside inner margin of each eye. Major male with frons smooth, minor male with a pair of fine transverse ridges arising at terminations of genal sutures and running for a short distance inward, sometimes raised into low points. Eyes very large, with about 25 facet rows across widest point, separated by 5 widths, canthus complete. Centre of head smooth and impunctate, nitid, genae with a few small shallow punctures, clypeus finely asperate along margin, glabrous. Labium incised about halfway. *Pronotum.*–Flattened, major male with a narrow flattened horn arising from middle near anterior margin and directed forward, a pair of small lateral ridges at its base. This horn more or less curved down and with maximum development extending just beyond edge of clypeus. Minor male with at least an angular protuberance here always present. Anterior angles subquadrate, acute in major male, the apices rounded, middle of lateral margin strongly curved outward. Hind edge unmargined. Very finely and sparsely punctate, the punctures extremely small on base and disc, glabrous, surface smooth, nitid. *Elytra.*–Intervals moderately convex, smooth, nitid, with very small punctures, glabrous. Striae impressed, fine, simple, with numerous very small punctures a little wider than stria. *Metasternum.*–With large punctures (setigerous in young specimens) on either side of midline near hind edge. *Legs.*–Forelegs greatly elongated and slender in major male, fore tibia with a fringe of long setae along its inner edge and curving around apical angle, which is rounded, and distal edge. Spurs and claws large. *Abdomen.*–Pygidium small, nitid or sericeous, densely punctate with small punctures, glabrous. Aedeagus normal.

*Female*

Clypeal margin evenly rounded and feebly bilobate medially, clypeal surface densely punctate, asperate or rugulose in some specimens. Clypeal suture with frontal section present, straight, beaded, joining genal sections at obtuse angles well away from margins. Frons with a fine transverse carina, sometimes depressed briefly in middle. Pronotum of major female with a feeble transverse median tumescence near anterior edge, that of minor female unsculptured. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, Van Diemen's Land, Schayer, ISZ 26844. Seen by the author.

*Distribution* (Fig. 93)

Tasmania, the south-east of South Australia, Victoria, and parts of New South Wales. Its occurrence appears to be mainly coastal in the south, although a few inland records are known there (the Grampians, Khancoban in the Murray valley), but north of the Bateman's Bay area, N.S.W., which is its northernmost coastal point, *pronus* has been found inland only, on the eastern edges of the southern and New England tablelands. Its range therefore coincides approximately with the area enclosed within the 60°F mean annual isotherms (Fig. 93).

*O. pronus* was collected by Dr. Bornemissza primarily in forested areas, but on cloudy days it may emerge onto pastures. In the south it occurs in both sand and loam soils, but at Durras Water, N.S.W., where it is sympatric with *leanus*, it is confined to heavier soils while *leanus* occupies loose sand. One individual was collected by the author near Dorrigo, N.S.W., in a pasture of loam soil under cow dung. This species is nocturnal and comes to light. It has been collected at all types of excrement and rabbit entrails.

Collected in all months of the year except August and September, with only one record each for July and February. Most available specimens were collected in early summer (November–January).

*Material Examined*

The type and 93 specimens. TASMANIA: Flinders I., Badger Corner near Lady Barron; Green's Beach; Kelso; 13 miles S. of Westbury. SOUTH AUSTRALIA: Adelaide; Kangaroo I., Mt. Thisby, 10 miles W. of Vivonne Bay; 17 miles SE. of Mt. Gambier. VICTORIA: Beaconsfield; Boolarra; 13–23 miles N. of Cann River; Cape Otway; Dalimurla; Darby Saddle; Gunyah; Grampians, Barney's Ck., Jimmy's Ck. Rd.; Hall's Gap; Mallacoota; Morwell; Orbost–Mt. Drummer; 28 miles NW. of Portland; Stony Pt., 6 miles S. of Hastings. NEW SOUTH WALES: Acacia Plateau; Boro; 11 miles E. of Cathcart; Clyde Mountain; Dorrigo National Park; Durras Water; Khancoban; 13 miles N. of Marulan; Pambula Beach; Shoalhaven.

## 33. ONTHOPHAGUS LEANUS Goidanich

(Figs. 97, 98, 500)

*Onthophagus interruptus* Lea, 1923 (non Raffrey, 1877), p. 386.

*Onthophagus leanus* Goidanich, 1926, p. 76 (nom. nov.); Boucomont and Gillet, 1927, p. 213.

Piceous, antennal clubs fulvous. Total length 10–12 mm.

*Male*

*Head.*–Clypeal margin medially very slightly produced and bilobate or evenly rounded in worn specimens, rest of margin evenly rounded to genal angles, which are not very prominent and subangulate. Clypeal suture with frontal section effaced, genal sections finely carinate, nearly transverse near margins, sharply curved backward onto frons. Frons and vertex flat, the edges raised into a fine ridge along inner edge of eyes. Frons with a pair of fine transverse ridges arising at terminations of genal sutures and running for a very short distance inward, these ridges very short in large

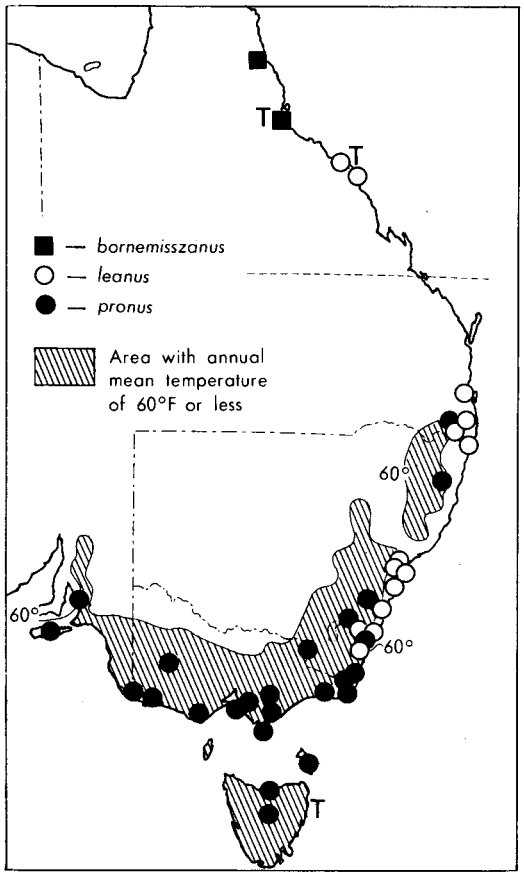
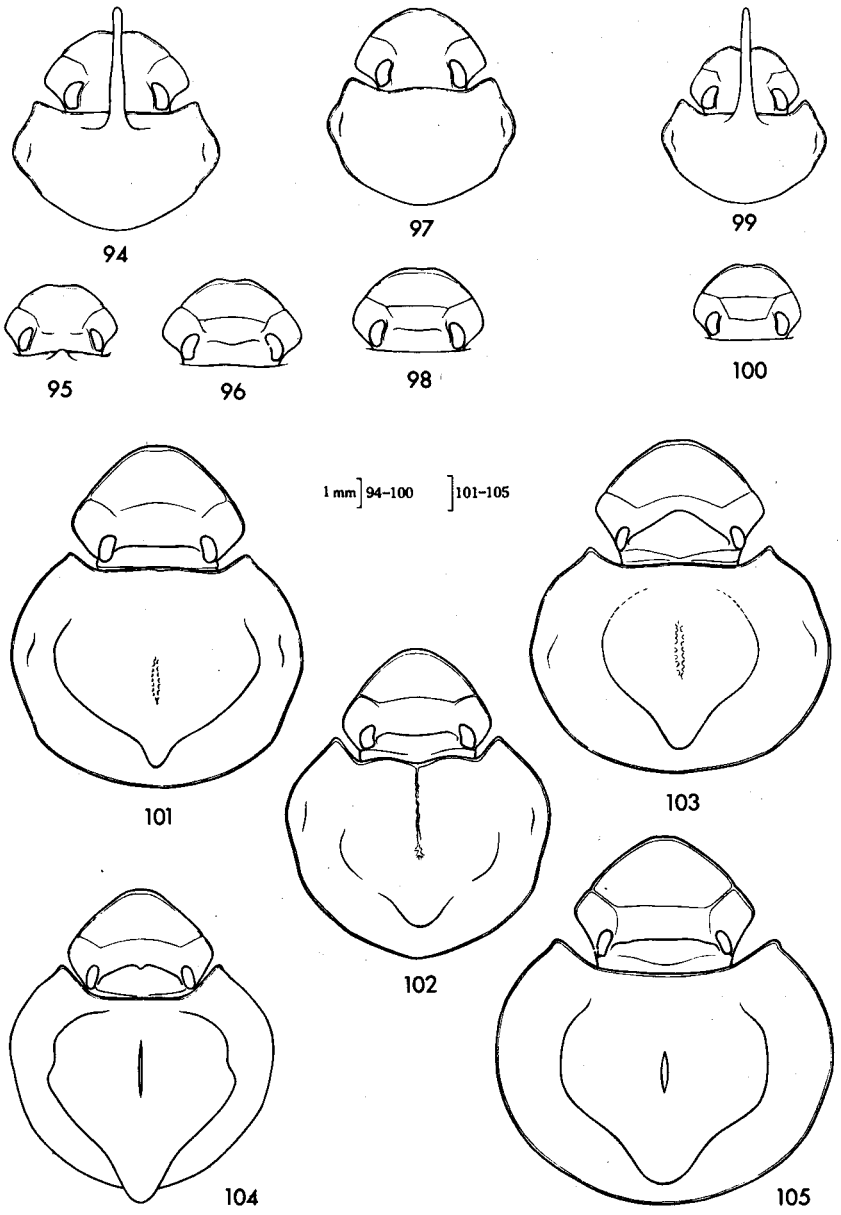



Fig. 93.–Known distribution of the *pronus* group in relation to annual mean temperature.

male, a little longer in small one. Eyes very large, with about 27 facet rows across widest point, separated by about 4.5 times width of an eye, canthus complete. Centre of head smooth and impunctate, nitid, genae and most of clypeus with numerous shallow punctures. Labium incised more than halfway to base. *Pronotum.*–Flattened or feebly convex, unarmed but with a feeble transverse swelling in middle very near front margin, this swelling never extending beyond front edge of pronotum, barely visible in minor male. Anterior angles subquadrate, the apices subangular. Hind edge




Figs. 94–105.–*Onthophagus* spp.: *94–96, O. pronus*: *94*, major male, fore body; *95*, minor male, head and front edge of pronotum; *96*, female head; *97, 98, O. leanus*: *97*, male fore body; *98*, female head; *99, 100, O. bornemisszanus*: *99*, male fore body; *100*, female head; *101–105*, male fore body: *101, O. declivis*; *102, O. desectus*; *103, O. alquirta*; *104, O. devexus*; *105, O. apterus.*

unmargined. With extremely small punctures, appearing impunctate, surface smooth, nitid, glabrous. *Elytra.*–Intervals flat, smooth, alutaceous, with numerous extremely small punctures, appearing impunctate, glabrous. Striae superficial, not sharply defined, simple, with small shallow punctures not wider than stria. *Metasternum.*–Impunctate or with very small punctures, not setigerous, in centre near hind edge. *Legs.*–Fore tibia of male a little elongated and slender, bent inward, with long setae at inner apical angle forming a thin brush of a few hairs, no dense fringe. Claws and spur large. *Abdomen.*–Pygidium small, sericeous, with numerous small shallow punctures which are somewhat transverse, glabrous. Aedeagus normal.

*Female*

Clypeal margin a little wider, clypeal surface densely asperate, clypeal suture with frontal section complete, straight, carinate. Frons with a single fine transverse carina not reaching eyes, sometimes notched in middle. Pronotum entirely unsculptured, without trace of anterior median swelling. Front tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, Bowen, Qld., SAM I.15422. Seen by the author.

*Distribution* (Fig. 93)

Coastal New South Wales from Broulee northward, penetrating inland along river valleys and in the McPherson Range on the New South Wales–Queensland border climbing to 3000 ft. North of Brighton, near Brisbane, it has not been collected at all except in the Bowen area. The author collected it in Conway Range National Park near Proserpine, south of Bowen. *O. leanus* appears to replace *pronus* along the coast of New South Wales northward from Bateman's Bay, where Dr. Bornemissza observed the two species occurring close together, with *leanus*, however, occupying areas of loose sand while *pronus* was confined to heavier soils. All localities in which the author collected this species were coastal forests (casuarina, eucalypt, or dense monsoon forest in the Conway Range), in sandy soil, or light soil mixed with stones. *O. leanus* is nocturnal and has been collected from October to January and from March to May at human excrement.

*Material Examined*

The type and 117 specimens. NEW SOUTH WALES: Bateman's Bay, 2.iii.1964, 19.x.1964, G. F. Bornemissza, ANIC, 1; 5 miles N. of Bateman's Bay, 15.xii.1967, E. G. Matthews, ANIC, 1; Bargo, 4.iv.1964, G. F. Bornemissza, ANIC, 2; Braidwood, Shoalhaven Bridge, 5.v.1965, G. A. Yapp, ANIC, 1; Broulee, 2.iii.1964, G. F. Bornemissza, ANIC, 2; Depot Beach, 10 miles NE. of Bateman's Bay, 24.xii.1967, 7.i.1968, I. F. B. Common, ANIC, 8; Durras Water, 20–26.xii.1964, G. F. Bornemissza, ANIC, 51; Gallagher's Camp, 14.iii.1965, 14.iv.1965, G. F. Bornemissza, ANIC, 24; Mt. Dromedary, 23.xi.1965, Britton and Upton, ANIC, 1; Ourimbah State Forest, 9.xi.1955, T. G. Campbell, ANIC, 1; Putty, 14.iv.1965, Bornemissza and Yapp, ANIC, 1; Somersby, 9.iv.1964, G. F. Bornemissza, ANIC, 2; Sydney, E. W. Ferguson, ANIC, 1; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 1; 10 miles SW. of Woodenbong, 7.xii.1965, G. A. Yapp, ANIC, 1. QUEENSLAND: Brighton, 13.iv.1965, K. Madden, UQ, 1; Conway Range National Park, 28.iii.1968, E. G. Matthews, ANIC, 2; Lamington National Park (3000 ft), 6.xi.1961, Common and Upton, ANIC, 1; Mt. Lindesay Forest, 12.iv.1965, Bornemissza and Yapp, ANIC, 2.

## 34. ONTHOPHAGUS BORNEMISSZANUS, sp. nov.

(Figs. 99, 100, 501)

Piceous, antennal clubs fulvous. Total length 10–12 mm.

*Male*

*Head.*–Clypeal margin medially excised in a shallow arcuate or feebly angulate emargination, rest of head margin evenly rounded to genal angles, which are angulate, not very prominent. Clypeal suture with frontal section effaced, genal sections finely carinate, almost transverse outwardly, abruptly bending backward onto frons. Frons flat, without carinae, the edges raised into fine ridges alongside inner margin of eyes. Eyes very large, with about 28 facet rows across widest point, separated by 4.5 widths, canthus complete. Base and centre of head impunctate, genae with small, very shallow punctures, edge of clypeus with more distinct punctures and feeble rugae. Labium excised more than halfway to base. *Pronotum.*–Flattened, with a narrow flattened horn arising from middle near anterior margin, directed forward and curved downward, without any lateral ridges at its base (except in Atherton specimen). This horn extending beyond edge of clypeus in nearly all specimens, proportionately longer than in *pronus* (Fig. 106). Anterior angles subquadrate, the apices angulate. Hind edge unmargined. Middle of lateral margin strongly curved outward. Surface with extremely small punctures, appearing impunctate (except in Atherton specimen), glabrous, smooth, nitid. *Elytra.*–Intervals flat, smooth, alutaceous, impunctate, glabrous. Striae superficial, not sharply defined, simple, with small punctures not wider than stria. *Metasternum.*–Impunctate in middle near hind edge. *Legs.*–Fore tibiae elongated, slender, without any brush or dense fringe of setae apically (except in Atherton specimen). *Abdomen.*–Pygidium small, alutaceous, with numerous small shallow round punctures, glabrous. Aedeagus normal.

*Female*

Clypeal margin medially broader and feebly bilobate. Clypeal surface densely rugose or subasperate. Clypeal suture with frontal section present, carinate, forming very obtuse angles with genal sections. Frons with a single sharp transverse carina a little bent back in middle, not reaching eyes. Pronotum with a trace of a median anterior swelling near margin. Front tibiae not modified. Otherwise like male.

*Type*

Holotype ♂, Paluma, Qld., 20.xii.1965, G. F. Bornemissza, ANIC.

*Remarks*

A male collected near Herberton, on the Atherton Tableland, Qld., is tentatively ascribed to this species although the horn is proportionately shorter, the pronotum more punctate and proportionately smaller and flatter, and the overall size a little larger than *bornemisszanus* from Paluma. Also, the fore tibiae possess a dense fringe of setae as in *pronus*. A female associated with this male, plus two females collected on Gillie's Highway east of Atherton, are also ascribed to *bornemisszanus*.

This species is nearly indistinguishable from *leanus* in the female sex, but the males are the opposite of *leanus* with regard to the pronotal horn. Whereas *leanus* never has a recognizable horn, regardless of individual size, *bornemisszanus* has a very

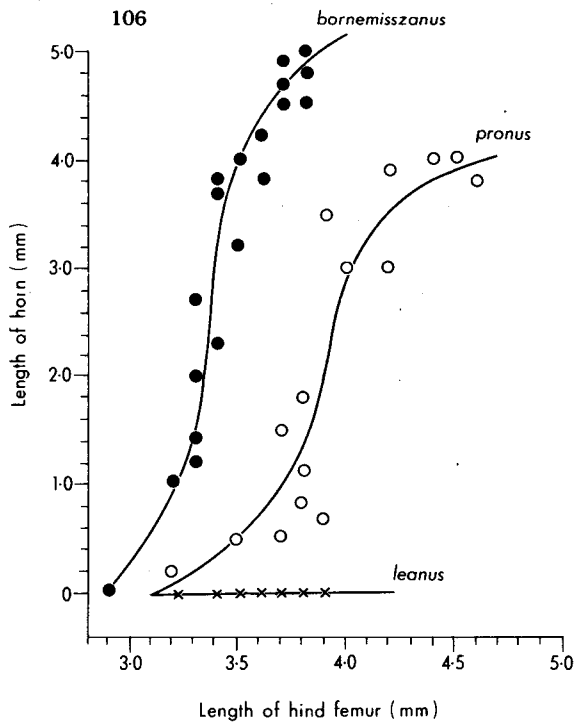



Fig. 106.–Plot of pronotal horn length against length of hind femur in individual males of the three species of the *pronus* group, to shown different allometric relationships. *O. leanus* has no horn, hence its curve is horizontal.

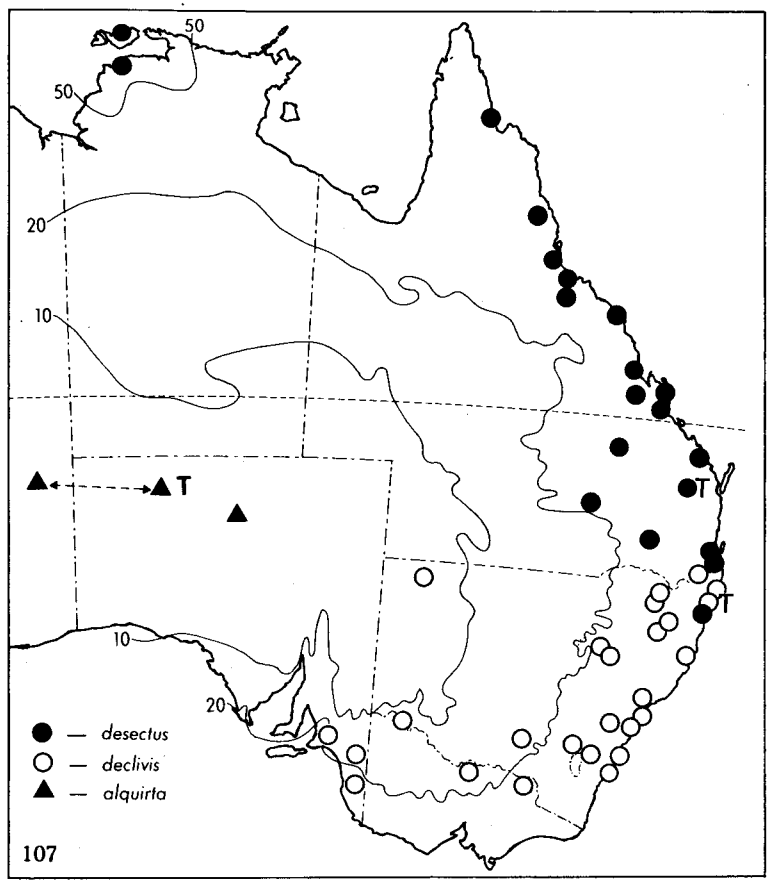



Fig. 107.–Known distribution of three species of the *declivis* group in relation to annual rainfall (in.).

long horn, proportionately longer even than *pronus*. The horn-length relationship in these three species is shown in Figure 106. The length of the hind femur was chosen as an easily measurable index of general individual size. It may be seen that for a given individual size, throughout the size range of all three species, *bornemisszanus* has a consistently longer horn than *pronus* (which is a larger species), while *leanus* has none at all. The biological significance of these different allometric ratios between species, as well as the reason for the somewhat sigmoid shape of the curves, are unknown.

The author is pleased to name this species after his friend and colleague, Dr. G. F. Bornemissza.

*Distribution* (Fig. 93)

Paluma (Mt. Spec), north-west of Townsville, Qld., at about 3000 ft altitude in rain forest or wet sclerophyll forest, also found in nearby pastures at times, in loam soil. Four specimens of this or a closely related species (see above) have been found on the Atherton Tableland.

*Material Examined*

The type and 45 specimens. QUEENSLAND: The Crater, near Herberton, 16.xii.1961, McAlpine and Lossin, AM, 2; Gillies Highway, Heale's Lookout, 7.v.1963, G. F. Bornemissza, ANIC, 2; Paluma, 20.xii.1965, G. F. Bornemissza, ANIC, 6; 3.6–8 miles W. of Paluma, 24.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 35.

## V. *The* DECLIVIS *Group*

Eyes moderate or wide, with 13 or 24 facet rows across widest point, separated by 8 or 10–15 widths, canthus complete. Labium excised one-third to half of way to base. Dorsal surfaces entirely glabrous. Pygidium glabrous. Colour all black. Total length 11–18 mm.

Male with frontoclypeal and frontal carinae, head unarmed. Pronotum with a median flattened or concave area, inclined forward and prolonged backward into a point. Fore tibiae elongated or not, with or without an apical brush of setae. Female unarmed.

Five species: 35. *declivis* Harold; 36. *desectus* Macleay; 37. *alquirta*, sp. nov.; 38. *devexus* Macleay; 39. *apterus*, sp. nov.

The species making up the *declivis* group are easily recognizable in the male and closely related to one another. They appear to represent fragments of a former single species widespread throughout all of Australia except the south-west. *O. alquirta* is known only from north-western South Australia (the only species with this distribution) and is clearly derived from the south-eastern *declivis* (or vice versa), as is also the north-eastern *desectus*. The two tropical northern species, *devexus* and *apterus*, are closely interrelated and each represented only by the unique types, from the Kimberleys and Queensland respectively. *O. apterus* has the distinction of being the only flightless *Onthophagus* so far described, to the author's knowledge.

In habitat preference the species form a series from *desectus*, inhabiting forests or woodlands, through *declivis* and *devexus* to *alquirta*, presumably a desert form. The habitat of *apterus* is unknown.

KEY TO SPECIES OF THE *DECLIVIS* GROUP

1. Eyes large, about 24 facet rows across, separated by about 6 widths; genal angles about halfway on genal margins; elytral intervals impunctate ..... 2
Eyes small, about 14 facet rows across, separated by about 10–15 widths; genal angles advanced; elytral intervals punctate ..... 3

2(1). Flattened median area of pronotum with a median longitudinal raised line arising from front margin; major male with pronotal area pentagonal, raised at each angle, and with front tibiae elongate, with a concentration of setae at distal end; female with clypeal carina not raised and pronotum without median tubercle. N. N.S.W., Qld., N. N.T. ..... 36. *desectus* Macleay
Pronotum with median longitudinal raised line not arising from front margin, more or less centrally located; major male with pronotal area lanceolate, the sides and posterior edges bordered by a continuous ridge; front tibiae not elongate, without concentration of setae; female with clypeal carina medially raised and pronotum with median tubercle or tumosity. N.S.W., N. Vic. ..... 35. *declivis* Harold

3(1). Frontal carina strongly bent forward, forming a median angle; elytral surfaces nitid; pronotal area of males flat. N. S.A. ..... 37. *alquirta*, sp. nov.
Frontal carina only slightly bent forward; elytral surfaces rugose, matt; median pronotal area of male depressed, at least laterally, and its sides raised into vertical ridges ..... 4

4(3). Frontal carina medially sinuate; fully winged; 13 mm in length. N. W.A. ..... 38. *devexus* Macleay
Frontal carina medially straight; brachypterous (detected without lifting elytra by relative foreshortening of hind body); 18 mm in length. Qld. ..... 39. *apterus*, sp. nov.

## 35. ONTHOPHAGUS DECLIVIS Harold

(Figs. 101, 502)

*Onthophagus declivis* Harold, 1869, p. 85; Waterhouse, 1894, p. 10; Blackburn, 1903, p. 278; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 211.

Black, antennal clubs fulvous. Total length 10-16 mm.

*Male*

*Head.*–Clypeal margin medially produced into a small rounded lobe and sharply reflexed in major male, evenly rounded in minor one, not emarginate, genal margins subangulate, the angle about halfway along genal margin. Frontal section of clypeal suture feebly arcuate or straight, sometimes a little raised medially, forming obtuse angles at junction with genal sections. Frontal carina low, sharp, nearly straight or feebly bent forward medially. Eyes large, somewhat rectangular, with about 24 facet rows across widest point, separated by about 6 widths, canthus complete. Entirely, densely punctate, the punctures coarser along edges, or entirely coarse in minor male. Labium incised about halfway to base. *Pronotum.*–With a large median lanceolate flattened area bordered along sides and posteriorly by a continuous ridge, posterior point of area continued rearward in same plane, therefore strongly elevated from discal surface. In smaller males, point becomes progressively more anterior and flattened area becomes reduced and indistinct. Middle of flattened area with an indistinct vermiculate longitudinal ridge. Anterior angles acute, moderately prominent. Hind edge margined. Entirely very coarsely and closely punctate, the punctures often running together to form grooves, shagreened inside. *Elytra.*–Intervals flat, shagreened, impunctate, glabrous. Striae superficial, geminate, impunctate. *Legs.*–Fore tibiae not slender. *Abdomen.*–Pygidium shagreened and moderately densely punctate, glabrous. Parameres of aedeagus produced downward.

*Female*

Clypeal margin not medially produced or reflexed, clypeal surface transversely rugose. Clypeal suture medially elevated. Frontal carina tending to be slightly bent back medially. Flattened area of pronotum greatly reduced, not margined by a ridge but surmounted in major female by a low median posterior tubercle or tumosity, often drawn back into a short longitudinal ridge. Otherwise like male.

*Type*

Holotype ♂, Clarence River, N.S.W., MNHN(Ob). Seen by the author.

*Distribution* (Fig. 107)

Along both sides of the Great Dividing Range in New South Wales and extreme northern Victoria to south-eastern South Australia, with one isolated record in extreme north-western New South Wales at Tibooburra. In the east it is occasionally found along the coast, but it appears to be basically a tableland form, inhabiting open woodland or scrub. It was collected at human faeces and rabbit entrails by Dr. Bornemissza, but most available specimens came to light. At the Black Mountain light trap in Canberra it is a frequent visitor, and the 155 collections (231 specimens) of *declivis* made at this trap since 1951, and kept in ANIC, show the following monthly distribution: no specimens in June, July, or August, 3 in September, 17 in October, 30 in November, 39 in December, 21 in January, 20 in February, 17 in March, 5 in April, and 3 in May. *O. declivis* is therefore a summer species, unlike most other southern species, such as *australis*, which have separate spring and autumn seasons.

*Material Examined*

The type and 296 specimens. SOUTH AUSTRALIA: Inglewood; Lucindale; Murray Bridge. VICTORIA: 2 miles N. of Kiewa; Nathalia. AUSTRALIAN CAPITAL TERRITORY: Black Mountain. NEW SOUTH WALES: Armidale; Arrawarra; Ballina; 10 miles NE. of Bateman's Bay; Beecroft; Bingara Rd., 25 miles N. of Bundarra; 20 miles NE. of Binnaway; Blue Mountains; Boro; Cabramatta; Crescent Heads; Gallagher's Camp; Glenfield; Gosford; Inverell; Lindfield, Sydney; Mendooran; 3 miles W. of Narrandera; Quaker's Hill; Shoalhaven; Tamworth; 12 miles N. of Tenterfield; Tibooburra; Upper Yarraman; Wahringa; Warrumbungle National Park; 15 miles NW. of Yass.

## 36. ONTHOPHAGUS DESECTUS Macleay

(Figs. 102, 503, 504)

*Onthophagus desectus* Macleay, 1871, p. 182; Waterhouse, 1894, p. 10; Blackburn, 1903, p. 278; Boucomont and Gillet, 1927, p. 211.

*Onthophagus howitti* Blackburn, 1903, p. 282; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 212. New synonymy.

Black, antennal clubs fulvous. Total length 11-15 mm.

*Male*

*Head.*—Clypeal margin medially slightly produced and reflexed, the process rounded. Frontal section of clypeal suture feebly arcuate or straight, not raised medially, sometimes almost effaced here. Frontal carina feebly sinuate, medially effaced in some specimens, a little bent back medially, laterally somewhat raised where it curves back near eyes. Eyes large, somewhat rectangular, with about 24 facet rows across widest point, separated by about 6 widths, canthus complete. Entirely densely

punctate, the punctures coarser along edges, or entirely coarse in minor male. Labium incised halfway to base. *Pronotum.*–With a large median pentagonal area, the posterior 3 points of the pentagon prominent in major male and joined by 2 obtuse carinae, the anterior 2 points represented by a pair of tumosities near front margin. Flattened area becoming reduced, more triangular, and points approximate and less prominent, not joined by carinae, in minor male. Median posterior point the last to disappear. Anterior half or more of flattened area with a median longitudinal, slightly vermiculate ridge arising from anterior margin. Anterior angles acute, moderately prominent. Hind edge margined. Surface of flattened area and anterior half of sides coarsely and closely punctate, the punctures often running together to form grooves, inside of punctures shagreened. Posterior part of sides and base of pronotum contrastingly less coarsely punctate, the punctures not confluent, becoming extremely finely punctate and shiny in some specimens. *Elytra.*–Intervals flat, impunctate, very finely shagreened, or entirely smooth and nitid in northern specimens, glabrous. Striae superficial, geminate, impunctate. *Legs.*–Fore tibiae slenderer in male, with a concentration of setae along inner edge of distal end. *Abdomen.*–Pygidium shagreened and moderately densely punctate, glabrous. Parameres produced downward.

*Female*

Clypeal margin not medially produced, evenly rounded. Clypeal surface transversely rugose. Clypeal suture a little more beaded than in male but not sharply raised. Flattened area of pronotum reduced to a coarsely punctate patch near front margin (sometimes not flattened at all), longitudinally crossed by a low median ridge, this area not surmounted by a tubercle. Fore tibia not slender, without distal concentration of setae. Otherwise like male.

*Types*

Holotype of *desectus*: ♂, Gayndah, Qld., MM.
Holotype of *howitti*: ♀, Northern Territory, BMNH.
Both seen by the author.

*Remarks*

Although the type of *howitti* is marked as a male, it is in fact a female of *desectus*. Lea (1923) erroneously listed this species as a variety of *declivis*. As noted in the description, the specimens from Cape York and the Northern Territory are shinier (more finely punctate) and have the elytral intervals smooth, not shagreened as in specimens from the rest of Queensland and New South Wales.

*Distribution* (Fig. 107)

*O. desectus* completely replaces the closely related *declivis* to the north of the McPherson Range, which divides Queensland from New South Wales. Only one specimen of *desectus* has been collected south of this range, near Grafton. In the north, it extends to the Cape York Peninsula and across to the Darwin region. It was trapped singly by the author with human excrement in rain forest at Tamborine Mountain, in open woodland near Marlborough, Qld., and in dense monsoon forest on Melville I., N.T. No collection series comprises more than three specimens.

*Material Examined*

The types and 47 specimens. NEW SOUTH WALES: 15 miles S. of Grafton. QUEENSLAND: Boothill Ck., 80 miles S. of Mackay; Bowen; Brisbane; Burlekit; Byfield; Carnarvon Range; Condamine; Eidsvold; Gayndah; Hidden Valley; Ingham; Kenmore; 10 miles W. of Marlborough; Moolayember Dip; W. of Ravenshoe; caves near Rockhampton; Rocky Ck., Atherton Tableland; Serpentine Lagoon via Yeppoon; Silver Plains H.S.; Stormy Ck.; Tamborine Mountain; Toowong; Townsville; Yeppoon. NORTHERN TERRITORY: Fanny Bay, Darwin; Snake Bay, Melville I.

## 37. ONTHOPHAGUS ALQUIRTA, sp. nov.

(Figs. 103, 505)

Black, antennal clubs fulvous. Total length 11-15 mm.

*Male*

*Head.*—Clypeal margin medially slightly produced, moderately reflexed and very feebly bilobate. Genal margins subangulate, the angle much closer to anterior end of genal margin. Frontoclypeal suture bent forward more than in other species of group. Frontal carina strongly bent forward, forming an obtuse angle in middle. Eyes small, with about 13 facet rows across widest point, separated by about 12 widths, canthus complete. Entirely, densely punctate, the punctures coarser along edges. Labium incised about halfway to base. *Pronotum.*—With median lanceolate flattened or slightly concave area distinctly set off from rest of surface but without raised edges, the posterior point of area prolonged backward in same plane and therefore elevated above surface behind it. Middle of area with distinct longitudinal vermiculate ridge not joining front margin. Anterior angles acute, prominent, lateral margins somewhat sinuate. Hind edge margined. Entirely very coarsely and closely punctate, the punctures often running together to form grooves, inside of punctures shagreened. *Elytra.*—Intervals slightly convex, very finely shagreened, nitid, finely and sparsely punctate, glabrous. Striae superficial, geminate, distinctly transversely punctate. *Legs.*—Fore tibia not slender. *Abdomen.*—Pygidium shagreened and moderately densely punctate, glabrous. Parameres produced downward.

*Female*

Clypeal margin not medially produced or reflexed, feebly bilobate. Clypeal surface transversely rugose. Flattened area of pronotum greatly reduced or absent, with a median longitudinal raised line on anterior two-thirds of pronotum, almost joining anterior margin, more prominent in middle of pronotum. Otherwise like male.

*Type*

Holotype ♂, Everard Ranges, central Australia, ANIC.

*Distribution* (Fig. 107)

Known only from an unspecified area between the Everard Ranges of the northwest of South Australia and the Warburton Ranges in the east of Western Australia, and from Oodnadatta, S.A., in an area of about 8 in. of annual rainfall and known to contain only one other species of *Onthophagus*, *O. sloanei*. All 31 available specimens are part of the same series collected by A. Brumby.

*Material Examined*

The holotype and 30 specimens. SOUTH AUSTRALIA: Everard Ranges to Warburton Ranges, W.A., A. Brumby, SAM, 20; Everard Ranges, ANIC, 4, AM, 2, NMV, 4; Oodnadatta, 1931–32, A. Brumby, SAM, 1.

## 38. ONTHOPHAGUS DEVEXUS Macleay

(Figs. 104, 506)

*Onthophagus devexus* Macleay, 1888, p. 899; Blackburn, 1903, p. 279; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 211.

Black, antennal clubs fulvous. Total length 13 mm. The female is unknown.

*Male*

*Head.*–Clypeal margin slightly produced and reflexed, rounded. Genal angles rounded, advanced in front of middle of margin. Frontal section of clypeal suture feebly arched forward, sharp, forming moderate angles with genal sections. Frontal carina angled forward, but a small middle section sharply bent back, sinuate. Eyes moderate, with 14 facet rows across widest point, separated by about 10 widths, canthus complete. Densely punctate. Labium incised about one-third of way to base. *Pronotum.*–With a large median lanceolate flattened area which is laterally depressed, each depression delimited on the outside by a sharply raised angular projection. Posterior point of flattened area continued backward in the same plane, as in all species of this group. Middle of area with a feeble longitudinal vermiculate ridge. Anterior angles acute, very prominent. Hind edge feebly margined. Surface entirely very densely and coarsely punctate, the punctures tending to run together, except on inside of lateral projections, which are smooth. *Elytra.*–Intervals slightly convex, feebly rugose, shagreened, finely punctate, glabrous. Striae superficial, geminate, extremely finely punctate. *Legs.*–Fore tibiae not slender, without distal concentration of setae. *Abdomen.*–Pygidium shagreened and moderately densely punctate, glabrous. Parameres produced downward.

*Type*

Holotype ♂, Barrior Range, N.W. Australia, MM. Unique. Seen by the author.

*Distribution*

The location of the "Barrior Range" could not be determined, although it is assumed to be in the vicinity of King Sound in the western Kimberleys, W.A.

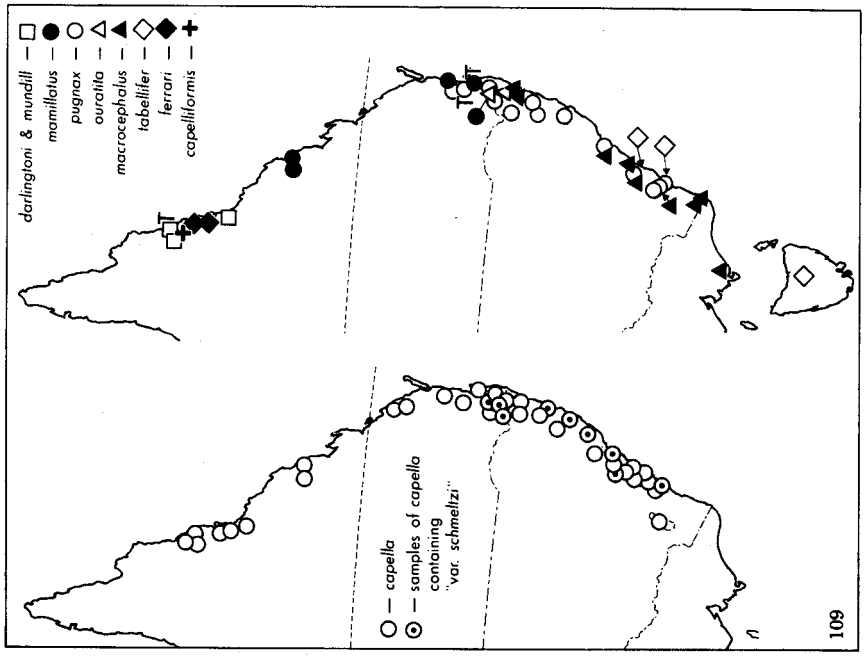
## 39. ONTHOPHAGUS APTERUS, sp. nov.

(Figs. 105, 507)

Black, antennal clubs fulvous. Total length 18 mm. The female is unknown.

*Male*

*Head.*–Clypeal margin medially produced into a small rounded lobe and reflexed, not emarginate, the genal margins subangulate, the angles closer to anterior end of genal margin. Frontal section of clypeal suture straight, strongly angled at junction with genal sections. Frontal carina moderately bent forward, medially straight. Eyes



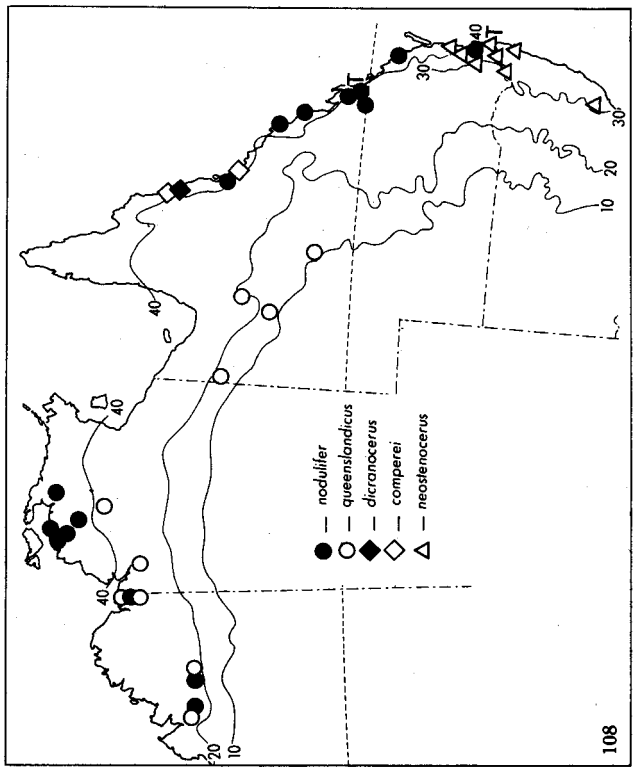




Fig. 108.–Known distribution of part of the *capella* group in relation to annual rainfall (in.).
Fig. 109.–Known distribution of the rest of the *capella* group.

small, with about 12 facet rows across widest point, separated by about 15 widths, canthus complete. Densely punctate, the punctures forming transverse grooves on clypeus. Labium incised halfway to base. *Pronotum.*–With large median lanceolate depressed area bordered along sides and back by a continuous ridge which is vertically elevated at sides of depression, posterior point of area projecting backward as in other species of the group. Centre of depression with a short raised longitudinal ridge. Anterior angles acute, moderately prominent. Hind edge strongly margined. Entirely very coarsely and densely punctate, the punctures running together to form grooves. *Elytra.*–Proportionately short, narrow at humeri, strongly convex. Intervals very feebly convex, with uneven shagreened surface and moderately dense punctures, matt, glabrous. Striae slightly raised from surface, consisting of a double row of fine ridges interrupted at each puncture, punctures frequent and transverse. *Hind wings.*–Very short, not folded. *Legs.*–Fore tibiae not slender. *Abdomen.*–Pygidium densely and coarsely punctate, glabrous. Parameres produced downward.

*Type*

Holotype ♂, Queensland, ex musaeo H. W. Bates, 1892, MNHN(Gen).

*Remarks*

The only flightless Australian *Onthophagus*, and perhaps the only one in the world.

*Distribution*

The exact collection locality of the unique specimen is unknown.

## VI. *The* CAPELLA *Group*

Eyes narrow to wide, with 11–30 facet rows across widest point, separated by 3–10 widths, canthus complete. Labium incised about halfway to base. Dorsal surfaces entirely glabrous. Pygidium glabrous (except in *comperei*). Colour entirely black. Total length 6–17 mm.

Male with frontoclypeal suture carinate (except in *comperei*, where it is effaced), vertex armed. Pronotum usually armed. Fore tibiae not elongate, without distal seta brush (except in *darlingtoni*). Female with a crest or strong carina on vertex, pronotum usually armed.

Fifteen species: 40. *nodulifer* Harold; 41. *dicranocerus* Gillet; 42. *neostenocerus* Goidanich; 43. *queenslandicus* Blackburn; 44. *comperei* Blackburn; 45. *ferrari*, sp. nov.; 46. *capelliformis* Gillet; 47. *capella* Kirby; 48. *pugnax* Harold; 49. *tabellifer* Gillet; 50. *ouratita*, sp. nov.; 51. *macrocephalus* Kirby; 52. *mamillatus* Lea; 53. *mundill*, sp. nov.; 54. *darlingtoni*, sp. nov.

Within this large group there are some well-defined subgroups, only *nodulifer*, *queenslandicus*, and *comperei* standing somewhat apart. *O. dicranocerus* and *neostenocerus* are related, large-eyed rain forest species, while *capella*, *capelliformis*, *ferrari*, *pugnax*, *tabellifer*, and *ouratita* are related, generally woodland or savannah woodland forms which replace one another along the east coast, except that *capella* itself is a very widespread clearing and pasture species. The remaining species, *macrocephalus*, *mamillatus*, *mundill*, and *darlingtoni*, are all characterized by a long tapering cephalic

lamina in the male. *O. macrocephalus* is the southern element in this series and inhabits dense woodlands, while the remaining species are all strictly rain forest forms, replacing one another along the Queensland montane rain forest system.

KEY TO SPECIES OF THE *CAPELLA* GROUP

1. Clypeal carina evenly recurved and elevated into a small point in middle; pronotum with a single median transverse or conical tubercle; major male with divergent, very long, very slender cephalic horns; female with 2 small points on frontal carina. N. Qld., N. N.T., N. W.A. ..... 40. *nodulifer* Harold

Clypeal carina straight or procurved in middle, or may be effaced medially, without median point; pronotum without a distinct median tubercle; male horns not as above, female with simple frontal carina or with none ..... 2

2(1). Eyes wide, with 25–30 facet rows across widest point, separated by 3–4 times their width ..... 3

Eyes narrower, with not more than 15 facet rows across widest point, separated by more than 6 times their width ..... 4

3(2). Male with a pair of slender horns on vertex; pronotum unsculptured in both sexes. S. Qld. ..... 42. *neostenocerus* Goidanich

Male with a single bifurcate horn on frons; pronotum of male with 4 prominences in a transverse row, that of female with 2 small tubercles. N. Qld. ..... 41. *dicranocerus* Gillet

4(2). Pygidium with short setae; male with frontoclypeal suture not carinate, vertex with a pair of compound (toothed), divergent horns; female without frontal carina, with 2 conical tubercles there. N. Qld. ..... 44. *comperei* Blackburn

Pygidium glabrous; frontoclypeal suture carinate; if male has 2 horns, these are not compound or divergent; female with frontal carina ..... 5

5(4). Posterior part of pronotal disc more finely punctate and more matt than rest of surface; pronotum unsculptured; male with a pair of slender, subparallel horns on vertex, not joined by any carina; female with evenly rounded head and feeble frontal carina medially straight and displaced forward. N. W.A., N. N.T., NW. Qld. ..... 43. *queenslandicus* Blackburn

Pronotal disc evenly punctate, pronotum usually sculptured in both sexes; if male has a pair of horns on vertex, then these arise from a broad lamina or are joined by a carina; female seldom with head evenly rounded, with more prominent carina or projections on frons or vertex ..... 6

6(5). With 2 median tubercles or ridges on pronotum, or with none; major male with cephalic lamina inclined backward to cover front edge of pronotum ..... 7

With transverse row of 4 tubercles on pronotum; major male with frontal crest or horn erect, not reclined ..... 13

7(6). Pronotal surface coarsely punctate, the punctures on disc separated by 1–2 diameters; major male with cephalic lamina broad and bicornuate, clypeus not greatly prolonged; female with simple or angular carina on vertex ..... 8

Pronotal surface very finely punctate or impunctate, the punctures on disc, if present, separated by distances far greater than their diameter; major male with cephalic lamina narrow, ending in 1 or 3 points, clypeus prolonged; female with vertex bearing 1, 2, or 3 points ..... 10

8(7). Major male with edge of clypeus produced into a short bilobate process, clypeus relatively short; clypeal surface rugulose only along edges; both sexes with clypeal carina feebly sinuate; total length 7–10 mm. N. Qld. ..... 45. *ferrari*, sp. nov.

Both sexes with edge of clypeus broadly rounded or truncate, without a projecting lobe; clypeus relatively long, the surface entirely transversely rugose in both sexes; clypeal carina angulate between frontal and genal sections ..... 9

9(8). Cephalic horns of major male strongly incurved, edge of lamina between them with a small median point; edge of clypeus broadly rounded; female with transverse carina on vertex raised into a pair of approximated angles; total length 9–12 mm. N. Qld. ..... 46. *capelliformis* Gillet

Cephalic horns of major male erect or moderately incurved, edge of lamina between them either straight or raised into a quadrate process; edge of clypeus truncate; female with transverse carina on vertex simple; total length 11–17 mm. Qld., N.S.W. ..... ..... 47. *capella* Kirby

10(7). Male with elongate fore tibiae bearing a conspicuous tuft of dense setae apically; cephalic lamina ending in 3 points; female without a vertical carina, with 2 tubercles, on vertex. N. Qld. ..... 54. *darlingtoni*, sp. nov.

Male with fore tibiae unmodified, without tuft of setae; female with a vertical carina bearing 1, 2, or 3 points ..... 11

11(10). Surfaces nitid or glossy–sericeous; major male with frontal lamina rather broad, terminating in a rounded lobe or truncate, and bearing an erect conical projection; female vertical carina with 2 points. Vic., N.S.W. ..... 51. *macrocephalus* Kirby

Surfaces matt or dull–sericeous; major male with frontal lamina rather narrow, tapering to a single point; female vertex with 1 or 3 points ..... 12

12(11). Female with a transverse carina on vertex bearing 3 points, with pronotal prominences rounded, tuberculiform; male indistinguishable from that of next species. S. Qld. ..... 52. *mamillatus* Lea

Female without a carina on vertex, with a single prominent conical point, with pronotal prominences longitudinal, carinate. N. Qld. ..... 53. *mundill*, sp. nov.

13(6). Discal elytral intervals very smooth, shagreened, matt; male with a pair of well-separated frontal horns, joined by a very low carina which is strongly procurved, or with a strong, transverse slab-like crest the upper edge of which is completely straight; female with a simple transverse frontal carina. N.S.W., S. Qld. ..... 48. *pugnax* Harold

Discal elytral intervals finely rugulose and unevenly or not shagreened, more nitid; male with a single frontal crest or horn which is either bifurcate or trisinuate at the upper edge; major female with frontal carina more or less 3-pointed ..... 14

14(13). Male bearing a high, slab-like transverse frontal crest with a trisinuate distal edge; female indistinguishable from that of next species. S. N.S.W., Tas. ..... 49. *tabellifer* Gillet

Major male bearing a high, expanding bifurcate horn on frons, in minor male this is reduced to a parallel-sided lobe ending in 2 lateral points. N. N.S.W., S. Qld. ..... ..... 50. *ouratita*, sp. nov.

## 40. ONTHOPHAGUS NODULIFER Harold

(Figs. 110, 111, 508, 509)

*Onthophagus nodulifer* Harold, 1867, p. 37; Harold, 1869, p. 83; Blackburn, 1903, p. 268; Lea, 1923, p. 366; Boucomont and Gillet, 1927, p. 214.

*Onthophagus divaricatus* Macleay, 1871, p. 179; Harold, 1875, p. 211 (syn.).

Black, legs rufopiceous, antennal clubs flavous. Total length 7–11 mm.

*Male*

*Head.*–Clypeal margin very feebly bilobate, a little more strongly so in minor male, narrowly reflexed, rest of margin evenly rounded to genal angles, which are rounded or subangulate. Clypeal suture not divided into frontal and genal sections, forming a single line, curved or bent back, finely carinate, the middle raised into a small point. Frons of major male with a pair of very long, very slender divergent

incurved horns, strongly reclined and somewhat flattened, these joined across frons by a transverse ridge. Smaller male with the horns shorter, minor male without horns, with sharp oblique ridges near eyes joined by a fine transverse carina. Eyes wide, with about 16 facet rows across widest point, separated by about 7 widths, canthus complete. Impunctate, transversely rugose on genae and clypeus, and on frons before frontal carina in minor male. Glabrous. Surface finely shagreened, alutaceous. Labium incised more than halfway. *Pronotum.*–With a median tubercle which is transverse and situated near anterior margin in minor male, moving posteriorly in larger individuals, until in major male it is in middle of pronotum and high, longitudinally conical, and preceded by a round concavity. Anterior angles acute, the points rounded. Hind edge strongly margined. Densely punctate with small to medium-sized shallow punctures, very indistinct in major male, stronger in minor male but leaving the base almost impunctate. Surface shagreened, sericeous. *Elytra.*–Intervals very feebly convex, shagreened, sericeous, impunctate, glabrous. Striae impressed, geminate, with numerous small shallow indistinct punctures, glabrous. Aedeagus normal.

*Female*

Clypeal margin medially more strongly bidentate (when not worn), clypeal surface and clypeal suture as in male, with median tubercle. Frons with a transverse carina running almost straight from eye to eye, the edge slightly raised into small points on either side of middle. Pronotum densely and coarsely punctate, the punctures separated by less than 1 diameter on disc, base of pronotum more finely punctate, more matt than rest of surface. Pronotum with single median transverse ridge near front margin. Otherwise like male.

*Types*

Holotype of *nodulifer*: ♂, Rockhampton, Qld., MNHN.
Holotype of *divaricatus*: ♂, Gayndah, Qld., Masters, MM.
Both seen by the author.

*Remarks*

The various forms of the male described by Lea (1923, pp. 366–7) are not consistent types, as the characters he mentions depend on the degree of individual wear and development. In general, minor males have the clypeal margin more distinctly bilobate than major males, whose clypeal margin is almost evenly rounded, the cephalic horns shorter, the pronotal tubercle less acute and more anterior, and the pronotal surface more coarsely punctate. Both sexes have a band along the base of the pronotum more matt than the rest of the surface, reminiscent of a similar (but narrower) band in *queenslandicus.*

*Distribution* (Fig. 108)

The coast of Queensland from Brisbane to Ingham, the Northern Territory around Darwin, and the Kimberley District of Western Australia, in areas of around 40 in. annual rainfall except in the Kimberleys, where it was found in very small numbers during the wet season in areas of as little as 25 in. annual rainfall. It occurs in open savannah woodland and open pastures in sand or sandy loam at human faeces, cow and buffalo dung, and at light at night. Nocturnal. Collected in all months except July and August.

*Material Examined*

The types and 371 specimens. NEW SOUTH WALES: Collector. QUEENSLAND: Adams; Belmont, 8 miles NW. of Rockhampton; Brisbane; Bundaberg; Edungalba, 50 miles SW. of Rockhampton; Fitzroy R., Rockhampton; Ingham; 25 miles SW. of Ingham; Proserpine; Rockhampton; Sarina, Lotus Ck.; 14 miles SW. of Sarina; Yaamba. NORTHERN TERRITORY: Batchelor; Brock Ck., Burnside; 15–27 miles S. of Darwin; 30 miles E. of Darwin; Howard Springs; Humpty Doo; Oenpelli. WESTERN AUSTRALIA: Camballin; Fitzroy Crossing; Kununurra.

## 41. ONTHOPHAGUS DICRANOCERUS Gillet

(Figs. 112-115, 510, 511)

*Onthophagus dicranocerus* Gillet, 1925, p. 12; Boucomont and Gillet, 1927, p. 211.
*Onthophagus demarziellus* Frey, 1963, p. 538. New synonymy.

Rufopiceous or black, antennal clubs flavous. Total length 10-12 mm.

*Male*

*Head.*–Broadly oval in outline, clypeus evenly rounded and reflexed. Clypeal suture with frontal section carinate, straight or very feebly procurved, very feebly angled with genal sections, which are scarcely oblique. Frons of major male with an erect transverse bifurcate horn, its edges diverging apically. In smaller individuals the horn is more transverse, shorter, the edges perpendicular or feebly divergent. In minor male there is a pair of short processes joined by a strongly procurved carina. Eyes very large, with about 30 facet rows across widest point, separated by about 3 widths, canthus complete. Clypeal surface fairly densely but shallowly punctate, not or finely rugulose, rest of head moderately punctate except horn and frons behind it, which are impunctate. Labium incised a little less than halfway to base. *Pronotum.*–With a transverse row of 4 more or less equidistant prominences, of which the 2 median ones are conical, separated by only a shallow depression, the lateral ones a little flattened, separated by deeper depressions from middle ones. Anterior declivity vertical medially, with a median vertical rounded ridge arising from front margin, absent in minor male, laterally with 2 moderate concavities. Anterior angles acute, prominent, margin immediately behind them slightly sinuate, rest of lateral margin strongly curved out. Hind edge not margined. Median longitudinal sulcus of disc very shallow. Extremely finely punctate, the punctures well separated, glabrous, surface smooth, nitid or alutaceous. *Elytra.*–Intervals flat, smooth, extremely finely shagreened, impunctate or with extremely small, dense punctures, entirely glabrous. Striae superficial, simple, with extremely small, shallow transverse punctures. *Legs.*–Fore tibiae not modified. *Abdomen.*–Pygidium shagreened and moderately densely punctate with small punctures, glabrous. Aedeagus normal.

*Female*

Anterior edge of head more produced, head subtriangular. Clypeal surface transversely rugose. Frons with a transverse carina in middle, running from eye to eye, slightly procurved. Pronotum with 2 small, very closely placed tubercles at vertex of anterior declivity, which is further defined by 2 vague short oblique ridges flanking tubercles. Surface more densely punctate. Otherwise like male.

*Types*

Holotype of *dicranocerus*: ♂, Queensland, Brussels Museum.
Holotype of *demarziellus*: ♂, Mareeba, Qld., MGF.
Neither seen by the author.

*Remarks*

The synonymy of this species is based on the original descriptions only, but it is such a strikingly characteristic form in the male that there can be little doubt of the synonymy proposed here. The female is very similar to that of *neostenocerus*, but may be distinguished by the presence of the pronotal tubercles. The female of *tabellicornis* is also similar, but may be distinguished by the less triangular head and the presence of four tubercles on the pronotum, of which the middle two are more transverse and sharper.

*Distribution* (Fig. 108)

The Atherton Tableland in northern Queensland, in dense rain forest. Collected at human excrement and at light. Nocturnal. January–May.

*Material Examined*

Thirty-one specimens. QUEENSLAND: Cairns, 13.i.1962, E. B. Britton, BMNH, 1; Lake Eacham (2500 ft), Feb. 1958, Darlingtons, MCZ, 1; Millaa Millaa, Apr. 1932, P. J. Darlington, MCZ, 5; mountains above Atherton (3000–4000 ft), 4.ii.1958, Darlingtons, MCZ, 1; Yungaburra, 7.v.1964, 7.v.1969, G. F. Bornemissza, ANIC, 23.

## 42. ONTHOPHAGUS NEOSTENOCERUS Goidanich

(Figs. 116–118, 512)

*Onthophagus stenocerus* Lea, 1923, p. 388 (non Harold, 1867); Boucomont and Gillet, 1927, p. 214.

*Onthophagus neostenocerus* Goidanich, 1926, p. 76; Boucomont and Gillet, 1927, p. 214.

Black, legs rufopiceous, antennal clubs flavous. Total length 9–13 mm.

*Male*

*Head.*—Clypeal margin medially a little reflexed and produced, rounded, laterally almost straight to genal angles, which are subangulate, not prominent. Clypeal suture with frontal section present, finely carinate, feebly procurved, obtusely angled with genal sections. Vertex with a pair of long, subparallel and slightly incurved, slender tapering horns reclined at about 45° from plane of head, joined by a feeble procurved carina. In minor male the carina is stronger, bent forward in 3 arcs, and the ends are raised into lateral crests representing the horns. Eyes wide, with about 25 facet rows across widest point, separated by about 4 widths, canthus complete. Very densely and very finely punctate, glabrous, surface smooth, nitid. Labium incised nearly halfway to base. *Pronotum.*—Unsculptured, anterior half deplanate in major male, strongly convex on posterior half, minor male with pronotum evenly convex. Anterior angles quadrate, the points turned out, lateral margins strongly rounded. Hind edge unmargined. Extremely finely punctate, appearing impunctate, glabrous, smooth, alutaceous. *Elytra.*—Intervals flat, smooth, impunctate, glabrous, sericeous. Striae shallow, simple, very fine, with extremely small shallow punctures. *Legs.*—Fore

tibiae unmodified. *Abdomen.*–Pygidium smooth, very finely and densely punctate, glabrous, sericeous. Aedeagus normal.

*Female*

Head more triangular in outline, clypeal margin more produced, rounded, not reflexed, more broadly margined, clypeal and genal surfaces transversely rugose. Fronto-clypeal suture more strongly carinate, frons with a straight or medially slightly angled, sharp transverse carina in middle running from eye to eye, the surface more finely punctate behind it. Pronotum with a flattened semicircular area in front in major female, otherwise unsculptured. Otherwise like male.

*Type*

Holotype ♂, Mt. Tamborine, Qld., H. Hacker, QM. Seen by the author.

*Distribution* (Fig. 108)

The general area of the McPherson Range on the Queensland-New South Wales border, north along mountain ranges to the Blackall Range, about 50 miles north of Brisbane, and south as far as Barrington Tops, N.S.W., in rain forest or wet sclerophyll forest, occasionally in more open woodland, in clay and loam soils (rarely sand). Nocturnal, beginning its activity soon after sunset. Collected at marsupial entrails and human excrement. August-December and April-May.

*Material Examined*

The type and 42 specimens. NEW SOUTH WALES: Barrington Guest House via Salisbury, 17–20.xii.1963, D. F. O'Sullivan, UQ, 1; Donaldson State Forest, 12.iv.1965, Bornemissza and Yapp, ANIC, 1; Tweed River, Oct. 1904, H. J. Carter, NMV, 1; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 1; 4 miles W. and 6 miles E. of Woodenbong, 8–9.xii.1967, E. G. Matthews, ANIC, 9. QUEENSLAND: Ballengarra, 15.xii.1965, G. A. Yapp, ANIC, 1; Brisbane, 16.xi.1915, H. Hacker, SAM, QM, 2; Kenilworth, W. Blackall Range, May 1958, Darlingtons, MCZ, 4; Lamington National Park, 17–21.ii.1964, G. Monteith and H. A. Rose, UQ, 1; Maleny, Blackall Range (*c.* 2000 ft), May 1958, Darlingtons, MCZ, 1; Mt. Glorious, 8.iv.1968, E. G. Matthews, ANIC, 1; Mt. Lindesay Forest, 12.iv.1965, G. A. Yapp, ANIC, 3; Mt. Nebo, 11.viii.1966, B. Cantrell, UQ, 1; Stanthorpe, E. Sutton, QM, 1; Tamborine Mountain, 29.xi.1925, H. Hacker, QM, SAM, 2; Tamborine Mountain, 7.xii.1967, E. G. Matthews, ANIC, 9; Toowoomba, 29.xii.1963, J. C. Cardale, UQ, 1.

## 43. ONTHOPHAGUS QUEENSLANDICUS Blackburn

(Figs. 118-120, 513, 514)

*Onthophagus queenslandicus* Blackburn, 1903, p. 287; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

*Onthophagus fitzroyensis* Blackburn, 1903, p. 288; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212. New synonymy.

Rufopiceous to black, antennal clubs greyish yellow. Total length 6-8 mm.

*Male*

*Head.*–Clypeal margin a little expanded on either side of middle and just before genal sutures, evenly arcuate in worn specimens, genal angles subangulate, not prominent. Clypeal suture with frontal section finely carinate, straight, obtusely angled with genal sections. Frons with a pair of long, slightly incurved, flattened tapering horns in major

male, strongly inclined backwards, in minor male the horns becoming reduced to flattened spurs above eyes and, in extreme cases, a pair of small oblique ridges. No carina between horns. Eyes moderately wide, with about 15 facet rows across widest point, separated by about 7 widths, canthus complete. Densely punctate with small punctures becoming larger on clypeus, more coarsely punctate in minor male, surface very finely shagreened, alutaceous. Labium incised about halfway to base. *Pronotum.*–Anterior half deplanate with a shallow central concavity in major male, this surmounted by a slight protuberance in centre of pronotum, medium male with anterior part simply deplanate, no protuberance, minor male with pronotum evenly convex. Anterior angles acute, the apices rounded. Hind edge not margined. Densely punctate with small punctures separated by 1–2 diameters, the punctures becoming extremely small along posterior edge, glabrous, surface smooth, very finely shagreened, alutaceous. *Elytra.*–Intervals flat, smooth, shagreened, sericeous, with numerous extremely small punctures, glabrous. Striae shallow, indistinct on disc, simple, marked by numerous very small punctures. *Legs.*–Fore tibia unmodified, spur broad, a little spatulate. *Abdomen.*–Pygidium shagreened, densely punctate, with very small punctures, glabrous. Parameres with the points spatulate.

*Female*

Clypeal margin evenly rounded, more strongly reflexed. Clypeal suture as in male. Head more densely and coarsely punctate, the punctures of clypeus transverse or forming transverse grooves. Frons with a low carina which is medially transverse and laterally bent back to about middle of edge of eye. Pronotum evenly convex, densely punctate as in male. Otherwise like male.

*Types*

Holotype of *queenslandicus*: ♀, north Queensland, Cowley, BMNH.

Holotype of *fitzroyensis*: ♂, junction of Fitzroy and Margaret Rivers, north Western Australia, 1896 Calvert Expedition, SAM.

Both seen by the author.

*Remarks*

The specimens labelled *queenslandicus* seen by the author, including the type, are all females indistinguishable from female *fitzroyensis* collected in the Kimberleys. The specimen in SAM associated with the male type of *fitzroyensis*, and which Blackburn believed to be the female, is a male *glabratus*.

*Distribution* (Fig. 108)

The Kimberley District of Western Australia, the Northern Territory south of the 40-in. isohyet, and north-western Queensland along the 15- to 20-in. isohyets. Most specimens are collected at light. Collected by the author at human faeces and cow dung in open savannah areas without tree cover, in sandy soil. Nocturnal. January–May.

*Material Examined*

The types and 17 specimens. QUEENSLAND: Camooweal, C. F., NMV, 2; 5 miles SSW. of Canobie H. S., 13.iv.1962, K. H. L. Key and E. L. Corby, ANIC, 1; Cloncurry, 7.v.1947, H. Bell, UQ, 1; 8 miles NW. of Winton, 4.v.1958, L. J., M. F. Chinnick and J. Walker, ANIC, 3; no exact locality, SAM, BMNH, 2. NORTHERN TERRITORY: 2–4 miles E. of Katherine,

8.ii.1968, E. G. Matthews, ANIC, 9. WESTERN AUSTRALIA: Camballin, Kimberleys, 1.iii.1968, J. A. L. Watson, ANIC, 13; Fitzroy Crossing, 25.ii.1968, E. G. Matthews, ANIC, 32; Kimberley Research Station, via Wyndham, Jan. 1956, E. C. B. Langfield, ANIC, 1; Kununurra, 13–22.ii.1968, E. G. Matthews, ANIC, 2; 60 miles NW. of Kununurra, 14, 18.ii.1968, E. G. Matthews, ANIC, 6; 100 miles E. of Kununurra, 27.iii.1966, J. A. Mahon, ANIC, 1.

## 44. ONTHOPHAGUS COMPEREI Blackburn

(Figs. 121–123, 515, 516)

*Onthophagus comperei* Blackburn, 1903, p. 295; Lea, 1923, p. 370; Boucomont and Gillet, 1927, p. 210.

Black, antennal clubs flavous. Total length 7–9 mm.

*Male*

*Head.*—Clypeal margin medially produced into a reflexed bilobate process, rest of margin evenly rounded to genal angles, which are obtusely angulate. Clypeal suture with frontal section not carinate, indicated by a feeble transverse ridge, genal sections distinct, oblique. Vertex with a pair of divergent, reclined, flattened horns, these horns somewhat bent out in the middle, the inner edge sometimes forming an angle here, and terminating in 2 unequal rounded points, the inner one much longer. Medium male with short, somewhat crooked horns, minor male with only a pair of conical tubercles on vertex. No carina between horns. Eyes moderate, with 11–12 facet rows across widest point, separated by about 5.5 widths, canthus complete. Evenly, rather sparsely punctate with very small punctures, appearing impunctate in worn specimens. Glabrous. Surface smooth, nitid. Labium incised about one-third of way to base. *Pronotum.*—Anterior half deplanate, rounding into posterior half, which is somewhat flattened. No trace of median tubercle. Anterior angles acute or quadrate, the apices angulate. Hind edge unmargined. Densely punctate with small punctures separated by 2–3 diameters, the punctures becoming smaller and sparser toward anterior margin. Glabrous. Surface very finely shagreened, alutaceous. *Elytra.*—Intervals feebly convex, smooth, shagreened, sericeous, with numerous extremely small punctures, glabrous. Striae superficial, fine, simple, with very small shallow punctures not wider than stria, often appearing impunctate. *Legs.*—Fore tibiae somewhat slender, claws large. *Abdomen.*—Pygidium unusually large, crowding abdominal sternites medially, shagreened, matt, with numerous very small punctures in fresh specimens bearing extremely short setae directed inward on lateral punctures. Parameres falcate.

*Female*

Clypeus shaped as in male, the surface more densely punctate and rugulose. Frontoclypeal suture strongly carinate, feebly procurved. Vertex with a pair of conical tubercles, well separated and not joined by a carina. Pronotum more coarsely punctate, the punctures separated by 1–2 diameters. Elytral striae a little more impressed and with deeper punctures, a little wider than stria. Fore tibiae wide. Otherwise like male.

*Type*

Holotype ♀, north Queensland, BMNH. Seen by the author.

*Remarks*

The type of *comperei* is a female; however, in Blackburn's note following the description he mentions some males which he correctly associated with the type.

*Distribution* (Fig. 108)

North Queensland from Townsville to the Stewart River (Silver Plains). At least five of the 14 specimens seen by the author were collected at light.

*Material Examined*

The type and 13 specimens. QUEENSLAND: Kuranda, ANIC, 1; Silver Plains H.S., 31.xii.1964, 15.iii.1965, J. L. Wassell, ANIC, 4; Stewart R., 1.ii.1927, SAM, 1; Townsville, 17–29.i.1968, P. Ferrar, ANIC, 1; Townsville, G. F. Hill, NMV, 2; Townsville, Dodd, SAM, 4.

## 45. ONTHOPHAGUS FERRARI, sp. nov.

(Figs. 124–126, 517)

Black, legs rufopiceous, antennal clubs flavous. Total length 7–10 mm.

*Male*

*Head.*–Clypeal margin medially a little produced into a projecting, feebly bilobate lobe in major male, the margin simply bilobate in minor male, reflexed, laterally evenly rounded, slightly notched at genal sutures, genal angles rounded, not prominent. Clypeal suture finely carinate, forming a feebly bisinuate line across head. Vertex with a broad, posteriorly inclined lamina which is laterally produced into a pair of inwardly curved horns, the edge between these bent forward and medially excised in major male, in minor male with a feebly triarcuate transverse carina near occiput. Eyes small, with about 13 facet rows across widest point, separated by about 10 widths, canthus complete. With extremely small punctures, except along edges of clypeus, which are more coarsely punctate and rugulose, the punctures a little larger in minor male. Surface smooth, nitid. Labium excised about halfway to base. *Pronotum.*–Major male with a median anterior gibbosity which forms 2 approximated tubercles at apex, the anterior declivity slightly concave on either side of gibbosity. Minor male with evenly convex pronotum and only a trace of median gibbosity near anterior margin. Anterior angles subacute, the points rounded. Hind edge distinctly margined. Fairly densely punctate with small shallow punctures, these separated by about 2 diameters, anterior declivity much more finely punctate, glabrous, surface smooth, nitid. *Elytra.*–Intervals flat, extremely finely punctate, smooth, alutaceous, glabrous. Striae shallow, fine, simple, with small impressed transverse punctures. *Legs.*–Fore tibia unmodified. *Abdomen.*–Pygidium smooth, sericeous, densely punctate with small punctures, glabrous. Aedeagus normal.

*Female*

Clypeal margin feebly bilobate, reflexed, not more produced than that of male, surface transversely rugose, clypeal suture more carinate. Frons with strongly elevated, straight transverse carina in middle running from eye to eye. Pronotum with a pair of approximated median anterior tubercles. Otherwise like male.

*Type*

Holotype ♂, Tully, north Queensland, 18.iv.1967, P. Ferrar, ANIC.

*Remarks*

The author is pleased to name this species after Mr. Paul Ferrar, the collector of the only known major male.

*Distribution* (Fig. 109)

Known only from the vicinity of Tully and Ingham, on the coast of northern Queensland. Ecology unknown.

*Material Examined*

The type and three specimens. QUEENSLAND: Ingham, 1.v.1964, G. F. Bornemissza, ANIC, 3.

## 46. ONTHOPHAGUS CAPELLIFORMIS Gillet

(Figs. 127-129, 518)

*Onthophagus capelliformis* Gillet, 1925, p. 12; Boucomont and Gillet, 1927, p. 210.

Black, antennal clubs flavous or fuscous. Total length 9-12 mm.

*Male*

*Head.*—Clypeal margin medially produced, rounded or very slightly truncated. Clypeal suture with frontal section finely carinate, straight, obtusely angled with genal sections. Vertex with a broad lamina, inclined backward and terminating in 2 short, inwardly curved taurine horns, the margin between these angled forward and slightly raised to a point in middle. Eyes small, with about 15 facet rows across widest point, separated by about 12 widths, canthus complete. Clypeal surface densely transversely rugose and punctate, rest of head surface moderately and shallowly punctate becoming impunctate on frontal lamina. Labium incised halfway to base. *Pronotum.*—Medially with 2 low approximated tubercles, anterior declivity of pronotum slightly flattened in major individuals and feebly undulate below tubercles. Anterior angles quadrate, the apices rounded, lateral margins evenly rounded, not prominent. Hind edge finely margined. Pronotal surface moderately densely, coarsely punctate, the punctures separated by distance about equal to their own diameter, becoming very finely punctate on anterior declivity, glabrous. Surface nitid. *Elytra.*—Intervals flat, smooth, sericeous, extremely finely punctate, glabrous. Striae moderately impressed, fine, simple, with extremely small, shallow punctures. *Legs.*—Fore tibiae not slender. *Abdomen.*—Pygidium shagreened, moderately densely punctate with small shallow punctures, glabrous. Aedeagus normal.

*Female*

Clypeus a little more produced, rounded, more strongly rugose, rugose also on genae, vertex posteriorly truncated, the edge forming a ridge which is elevated into 2 small points on either side of midline. Pronotum with the 2 tubercles more approximated to anterior margin, more prominent, surface a little more coarsely punctate. Otherwise like male.

*Type*

Holotype ♂, Malanda, Qld., Mjöberg, NRM. Seen by the author.

*Distribution* (Fig. 109)

The Atherton Tableland in northern Queensland, in rain forest. Trapped with human excrement.

*Material Examined*

The type and 11 specimens. QUEENSLAND: Millaa Millaa (2500 ft), 5.iv.1932, P. J. Darlington, MCZ, 1; 9 miles W. of Millaa Millaa, 1.iv.1968, E. G. Matthews, 1; 9 miles SSE. of Ravenshoe (2750 ft), 21.iv.1969, I. F. B. Common and M. S. Upton, ANIC, 1; Yungaburra, 7.v.1964, 27.ii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 8.

## 47. ONTHOPHAGUS CAPELLA Kirby

(Figs. 130–133, 519–520)

*Onthophagus capella* Kirby, 1818, p. 398; Harold, 1867, p. 29; Harold, 1869, p. 83; Blackburn, 1903, p. 279; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

*Onthophagus schmeltzi* Harold, 1869, p. 84; Blackburn, 1903, p. 279 (syn.); Boucomont and Gillet, 1927, p. 210.

Black, antennal clubs fulvous. Total length 10–17 mm.

*Male*

*Head.*—Broadly oval in outline, clypeus somewhat elongated, reflexed, and truncate. Frontal section of clypeal suture procurved, moderately bent at junction with genal sections. Vertex with a broad lamina directed backward and upward, terminating in a pair of curved horns. Margin between these horns either feebly undulated, or more deeply incised with a median quadrate process. Medium male with a trisinuate frontal carina raised into points laterally. Minor male with a low transverse occipital carina which is slightly trisinuate and only very feebly elevated at the lateral ends, or, in extremely minor male, less posteriorly positioned and simple as in female. Eyes moderate, with about 15 facet rows across widest point, separated by about 8 widths, canthus complete. Clypeal surface densely, coarsely punctate and transversely rugose, rest of head moderately punctate, becoming impunctate on frontal lamina in major male. Labium incised halfway to base. *Pronotum.*—With a single pair of approximated median tubercles. Anterior angles prominent, the margin behind them slightly sinuate. Coarsely punctate, the punctures separated by distance about equal to their diameter, more finely and sparsely punctate on anterior declivities. *Elytra.*—Intervals flat, shagreened, becoming moderately punctate on sides, glabrous. Striae shallow, fairly closely punctate, the punctures round. *Legs.*—Fore tibiae not elongated. *Abdomen.*—Pygidium shagreened, moderately densely punctate, with small shallow punctures, glabrous. Aedeagus normal.

*Female*

Clypeal margin rounded, frontal section of clypeal suture more raised. Frons with a low straight even transverse carina between eyes. Pronotal tubercles more prominent. Otherwise like male.

*Types*

Holotype of *capella*: ♂, Australasia, BMNH.
Holotype of *schmeltzi*: ♂, New South Wales, MNHN(Ob).
Both seen by the author.

*Remarks*

*O. schmeltzi* was described by Harold (1869) as a distinct species, but Blackburn (1903) correctly considered it to be a variety of *capella*, and it was so treated by

Boucomont and Gillet (1927). This morph, which is distinguished by the quadrate lobe on the cephalic lamina between the horns, occurs throughout most New South Wales populations of *capella* (Fig. 109). It makes up about 11% of the total number of males over 14 mm in length (the morph cannot be recognized in smaller individuals), or 6–54% (average 28%) of the males in the samples from populations where it occurs.

*Distribution* (Fig. 109)

A very extended distribution from around Nowra, N.S.W., (with one specimen collected in the Australian Capital Territory) to the Atherton Tableland in northern Queensland. Common in wet pastures, particularly those occupying clearings in montane areas up to about 4500 ft in northern New South Wales. Elsewhere it is a regular member of the dung fauna in moist pastures and open savannah woodland, occurring under cow dung and human faeces in loam and sand. December–May. Nocturnal.

*Material Examined*

The type and 764 specimens. AUSTRALIAN CAPITAL TERRITORY: Canberra. NEW SOUTH WALES: Bargo; Barrington House; Bonalbo; Bonville; 10 miles W. of Cangai; Donaldson State Forest; Dorrigo; Gallagher's Camp; Glenugie; Gosford; Grafton; Kangaroo Valley; Kempsey; Kendall; Killara; Kingcumber; Kyogle; Macksville; Maclean; Megan; 16 miles N. of Mittagong; Mt. Tomah; Nambucca; Newcastle; New England National Park; Nowra; Orara R.; Parramatta; 5 miles W. of Port Macquarie; Putty; Quaker's Hill; Richmond R.; 26 miles S. of Singleton; Somersby; Sydney; Tenterfield; Terrigal; Thomleigh; Tooloom Plateau; Tooloom Scrub; Upper Allyn R.; Valery; Wahroonga; Wamberal; Woodenbong. QUEENSLAND: Atherton; Ballengarra; Brookfield; Bundaberg; Bunya Mts.; Cardwell; Charters Towers; Eungella National Park; Finch Hatton; 30 miles N. of Gin Gin; Kenilworth State Forest; Kolan Ck.; Kuranda; Mackay; Millaa Millaa; Mt. Glorious; Mt. Lindesay Forest; Mt. Spec; Mt. Tamborine; Palen Ck.; Paluma; Paluma Heights; 2–17 miles W. of Ravenshoe; Stradbroke I.; Yungaburra.

## 48. ONTHOPHAGUS PUGNAX Harold

(Figs. 134–137, 521)

*Onthophagus pugnax* Harold, 1868*a*, p. 83; 1869, p. 83; Gillet, 1925, p. 11; Boucomont and Gillet, 1927, p. 215.

*Onthophagus opacipennis* Lea, 1923, p. 387; Boucomont and Gillet, 1927, p. 214. New synonymy.

Black, antennal clubs fulvous. Total length 11–16 mm.

*Male*

*Head.*—Broadly oval in outline, clypeus evenly rounded. Frontal section of clypeal suture evenly arcuate, sharply bent at junction with genal sections. Frons with 2 erect horns arising near inner margin of eyes, these horns of varying length according to development, with a sharp prominent carina between them strongly arched forward. Some males with an entirely different frontal carina consisting of a simple high transverse slab-like quadrate crest, the upper edge of which is quite straight. Minor male of this morph with a simple low transverse carina as in female. Eyes moderate, with about 13 facet rows across widest point, separated by about 8 widths, canthus complete. Clypeal surface densely, coarsely punctate and transversely rugose, rest of head moderately punctate, becoming impunctate on

disc of frons. Labium incised halfway to base. *Pronotum.*–With a transverse row of 4 more or less equidistant tubercles, the middle 2 joined by an indistinct concave or V-shaped transverse ridge. Anterior angles rounded, not prominent. Hind edge finely margined. Coarsely punctate, the punctures separated by about 1 diameter except on anterior declivities, which are more finely and sparsely punctate. *Elytra.*–Intervals flat, shagreened, becoming moderately punctate on sides, glabrous. Striae shallow, fairly closely punctate, the punctures round. *Legs.*–Fore tibiae not elongated. *Abdomen.*–Pygidium shagreened, moderately densely punctate with small shallow punctures, glabrous. Middle of apical sternite with a very narrow, shiny lip. Aedeagus with apices moderately projecting.

*Female*

Clypeus a little longer, low. Frons with a simple transverse carina between eyes, its sides sloping toward eyes, the top edge straight or very slightly concave. Otherwise like male.

*Types*

Holotype of *pugnax*: ♂, Brisbane, MNHN(Ob).
Holotype of *opacipennis*: ♂, Tamborine Mountain, 28.xii.1911, QM C/2702.
Both seen by the author.

*Remarks*

The specimen in MNHN is marked *pugnax* Harold t. and is thus the holotype. Lea redescribed the species under the name *opacipennis* because he (and also Blackburn) misassigned the name *pugnax*. This error was pointed out by Gillet (1925), who correctly identified *pugnax* but who did not take the further step of synonymizing *opacipennis*, apparently because he did not know to which species this name was being applied by Lea.

*Distribution* (Fig. 109)

From the area around Bateman's Bay, N.S.W., to Mt. Glorious, near Brisbane. Occupies coastal habitats in the south of its range but becomes montane north of Gosford. Occurs in dense forests, ranging from wet sclerophyll to the southern fragments of the tropical rain forest at Dorrigo, Gibraltar Range, and Tamborine. In loam or clay-loam, occasionally in sand. In September 1967, the author found this to be the only species of *Onthophagus* active in Dorrigo National Park at night in a soil temperature of 9°C, and at Bateman's Bay it was one of two species active at 12°C. Nocturnal. Trapped with human excrement and marsupial intestines. September–January and April–May.

*Material Examined*

The types and 104 specimens. NEW SOUTH WALES: 5 miles N. of Bateman's Bay, 29.ix.1967, E. G. Matthews, ANIC, 1; Cabbage Tree Ck., Nelligen, 5.v.1965, G. F. Bornemissza, ANIC, 3; Comboyne, 1937, H.J.D. and D.T.S., ANIC, 1; Dorrigo National Park, 6.ix.1967, E. G. Matthews, ANIC, 4; Exeter, Jan. 1935, H. J. Carter, ANIC, 4; Gibraltar Range National Park, 5.xii.1967, E. G. Matthews, ANIC, 4; Gosford, Carter, ANIC, 1; 13 miles N. of Marulan, 25.iii.1969, G. F. Bornemissza, ANIC, 1; New England National Park, 3.xii.1967, E. G. Matthews, ANIC, 2; Shoalhaven Bridge, Braidwood, 5.v.1965, G. A. Yapp, ANIC, 1; Upper Allyn R. (1500 ft), 11.xi.1960, I. F. B. Common and M. S. Upton, ANIC, 1; Urbenville, 12.xii.1965, G. A. Yapp,

ANIC, 2; 4 miles W. and 6 miles E. of Woodenbong, 8–9.xii.1967, E. G. Matthews, ANIC, 6. QUEENSLAND: Blackall Range, Oct. 1920, F. E. Wilson, NMV; Brisbane, MNHN(Ob), 6; Lamington National Park, 28.v.1962, J. Cribb, UQ, 1; Mt. Glorious, 8.iv.1968, E. G. Matthews, ANIC, 13: Mt. Lindesay Forest, 12.iv.1965, Bornemissza and Yapp, ANIC, 2; National Park, McPherson Range (3000–4000 ft), Mar. 1932, P. J. Darlington, MCZ, 1.

## 49. ONTHOPHAGUS TABELLIFER Gillet

(Figs. 138–140, 522)

*Onthophagus tabellifer* Gillet, 1927, p. 258.

Black, antennal clubs fulvous. Total length 11.5–15 mm.

*Male*

*Head.*—Broadly oval in outline, clypeus evenly rounded. Frontal section of clypeal suture arcuate, forming a sharp angle with genal sections. Frons with a high erect transverse crest with slightly diverging sides and trilobed distal edge, minor male with this crest reduced to a carina, but always clearly 3-pointed. Eyes moderate, with about 16 facet rows across widest point, separated by about 10 widths, canthus complete. Clypeal surface transversely rugose anteriorly, becoming smooth and finely punctate near frontoclypeal suture, genae coarsely punctate, rest of head very finely punctate, frontal lamina impunctate. *Pronotum.*—With a transverse row of 4 more or less equidistant tubercles, the middle 2 more prominent, separated by a depression and not joined by a carina or ridge. Anterior angles rounded, not projecting. Hind edge distinctly margined. Densely and coarsely punctate, the punctures separated by about 1 diameter or a little less, anterior declivities impunctate. *Elytra.*—Intervals slightly convex and rugose, glabrous. Striae moderately impressed, closely punctate, the punctures round. *Legs.*—Fore tibiae not elongated. *Abdomen.*—Pygidium shagreened, moderately densely punctate with small shallow punctures, glabrous. Aedeagus with parameres relatively long.

*Female*

Clypeus slightly longer, giving head a more triangular appearance. Frontal carina very low, still indistinctly trilobed as in minor male. Otherwise like male.

*Type*

Holotype ♂, New South Wales, BMNH. Seen by the author.

*Distribution* (Fig. 109)

Collected by Dr. Bornemissza and the author in the vicinity of Bateman's Bay, N.S.W., by W. W. Froggatt at Gerringong, on the coast about 100 miles to the north, and by Verreaux in Tasmania during the last century. The Tasmanian record needs confirmation. The species is apparently very localized, since it is not uncommon around Bateman's Bay but was not collected further south near Eden, in spite of intensive trapping. It occurs in shaded situations in coastal forests, very near the sea, in sand. Trapped with human faeces and found under cow dung from August to December.

*Material Examined*

The type and 24 specimens. NEW SOUTH WALES: Bateman's Bay, 10.x.1964, G. F. Bornemissza, ANIC, 4; 5 miles N. of Bateman's Bay, 29.ix.1967, E. G. Matthews, ANIC, 1; Durras Water, 20–26.xii.1964, G. F. Bornemissza, ANIC, 15; Gerringong, 1.viii.1892, Froggatt, ANIC, 1; no specific locality, BMNH, 2. TASMANIA: Apr. 1846, Verreaux, MNHN(Gen), 1.

## 50. ONTHOPHAGUS OURATITA, sp. nov.

(Figs. 141, 142, 523, 524)

Black, antennal clubs rufous. Total length 12–16 mm.

*Male*

*Head.*—Clypeus evenly rounded, Frontal segment of clypeal suture arcuate or medially bent forward at a rounded angle in major male. Frons with a high slender horn terminally expanding and bifurcate, sometimes with a small posterior horizontal projection at middle of apex of horn. Minor male with horn lower, broader, parallel-sided, semicircularly excised distally. Eyes moderate with about 12 facet rows across widest point, separated by about 10 widths, canthus complete. Clypeal surface transversely rugose anteriorly, becoming smooth and very finely punctate near frontoclypeal suture, genae coarsely punctate, rest of head very finely punctate, frontal horn impunctate. Labium excised about halfway to base. *Pronotum.*—With a transverse row of 4 more or less equidistant tubercles, the middle 2 united by an indistinct V-shaped transverse ridge in major male, delimiting a punctate posterior from an impunctate anterior area. In minor male this delimitation is less evident or absent. Anterior angles rounded, not projecting. Pronotal surface densely and coarsely punctate, the punctures separated by a distance about equal to their diameter or a little less, anterior declivities very finely punctate. *Elytra.*—Intervals flat, shagreened, becoming rugose on sides, glabrous. Striae shallow, fairly closely punctate, the punctures round. *Legs.*—Fore tibiae not elongated. *Abdomen.*—Pygidium shagreened, moderately densely punctate with small shallow punctures, glabrous. Aedeagus normal.

*Female*

Clypeus more prominent, giving head a more triangular appearance. Frons with a low, strong transverse carina which is slightly 3-pointed, or straight in minor female. Otherwise like male.

*Type*

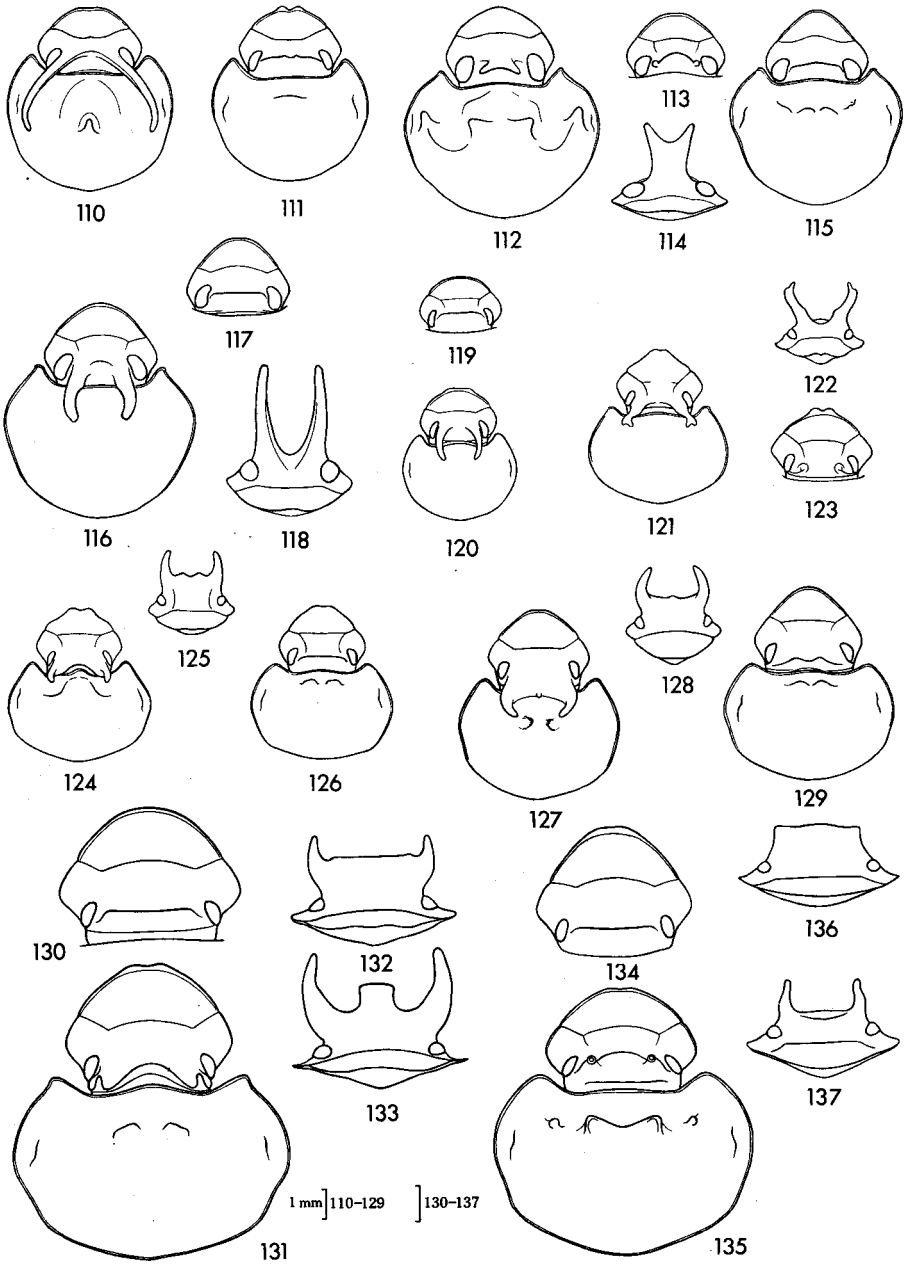
Holotype ♂, Mt. Lindesay Forest, Qld., 12.iv.1965, G. A. Yapp, ANIC.

*Remarks*

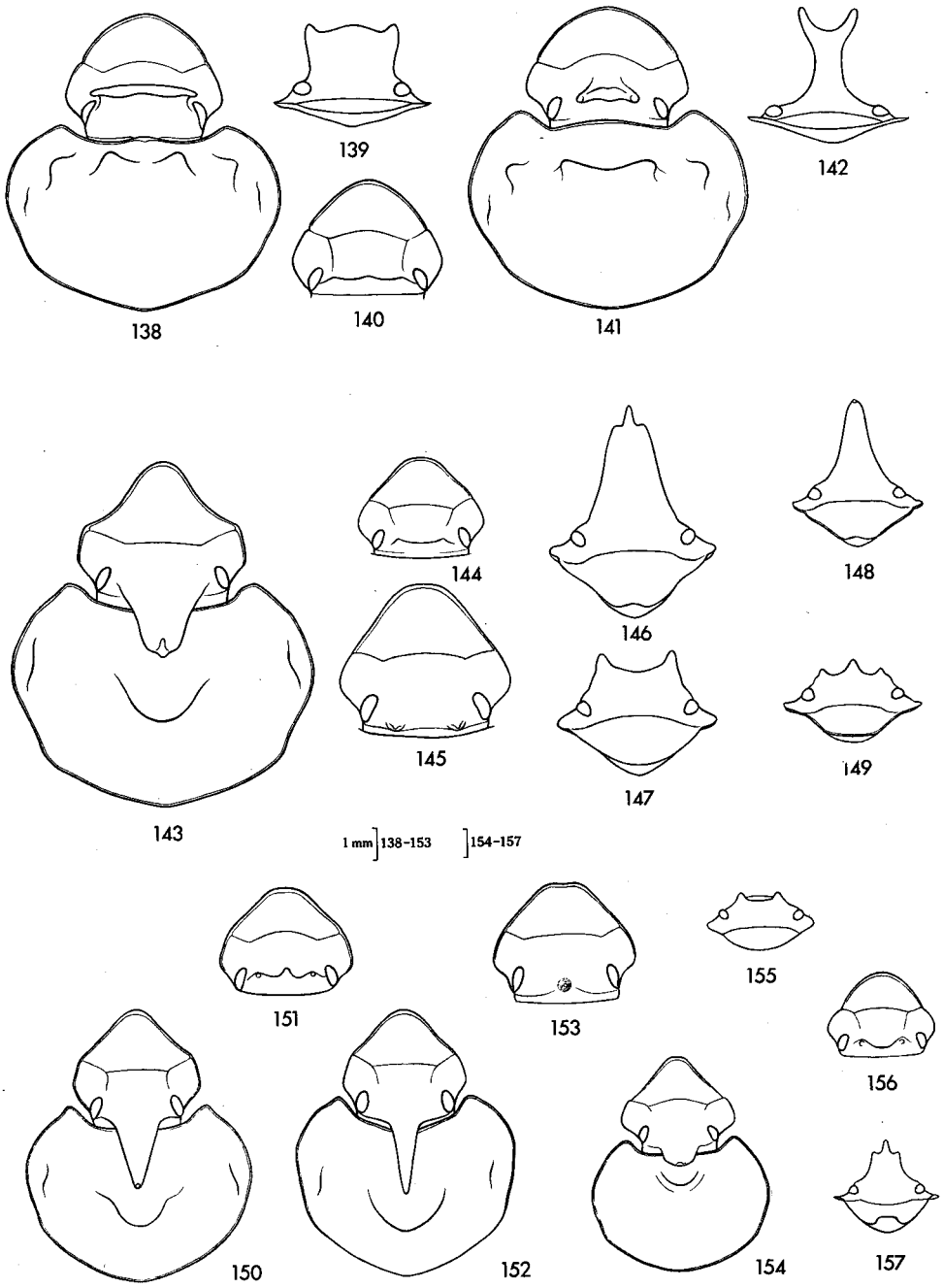
This species is very close to *tabellifer*, from which it may be distinguished by the male cephalic armament only, and in major males by the fact that the two median pronotal prominences are joined by an indistinct open-V-shaped ridge in *ouratita* and not in *tabellifer*. However, the specific separation is based equally on the distance between the geographical ranges of the two forms.

*Distribution* (Fig. 109)

The McPherson Range on the New South Wales–Queensland border near the coast. In forest, at human excrement.




Figs. 110–137.–*Onthophagus* spp.: *110*, *111*, *O. nodulifer*, fore body: *110*, male, *111*, female; *112–115*, *O. dicranocerus*: *112*, major male, fore body; *113*, minor male, head; *114*, major male, head, front view; *115*, female fore body; *116–118*, *O. neostenocerus*: *116*, male fore body; *117*, female head; *118*, major male, head, front view; *119*, *120*, *O. queenslandicus*: *119*, female head; *120*, male fore body; *121–123*, *O. comperei*: *121*, male fore body; *122*, male head, front view; *123*, female head; *124–126*, *O. ferrari*: *124*, male fore body; *125*, male head, front view; *126*, female fore body; *127–129*, *O. capelliformis*: *127*, male fore body; *128*, male head, front view; *129*, female fore body; *130–133*, *O. capella*: *130*, female head; *131*, male fore body; *132*, typical male head, front view; *133*, "var. *schmeltzi*" male head; *134–137*, *O. pugnax*: *134*, female head; *135*, male fore body; *136*, polymorphic male, head, front view; *137*, typical male head.




Figs. 138–157.–*Onthophagus* spp.: *138–140*, *O. tabellifer*: *138*, male fore body; *139*, male head, front view; *140*, female head; *141*, *142*, *O. ouratita*, male: *141*, fore body; *142*, head, front view; *143–147*, *O. macrocephalus*: *143*, male fore body; *144*, minor male, head; *145*, female head; *146*, major male, head, front view; *147*, female head, front view; *148–151*, *O. mamillatus*: *148*, male head, front view; *149*, female head, front view; *150*, male fore body; *151*, female head, dorsal view; *152*, *153*, *O. mundill*: *152*, male fore body; *153*, female head; *154–157*, *O. darlingtoni*: *154*, male fore body; *155*, female head, front view; *156*, female head, dorsal view; *157*, male head, front view.

*Material Examined*

The type and 23 specimens. NEW SOUTH WALES: Donaldson State Forest, 12.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 7; Kyogle–Lismore Rd., 14.xii.1965, G. F. Bornemissza, ANIC, 3. QUEENSLAND: Mt. Lindesay Forest, 12.iv.1965, G. A. Yapp, ANIC, 13.

## 51. ONTHOPHAGUS MACROCEPHALUS Kirby

(Figs. 143–147, 525, 526)

*Onthophagus macrocephalus* Kirby, 1818, p. 398; Blackburn, 1903, p. 279; Lea, 1923, p. 363; Boucomont and Gillet, 1927, p. 213.

Black, antennal clubs rufous. Total length 12–18 mm.

*Male*

*Head.*–Clypeal margin prolonged forward, very strongly so in major male, less so in minor one, rounded medially with the sides more or less concave. Margin at junction of clypeus and genae angular, strongly so in major male. Frontal section of clypeal suture straight, genal sections sharply bent forward. Vertex with a thin tapering lamina strongly inclined backward, very long in major male and terminating in a broad lobe bearing an erect median projection, the lamina reduced or even entirely absent in minor male. Eyes moderate, with about 15 facet rows across widest point, separated by about 10 widths, canthus complete. Sides of clypeus strongly punctate and transversely rugose, becoming finely punctate medially, genae strongly punctate, rest of head very finely punctate or impunctate. Labium excised about halfway to base. *Pronotum.*–With a median depression in major male receiving the vertical lamina, without tubercles. In minor male with a pair of approximated median tubercles as in female. Anterior angles quadrate, the apices rounded, not projecting. Hind edge distinctly margined. Very finely punctate, extremely finely shagreened, producing a slight satiny lustre. *Elytra.*–Intervals flat, very finely punctate, finely shagreened, sericeous, glabrous. Striae superficial, very indistinctly punctate. *Legs.*–Fore tibiae not elongated. *Abdomen.*–Pygidium shagreened, moderately densely punctate with small shallow punctures, glabrous. Aedeagus normal.

*Female*

Clypeus prominent, but not as much so as in major male, entirely transversely rugose. Vertex raised into a strong transverse carina bearing a pair of erect points in major female, the points about halfway between midline and eyes, this carina reduced in minor female, not raised into points, feebly arcuate as in minor male. Pronotum with a single pair of approximated tubercles near front margin. Otherwise like male.

*Type*

Holotype ♂, Australasia, BMNH. Seen by the author.

*Distribution* (Fig. 109)

From southern Gippsland, Vic., to northern New South Wales in coastal eucalypt and casuarina woodlands, in sand. Climbing the coastal escarpment in the southern part of its range but not emerging onto the tableland. Trapped with human excrement and mammal entrails, from December to May.

*Material Examined*

The type and 73 specimens. VICTORIA: Boolarra, 26.v.1963, G. F. Bornemissza, ANIC, 7; Morwell, 15.v.1963, G. F. Bornemissza, ANIC, 1. NEW SOUTH WALES: Bargo, 4.iv.1964, G. F. Bornemissza, ANIC, 3; 11 miles E. of Cathcart, 13.i.1968, E. G. Matthews, ANIC, 4; Clyde Mountain, 31.iii, 20.iv.1964, G. F. Bornemissza, ANIC, 6; 3–7 miles N. and 5–17 miles S. of Eden, 13.i.1968, E. G. Matthews, ANIC, 6; Glenugie, 15 miles S. of Grafton, 10.xii.1965, G. F. Bornemissza, ANIC, 2; 13 miles N. of Marulan, 4.iv.1964, G. F. Bornemissza, ANIC, 8; Mittagong, 4.iv.1964, ANIC, 2; Somersby, 9.iv.1964, G. F. Bornemissza, ANIC, 23; Sydney, 1895, W. W. Froggatt, ANIC, 1; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 10.

## 52. ONTHOPHAGUS MAMILLATUS Lea

(Figs. 148–151, 527)

*Onthophagus mamillatus* Lea, 1923, p. 372; Boucomont and Gillet, 1927, p. 213.

Black, antennal clubs rufous. Total length 8–13 mm.

*Male*

*Head.*–Clypeus triangular, prolonged into a median rounded point which is moderately reflexed. Margin at junction of clypeus and genae angled out. Frontal section of clypeal suture straight, forming sharp angles with genal sections. Vertex with a thin tapering lamina strongly inclined backward, very long in major male and terminating in a point bearing a small tubercle. With decreasing development lamina becomes reduced eventually to a transverse carina with 3 points as in female, then only 2 lateral points, then, in extreme minors, a simple carina with no points at all. Sides of clypeus strongly punctate and transversely rugose, middle of clypeus finely punctate or impunctate. Eyes moderate, with about 15 facet rows across widest point, separated by about 10 widths, canthus complete. Genae strongly punctate, rest of head finely punctate or impunctate. Labium excised about halfway to base. *Pronotum.*–Major male with a median depression receiving vertical lamina, without tubercles. In medium and minor male this is replaced by 2 very prominent, approximated, somewhat elongated tubercles just before midpoint. Anterior angles quadrate, slightly prominent. Hind edge distinctly margined. Very finely punctate, almost impunctate on disc and anterior declivity, very finely shagreened, producing a satiny lustre on surface. *Elytra.*–Intervals flat, impunctate, shagreened, glabrous. Striae superficial, very finely and indistinctly punctate. *Legs.*–Fore tibiae not elongated. *Abdomen.*–Pygidium shagreened, moderately densely punctate with small shallow punctures, glabrous. Aedeagus normal.

*Female*

Clypeus rounded, only slightly prolonged, entirely transversely rugose. Frons with a transverse carina between eyes raised into 3 points, only 2 in some specimens. Pronotum with a single pair of prominent, approximated median tubercles near front margin. Otherwise like male.

*Type*

Holotype ♂, Mt. Tamborine, Qld., H. Hacker, H. Pottinger, A. M. Lea, SAM I.3750. Seen by the author.

*Remarks*

The type and other males used by Lea for his description are minor males and therefore armed like the female. The larger series now available reveals that major males have a long, tapering lamina on the head.

*Distribution* (Fig. 109)

Known from Mt. Tamborine and Lamington National Parks in the McPherson Range and from Eungella National Park inland from Mackay, with one specimen recorded from Bribie I. According to the author's collecting data this species is restricted to montane rain forest with heavy clay soil. Trapped with human excrement bait. Nocturnal.

*Material Examined*

The type and 33 specimens. QUEENSLAND: Bribie I., Moreton Bay, H. Hacker, QM, 1; Eungella National Park, 25.iii.1968, E. G. Matthews, ANIC, 18; Finch Hatton Ck., 27.iii.1968, E. G. Matthews, ANIC, 1; Lamington National Park, 6.iv.1957, S. Sekhon, UQ, 1; Mt. Tamborine, 28.xii.1911, H. Hacker, QM, 1; Mt. Tamborine, A. M. Lea, SAM, 4; Mt. Tamborine, 7.xii.1967, E. G. Matthews, ANIC, 7.

## 53. ONTHOPHAGUS MUNDILL, sp. nov.

(Figs. 152, 153, 528)

Black, antennal clubs fulvous. Total length 10–13 mm.

*Male*

*Head.*–Clypeus medially a little prolonged, bluntly rounded, the margin reflexed, laterally straight to sutures, genal angles subangulate. Clypeal suture with frontal section feebly carinate, almost straight, obtusely angled with genal sections. Vertex with a long, thin, backwardly inclined process which is flattened, tapering, and acute, terminating in a feeble tubercle. Minor male with a feeble transverse tumescence on vertex. Occipital margin indistinctly carinate. Eyes moderate, with about 10 facet rows across widest point, separated by about 9 widths, canthus complete. Densely punctate with shallow indistinct punctures, glabrous, clypeal surface densely but shallowly punctate, rugose in minor male, subnitid, rest of head surface smooth to feebly rugulose, sericeous. Labium excised about one-third of way to base. *Pronotum.*–With a median depression sharply delineated posteriorly, or with a pair of parallel longitudinal rounded ridges on anterior part in minor male, median longitudinal sulcus distinct on base or for entire length of pronotum in minor male. Anterior angles quadrate, the apices rounded. Hind edge very finely margined. With dense, very shallow punctures and rugulose near anterior angles, rest of surface smooth, impunctate, sericeous, glabrous. *Elytra.*–Intervals flat, smooth, sericeous, glabrous. Striae shallow, simple, almost impunctate. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium smooth, sericeous, impunctate, glabrous. Points of parameres prolonged, curved, slender.

*Female*

Clypeal margin broader, clypeal surface more strongly rugose. Head surface nitid. Occipital margin strongly carinate, the middle raised into a single prominent conical tubercle. Pronotum with 2 parallel ridges strongly elevated and separated by a deep concavity. Otherwise like male.

*Type*

Holotype ♂, Gillies Highway (Atherton-Gordonvale), Heales Lookout, Qld., 7.v.1969, G. F. Bornemissza and P. Ferrar, ANIC.

*Remarks*

The female of this species is easily recognizable by the single point on the base of the head, instead of two points in *darlingtoni* and three in *mamillatus*, and by the pronotal ridges. The male, however, is indistinguishable from that of *mamillatus*. Nevertheless, confusion between the two species is not likely because of their wide geographic separation.

*Distribution* (Fig. 109)

Known only from the Atherton Tableland, Qld., in rain forest with clay soil.

*Material Examined*

The type and 23 specimens. QUEENSLAND: Gillies Highway, Heales Lookout, 7.v.1969, G. F. Bornemissza and P. Ferrar, ANIC, 20; L. Barrine, 24.iii.1965, G. A. Yapp, ANIC, 3.

## 54. ONTHOPHAGUS DARLINGTONI, sp. nov.

(Figs. 154-157, 529)

Black, antennal clubs fulvous. Total length 9-11 mm.

*Male*

*Head.*—Clypeus triangular, prolonged into a median truncate lobe which is sharply reflexed. Margin at junction of clypeus and genae slightly emarginate, genal margins somewhat expanded. Frontal section of clypeal suture moderately bent forward at middle, forming strong angles with genal sections. Vertex with a thin subquadrate lamina strongly reclined and terminating in 3 points, of which the middle one is the longest. Eyes moderate, with about 11 facet rows across widest point, separated by about 8 widths, canthus complete. Finely and sparsely punctate, impunctate in middle of clypeus. Labium excised about one-third of way to base. *Pronotum.*—With median depression receiving vertical lamina, this depression delimited posteriorly by a pair of very low oblique ridges, without any tubercles even in minor male. Anterior angles quadrate. Hind edge finely margined. Very finely punctate and shagreened, with a satiny lustre. *Elytra.*—Intervals flat, impunctate, shagreened, glabrous. Striae superficial, very finely and indistinctly punctate. *Legs.*—Fore tibia elongated, bearing a large tuft of golden setae distally, longer than spur. *Abdomen.*—Pygidium smooth, sericeous, impunctate, glabrous. Aedeagus normal.

*Female*

Clypeal margin not elongated, rounded, genae not expanded. Clypeal surface transversely rugose. Frontal section of clypeal suture evenly rounded, more carinate. Without a vertical carina, vertex bears 2 erect tubercles well separated by a feeble ridge. Front of pronotum with a pair of oblique ridges, more prominent than in male but not very strongly pronounced. Median longitudinal sulcus of pronotum more distinct. Fore tibiae not elongated, without seta tuft. Pygidium exceptionally short. Otherwise like male.

*Type*

Holotype ♂, Paluma Dam Rd., Mt. Spec, Qld., 30.iii.1968, E. G. Matthews, ANIC.

*Remarks*

The author is pleased to name this species after Dr. P. J. Darlington, Jr., its first collector.

*Distribution* (Fig. 109)

Mt. Spec, north-west of Townsville, and the Atherton Tableland, Qld. Collected by the author in wet sclerophyll forest on Mt. Spec at about 3000 ft and by Dr. Bornemissza in rain forest near Yungaburra. This and *mundill* are montane wet-forest species replacing *mamillatus* in the same habitat to the north of the latter's range. At human excrement.

*Material Examined*

The type and 6 specimens. QUEENSLAND: Atherton, 7.ii.1958, Darlingtons, MCZ, 1; Mountains SW. of Atherton (3000–4000 ft), Feb. 1958, Darlingtons, MCZ, 1; Paluma Dam Rd., Mt. Spec, 30.iii.1968, E. G. Matthews, ANIC, 3; Yungaburra, G. F. Bornemissza, ANIC, 1.

## VII. *The* ERICHSONI *Group*

Eyes wide, with 14–22 facet rows across widest point, separated by 4–8 widths, canthus complete. Labium excised shallowly to one-third of way to base. Disc of pronotum smooth and glabrous, sides usually glabrous. Elytra with short setae along epipleural edge or entirely glabrous. Pygidium with short setae. Colour black or brown. Total length 8–11 mm.

Male with clypeal margin generally a little produced medially, subacute (truncate in *wigmungan*), frontoclypeal suture carinate. Vertex usually armed, pronotum armed or carinate. Fore tibiae elongate or not, with or without a distal brush of long setae. Female with carinae or tubercles on head and pronotum.

Six species: 55. *bicornis* Macleay; 56. *tabellicornis* Macleay; 57. *erichsoni* Hope, 58. *wigmungan*, sp. nov.; 59. *picipennis* Hope; 60. *capellinus* Frey.

The first three species listed above have pronounced sexual dimorphism, while the latter three, although highly ornate, are very similar or identical in both sexes. All appear to be savannah woodland forms, but little is known of their ecology.

### KEY TO SPECIES OF THE *ERICHSONI* GROUP

1. Lateral interval of elytra with numerous setae; sides of pronotum anteriorly sinuate, medially expanded, anterior angles acute; front tibia of major male with an apical brush of dense setae; sexual dimorphism marked ..... 2
   Elytra entirely glabrous; sides of pronotum evenly curved, anterior angles broadly rounded; front tibia of major male without brush of setae; very little sexual dimorphism ..... 4

2(1). Sides of pronotum setose anteriorly; male with a pair of erect horns arising directly from frons just near eyes, without frontal lamina. Total length 8 mm. N. W.A., N. N.T., N. Qld. ..... 55. *bicornis* Macleay
   Pronotum glabrous; male without frontal horns, or these at end of a broad frontal lamina ..... 3

3(2). Male with a bilobed frontal lamina inclined back over part of pronotum, terminating in a pair of erect horns, pronotum without a very strongly projecting median lobe, with a transverse ridge which is feebly bilobate in major specimens, flanked by a pair of tubercles; female indistinguishable from that of next species. N. Qld. ..... 56. *tabellicornis* Macleay

Male without any frontal lamina, with feeble lobular extensions near eyes; pronotum with a strongly projecting, distally excised median lobe which is parallel-sided or expanding in major male, reduced to a pair of triangular lobes in minor one, not flanked by a pair of tubercles except in smallest specimens. N. N.T. ..... 57. *erichsoni* Hope

4(1). Edge of clypeus broadly truncate; frontal lamina very short, raised into 2 small lateral points and 1 median tubercle; pronotum with 3 projections joined by an inverted-V-shaped carina. N. Qld. ..... 58. *wigmungan*, sp. nov.

Edge of clypeus medially prolonged into a rounded point; frontal lamina long, covering part of pronotum, extended into a pair of prominent horns; pronotum with a straight or arcuate transverse fold ..... 5

5(4). Margin of frontal lamina between horns with a small median point or a shallow excision; pronotum with large punctures, clypeus of male entirely punctate and rugose. N. N.T. ..... 59. *picipennis* Hope

Margin of frontal lamina between horns with 3 points, or with a subquadrate median lobe; pronotum with fine punctures, impunctate on disc, clypeus of male basally smooth. N. Qld. ..... 60. *capellinus* Frey

## 55. ONTHOPHAGUS BICORNIS Macleay

(Figs. 159, 160, 530)

*Onthophagus bicornis* Macleay, 1888, p. 901; Blackburn, 1903, p. 284; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 209.

Rufous, antennal clubs flavous. Total length 8 mm.

*Male*

*Head.*—Clypeal margin medially a little extended into a rounded lobe and reflexed. Genal margins rounded, not prominent. Clypeal suture carinate, the frontal section strongly arcuate, the genal sections basally carinate and forming a strong angle with it. Frons with a pair of strong erect acute projections next to eyes, the projections not joined by a carina. Eyes very wide, with about 20 facet rows across widest point, separated by about 6 widths, canthus complete, narrow. Finely punctate, sericeous. Genae with a few long, very fine, straight setae. Labium excised a little less than halfway. *Pronotum.*—With a median anterior bilobate shelf-like process, the lobes rounded and separated by a shallow V-shaped emargination, anterolaterally with a pair of prominent compressed tubercles. Anterior angles quadrate, the margin behind them only slightly sinuate. Hind edge margined. Extremely finely punctate, smooth, anterior surfaces with numerous short setae. *Elytra.*—Intervals feebly convex, appearing impunctate, nearly smooth, nitid. Last interval near epipleura with numerous short setae. Striae finely geminate, moderately punctate, the punctures slightly crenulating edges of intervals. *Legs.*—Front tibiae slender, with a dense apical brush of setae. *Abdomen.*—Pygidium with punctures of various sizes, the lateral ones larger and with short setae, the median ones without setae. Aedeagus normal.

*Female*

Head margin evenly rounded, reflexed. Clypeal and genal surfaces strongly rugose. Frontoclypeal suture carinate but less arcuate than in male. Frons with a

straight sharp transverse carina between eyes, slightly more elevated laterally. Pronotum with a feeble transverse ridge medially and 2 indistinct tubercles to the sides of it, surface anterolaterally more distinctly punctate, with scattered short setae. Fore tibiae not slender, without apical brush. Otherwise like male.

*Type*

Holotype ♂, King's Sound, W.A., MM. Seen by the author.

*Distribution* (Fig. 158)

The Kimberley District of Western Australia, the north of the Northern Territory, and northern Queensland, apparently very rare. Ecology unknown.

*Material Examined*

The type and nine specimens. QUEENSLAND: 11 miles W. of Paluma, 28.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 2; 9 miles W. of Paluma (2500 ft), 15.iv.1969, I. F. B. Common and M. S. Upton, ANIC, 5. NORTHERN TERRITORY: Groote Eylandt, A. M. Wade, ANIC, 1; no exact locality, SAM, 1.

## 56. ONTHOPHAGUS TABELLICORNIS Macleay

(Figs. 161–163, 531)

*Onthophagus tabellicornis* Macleay, 1864, p. 120; Blackburn, 1903, p. 302; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 216.

*Onthophagus hackeri* Paulian, 1937, p. 341. New synonymy.

Piceous or fuscous, antennal clubs flavous. Total length 10–11 mm.

*Male*

*Head.*—Clypeal margin medially prolonged into a rounded point, reflexed. Genal margins rounded, not projecting. Clypeal suture carinate, frontal section evenly arcuate, angled with genal sections. Frons extended backward into a broad bilobate lamina, each lobe terminating in an erect cylindrical horn, the margin between these excised in a shallow V. Eyes very wide, with about 21 facet rows across widest point, separated by about 7 widths, canthus complete, narrow. Head surface entirely smooth and impunctate, sericeous, except for a transversely rugose border along clypeal margin. Labium shallowly excised. *Pronotum.*—Anterior declivity perpendicular, surmounted by a broad median, feebly bilobate shelf-like projection and a pair of lateral tubercles. Anterior angles acute, the apices rounded, lateral margin behind them sinuate. Hind edge very finely margined. Extremely finely punctate, smooth and sericeous between punctures. *Elytra.*—Intervals feebly convex, appearing impunctate, shagreened, with short setae along epipleural edge. Sutural interval evenly raised. Striae finely geminate, impressed, with very small punctures not crenulating edge of intervals. *Legs.*—Fore tibiae slender, with a broad apical brush of setae. *Abdomen.*—Pygidium moderately punctate with large punctures bearing short setae, shagreened, with a trace of a median keel. Aedeagus normal.

*Female*

Clypeal margin evenly rounded, not reflexed. Surface of clypeus and genae strongly rugose. Clypeal suture more strongly carinate, the frontal section not arched forward. Frons with a sharp low transverse carina bent back at the sides, medially

straight in minor female, in major one drawn up into a pair of approximated feeble lobes. Pronotum with a median transverse carina, slightly interrupted in middle, and a pair of lateral tubercles. Surface anteriorly more strongly punctate than in male. Front tibia not slender, without apical brush of setae. Otherwise like male.

*Types*

Holotype of *tabellicornis*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *hackeri*: ♀, Coen District, Cape York, Qld., Hacker, DEI.
Both seen by the author.

*Remarks*

The type of *hackeri* is a female *tabellicornis*.

*Distribution* (Fig. 158)

Queensland from Mackay to Coen. Collected by the author and Dr. Bornemissza in open savannah woodland with sandy soil at traps baited with marsupial entrails and human faeces.

*Material Examined*

The type and 17 specimens. QUEENSLAND: Cairns to Mackay, Feb. 1958, P. F. Darlington, MCZ, 3; Cape York, MNHN(Gen), 2; Charters Towers, W. W. Froggatt, ANIC, 1; Coen District, H. Hacker, MNHN(Gen), DEI, 2; Hidden Valley, 15 miles W. of Paluma, 30.v.1969, G. F. Bornemissza, ANIC, 1; 23 miles W. of Mackay, 27.iii.1968, E. G. Matthews, ANIC, 3; 11 miles W. of Paluma, 28.iv.1969, G. F. Bornemissza, ANIC, 2; 2–17 miles W. of Ravenshoe, 1.iv.1968, E. G. Matthews, ANIC, 2; no exact locality, Lea, SAM, 1.

## 57. ONTHOPHAGUS ERICHSONI Hope

(Figs. 164, 165, 532)

*Onthophagus erichsoni* Hope, 1841, p. 43; Hope, 1842, p. 424; Harold, 1869, p. 87; Blackburn, 1903, p. 282; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 211.

*Onthophagus quadrinodicollis* Lea, 1924, p. 283; Boucomont and Gillet, 1927, p. 215. New synonymy.

Black or rufopiceous, antennal clubs fuscous. Total length 8–11 mm.

*Male*

*Head.*—Middle of clypeal margin produced into a rounded lobe and reflexed, genal margins projecting, rounded. Clypeal suture very finely carinate, the frontal section arcuate, the genal sections forming obtuse angles with it. Frons with feeble lobular extensions near occipital margin near eyes, joined by a feeble carina or none. Eyes very wide, with about 22 facet rows across widest point, separated by about 7 widths, canthus complete, narrow. Impunctate, smooth, sericeous, with some indistinct rugae near clypeal margins. Labium excised about one-third of way to base. *Pronotum.*—With a single median shelf-like bilobate projection overhanging base of head and excised in a V, parallel-sided or expanding in major individuals, reduced to a pair of triangular lobes in minor ones, with a pair of shallow concavities on either side, these delimited outwardly by an indistinct convexity, but without any lateral tubercles in major male, with a pair of low tubercles in minor one. Anterior angles prominent, rounded, the sides concave behind them. Extremely finely punctate, smooth and sericeous, a little

more distinctly shagreened on anterior surfaces. *Elytra.*—Intervals feebly convex, impunctate, smooth, sericeous, with short setae occupying most of lateral intervals near epipleurae, a few scattered short setae along apical edges and at base of sutural intervals, which are evenly raised. Striae impressed, geminate, very finely punctate. *Legs.*—Elongate, with a dense brush of setae apically, reduced in minor male. *Abdomen.*—Pygidium shagreened, moderately or densely punctate with large shallow punctures bearing short bristles. Aedeagus normal.

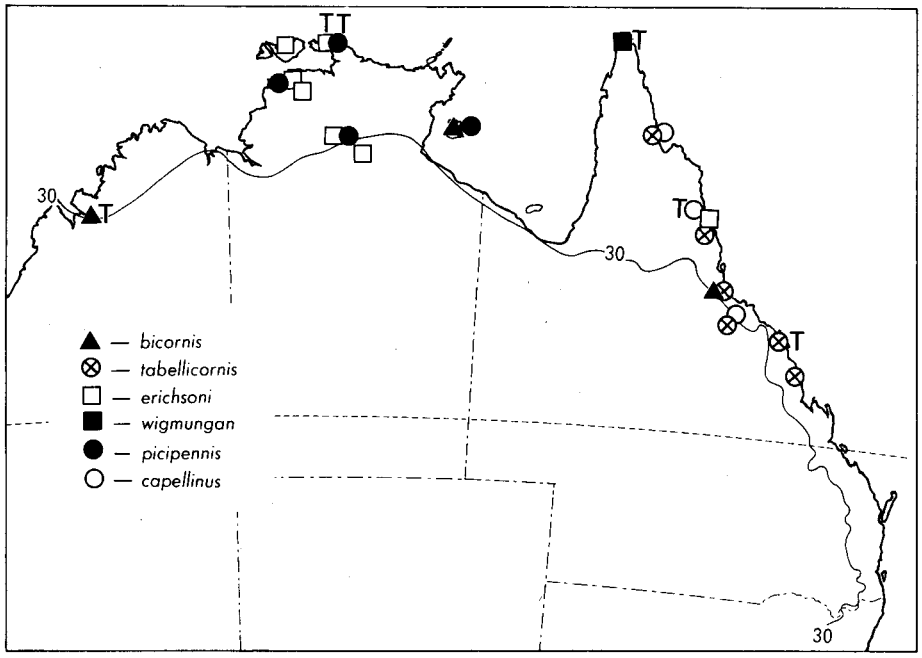



Fig. 158.—Known distribution of the *erichsoni* group in relation to the 30-in. isohyet.

*Female*

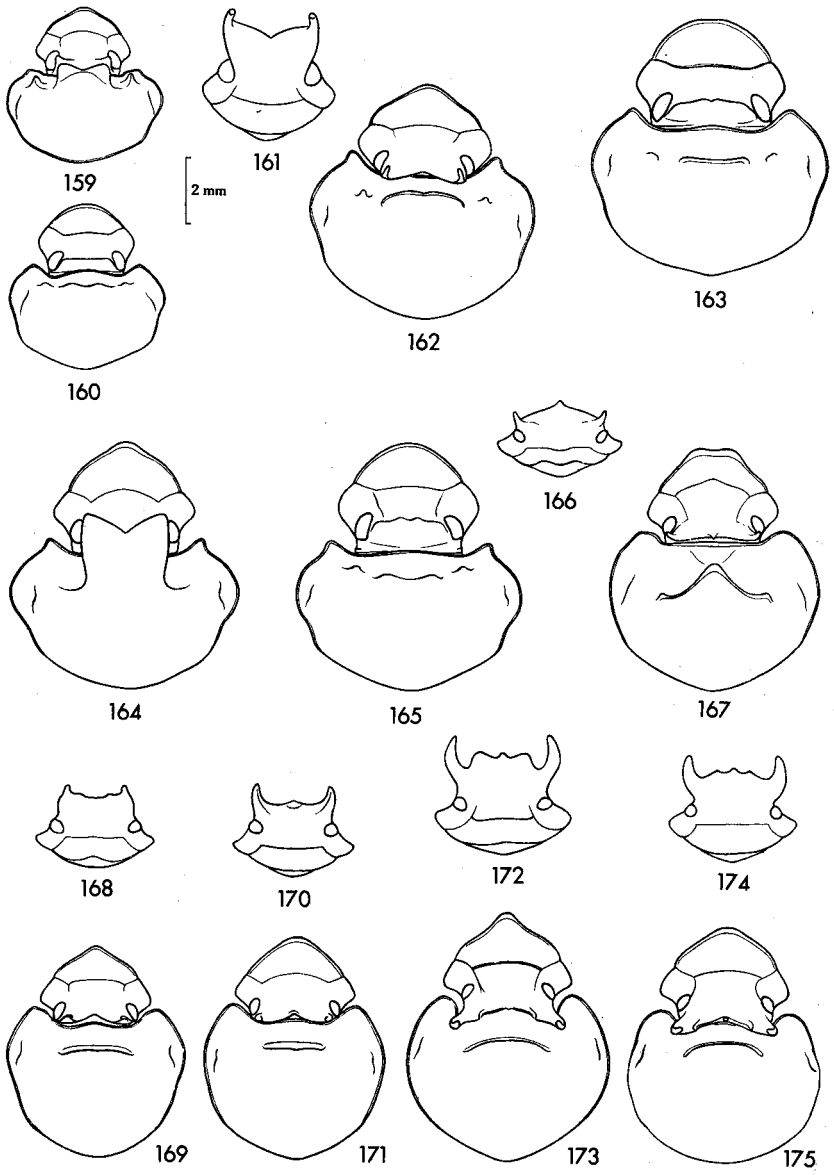
Clypeus evenly rounded, less reflexed, its surface entirely transversely rugose, as are edges of genae. Frons with a transverse carina running from eye to eye, laterally sharply curved back and nearly touching eye, medially forming a pair of small approximated rounded lobes, except in minor female, where these are absent. Pronotum with a pair of approximated short transverse carinae anteriorly, these carinae may be joined together or not. Laterally a pair of small tubercles, indistinct in minor female. Otherwise like male.

*Types*

Holotype of *erichsoni*: ♂, Port Essington, N.T., HM 463.
Holotype of *quadrinodicollis*: ♀, Darwin, N.T., N. Davies, SAM.
Both seen by the author.

*Remarks*

In spite of Lea's statement that his type of *quadrinodicollis* is a male, it is in fact a female of *erichsoni.*




Figs. 159–175.–*Onthophagus* spp.: *159*, *160*, *O. bicornis*, fore body: *159*, male; *160*, female; *161–163*, *O. tabellicornis*: *161*, male head, front view; *162*, male fore body; *163*, female fore body; *164*, *165*, *O. erichsoni*, fore body: *164*, male; *165*, female; *166*, *167*, *O. wigmungan*, male or female: *166*, head, front view; *167*, fore body; *168–171*, *O. picipennis*: *168*, male head, front view; *169*, male fore body; *170*, female head, front view; *171*, female fore body; *172–175*, *O. capellinus*: *172*, male head, front view; *173*, male fore body; *174*, female head, front view; *175*, female fore body.

*Distribution* (Fig. 158)

The Northern Territory from Melville I. and the Cobourg Peninsula to Mataranka, or approximately the 30-in. isohyet, and one specimen from north Queensland. The species occurs in open eucalypt forest with loose (not hard-packed) sandy soil and came to traps baited with human faeces and to horse dung, once to light. It seemed to be quite abundant on Melville I. and rare elsewhere.

*Material Examined*

The types and 49 specimens. QUEENSLAND: Mutchilba, Aug. 1933, A. D. Selby, NMV, 1. NORTHERN TERRITORY: Brock Ck., Burnside, 26.iv.1929, T. G. Campbell, ANIC, 1; 15–27 miles S. of Darwin, 29.i.1968, E. G. Matthews, ANIC, 3; Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 1; 16 miles W. of Katherine, 9–10.ii.1968, E. G. Matthews, ANIC, 1; Mataranka, 26.iii.1955, K. H. L. Key, ANIC, 1; Snake Bay, Melville I., 4–6.ii.1968, E. G. Matthews, ANIC, 41.

## 58. ONTHOPHAGUS WIGMUNGAN, sp. nov.

(Figs. 166, 167, 533)

Rufopiceous, antennal clubs flavous. Total length 8–11 mm.

*Male*

*Head.*–Middle of clypeal margin broadened into a wide, truncate or very slightly emarginate, reflexed lobe, genal margins angulate. Clypeal suture with frontal section strongly carinate, feebly arcuate, genal sections forming obtuse angles with it, indistinct. Frons extended back into a very short broad lobe overhanging occipital margin and terminating in 2 lateral erect points or short horns near eyes and a small median tubercle. Eyes moderately wide, with about 14 facet rows across widest point, separated by about 10 widths, canthus complete, wide. Clypeus and edges of genae coarsely punctate, clypeus rugose. Rest of surface very finely punctate, smooth, nitid. Labium shallowly excised in an arc. *Pronotum.*–Anterior declivity inclined, divided in major specimens into 5 concave cells by undulations of surface, 1 of these concavities occupying middle of declivity. Minor specimens with simple sloping declivity. Declivity surmounted by an inverse-V-shaped carina of which the ends and angle are each raised into a point or tubercle, thus forming 3 points in major individuals. Anterior angles quadrate or slightly obtuse, the apices broadly rounded. Hind edge finely margined. Moderately punctate with small remote punctures on disc and sides, slightly larger and denser punctures, with faint asperation, on anterior declivity. Surface between punctures smooth, nitid, faintly sericeous on anterior declivity. *Elytra.*–Intervals flat, smooth, nitid, finely and regularly punctate, entirely glabrous. Striae impressed, simple, extremely finely punctate. *Legs.*–Fore tibiae not elongated, without apical brush of long setae. *Abdomen.*–Pygidium with punctures of different sizes, shagreened, with sparse short setae on either side of midline. Aedeagus normal.

*Female*

Does not differ externally from male.

*Type*

Holotype ♂, Lockerbie, Cape York, Qld., 10–15.vi.1969, G. B. Monteith, QM 6906.

*Distribution* (Fig. 158)

Known only from the extreme northern tip of Cape York Peninsula.

*Material Examined*

The type and three specimens. QUEENSLAND: Lockerbie, Jan. 1958, Darlingtons, MCZ, 2; Lockerbie, 31.iii.1964, I. F. B. Common and M. S. Upton, ANIC, 1.

## 59. ONTHOPHAGUS PICIPENNIS Hope

(Figs. 168–171, 534)

*Onthophagus picipennis* Hope, 1841, p. 44; Hope, 1842, p. 424; Harold, 1869, p. 84; Blackburn, 1903, p. 280; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214.

Rufopiceous, antennal clubs flavous or fuscous. Total length 9–10 mm.

*Male*

*Head.*—Clypeal margin medially prolonged into a rounded point, reflexed, margins feebly curved to genal angles, which are quadrate. Frontal section of clypeal suture carinate, arcuate, forming strong angles with genal sections. Frons extended back into a lamina which terminates in a pair of erect horns, margin between horns sinuate in front view, medially feebly arcuately excised in major male, with a very small median point in minor male, in dorsal view margin is angled forward. Eyes wide, with 15–16 facet rows across widest point, separated by about 7 widths, canthus complete. Clypeus coarsely punctate and rugose, rest of head finely punctate, shiny. Labium very shallowly excised. *Pronotum.*—Anteromedially with a strong transverse fold, not shelf-like, sharply margined on posterior edge only. Anterior angles broadly rounded. Hind edge finely margined. Strongly punctate, the punctures finest on disc, coarsest anteriorly, where they are separated by 1 diameter or less, surface between punctures shiny, finely shagreened on anterior declivity. *Elytra.*—Intervals flat, finely punctate, smooth, nitid, glabrous. Striae impressed, finely geminate, very finely punctate, the punctures not crenulating edges of intervals. *Legs.*—Fore tibiae not slender, without long setae apically. *Abdomen.*—Pygidium shagreened, with medium-sized shallow punctures bearing short setae, smallest medially. Aedeagus normal.

*Female*

Not differing from male except in coarser rugosity of clypeus and in possessing a small median point on margin of frontal lamina in minor female. Major female like male.

*Type*

Lectotype ♂, Port Essington, N.T., HM 465½. Seen by the author.

*Distribution* (Fig. 158)

The Northern Territory north of the 30-in. isohyet. Collected by the author only at light. It did not come to baited traps or occur under dung.

*Material Examined*

The type and 20 specimens. NORTHERN TERRITORY: Groote Eylandt, H. E. Warren, SAM, 1; Groote Eylandt, N. B. Tindale, SAM, 2; Groote Eylandt, A. M. Wade, ANIC, 1; Katherine, 7–10.ii.1968, E. G. Matthews, ANIC, 3; Port Darwin, G. F. Hill, E. W. Ferguson,

ANIC, 4; Port Darwin, Griffith, SAM, 3; Port Darwin, G. F. Hill, AM, 2; Port Darwin, WADA, 1; Port Essington, HM, 1; Tenolan Caves, Griffith, SAM, 1; no exact locality, Lea, SAM, 1.

## 60. ONTHOPHAGUS CAPELLINUS Frey

(Figs. 172–175, 535)

*Onthophagus capellinus* Frey, 1963, p. 540.

Rufopiceous, antennal clubs flavous. Total length 10–11 mm.

*Male*

*Head.*–Clypeal margin medially strongly produced into a rounded point and reflexed, sides a little expanded before genal sutures, genal angles quadrate. Frontal section of clypeal suture carinate, arcuate, forming strong angles with genal sections. Vertex extended back into a lamina which terminates in a pair of strong divergent taurine horns and a median subquadrate lobe, this lobe usually with a small median point, or 3 sharp points in minor male. Eyes large, with 13 or 14 facet rows across widest point, separated by about 7 widths, canthus complete. Surface smooth, nitid, impunctate except along edges of clypeus, which bear rows of coarse punctures. Labium very shallowly excised. *Pronotum.*–Anteromedially with a strong arcuate transverse fold, sharply margined along posterior edge only. Anterior angles rounded. Hind edge not margined. Surface smooth, impunctate on disc, with evenly spaced shallow but distinct punctures on anterior declivity and just behind transverse fold, surface between punctures nitid, finely shagreened on anterior declivity, glabrous. *Elytra.*–Intervals flat, smooth, extremely finely punctate, glabrous. Striae impressed, impunctate. *Legs.*–Fore tibiae not slender, without fringe of apical setae. *Abdomen.*–Pygidium rugose, shagreened, with scattered punctures bearing short setae on either side of middle. Aedeagus normal.

*Female*

Not differing from male except for clypeal surface, which is entirely transversely rugose. Head ornamented as in minor male, with 3 points on margin of vertical lamina.

*Type*

Holotype, Mt. Molloy, Qld., MGF. Not seen by the author.

*Distribution* (Fig. 158)

Known from three widely separated localities in north Queensland. The specimens collected by J. C. Wassell bear the data: "Open forest, foot of McIlwraith Range".

*Material Examined*

Six specimens. QUEENSLAND: Rocky River, Silver Plains, 6.i.1960, J. C. Wassell, ANIC, 5; Sellheim, Jan. 1959, G. Brooks, GB, 1.

## VIII. *The* DUNNINGI *Group*

Eyes very narrow or moderate, with 6–8 or 12 facet rows across widest point, separated by 10 or 20–25 widths, canthus variable. Labium excised shallowly to one-third of way to base. Dorsal surfaces glabrous or with short setae. Colour piceous or brown. Total length 7–9 mm.

Male with edge of clypeus bearing prominent median lobe or projection, often very long. Frontoclypeal suture variable. Vertex generally unarmed except in minor male *dunningi*. Pronotum with a median anterior projection of varying length. Fore tibiae elongate, with a distal brush of long setae. Female with frontal carina and transverse pronotal process (acute as in male in *brooksi*).

Four species: 61. *anchommatus* Lea; 62. *kumbaingeri*, sp. nov.; 63. *dunningi* Harold; 64. *brooksi*, sp. nov.

The curiously ornamented species of this group are probably all mycetophagous, feeding on fresh mushrooms. *O. anchommatus*, *kumbaingeri*, and *dunningi* have all been collected in or under mushrooms by Dr. Bornemissza, who has (1971*b*) studied the habits of the latter species in detail. The food habits of *brooksi* are unknown. All of the species may also be collected in the normal manner at excrement or carrion baits and at light. All are woodland or forest forms.

### KEY TO SPECIES OF THE *DUNNINGI* GROUP

1. Anterolateral areas of pronotum and elytra setose; major male with frontoclypeal suture complete, strongly elevated; frons extended back into a large 2-horned process; major female with frontal carina 3-pronged, pronotum with an anvil-shaped process. N.S.W., S. Qld. ..... 61. *anchommatus* Lea

   Dorsal surfaces entirely glabrous; frontoclypeal suture of major male not in form of single, strongly elevated carina; frons not extended backward, never with a 3-pronged carina ..... 2

2(1). Disc of pronotum very strongly punctate, the punctures separated by 1 diameter or less; elytral surfaces rugose; major male with frontoclypeal suture greatly displaced forward and elevated into a pair of points near base of clypeal process; genal margins angulate; clypeal process strongly spatulate, the clypeal margin usually excised on either side of it; pronotal process strongly margined. Female pronotum with arcuate carina. N.S.W. ..... 62. *kumbaingeri*, sp. nov.

   Disc of pronotum less strongly punctate, the punctures separated by more than 1 diameter; elytral surfaces smooth or finely rugulose; frontoclypeal suture effaced in major male, never raised into a pair of points, and otherwise unlike above ..... 3

3(2). Eyes narrow, with about 7 facet rows across; frontal carina either absent (major male) or transverse, often raised into lateral angles or points (minor male and female); pronotal process of major male not extending beyond front edge of head, that of female consisting of a transverse lobe. Vic., N.S.W., Qld. ..... 63. *dunningi* Harold

   Eyes wide, with about 12 facet rows across; frontal carina strongly angled forward and low, but visible, in both sexes; pronotal process of major male extending beyond front edge of head, that of female consisting of a long slender process, as in male but shorter. N. Qld. ..... 64. *brooksi*, sp. nov.

### 61. ONTHOPHAGUS ANCHOMMATUS Lea

(Figs. 177, 178, 536, 537)

*Onthophagus anchommatus* Lea, 1923, p. 373; Boucomont and Gillet, 1927, p. 208.

Rufopiceous, antennal clubs flavous. Total length 8–9 mm.

*Male*

*Head.*–Middle of clypeal margin with a broad rounded upturned lobe, sides of clypeus strongly convex just before genal sutures, genal margins rounded. Clypeal suture with frontal section strongly carinate, arched forward, genal sections forming a strong angle with it. Frons extended backward and upward into an expanded lobe laterally elevated into a pair of erect prominent semiconical horns, medially with the margin forming a small point. Eyes very narrow, with about 8 facet rows across widest point, separated by about 20 widths, canthus complete, narrow. Margins of head fairly densely punctate, very feebly rugose, middle of head more sparsely punctate, genal punctures and those behind eyes with very short setae, a few at outer base of frontal horns with longer setae. Labium very shallowly excised. *Pronotum.*–With a flattened triangular median anterior projection with expanded margins, terminating in a point, parallel-sided at extreme base, ventrally flat, dorsally convex, and laterally margined, flanked by a pair of shallow concavities. Anterior angles subquadrate, the points rounded. Hind edge unmargined. Disc and sides very coarsely and densely punctate, cribrate, the anterior declivities more sparsely punctate, finely shagreened. A patch of short setae near lateral margins from about middle of margin to anterior angle. *Elytra.*–Intervals feebly convex, coarsely punctate and rugose or vermiculate between punctures, each puncture with a seta, very short on all but lateral intervals near epipleurae, where setae are longer and recumbent. Striae geminate, impressed, with very small punctures. *Legs.*–Fore tibiae moderately slender, with a distal fringe of long setae, inner apical angle acute, not very prominent. *Abdomen.*–Pygidium shagreened, coarsely punctate, with numerous downwardly directed short setae on either side of midline. Parameres with ventral point drawn out.

*Female*

Clypeal margin not drawn out into a lobe, or forming a very small one. Clypeal surface transversely rugose. Frontal section of clypeal suture carinate and arcuate as in male. Frons with 3 erect horns, the lateral ones highest and subcylindrical, divergent, outwardly setose, the middle one transverse and acute. Pronotum with a prominent transverse anvil-shaped median process in major female, a basally narrowed truncate lobe in minor one, flanked by a pair of feeble depressions. Pronotum punctate and setose in same manner as in male. Fore tibiae not elongated, without long setae apically. Otherwise like male.

*Type*

Holotype ♂, Brisbane, 20.ii.1917, H. Hacker, QM. Seen by the author.

*Distribution* (Fig. 176)

Known from extreme south-eastern Queensland and from near Marulan, in southern New South Wales, where it was collected by Dr. Bornemissza under fresh mushrooms. A specimen in MNHN is labelled "Victoria".

*Material Examined*

The type and five specimens. VICTORIA: No exact locality, MNHN, 1. NEW SOUTH WALES: 13 miles N. of Marulan, 25.iii.1969, G. F. Bornemissza, ANIC, 1. QUEENSLAND: Brisbane, 20.ii.1917, H. Hacker, QM, 1; Greenbank Rd., 23.iv.1933, GB, 1; Kingaroy, 26.xi.1965, H. Ruscoe, UQ, 1.

## 62. ONTHOPHAGUS KUMBAINGERI, sp. nov.

(Figs. 21, 179, 180, 436, 538)

Rufopiceous, antennal clubs flavous. Total length 7–10 mm.

*Male*

*Head.*–Middle of clypeal margin with a very long, erect slender spatulate process, margin on either side of base of this process feebly emarginate, rest of margin not expanded, genal margins strongly angular. Clypeal suture with frontal section drawn strongly forward and raised into a pair of low oblique pointed processes on either side of middle near base of marginal spatula. Frons with a pair of low indistinct ridges near inner side of eyes. Eyes very narrow, with about 6 facet rows across widest point, separated by about 25 widths, canthus complete, narrow. Frons and genae finely to moderately punctate, clypeus impunctate or very finely punctate, surfaces alutaceous. Labium incised about one-third of way to base. *Pronotum.*–With a strong median anterior projection, strongly margined laterally, very broad at base, rapidly narrowing to a flattened truncate or rounded point which is somewhat upturned and overhangs about half of head. Anterior declivity and anterior angles concave on either side of median projection. Anterior angles acute, the apices rounded or angulate. Hind edge unmargined. Disc and sides coarsely and densely punctate, vermiculate, underside of median projection a little less densely punctate, anterolateral depressions finely and sparsely punctate, shagreened. Glabrous. *Elytra.*–Intervals flat, rugose and shagreened, moderately punctate, glabrous. Striae impressed, finely geminate, very finely punctate. *Legs.*–Fore tibiae moderately slender, with a broad apical brush of long setae, inner apical angle prominent, acute. *Abdomen.*–Pygidium shagreened, rugose and coarsely punctate, with numerous inwardly directed short setae on either side of midline. Aedeagus with apical angle projecting.

*Female*

Clypeal margin medially with a short subquadrate lobe, rest of head margin fairly evenly rounded. Head surface moderately punctate, not rugose. Frontal segment of clypeal suture nearly effaced, represented by 2 feebly curved ridges laterally. Frons with a transverse carina laterally raised into a pair of sharp points. Pronotum with an anteromedian arcuate carina, slightly interrupted in middle, flanked by very small, shallow depressions. Surface coarsely vermiculate and punctate as in male. Fore tibiae not slender, without brush of setae. Otherwise like male.

*Type*

Holotype ♂, Dorrigo, N.S.W., W. Heron, ANIC.

*Distribution* (Fig. 176)

Known from four pairs, all apparently collected at the same time by W. Heron in the vicinity of Dorrigo, N.S.W., probably at light, as some individuals have adhering lepidopterous scales, and six specimens of both sexes collected by Dr. Bornemissza under fresh mushrooms near Marulan, together with *anchommatus* and *dunningi*. Probably occurs sporadically along the eastern escarpment of New South Wales.

*Material Examined*

The type and 13 specimens. NEW SOUTH WALES: Brooklana, E. of Dorrigo, 1929, W. Heron, AM K59228, 1; Dorrigo, W. Heron, ANIC, SAM, 5; The Dorrigo (3000 ft), W. Heron, MCZ, 1; 13 miles N. of Marulan, 25.iii.1969, G. F. Bornemissza, ANIC, 6.

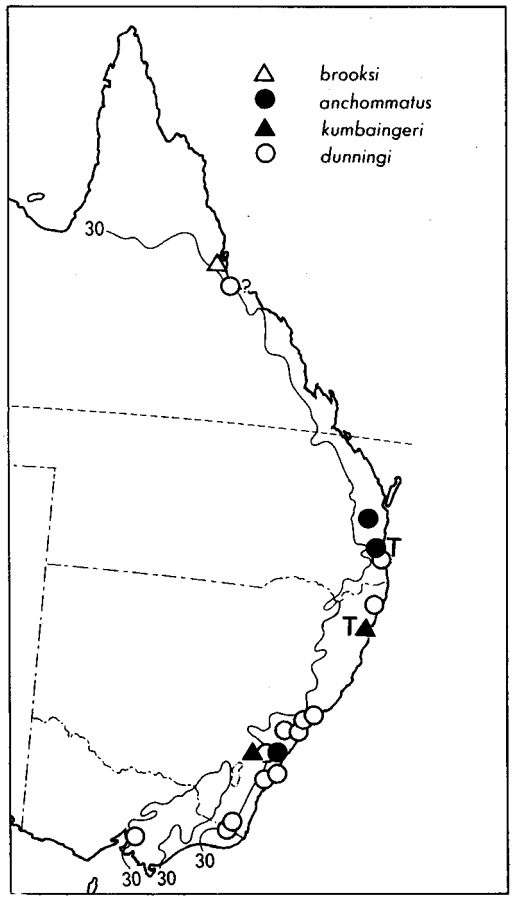



Fig. 176.–Known distribution of the *dunningi* group in relation to the 30-in. isohyet.

## 63. ONTHOPHAGUS DUNNINGI Harold

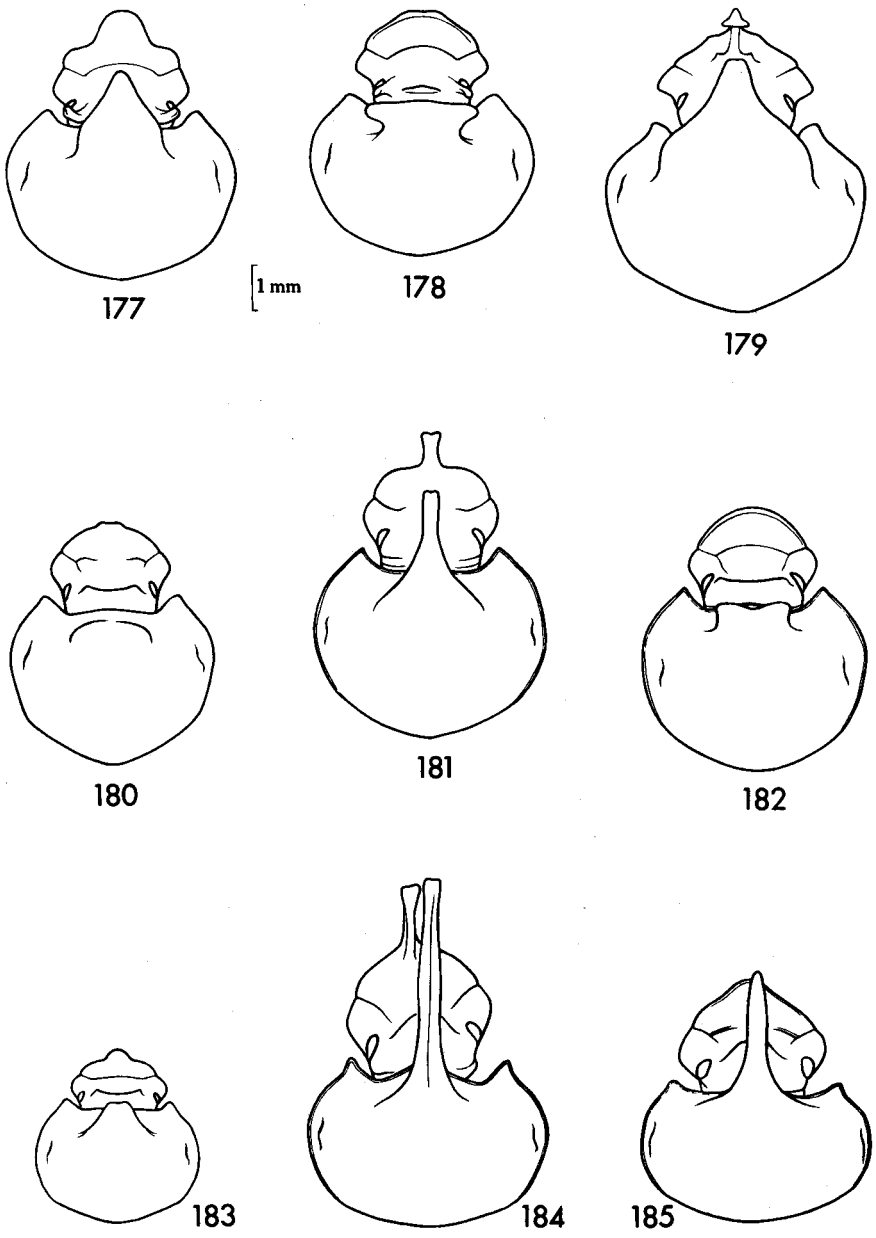
(Figs. 181–183, 539, 540)

*Onthophagus dunningi* Harold, 1869, p. 85; Blackburn, 1903, p. 272; Lea, 1923, p. 367; Boucomont and Gillet, 1927, p. 211.

*Onthophagus dumbrelli* Blackburn, 1903, p. 297; Boucomont and Gillet, 1927, p. 211. New synonymy.

*Onthophagus sydneyicus* Paulian, 1937, p. 346. New synonymy.

Rufopiceous, antennal clubs flavous. Total length 5–9 mm.




Figs. 177–185.–*Onthophagus* spp., fore body: *177, 178, O. anchommatus*: *177*, male; *178*, female; *179, 180, O. kumbaingeri*: *179*, male; *180*, female; *181–183, O. dunningi, 181*, major male; *182*, female; *183*, minor male; *184, 185; O. brooksi*: *184*, male; *185*, female.

*Male*

*Head.*–Middle of clypeal margin prolonged into a long erect slender truncate process, parellel-sided or slightly expanded apically in major male. In smaller individuals this process becomes progressively shortened and finally reduced to only a slight median expansion of the margin. Sides of clypeal margin strongly expanded in major male, less so in minor one, genal margins rounded. Frontal section of clypeal suture effaced in major male, in medium individuals represented by a transverse raised line with a median tumescence, in minor male represented by a distinctly raised, arcuate suture as in female. Genal sections distinct, strongly angled with frontal section. Frons smooth, without any carina or other projection in major male, in minor male with a strong transverse carina laterally raised into points. Eyes very narrow, with about 7 facet rows across widest point, separated by about 20 widths, canthus complete. Outer edges of clypeus and genae distinctly punctate, rest of head smooth, extremely finely punctate, sericeous. Labium shallowly emarginate. *Pronotum.*–With a median anterior tapering projection terminating in a slender, flattened, truncate prong overhanging part of head in major male; in smaller individuals this projection becomes progressively shorter, first truncate, then rounded, finally reduced to a small arcuate transverse median carina. Anterior declivity vertical beneath projection. Anterior angles quadrate or slightly acute, the apices angular. Hind edge unmargined. Disc and sides finely and regularly punctate, becoming coarsely and densely punctate on dorsum of anterior projection and anterior part of disc. Anterior declivities and underside of median projection smooth, impunctate and shagreened, rest of surface sericeous between punctures, glabrous. *Elytra.*–Intervals flat, very finely punctate, shagreened, glabrous. Striae superficial, finely geminate, with very small punctures not crenulating edges of intervals. *Legs.*–Fore tibiae somewhat slender, with a brush of long setae at distal end in major male only. Medium and minor males with fore tibiae unmodified. Inner apical angle of fore tibia not acute. *Abdomen.*–Pygidium shagreened, feebly punctate, with numerous short, downwardly directed setae on either side of midline. Aedeagus normal.

*Female*

Clypeal margin without projections or expansions, or slightly expanded medially in major female. Clypeal surface densely transversely rugose. Frontal section of clypeal suture strongly carinate, arcuate. Frons with a strong transverse carina with slightly elevated and perpendicular ends, not raised into distinct points but acutely angulate in major female, occupying most of interocular distance. In minor female this carina is reduced to a low ridge with rounded ends. Pronotum with a prominent anteromedian transverse lobe which is expanded, with laterally projecting rounded angles and medially concave in major female, subquadrate and medially straight in medium one, and consisting of an indistinct transverse tumosity in minor one, flanked by a pair of small shallow depressions. Fore tibiae not elongated, without seta brush. Otherwise like male.

*Types*

Holotype of *dunningi*: ♂, New South Wales, MNHN(Ob).
Holotype of *dumbrelli*: ♀, Galston, N.S.W., BMNH.
Holotype of *sydneyicus*: ♂, Sydney, Lüddemann, DEI.
All seen by the author.

*Remarks*

The strong differences between major and minor individuals of both sexes (see description) has caused the minor forms to be considered separate species by authors who did not examine complete series. The type of *dumbrelli* is a minor female, and that of *sydneyicus* a minor male.

*Distribution* (Fig. 176)

Eastern Victoria to at least south Queensland, possibly as far as Paluma, north of Townsville. A specimen which appears to be a typical female *dunningi* was collected on Mt. Eliot, near Townsville, by the Darlingtons, and another typical female was collected by Mr. G. Brooks on Mt. Spec, near Paluma. Males are needed from these areas to confirm that this is indeed *dunningi*.

*O. dunningi* inhabits sclerophyll forest with sandy soil. The feeding and nesting habits of this species have recently been studied by Bornemissza (1971*b*), who showed it to be a mushroom feeder, attacking live mushrooms, primarily *Amanita* spp., to provision its nest. Lea (1923) reports it to live "solely" in agaric fungi. In fact the adults also feed on excrement and come to excrement and intestine baits, but it is unlikely that these foods are used for nesting purposes (Bornemissza 1971*b*). Active in December–January and March–May. Diurnal.

*Material Examined*

The types and 200 specimens. VICTORIA: Belgrave, Jan. 1922, F. E. Wilson, AM, 1; 13–23 miles N. of Cann River, 13.i.1968, E. G. Matthews, ANIC, 30; Mt. Drummer, 13.i.1968, E. G. Matthews, ANIC, 1; Nunawading, 14.xi.1954, A. Neboiss, NMV, 1; Woori Yallock, Dec. 1952, R. Le Rossignol, NMV, 2; no exact locality, ANIC, 2. NEW SOUTH WALES: 15 miles S. of Bombala, 13.i.1968, E. G. Matthews, ANIC, 6; Cotter Junction, 6.i.1959, D. P. Carne, ANIC, 1; Durras Lake, 9.iv.1969, R. W. G. Jenkins, ANIC, 111; Gordon, 8.xii.1906, C. Gibbons, AM, 2; Huskisson, 9.i.1935, Rodway, ANIC, 2; 13 miles N. of Marulan, 4, 23.iv.1964, 25.iii.1969, G. F. Bornemissza, ANIC, 19; Moss Bay, 9.iii.1894, W. W. Froggatt, ANIC, 1; Narrabeen, 18.xii.1921, ANIC, 1; Nilson I., Hawkesbury R., 8.v.1915, E. W. Ferguson, ANIC, 1; Somersby, 9.iv.1964, G. F. Bornemissza, ANIC, 1; Sydney, 1929, A. Lüddemann, MNHN, 2; Wahroonga, 23.iv.1943, A. Musgrave, AM, 1; Wallacia, Jan. 1931, UNE, 1; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 2; no exact locality, MNHN(Ob), 5. QUEENSLAND: Brisbane, 31.vi.1947, S. Gossins, UQ, 1; Greenbank Rd., 23.iv.1933, GB, 1; Mt. Spec, Jan. 1968, G. Brooks, GB, 1; St. Lucia, Dec. 1929, GB, 2; v. Townsville (*c.* 3000 ft), Mar. 1958, Darlingtons, MCZ, 1.

## 64. ONTHOPHAGUS BROOKSI, sp. nov.

(Figs. 184, 185, 541)

Black, antennal clubs flavous. Total length 9–10 mm (without clypeal process).

*Male*

*Head.*—Clypeal margin medially prolonged into a very long process which is compressed for most of its length, terminally dilated and spatulate, rest of clypeal margin rounded, only slightly expanded before genal suture, genal margins rounded. Frontal section of clypeal suture entirely effaced, genal sections fine, oblique. Frontal carina very low, indistinct, pushed far forward medially and angulate, slightly raised at angle. Eyes wide, oval, with 11–12 facet rows across widest point, separated by about 10 widths, canthus complete. Largely impunctate, very smooth, nitid, some indistinct

punctures along edges. Labium very shallowly emarginate in an arc. *Pronotum.*–With an extremely long, thin anteromedian prong which is ventrally and dorsally grooved, terminally truncate, the anterior declivity vertical and concave. Anterior angles very prominent, acute. Hind edge margined. Disc and sides with medium-sized shallow punctures separated by 2 or 3 diameters, base and dorsum of median prong rugose, rest of surface smooth, nitid, anterior declivity impunctate, shagreened. Glabrous. *Elytra.*–Intervals flat, finely rugulose and densely, finely punctate, nitid, glabrous. Striae superficial, geminate, with small impressed punctures. *Legs.*–Fore tibiae slender, elongate, with a fringe of a few long setae at distal inner margin. *Abdomen.*–Pygidium smooth, shagreened, with some large punctures laterally bearing moderate, downwardly directed setae. Aedeagus with parameres lengthened, the points prolonged and rounded.

*Female*

Clypeal margin without a process, but somewhat prolonged and medially reflexed. Frontal section of clypeal suture straight, transverse, laterally raised into a pair of ridges, medially effaced. Frontal carina as in male, strongly angled forward. Clypeal surface laterally strongly punctate and rugose, rest of head feebly punctate. Pronotum as in male, with a very long median process, but punctures larger and denser. Fore tibiae not elongate, without long apical setae, the teeth smaller. Otherwise like male.

*Type*

Holotype ♂, 3 miles W. of Paluma (2100 ft), Qld., 14.i.1970, E. B. Britton and S. Misko, ANIC.

*Remarks*

The author is pleased to name this species after Mr. J. G. Brooks, its first collector.

*Distribution* (Fig. 176)

Known only from the vicinity of Paluma, Qld., in rain forest. It was first collected by Mr. Brooks in 1967, then again by him in January 1968, at traps baited with fish bones; also by other collectors, in the same area at light, in April 1969 and January 1970. Extensive trapping in the area both by Dr. Bornemissza and the author, with excrement and carrion baits, failed to turn up this species.

*Material Examined*

The type and eight specimens. QUEENSLAND: Mt. Spec, Jan. 1967, Jan. 1968, G. Brooks, GB, 4; 4 miles W. of Mt. Spec, 9.i.1968, G. Brooks, GB, 1; 4 miles W. of Paluma (3000 ft), 13.iv.1969, I. F. B. Common and M. S. Upton, ANIC, 2; 3 miles W. of Paluma (2600 ft), 14.i.1970, Britton and Misko, ANIC, 1.

## IX. *The* AUSTRALIS *Group*

Eyes moderate, with 7–12 facet rows across widest point, separated by 20–25 widths, canthus incomplete or just touching occipital margin. Labium excised about halfway to base. Pronotum glabrous. Elytra with microtrichia and usually some short setae along edges. Pygidium sparsely to moderately setose, with short setae. Colour black or partly or entirely green or cupreous. Total length 7–12 mm.

Male with frontoclypeal suture carinate, vertex with a pair of horns joined together at the bases by a carina which may bear a shorter median projection or lobe. Pronotum unarmed, although anterior declivity is undulate in major male (a median swelling present in *tweedensis*). Fore tibiae elongate or not, with or without distal brush of long setae or dentiform inner apical angle. Female with low frontal carina which is bent or curved back in middle, without any crest. Pronotum usually unsculptured, but with 2 anterior transverse tubercles in *australis*.

Nine species: 65. *hoplocerus* Lea; 66. *fuliginosus* Erichson; 67. *anisocerus* Erichson; 68. *australis* Guérin; 69. *nurubuan*, sp. nov.; 70. *paluma*, sp. nov.; 71. *tweedensis* Blackburn; 72. *thoreyi* Harold; 73. *parallelicornis* Macleay.

The first three species listed form a distinct southern subgroup separated by the characters in the first couplet of the key. The remaining species form a closely interrelated subgroup of temperate and tropical species occurring along the eastern coastline. The first three are largely allopatric species inhabiting dense woodland or forest, while the habitats occupied by the rest vary from fully open areas (*australis*, *thoreyi*), through open woodlands (*tweedensis*, *parallelicornis*) to dense woodlands (*nurubuan*, *paluma*). Where species of this subgroup are geographically sympatric, they may segregate ecologically according to vegetation cover, thus, *australis* and *nurubuan*, and *thoreyi* and *parallelicornis*, are two sympatric species-pairs of which the first member is found in clearings and pastures while the second remains in wooded areas.

## KEY TO SPECIES OF THE *AUSTRALIS* GROUP

1. Sutural interval of elytra not raised posteriorly; male with a brush of long setae on apical edge of fore tibia, with a narrow, usually bifurcate process between head horns ..... 2
   Sutural interval of elytra slightly raised posteriorly; male without a brush of long setae on fore tibia; if a process is present between head horns, it is not narrow and bifurcate ..... 4

2(1). With greenish or cupreous reflections; antennal clubs piceous (except in northern specimens of *fuliginosus*); head horns of male without basal tooth, pronotum of male with small or medium-sized punctures separated by many times their diameter ..... 3
   Pure black; antennal clubs flavous or fulvous; head horns of male with a tooth on inner edge near base; pronotum of male with coarse punctures separated by less than 1 diameter. Vic., S. N.S.W. ..... 65. *hoplocerus* Lea

3(2). Surfaces shagreened, matt; male with frontoclypeal suture feebly arcuate, head horns swollen at base (except in northern specimens); female with frontal carina bent back in 3 sections, not elevated at the ends. Tas., Vic., N.S.W., S. Qld. ..... 66. *fuliginosus* Erichson
   Surfaces smooth, nitid; male with frontoclypeal suture more strongly arched forward, head horns simple; female with frontal carina evenly arcuate, the ends elevated into low points. Tas. ..... 67. *anisocerus* Erichson

4(1). Entirely black; elytral surfaces rugose ..... 5
   At least pronotum with greenish or cupreous tinge (examine in natural light); elytral surfaces smooth or a little uneven, not rugose ..... 6

5(4). Elytral intervals shagreened as well as rugose, alutaceous; male with head horns broader at base, narrowing abruptly near middle, slightly divergent for their entire length; clypeus subtriangular in outline; frontoclypeal suture distinct; female with frontal carina arcuate, laterally terminating in a small point or angle. N. Qld. ..... 70. *paluma*, sp. nov.
   Elytral intervals rugose only, nitid; male with head horns evenly tapering, bent or curved inward for distal portion; clypeus more rounded in outline; frontoclypeal suture often effaced; female with frontal carina bisinuate, curved back in centre and at ends near eyes. N. Qld. ..... 73. *parallelicornis* Macleay

6(4). Elytra black; male head horns distally convergent ..... 7
Elytra greenish or cupreous; male head horns entirely divergent ..... 8

7(6). Fore body bright green; pygidium and humeral border glabrous; pronotum of male with a median protuberance arising between head horns, disc finely punctate. N. N.S.W., S. Qld. .....71. *tweedensis* Blackburn
Fore body black, usually with greenish tinge; pygidium and humeral borders setose; pronotum of male without any protuberance between head horns, disc with large, dense punctures. N. Qld. ..... 72. *thoreyi* Harold

8(6). Dark green or cupreous; pronotal surface not shagreened, nitid or alutaceous, elytral surfaces uneven, feebly convex; male with outline of clypeus subtriangular, lamina between head horns high, quadrate, sometimes a little expanded distally, head horns not incurved at tips, anterior angles prominent, acute, the margin behind them concave; female with frontal carina low, curved or bent back medially, pronotum without a pair of median transverse ridges anteriorly. N.S.W., S. Qld. ..... 69. *nurubuan*, sp. nov.
Of a lighter green or cupreous shade; pronotal surface shagreened, sericeous, elytral surfaces smooth and flat; male with outline of clypeus rounded, lamina between head horns low, without a median quadrate lobe, head horns slightly incurved at extreme tips; anterior angles quadrate or rounded, the margins behind them not concave; female with frontal carina high, straight or feebly arcuate, pronotum with a pair of median transverse ridges on anterior declivity. SE. S.A., Tas., Vic., N.S.W., S. Qld..... 68. *australis* Guérin

## 65. ONTHOPHAGUS HOPLOCERUS Lea

(Figs. 187–189, 542)

*Onthophagus hoplocerus* Lea, 1923, p. 370; Boucomont and Gillet, 1927, p. 212.

Black, antennal clubs fulvous or flavous. Total length 7–11 mm.

*Male*

*Head.*—Clypeal margin only a little produced, medially reflexed, very feebly bilobate, strongly produced at sides just before genae in major male, less so in minor one, genal margins subangulate. Frontal section of clypeal suture arched forward, distinctly angulate where joining clypeal section. Frons of major male bearing 3 erect posterior horns, of which the middle one is much shorter and bifurcate, the lateral ones slightly incurved, bearing a strong tooth on inner edge near base, minor male with a pair of straight erect horns a little swollen at base and without median bifurcate process. Eyes small, with about 9 facet rows across widest point, separated by about 20 widths, canthus just touching occipital margin. Clypeus and genae densely but shallowly punctate, the punctures running together to form grooves, frons becoming very finely and sparsely punctate posteriorly in major male, not shagreened, densely punctate in minor one. Labium excised a little less than halfway to base. *Pronotum.*—Anterior declivity nearly flat, not sharply set off, with a very slight median vertical tumescence or fold. Anterior angles quadrate, the margin behind them not concave. Hind edge distinctly margined. Densely punctate, the punctures large and separated by less than 1 diameter, becoming smaller and sparser on anterior declivity of major male, surface between punctures nitid. *Elytra.*—Intervals feebly convex, shagreened, densely and very finely punctate, glabrous. Striae superficial, geminate, extremely finely punctate. First interval not strongly elevated posteriorly. *Legs.*—Fore tibiae a little elongated, with a broad brush of setae arising from distal edge, as long as fore spur and partly covering it, without inner distal tooth. *Abdomen.*—Pygidium not

shagreened, densely and coarsely punctate, with a few sparse setae. Aedeagus normal.

*Female*

Clypeus medially truncate or very feebly bilobate, not reflexed. Head surface densely and coarsely punctate, rugose on clypeus, impunctate behind frontal carina. Frons with a very low, recurved arcuate carina not reaching eyes. Pronotum less convex, entirely densely punctate. Fore tibia without brush of setae. Otherwise like male.

*Type*

Holotype ♂, Victorian Alps, SAM I.15394. Seen by the author.

*Distribution* (Fig. 186)

Inhabits wet forests and woodlands on mountains and on the escarpment along the east coast from Wilsons Promontory to Wollongong. Trapped with human faeces, cow dung, and rabbit and possum entrails. Active mostly from December to May, but four specimens were collected by the author in September at Bateman's Bay.

*Material Examined*

The type and 628 specimens. VICTORIA: Boolarra, 29.iv.1963, 4.v.1963, G. F. Bornemissza, ANIC, 365; 13–23 miles N. of Cann River, 13.i.1968, E. G. Matthews, ANIC, 3; Gunyah, 12.v.1963, G. F. Bornemissza, ANIC, 236. NEW SOUTH WALES: 5 miles N. of Bateman's Bay, 29.ix.1967, E. G. Matthews, ANIC, 4; Cabbage Tree Ck., Nelligen, 5.v.1965, G. F. Bornemissza, ANIC, 9; Clyde Mountain, 31.iii.1964, 20.iv.1964, G. F. Bornemissza, ANIC, 18; Durras Water, 20–26.xii.1964, G. F. Bornemissza, ANIC, 9; Macquarie Pass, 29.xii.1967, E. G. Matthews, ANIC, 3, Mt. Keira (1000 ft), 7.iii.1967, E. Britton and S. Misko, ANIC, 1, Mt. Keira, 29.xii.1967, E. G. Matthews, ANIC, 2.

## 66. ONTHOPHAGUS FULIGINOSUS Erichson

(Figs. 190–195, 543)

*Onthophagus fuliginosus* Erichson, 1842, p. 156; Harold, 1869, p. 86; Blackburn, 1903, p. 269.

Black, with faint cupreous reflections, antennal clubs piceous, becoming flavous in northern specimens. Total length 7–11 mm.

*Male*

*Head.*—Clypeal margin moderately produced medially, reflexed, and bilobate, convex just before genal sutures, genal margins rounded. Frontal section of clypeal suture arcuate, forming strong angles with genal sections. Vertex bearing 3 erect posterior horns, of which the middle one is much shorter and usually bifurcate, the lateral ones parallel, very slightly incurved distally, swollen or expanded at inner edge of base but without a tooth here. Northern specimens with horns little or not expanded at base. Medium male with only a pair of short erect conical horns on vertex, the middle one absent. Minor male like female. Eyes small, with about 8 facet rows across widest point, separated by about 20 widths, canthus incomplete. Densely but shallowly punctate, clypeus transversely rugose in minor specimens. Clypeal surface nitid, rest of head shagreened. Labium excised a little less than halfway to base.
*Pronotum.*—Anterior declivity set off from rest of pronotum by a rounded bend in

surface, with 2 very feeble depressions behind lateral head horns and a very feeble median tumescence in major male. Minor male with a simple convex pronotum. Anterior angles rounded or quadrate, the margin behind them not concave. Hind edge feebly margined. Evenly, fairly densely punctate with moderate punctures separated by 3 or 4 diameters, surface between punctures shagreened, matt. Glabrous. *Elytra.*– Intervals flat or very slightly convex, shagreened, with very fine punctures or impunctate.

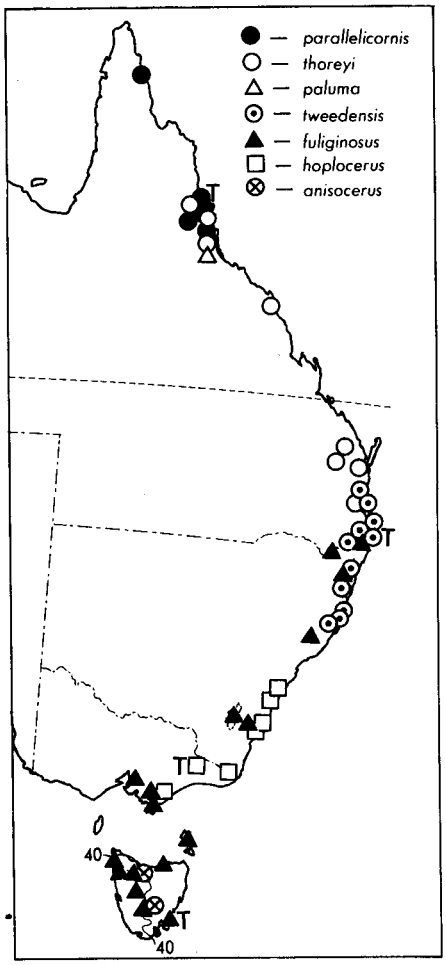
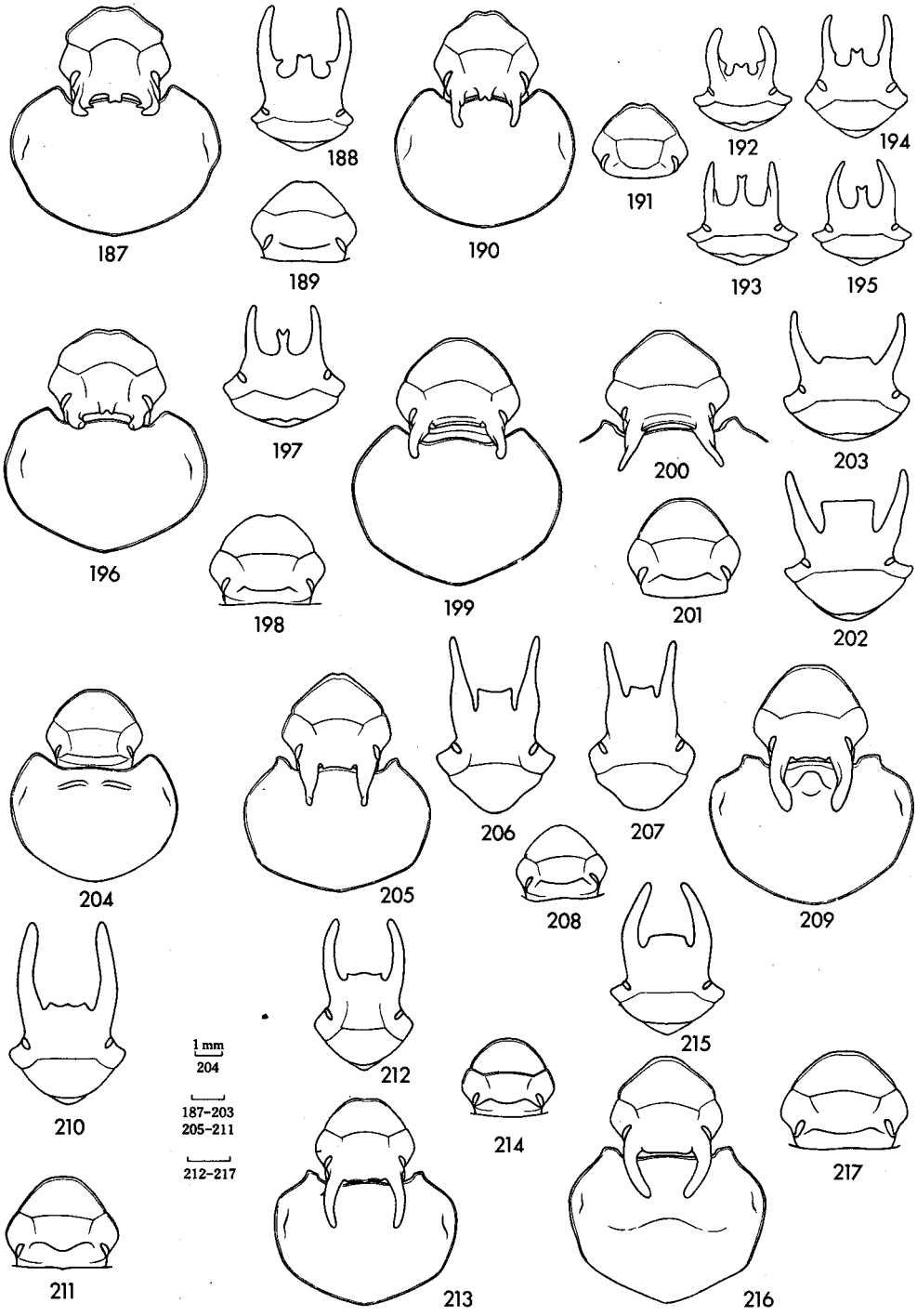



Fig. 186.–Known distribution of the *australis* group I.

First interval not elevated posteriorly. Glabrous. Striae superficial, narrowly geminate, extremely finely punctate, nitid. *Legs.*–Fore tibiae slightly elongated and with a broad brush of long setae arising from distal edge, as long as fore spur and partly covering it. *Abdomen.*–Pygidium shagreened, matt, finely punctate, with a few short sparse setae, often missing. Aedeagus normal.


187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
1 mm
204
187–203
205–211
212–217

*Female*

Clypeus less strongly bilobate medially, less reflexed, laterally not produced. Head surface densely and coarsely punctate and rugose on clypeus. Frons with a low carina bent back in 3 sections, not reaching eyes. Pronotum less convex, more coarsely punctate. Fore tibiae without brush of long setae. Otherwise like male.

*Type*

Holotype ♂, Van Diemen's Land, Schayer, ISZ 26893. Seen by the author.

*Remarks*

Lea (1923) synonymized *fuliginosus* with *anisocerus* and was followed in this by Boucomont and Gillet (1927). In fact the two species are easily separable by the characters given in couplet 3 of the key.

The Tasmanian males show the greatest basal expansion of the head horns and the shortest median process. Males from the northern border of New South Wales have the lateral head horns uniformly tapering and the antennal clubs yellow. The single known male from Barrington Tops, about halfway between the southern and northern populations, is intermediate in that the head horns are feebly expanded at the base and the antennal clubs are fuscous.

*Distribution* (Fig. 186)

Tasmania and Victoria, where it occurs on the coasts, climbing to the Southern Tableland and elevated parts of New South Wales to the McPherson Range on the Queensland border, evidently becoming increasingly montane to the north. In Tasmania, it seems to be largely confined to the wetter western half of the island. Occurring in woodland and forest. Found under excrement of wombat, wallaby, and man. Trapped with rabbit entrails. From September to June.

*Material Examined*

The type and 151 specimens. TASMANIA: Flinders I., Scott's Lagoon, 25.iii.1952, J. H. Calaby, ANIC, 1, George Town, 4.xi.1917, C. E. Cole, NMV, 1; Greens Beach, 3.iii.1961, 20.iv.1961, B. Mollison, ANIC, 8; Guildford, 21, 23.iv.1959, B. Mollison, ANIC, 5; Interview R. area, N. Pieman R., 31.xii.1953, T. G. Campbell, ANIC, 4; v. L. St. Clair (2400–4000 ft), Jan. 1957, Darlingtons, MCZ, 1; Launceston, 21.x.1917, C. E. Cole, NMV, 2; Marion Bay, 17.i.1961, F. J. D. McDonald, UQ, 1; Mt. Field, 28.ix.1959, B. Mollison, ANIC, 1; no exact locality, Schayer, ISZ, 4. VICTORIA: Beaconsfield, 9.vi.1920, F. E. Wilson, NMV, 4; Boolarra, 26.v.1963, G. F. Bornemissza, ANIC, 49; Darby Saddle, 13.v.1963, G. F. Bornemissza, ANIC, 18. AUSTRALIAN CAPITAL TERRITORY: Blundell's Flat, 15.iii.1964, G. F. Bornemissza, ANIC, 1; Bull's Head, 1.ii.1964, G. F. Bornemissza, ANIC, 3. NEW SOUTH WALES: Barrington Tops, 7.iv.1949,

Figs. 187–217.–*Onthophagus* spp.: *187–189*, *O. hoplocerus*: *187*, male fore body; *188*, male head, front view; *189*, female head; *190–195*, *O. fuliginosus*: *190*, male fore body; *191*, female head; *192–195*, male head: *192*, Tasmania; *193*, Barrington Tops, N.S.W.; *194*, Victoria; *195*, Acacia Plateau, N.S.W.; *196–198*, *O. anisocerus*: *196*, male fore body; *197*, male head, front view; *198*, female head; *199*, *O. australis*, male fore body; *200–202*, *O. nurubuan*: *200*, male head; *201*, female head; *202*, male head, front view; *203*, *204*, *O. australis*: *203*, male head, front view; *204*, female fore body; *205–208*, *O. paluma*: *205*, male fore body; *206*, male head, front view, Paluma, Qld.; *207*, male head, Atherton Tableland, Qld.; *208*, female head; *209–211*, *O. tweedensis*: *209*, male fore body; *210*, male head, front view; *211*, female head; *212–214*, *O. thoreyi*: *212*, male head, front view; *213*, male fore body; *214*, female head; *215–217*, *O. parallelicornis*: *215*, male head, front view; *216*, male fore body; *217*, female head.

E. F. Riek, ANIC, 1; Clyde Mountain, 10.x.1964, G. F. Bornemissza, ANIC, 1; Dorrigo, W. Heron, SAM, 2; McPherson Range, Oct. 1930, N. Favoloro, NMV, 1. QUEENSLAND: National Park, McPherson Range, Jan. 1928, H. J. Carter, ANIC, 1; National Park, Nov. 1920, H. Hacker, QM, 1; National Park, McPherson Range (1000 ft), 16.iii.1932, P. J. Darlington, MCZ, 1.

## 67. ONTHOPHAGUS ANISOCERUS Erichson

(Figs. 196-198, 544)

*Onthophagus anisocerus* Erichson, 1842, p. 155; Harold, 1869, p. 83; Blackburn, 1903, p. 269; Lea, 1923, p. 368; Boucomont and Gillet, 1927, p. 209.

Black, with cupreous or greenish tinge, antennal clubs piceous. Total length 8-11 mm.

*Male*

*Head.*—Clypeal margin medially moderately produced, reflexed, bilobate, laterally convex just before genal sutures, genal margins rounded. Frontal section of clypeal suture strongly arched forward in major male, forming strong angles with genal sections. Vertex bearing 3 erect horns, of which the middle one is about half as long as the lateral ones in major male and bifurcate, the lateral ones straight, evenly tapering and slightly twisted. Medium male without median process, with 2 short erect conical horns, minor male like female. Eyes small, with about 8 facet rows across widest point, separated by about 20 widths, canthus incomplete. Densely but finely punctate, becoming impunctate on posterior part of frons, surfaces nitid. Labium excised a little more than halfway to base. *Pronotum.*—Anterior declivity nearly flat, only slightly raised in middle behind head horns. Anterior angles quadrate, the margin behind them not concave. Hind edge feebly margined. Evenly, fairly densely punctate with small punctures separated by many times their diameter, surface between punctures smooth, nitid. Glabrous. *Elytra.*—Intervals flat, very finely shagreened, with very small punctures, glabrous. First interval not elevated posteriorly. Striae superficial, finely geminate, with very small punctures. *Legs.*—Fore tibiae a little elongated, with a broad brush of setae on distal edge as long as fore spur and partly covering it. Inner distal angle very feebly dentiform. *Abdomen.*—Pygidium finely shagreened, densely and finely punctate, with a few scattered setae. Aedeagus normal.

*Female*

Clypeus less produced medially and before genae. Head surface densely, coarsely punctate and transversely rugose on clypeus. Frons with a sharp, feebly arcuate carina, elevated into low points at both ends in major female, a simple transverse carina in minor one. Pronotum less convex, more densely and coarsely punctate. Fore tibiae without any brush of setae. Otherwise like male.

*Type*

Holotype ♂, Van Diemen's Land, Schayer, ISZ 26879. Seen by the author.

*Distribution* (Fig. 186)

Tasmania. This is the only species of the genus endemic to Tasmania. Its ecological distribution on the island is unknown. Collected by B. Mollison at wombat, wallaby, and thylogale (pademelon) excrement.

*Material Examined*

The type and 25 specimens. TASMANIA: Guildford, 21.iv.1959, B. Mollison, ANIC, 20; Maydena, 14.i.1959, B. Mollison, ANIC, 1; no exact locality, Schayer, ISZ, 4.

## 68. ONTHOPHAGUS AUSTRALIS Guérin

(Figs. 199, 203, 204, 545, 546)

*Onthophagus australis* Guérin, 1830, pl. 14, text p. 78 (1838); Harold, 1867, p. 35; Harold, 1869, p. 83; Blackburn, 1903, p. 285; Lea, 1923, p. 363; Boucomont and Gillet, 1927, p. 209; Fuller, 1934, p. 18.

*Onthophagus capella* Boisduval, 1832 (non Kirby, 1818), p. 153; Harold, 1867, p. 35 (syn.).

*Onthophagus cupreoviridis* Blanchard, 1853, p. 100; Harold, 1869, p. 83 (syn.).

Green to dark green, often with cupreous reflections, antennal clubs fulvous. Total length 7–12 mm.

*Male*

*Head.*—Clypeal margin very slightly produced and reflexed medially, rounded, genal margins rounded. Frontal section of clypeal suture straight or feebly arcuate, strongly angled when joining genal sections. Vertex in minor male with a low transverse carina, in major male with a lamina consisting of a broad, very low median lobe flanked by a pair of more backwardly inclined, flattened, slightly twisted, divergent horns, the tips of these slightly converging. Eyes small, with about 12 facet rows across widest point, separated by about 20 widths, canthus just touching occipital margin. Densely punctate, the punctures forming transverse rugae on clypeus, sparser on frons. Vertical lamina and horns impunctate. Labium excised a little more than halfway to base. *Pronotum.*—Anterior declivity with a low broad median tumescence, more pronounced in major male, flanked by a pair of flattened areas receiving head horns. Anterior angles quadrate or simply rounded. Hind edge finely margined. Very finely shagreened, tending to be nitid anteriorly in major male, moderately densely and evenly covered with fine to moderate punctures, these separated by more than 2 diameters, anterior declivities in major male impunctate. *Elytra.*—Intervals flat, shagreened, and extremely finely punctate. Humeral edges with a group of setae, otherwise glabrous. First interval elevated posteriorly. Striae superficial, narrowly geminate, very finely punctate. *Legs.*—Fore tibiae not elongated, without tuft or brush of setae, with small inner apical tooth. *Abdomen.*—Pygidium shagreened, densely and finely punctate, some lateral punctures with sparse long setae. Aedeagus normal.

*Female*

Head margin evenly rounded, feebly excised medially in some specimens. Frontoclypeal suture more strongly carinate medially. Frons with a distinct, straight or feebly arcuate transverse carina. Pronotum less convex, with a distinct anterior median transverse ridge nearly divided into 2. Surface more coarsely and densely punctate. Otherwise like male.

*Types*

Holotype of *australis*: Port Jackson, 1824, lost.

Holotype of *capella*: Port Jackson or Hobart, 1826–29; lost.

Holotype of *cupreoviridis*: ♀, Hobart, 1837-40, MNHN(Gen). A female with a circular pink label and bearing the number 210-59, labelled "*viridicupreus*", is considered to be the type of *cupreoviridis*. Seen by the author.

*Distribution* (Fig. 218)

Known from eastern Tasmania, Flinders I., Kangaroo I., southern and eastern Victoria (but not eastern Gippsland), eastern New South Wales, and south Queensland as far as Carnarvon Gorge. In Tasmania, South Australia, and Victoria it occurs at low elevations along the coasts. From extreme eastern Victoria northward it abandons coastal habitats and becomes montane, occupying tablelands along the Great Dividing Range to south Queensland. *O. australis* occurs in open areas (pastures and very open woodlands). It is replaced along the coast of New South Wales by the closely related *nurubuan*.

Found under all types of excrement and reported by Fuller (1934) to come to carrion. On the Southern Tablelands it is the only species found in fair abundance in cow dung during spring and autumn. In the south it has two seasons of adult activity: from August to December with a peak in September, and from February to June with a peak in April. In the north, a single summer season with a peak in December seems to be indicated. Diurnal.

*Material Examined*

1419 specimens. TASMANIA: Breadalbane; Flinders I., Lady Barron, Scott's Lagoon; Perth. SOUTH AUSTRALIA: Kangaroo I., Mt. Thisby; Sefton Park. VICTORIA: 8 miles NNW. of Acheron; 13 miles SE. of Albury; Ballarat; 7 miles E. of Bairnsdale; Boolarra; 19 miles NE. of Boorowa; 4 miles NE. of Bruthen; 5 miles NW. of Caramut; Castlemaine; Cheshunt; Corio; Corryong; 5 and 23 miles N. of Cressy; 2 miles W. of Dunkeld; Eltham; 1 mile E. of Eskdale; Everton; Exeter; Gunyah; 8 miles SE. of Hamilton; 5 miles NE. of Koo-wee-rup; 5 miles N. of Korumburra; 7 miles E. of L. Bolac; 19 miles ESE. of Lismore; 13 miles S. of Macarthur; 7 miles NW. of Maindample; Morwell; 8 miles ESE. of Penshurst; Preston; Rutherglen; 3 miles SW. of Sale; 7 miles SE. of Seymour; 2 miles W. of Skipton; 4 miles WSW. of Taralgon; 8 miles ESE. of Wangaratta; Wannon; Worndoo; Yanakie; 10 miles WNW. of Yea. AUSTRALIAN CAPITAL TERRITORY: Acton; Blundell's Flat; Canberra; Dickson Station; Narrabundah; Sheep's Head; Tidbinbilla; Turner. NEW SOUTH WALES: Acacia Plateau; Barrington Tops; Berrima; Braidwood, Shoalhaven R.; 2 miles E. of Delegate; Exeter; Forest Reefs; Gilmore; Gininderra Falls; Glen Innes–Inverell Rd.; Goulburn; Inverell; Kentucky; Laggan; Lower Acacia Ck.; 12 miles N. of Marulan; Moonbi; Mullaley; Nelligen, Cabbage Tree Ck.; New England National Park; Putty; 41 miles S. of Tamworth; 21 miles N. of Tenterfield; Uralla; 9 and 23 miles E. of Wagga; Yass. QUEENSLAND: Amberley; Ballandean; Carnarvon Range; Milmerran; Stanthorpe; Rathdowney, Lever's Plateau.

## 69. ONTHOPHAGUS NURUBUAN, sp. nov.

(Figs. 200-202, 547, 548)

Very dark green, often with cupreous reflections, antennal clubs fulvous. Total length 8-12 mm.

*Male*

*Head.*—Clypeal margin distinctly prolonged and reflexed medially, more strongly so in major male, the lateral margins straight, a little incised at clypeogenal sutures, genal margins rounded. Frontal section of clypeal suture distinct, straight or feebly

arcuated, forming distinct angles with genal sections. Vertex with a prominent erect quadrate lamina, sometimes a little expanded distally, flanked by a pair of more backwardly inclined, flattened, slightly twisted, divergent horns, the tips of these not converging, the bases somewhat widened. Minor male with a low transverse vertical carina only. Eyes small, with 9–11 facet rows across widest point, separated by about 20 widths, canthus just touching occipital margin. Densely punctate, the punctures tending to form transverse rugae on clypeus, sparser on frons. Vertical lamina and horns impunctate. Labium excised a little more than halfway to base. *Pronotum.*–Anterior declivity with a low broad median tumescence, absent in minor male, flanked by a pair of flattened areas receiving head horns. Anterior angles prominent, acute, the apices usually rounded, lateral margins behind them concave. Hind edge finely margined. Smooth, nitid or alutaceous, not shagreened, moderately densely punctate, the punctures separated by much more than 1 diameter, very finely punctate on anterior declivity in major male, glabrous. *Elytra.*–Intervals feebly convex, shagreened, densely punctate with very small punctures and faintly rugulose. First interval elevated posteriorly. Humeral edges with a group of short setae, otherwise glabrous. Striae moderately impressed, narrowly geminate, with very small punctures. *Legs.*–Fore tibiae not elongated, without tuft or brush of long setae, with small inner apical tooth. *Abdomen.*–Pygidium shagreened, densely and finely punctate, a few lateral punctures with long coarse setae. Aedeagus normal.

*Female*

Head margin more rounded, the clypeus still a little prolonged. Frontoclypeal suture more prominent, not much raised. Frons with a low sharp carina which is medially curved or bent back. Pronotum less convex, without any anterior median transverse ridges, the surface strongly punctate and rugose. Elytral intervals more distinctly rugose. Otherwise like male.

*Type*

Holotype ♂, 13 miles N. of Marulan, N.S.W., 4.iv.1964, G. F. Bornemissza, ANIC.

*Remarks*

The above descriptions and couplet 8 of the key refer to "pure" *australis* and *nurubuan* from areas where there is no gene exchange between the two. In fact there is extensive hybridization between them in northern New South Wales, as discussed at greater length below under Nos. 68–69.

*Distribution* (Fig. 218)

*O. nurubuan* replaces *australis* along the coast of New South Wales, the southernmost known locality being Bateman's Bay. Inland in this area it reaches the foot of the escarpment at Cabbage Tree Creek, occurring sympatrically with *australis* there. Further north it climbs to the top of the escarpment at Marulan. The northernmost coastal record is Wamberal, near Gosford, thereafter *nurubuan* occurs only inland and climbs further, occurring at Dorrigo and the top of the Gibraltar Range National Park. However, the hybrid populations (see below) return to the coast around the Queensland border. The northernmost locality for *nurubuan* is Mt. Glorious, Qld., just north of Brisbane, where the author collected it in dense forest. This population is almost pure *nurubuan.*

This species occurs only in forests and other shaded situations, where *australis* does not penetrate. Therefore, in the zone of contact where the two species occur together geographically, an ecological separation continues to be maintained. In the north, hybrids between *nurubuan* and *australis* occur both in shaded and open situations, particularly at moderate altitudes. Like *australis*, *nurubuan* is a general dung feeder and will occur in cow dung in shaded situations. It also appears to have the same spring–autumn activity season (September–December and March–May), according to the material available.

*Material Examined*

The type and 330 specimens. NEW SOUTH WALES: 5 miles N. of Bateman's Bay, 29.ix.1967, E. G. Matthews, ANIC, 1; Cattle Camp Ck., 10 miles W. of Cangai, 5.xii.1965, G. A. Yapp, ANIC, 1; Colo Heights, 14.iv.1965, G. A. Yapp, ANIC, 3; Comboyne, 1937, H.J.D. and D.T.S., ANIC, 1; Dinner Ck., Nelligen, 28.ix.1964, G. F. Bornemissza, ANIC, 5; Dorrigo, W. Heron, ANIC, 1; Durras Water, 24.xii.1964, G. F. Bornemissza, ANIC, 40; Gallagher's Camp, 14.iii.1965, G. F. Bornemissza, ANIC, 1; Gibraltar Range National Park, 5.xii.1967, E. G. Matthews, ANIC, 1; 28 miles E. of Glen Innes, 5.xii.1967, E. G. Matthews, ANIC, 3; 13 miles N. of Marulan, 4.iv, 23.iv, 18.v, 15.x, 22.x.1964, G. F. Bornemissza, ANIC, 232; Putty, 14.iv.1965, Bornemissza and Yapp, ANIC, 8; Wamberal, 11.iv.1964, G. F. Bornemissza, ANIC, 2. QUEENSLAND: Burleigh, Sept. 1943, J.M., GB, 1; Lamington National Park, Coomera R. (1200 ft), 18.v.1966, Z. Liepa, ANIC, 1; Mt. Glorious, 8.iv.1968, E. G. Matthews, ANIC, 7.

## 68–69. ONTHOPHAGUS AUSTRALIS × NURUBUAN

Many specimens from northern New South Wales and south-east Queensland cannot be placed either in *australis* or *nurubuan*, being intermediate in some or all of the characters used to separate the species (in couplet 8 of the key). These specimens are interpreted here as being hybrids between the two species. The concept of the allopatric subspecies or geographical race cannot apply here, as the two forms are broadly sympatric.

In Figure 218 the complex relationship between *australis* and *nurubuan* is illustrated. The graphs at the left of the figure indicate the relative frequency of pure and intermediate individuals in certain selected localities. To classify an individual, three characters in each sex were selected, and for each individual the "*australis*" condition of that character was arbitrarily given a value of 1, while the "*nurubuan*" condition was given a value of 3. The intermediate condition is given the value 2. It is evident that for three characters a typical or pure *australis* individual would have a value of 3, while a typical *nurubuan* would have a value of 9. Therefore, individuals coded at 3 or 4 were considered *australis* (white bars in the diagrams), while those coded at 8 or 9 were considered *nurubuan* (black bars). The code values 5 to 7 designate intermediates (cross-hatched bars).

It will be seen from Figure 218 that all samples from areas south of Grafton, N.S.W., segregate clearly as either *australis* or *nurubuan*, averaging either 3 or 9 in the code. Particularly significant are the areas where the two species occur together in direct contact, i.e. Marulan, Cabbage Tree Creek, and Putty (the latter not graphed). The individuals are all clearly separable into one species or the other and no intermediates occur, indicating that they are acting as indisputably separate species. However, in an area beginning around Grafton and centring about the McPherson Range on the Queensland border, large numbers of intermediates occur (see graphs for Glenugie,

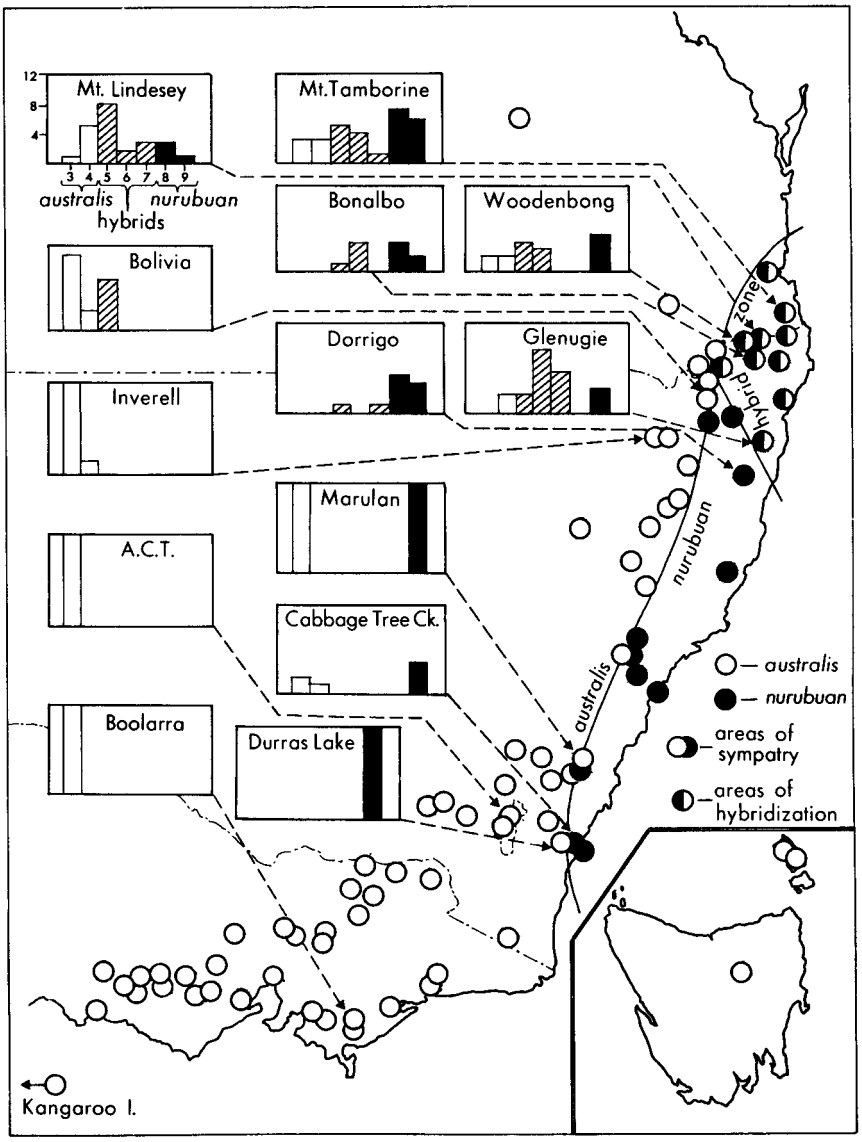



Fig. 218.–Known distribution of the sibling species *australis* and *nurubuan*. Small graphs show relative proportions of individuals of each species (white and black bars) and of hybrids between them (hatched bars) in samples of varying size from the localities indicated.

Mt. Tamborine, Mt. Lindesay, etc.), indicating that the reproductive isolation which so clearly operates further south has broken down. Typical *australis* populations maintain themselves to the west of this area (Lower Acacia Creek, Ballandean, Stanthorpe), but only mixed populations (not pure *nurubuan*) occur to the east, suggesting an introgression of *australis* genes eastward without a corresponding movement of *nurubuan* genes westward.

In spite of the fact that gene flow occurs between *australis* and *nurubuan*, these cannot be considered subspecies because they maintain complete reproductive isolation in the south, and apparently for most of their range of contact. As far north as Glen Innes, N.S.W., pure *australis* are found to the west and pure *nurubuan* to the east. There is plenty of opportunity for interbreeding in such areas as Marulan, intensively studied by Dr. Bornemissza, where in intermediate (semi-wooded) ecological situations the two species may occur in the same cow pads. Nevertheless, no intermediate specimens are found here or in other similar areas.

We can only speculate as to the reasons for the breakdown of reproductive isolation between the two species to the north. Both are at the extremes of their ranges there, and this may be a contributing factor. Also, the area has been extensively logged and cleared, to the detriment of the forest-dependent *nurubuan*, perhaps explaining the one-way flow of genes and apparent dominance of *australis* mentioned above.

*Material Examined* (Intermediates)

198 specimens. NEW SOUTH WALES: Bolivia, 13.iv.1965, G. F. Bornemissza, ANIC, 17; Bonalbo, 13.xii.1965, G. A. Yapp, ANIC, 14; Donaldson State Forest, 12.iv.1965, Bornemissza and Yapp, ANIC, 16; Glenugie, 15 miles S. of Grafton, 10.xii.1965, G. A. Yapp, ANIC, 38; Kyogle, 14.xii.1965, G. A. Yapp, ANIC, 1; 12 miles N. of Murwillumbah, 7.xii.1967, E. G. Matthews, ANIC, 1; Tabbimobile, 14.xii.1965, G. A. Yapp, ANIC, 12; Tooloom Scrub via Woodenbong, 26–27.xii.1968, B. Cantrell, UQ, 1; Urbenville, 12.xii.1965, G. A. Yapp, ANIC, 1; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 2; 4 miles W. of Woodenbong, 9.xii.1967, E. G. Matthews, ANIC, 10; 10 miles SW. of Woodenbong, 7.xii.1965, G. A. Yapp, ANIC, 5. QUEENSLAND: Bald Mt. area via Emu Vale (3000–4000 ft), 12–22.v.1969, G. B. Monteith, UQ, 2; Fletcher, E. Sutton, ANIC, 1; Girraween National Park, via Stanthorpe, 20.x.1968, A. B. Cribb, UQ, 1; Mt. Lindesay Forest, 12.iv.1965, Bornemissza and Yapp, ANIC, 44; Tamborine Mountain, 12.xii.1965, G. A. Yapp, ANIC, 26; Tamborine Mountain, 7.xii.1967, E. G. Matthews, ANIC, 4; Tamborine Mountain, Lahey's Lookout, 3.iv.1959, K. H. L. Key, ANIC, 1.

## 70. ONTHOPHAGUS PALUMA, sp. nov.

(Figs. 205–208, 549)

Black, antennal clubs fulvous or flavous. Total length 9–12 mm.

*Male*

*Head.*—Clypeal margin medially moderately produced and reflexed, subtriangular in outline, slightly incised at clypeogenal suture, genal margins rounded. Frontoclypeal suture very feebly arcuate or sinuate, strongly angled with clypeogenal sutures. Vertex with a reclined quadrate median lobe, its distal edge concave, flanked by a pair of flattened horns which are only slightly divergent and which become abruptly narrowed about halfway. The horns only a little more reclined than median lobe. Eyes small, with 9–10 facet rows across widest point, separated by about 20 widths,

canthus incomplete. Clypeus and genae densely, coarsely punctate, frons less densely punctate, becoming impunctate posteriorly. Labium incised a little more than halfway to base. *Pronotum.*—Anterior declivity with a very low median vertical tumescence medially, flanked by flattened areas, top of declivity not sharply set off from disc. Anterior angles quadrate or subacute in major male, the margin behind them sinuate. Hind edge finely margined. Nitid, not shagreened, with moderately large and fairly dense punctures on disc and sides, extremely finely punctate or impunctate on anterior declivity. Punctures on disc separated by 1–3 diameters. Glabrous. *Elytra.*—Intervals flat, shagreened and distinctly but feebly rugose, finely punctate, glabrous. First interval elevated posteriorly. Striae feebly impressed, geminate, with moderate round punctures. *Legs.*—Fore tibiae not elongated, without tuft of long setae, with very feeble inner apical tooth. *Abdomen.*—Pygidium shagreened, sparsely to moderately punctate and setose. Aedeagus normal.

*Female*

Head less triangular, clypeus less prolonged. Clypeal suture more transverse. Frons with a low arcuate transverse carina curved back in middle and terminating laterally in slightly raised points or sharp angles. Pronotum densely, coarsely punctate and rugose, evenly convex. Otherwise like male.

*Type*

Holotype ♂, 5 miles W. of Paluma, Qld., 21.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC.

*Remarks*

A male from Gillie's Highway, running east from the Atherton Tableland, has the genae less prominent, the head therefore relatively narrower, the frontal lamina and horns narrower and closer together, and the median lobe therefore also narrower. The pronotal disc is more finely punctate. A different species may be involved, but as only a single specimen is available a decision will not be made now.

*Distribution* (Fig. 186)

Known only from the area of Mt. Spec, near Paluma, Qld., where is it abundant, and from the Atherton Tableland. Primarily a forest or woodland form which will also occur in nearby pastures. Trapped with human excrement bait.

*Material Examined*

The type and 54 specimens. QUEENSLAND: Gillie's Highway, 20.iii.1965, G. F. Bornemissza, ANIC, 1; Ewan Rd., 8 miles W. of Paluma, 11.i.1968, J. G. Brooks, ANIC, 2; Paluma Dam Rd., Mt. Spec, 30.iii.1968, E. G. Matthews, ANIC, 2; Paluma Heights, 20.iii.1965, G. F. Bornemissza, ANIC, 4; Paluma, 20.iii.1965, G. F. Bornemissza, ANIC, 4; 5 miles W. of Paluma, 24.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 37; Paluma, Jan. 1964, G. Brooks, GB, 1; Ravenshoe, 6.v.1969, G. F. Bornemissza and P. Ferrar, ANIC, 3.

## 71. ONTHOPHAGUS TWEEDENSIS Blackburn

(Figs. 209–211, 550)

*Onthophagus tweedensis* Blackburn, 1903, p. 285; Lea, 1923, p. 369; Boucomont and Gillet, 1927, p. 216.

Fore body and pygidium green, front of clypeus and elytra black, underside, legs, and sutural intervals of elytra black with green reflections, antennal clubs fulvous. Total length 8–11 mm.

*Male*

*Head.*—Clypeus only a little prolonged, somewhat truncate, the edge reflexed. Frontal section of clypeal suture feebly arcuate, strongly angled with genal sections. Vertex with a very low 3-pointed lobe flanked by a pair of flattened horns which are parallel-sided or slightly widened distally in major male and incurved. Minor male with a pair of very low frontal tubercles joined by a simple transverse raised line. Eyes small, with about 11 facet rows across widest point, separated by about 20 widths, canthus incomplete or just touching occipital margin. Head moderately densely punctate, becoming impunctate on frontal lamina. Labium incised about halfway to base. *Pronotum.*—Anterior declivity flat with a single rounded median protuberance projecting between head horns, in minor male forming 2 approximated tubercles. Anterior angles acute in major male, quadrate in minor one, the margin behind them strongly to moderately concave. Hind edge very finely margined. Very finely shagreened or entirely smooth, nitid, moderately punctate on disc, very finely punctate to impunctate on sides and anterior declivity. Glabrous. *Elytra.*—Intervals feebly convex, shagreened, densely and extremely finely punctate, not rugose, glabrous. First interval raised posteriorly. Striae narrowly geminate, with extremely small punctures. *Legs.*—Fore tibiae not elongated, without tuft of long setae, with inner apical tooth well developed. *Abdomen.*—Pygidium shagreened, with small dense punctures, glabrous. Aedeagus normal.

*Female*

Edge of clypeus not reflexed, head surface densely transversely rugose, except area behind frontal carina, which is finely punctate. Frontal carina sinuate, recurved in middle. Pronotum with only a trace of a median lobe near front margin, surface entirely densely punctate and rugose. Fore tibiae without inner apical tooth. Otherwise like male.

*Type*

Holotype ♂, Tweed River, N.S.W., BMNH. Seen by the author.

*Distribution* (Fig. 186)

Occurring in the somewhat open sandy woodlands of extreme coastal New South Wales north of Taree to south Queensland a little north of Moreton Bay. Trapped with human excrement and marsupial entrails. Collected from August to May.

*Material Examined*

The type and 44 specimens. NEW SOUTH WALES: Ballengarra, 20 miles S. of Kempsey, 15.xii.1965, G. A. Yapp, ANIC, 2; Glenugie, 15 miles S. of Grafton, 10.xii.1965, G. A. Yapp, ANIC, 3; Kendall, Burawan State Forest, 5.iii.1965, G. F. Bornemissza, ANIC, 9; South West Rocks, Trial Bay, Dec. 1929, G. P. Whitley, AM, 1; Tabbimobile, 14.xii.1965, G. A. Yapp, ANIC, 16; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 2. QUEENSLAND: Beaudesert Rd., 29.i.1933, GB, 1; Lamington National Park, 3.v.1962, G. Monteith, UQ, 2; Montville, Blackall Range (*c.* 2000 ft), Apr. 1958, Darlingtons, MCZ, 2; Stradbroke I., 17.ix.1915, H. Hacker, QM, 2; Toobah, UQ, 1; Toorbul Pt., 6.v.1958, L. Clark, UQ, 1.

## 72. ONTHOPHAGUS THOREYI Harold

(Figs. 212-214, 551)

*Onthophagus thoreyi* Harold, 1868*a*, p. 83; Harold, 1869, p. 83; Blackburn, 1903, p. 302; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 216.

*Onthophagus mastersi* Macleay, 1871, p. 181; Harold, 1873, p. 146 (syn.); Lea, 1923, p. 363; Boucomont and Gillet, 1927, p. 216.

*Onthophagus sutilistriatus* Lea, 1923, p. 385; Boucomont and Gillet, 1927, p. 216. New synonymy.

Black with a faint greenish tinge on pronotum, antennal clubs flavous. Total length 8-11 mm.

*Male*

*Head.*—Clypeus only a little prolonged, medially somewhat truncate, rounded, reflexed. Clypeal suture with frontal section feebly arcuate, forming strong angles with genal sections. Vertex with a short reclined subquadrate lobe, its distal edge feebly to strongly biconcave and bisinuate, flanked by a pair of flattened horns which are evenly curved in and tapering, not twisted. Medium male with a pair of short tapering straight horns, slightly divergent, joined by a simple arcuate carina. Minor male with only a single recurved frontal carina as in female. Eyes small, with 7-8 facet rows across widest point, separated by about 25 widths. Densely and coarsely punctate, the punctures sparser on frons, frontal lamina and horns extremely finely punctate. Labium excised about halfway to base. *Pronotum.*—Anterior declivity with a fairly prominent median tumescence in major male, nearly plane in minor one. Anterior angles quadrate, the margin concave behind them. Hind edge finely margined. Very finely shagreened along edges only, nitid, with large dense punctures on disc and sides, extremely finely punctate on anterior declivity. Punctures on disc separated by about 1 diameter. Glabrous. *Elytra.*—Intervals feebly convex, smooth, shagreened, and densely and finely punctate, with a few setae on last interval near humeri. First interval raised posteriorly. Striae narrowly geminate, with very small punctures. *Legs.*—Fore tibiae not elongated, without tuft of long setae, with inner apical tooth. *Abdomen.*—Pygidium shagreened, with dense medium-sized punctures and short sparse setae. Aedeagus normal.

*Female*

Head margin as in male. Clypeus transversely rugose, clypeal suture more prominent, frons with a very low carina which is curved back medially and laterally, being bisinuate. Pronotum entirely coarsely and densely punctate. Fore tibiae without inner apical tooth. Otherwise like male.

*Types*

Holotype of *thoreyi*: ♂, Victoria (erroneous), MNHN(Ob).
Holotype of *mastersi*: ♂, Gayndah, Qld., AM K28208.
Holotype of *sutilistriatus*: ♀, Bowen, Qld., SAM I.15404.
All three seen by the author.

*Distribution* (Fig. 186)

Known from widely separated localities from the Brisbane area to the Atherton Tableland, Qld. It occurs primarily in open pastures, also in open woodland, replacing

*australis* in these habitats to the north. Trapped with human excrement bait.

*Material Examined*

The types and 120 specimens. QUEENSLAND: Atherton, 26.iii.1965, G. F. Bornemissza, ANIC, 10; Brisbane, June 1966, P. McFadyen, UQ, 1; Bulburin State Forest, 27–29.v.1960, E. A. Bernays, UQ, 1; Conway Range National Park, 28.iii.1968, E. G. Matthews, ANIC, 1; Evelyn, 8.viii.1967, R. J. Elder, ANIC, 1; Gayndah, MM, 2; Ingham, 21.ii.1961, I. M. Cook, UQ, 1; Kolan Ck., Miriam Vale, 10.iii.1965, G. F. Bornemissza, ANIC, 40; L. Eacham, 1.i.1964, G. Monteith, UQ, 1; Malanda, 24.v.1966, S. Hamlyn, UQ, 2; Maryborough, E. W. Fisher, SAM, 1; Montville, Blackall Range (*c.* 2000 ft), Apr. 1958, Darlingtons, MCZ, 1; National Park, Dec. 1923, H. Hacker, QM, 1; Obi Obi R., Blackall Range, 20.v.1951, W. L. Brown, MCZ, 1; Shute Harbour, 24.v.1968, G. Monteith, UQ, 1; The Boulders via Babinda, 15.xii.1966, B. Cantrell, UQ, 1; Yungaburra, 7.v.1964, 27.iii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 53.

## 73. ONTHOPHAGUS PARALLELICORNIS Macleay

(Figs. 215–217, 552)

*Onthophagus parallelicornis* Macleay, 1887, p. 223; Blackburn, 1903, p. 304; Boucomont and Gillet, 1927, p. 214.

Black, antennal clubs fulvous. Total length 8–11 mm.

*Male*

*Head.*–Clypeus not prolonged, medially somewhat truncate, rounded, the edges reflexed. Clypeal suture with frontal segment feeble, sometimes effaced, strongly angled with genal sections. Vertex with a short reclined subquadrate lobe posteriorly, its distal edge evenly arcuate in dorsal view in major male, straight in front view, flanked by a pair of flattened horns which are evenly tapering, not twisted, slightly bent near base, basally somewhat divergent, distally convergent. Medium male with a pair of short tapering straight horns which are parallel or convergent, joined by a low undulated carina. Minor male like female. Eyes small, with about 7 facet rows across widest point, separated by about 25 widths, canthus just touching occipital margin or incomplete. Densely and coarsely punctate, the punctures becoming sparser and finer posteriorly. Labium incised about halfway to base. *Pronotum.*–Anterior declivity consisting of 2 broad flattened areas joined in middle at slight angle forming a feeble vertical fold, the declivity fairly sharply bounded posteriorly, especially in middle, by a surface bend and an abrupt coarsening of punctuation in major male. Anterior angles prominent, quadrate or slightly acute, the margin behind them concave. Hind edge finely margined. Nitid, not shagreened, coarsely punctate on disc and sides, the punctures separated by about 1 diameter, becoming rather abruptly smooth and extremely finely punctate on anterior declivity. Glabrous. *Elytra.*–Intervals flat, rugose, not shagreened, coarsely punctate, glabrous. First interval raised posteriorly. A few long coarse setae on edge of last interval near humerus. Striae superficial, fine, very finely punctate. *Legs.*–Fore tibiae not elongated, without tuft of long setae, with inner apical tooth. *Abdomen.*–Pygidium shagreened, with moderately dense large punctures laterally bearing strong bristles, the median line impunctate and glabrous. Aedeagus normal.

*Female*

Head shaped as in male, the margin not reflexed. Clypeal surface densely transversely rugose, rest of head more coarsely punctate. Clypeal suture raised, distinct.

Frontal carina a bisinuate raised line, curved back in middle and at ends. Pronotum less convex, entirely coarsely and densely punctate, the punctures separated by about 1 diameter. Fore tibiae without inner apical tooth. Otherwise like male.

*Type*

Holotype ♂, Cairns, Qld., MM. Seen by the author.

*Remarks*

Distinguished from *thoreyi*, which occurs in the same area, by the median vertical lobe of the male not distally biconcave, the horns more convergent, bent, the frontal section of clypeal suture feeble or effaced, the pronotal declivity more abruptly set off from disc, the elytral surfaces rugose, the pygidium coarsely punctate and with long setae, and the colour black without any greenish tinge.

*Distribution* (Fig. 186)

This is the northernmost member of the *australis* group, occupying primarily sclerophyll forest of medium density from the Cardwell Range to near Iron Range, Qld.

*Material Examined*

The type and 128 specimens. QUEENSLAND: Atherton, 7.v.1964, 26.iii.1965, G. F. Bornemissza, ANIC, 3; Cardwell Range, 2.v.1964, G. F. Bornemissza, ANIC, 2; Claudie R. near Mt. Lamond, 26.iv.1966, D. K. McAlpine, AM, 1; Gillie's Highway, 30.iii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 114; L. Barrine, 5.v.1964, G. F. Bornemissza, ANIC, 1; 2 miles W. of Ravenshoe, 1.iv.1968, E. G. Matthews, ANIC, 4; Speewah Rd., 5 miles S. of Kuranda, 12.i.1967, D. McAlpine and G. Holloway, AM, 1; Upper Mulgrave R., 2.iv.1968, E. G. Matthews, ANIC, 1.

## X. *The* AURITUS *Group*

Eyes narrow, with 5–8 facet rows across widest point, separated by 10–20 widths, canthus incomplete or just touching occipital margin (complete in *furcaticeps*). Labium excised very shallowly to almost halfway to base. Pronotum very smooth and nitid, finely punctate. Elytra glabrous on disc, with rows of short setae along edges. Pygidium usually with long dense pilosity, only moderately setose in *discolor* and *purpureicollis*. Colour of pronotum never entirely black, either green cupreous, violet, or partly red, elytra black. Total length 6–11 mm.

Male with frontoclypeal suture carinate, vertex without horns, although a bilobed lamina may be present. Pronotum with ridges, a projection, or a median depression. Fore tibiae not elongate, without a distal brush of long setae (a loose tuft present in *rufosignatus*). Female with a frontal or vertical carina, no crest.

Eight species: 74. *discolor* Hope; 75. *purpureicollis* Macleay; 76. *auritus* Erichson; 77. *furcaticeps* Masters; 78. *cuniculus* Macleay; 79. *dandalu*, sp. nov.; 80. *walteri* Macleay; 81. *rufosignatus* Macleay.

The conspicuous metallic colours associated with diurnal activity are the chief characteristic of this group, although not exclusive to it. All but *auritus* are open savannah woodland or pasture forms. *O. rufosignatus* and *discolor* extend to north Western Australia.

One of the species (*walteri*) is at least partly mycetophagous. The rest are coprophagous, but there is a tendency to prefer human excrement and carrion, as opposed to herbivore dung, in this group.

## KEY TO SPECIES OF THE *AURITUS* GROUP

1. Pygidium with short or moderate setae on either side of a glabrous middle area, without a dense vestiture of long pilosity; elytral intervals not swollen at the bases or undulated laterally ..... 2

Pygidium with long dense pale pilosity not leaving a glabrous middle area; dorsal elytral intervals swollen at the base to some extent and lateral intervals undulated behind humeri ..... 3

2(1). Pronotum green; frons with a single, uninterrupted transverse carina between eyes in both sexes; male with 2 large shallow punctate depressions on anterior declivity of pronotum on either side of midline. N. N.T., N. Qld. ..... 74. *discolor* Hope

Pronotum violet; frons with transverse carina between eyes interrupted in middle in both sexes; male with a single median depression on anterior declivity of pronotum. N. Qld. ..... 75. *purpureicollis* Macleay

3(1). Colour red and black. N. Qld., N. N.T., N. W.A. ..... 81. *rufosignatus* Macleay

Without any red in colour pattern ..... 4

4(3). Male with clypeus truncate or feebly bilobate, not prolonged medially into a rounded lobe, frons not prolonged backward into a lamina or flap, but bearing a pair of erect separated transverse carinae; pronotum with a pair of tubercles separated by a median concavity in both sexes; strial punctures small, not appreciably crenulating elytral intervals. N. Qld. ..... 80. *walteri* Macleay

Major male with the clypeus prolonged medially into a rounded lobe, frons prolonged backward into a long lamina or a short flap covering occiput, never with a pair of erect transverse carinae; pronotum variable; strial punctures larger, crenulating edges of intervals ..... 5

5(4). Major male with only a short frontal flap covering part of occiput, pronotum with a single acute median process; minor male and female with frontal flap very small, low, sometimes reduced to a pair of oblique folds on frons or an arcuate fold here, not an erect carina or points; pronotum either pure green or coppery green ..... 6

Major male with a large frontal lamina inclined backward over part of pronotum, pronotum with a pair of tubercles; minor male and female with frontal carina or pair of flaps or points; pronotum dark green, violet, or greenish blue ..... 7

6(5). Both sexes with simple sinuate frontal flap covering occiput; major male with this flap not raised into angles laterally, with pronotal process evenly tapering, terminally somewhat flattened, basally not widened; female with median pronotal process consisting of a pair of tubercles separated by an even depression; head and pronotum finely punctate; fore body usually cupreous. N. Qld. ..... 78. *cuniculus* Macleay

Both sexes with a pair of oblique raised lines issuing from corners of frontal flap, usually not meeting in middle; major male with this flap raised into a pair of low angular processes, with pronotal process widened basally, laterally somewhat incurved, prow-like, terminally conical; female with median pronotal process consisting of a pair of transverse gibbosities with only a small concavity in middle; head and anterior part of pronotum more strongly punctate; fore body usually pure green. S. Qld., N.S.W., N. Vic. ... 79. *dandalu*, sp. nov.

7(5). Major male with an expanding bilobed frontal lamina excised in a broad V, the pronotal surface behind it glabrous; female with a simple erect transverse frontal carina not pushed back over occiput or appreciably bilobed. Tas., SE. S.A., Vic., N.S.W., S. Qld. ..... 76. *auritus* Erichson

Major male with a narrowing frontal lamina excised in a long narrow slit, the pronotal surface behind it with a few long bristles; female with frontal carina pushed back over occiput, consisting of 2 triangular flaps or short points; major female with median pronotal prominence expanded laterally into a large anvil-shaped process bearing some long bristles. N. Qld. ..... 77. *furcaticeps* Masters

## 74. ONTHOPHAGUS DISCOLOR Hope

(Figs. 221, 553)

*Onthophagus discolor* Hope, 1841, p. 44; Hope, 1842, p. 424; Blackburn, 1903, p. 305; Boucomont and Gillet, 1927, p. 211.

*Onthophagus viridiobscurus* Blanchard, 1853, p. 90; Blackburn, 1903, p. 305 (syn.).

*Onthophagus promptus* Harold, 1869, p. 82; Harold, 1877, p. 74; Blackburn, 1903, p. 305 (syn.); Lea, 1923, p. 367; Boucomont and Gillet, 1927, p. 215.

Fore body and pygidium green, elytra and rest of body and legs black, antennal clubs flavous. Total length 6–8 mm.

*Male*

*Head.*—Clypeal margin evenly rounded, moderately reflexed, genal margins rounded, not projecting. Clypeal suture finely carinate, frontal section straight, slightly curved forward for genal sections. Frons with a sharp low transverse carina, feebly sinuate, not reaching eyes. Eyes very narrow, with about 5 facet rows across widest point, separated by about 25 widths, canthus incomplete. Clypeus feebly rugose along edge, rest of head finely to moderately punctate, shiny. Labium excised nearly halfway. *Pronotum.*—Anterior declivity gentle, its posterior edge marked by a pair of indistinct transverse ridges about a third of way back on pronotum, delimiting a pair of shallow, more coarsely punctate anterior depressions separated by a low median tumescence a little less punctate. Minor male with evenly convex pronotum more coarsely and densely punctate anteriorly. Anterior angles quadrate. Hind edge very finely margined. Disc with median longitudinal sulcus strongly impressed. Extremely finely punctate, except on anterior declivity and inside anterior angles, which are coarsely punctate. Surface between punctures smooth, very nitid, tending to become finely shagreened anterolaterally. Glabrous. *Elytra.*—Intervals moderately convex, densely and finely punctate, feebly rugulose, nitid. Anterior part of outer edge of last interval with a few short setae. Sutural interval raised posteriorly. Striae moderately impressed, with close-set medium-sized punctures slightly crenulating edge of intervals. *Legs.*—Fore tibiae not elongate, without apical brush of long setae, without inner apical tooth. *Abdomen.*—Pygidium irregularly and moderately densely punctate, with comparatively few oblique short setae on either side of midline, midline and apical area smoother, glabrous. Parameres with strong spatulate ventral projections.

*Female*

Head like that of male, but clypeus more strongly rugose. Clypeal margin sometimes very feebly bilobate. Pronotum with anterior declivity shorter, not marked posteriorly by transverse ridges, but contrastingly punctate as in minor male. Otherwise like male.

*Type*

Holotype of *discolor*: ♂, Port Essington, N.T., HM 460 2/2. Seen by the author.
Holotype of *viridiobscurus*: ♀, Raffles Bay, N.T., lost.
Holotype of *promptus*: ♀, Northern Australia, MNHN(Ob). Seen by the author.

*Remarks*

Blackburn (1903) correctly synonymized the three names mentioned above, although he believed *viridiobscurus* to be the oldest name. The types of *discolor* and *promptus* seen by the author are conspecific, and that of *viridiobscurus*, although it could not be found in MNHN, is obviously a female of the same species, judging by the description and figure given by Blanchard.

*Distribution* (Fig. 219)

Northern Cape York and the north coast of the Northern Territory, apparently confined to areas of 50 in. annual rainfall or more. In the vicinity of Darwin and on Melville I. the author found this to be a common species in cow, horse, and buffalo dung in open situations subject to partial shading, such as forest roads. One individual was found under a dead dog. It was also the only species collected on shaded sand dunes at the edge of the sea. It flies in the daytime.

*Material Examined*

The type and 88 specimens. QUEENSLAND: Somerset, Jan. 1875, d'Albertis, MNHN, 5. NORTHERN TERRITORY: 15–27 miles S. of Darwin, 29.i.1968, E. G. Matthews, ANIC, 6; Groote Eylandt, N. B. Tindale, SAM, 2; Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 32; Humpty Doo, 28–29.i.1968, E. G. Matthews, ANIC, 2; Lee Point, Darwin, 28.i.1968, E. G. Matthews, ANIC, 18; Melville I., Snake Bay, 4–6.ii.1968, E. G. Matthews, ANIC, 13; Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 10.

## 75. ONTHOPHAGUS PURPUREICOLLIS Macleay

(Figs. 222, 223, 554)

*Onthophagus purpureicollis* Macleay, 1864, p. 123; Harold, 1869, p. 82; Blackburn, 1903, p. 303; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

Fore body and pygidium violet, or black with violet or mauve reflections, elytra and most of underside black, last abdominal sternite and legs rufous, antennal clubs pale brown. Total length 6–8 mm.

*Male*

*Head.*–Clypeal margin evenly rounded, feebly bilobate and reflexed medially, genal margins rounded, not projecting. Clypeal suture finely carinate, the frontal section straight or very slightly procurved medially, curving into genal sections. Frons with 2 sharp transverse ridges well separated by a median depression. Eyes narrow, with about 6 facet rows across widest point, separated by about 20 widths, canthus almost complete. Clypeus feebly rugose, rest of head finely punctate, nitid, glabrous. Labium excised about one-third of way to base. *Pronotum.*–Anterior declivity gentle, not sharply delimited from rest of pronotum except medially, where there is a small oval depression delimited posteriorly by a U- or V-shaped ridge located at about middle of pronotum. Anterior angles quadrate. Hind edge very finely margined. Surface extremely finely and remotely punctate except near anterolateral angles, in median depression, and along anterior edge, where punctures are somewhat coarser. Surface between punctures smooth, very shiny. Glabrous. *Elytra.*–Intervals flat, moderately densely punctate with very small punctures, shiny, glabrous except for a group of short setae beneath humeri. Striae impressed, complete, simple, with very small punctures not crenulating intervals. *Legs.*–Fore tibiae not elongated, without apical brush

of long setae. *Abdomen.*–Pygidium irregularly punctate, rugose, shiny, with comparatively short bristles on either side of midline on basal half. Parameres with terminations spatulate when seen end-on.

*Female*

Head similar to that of male, but clypeal surface transversely rugose, margin less evidently bilobate. Both clypeal and frontal ridges stronger, less sharp, frontal ridges a little less separated. Anteromedian depression of pronotum smaller, more anterior, posteriorly delimited by a faint ridge only, absent in minor specimens. Otherwise like male.

*Type*

Holotype ♂, Port Denison (Bowen), Qld., MM. Seen by the author.

*Distribution* (Fig. 219)

Queensland, along the drier parts of the coast from the tropic to just west of Ravenshoe, westward to the Gulf of Carpentaria. Collected in savannah woodland with excrement bait.

*Material Examined*

The type and 18 specimens. QUEENSLAND: Ingham, Forrest Beach, 1.v.1964, G. F. Bornemissza, ANIC, 1; Mackay, 12.iii.1965, G. F. Bornemissza, ANIC, 3; 10 miles W. of Marlborough, 24.iii.1968, E. G. Matthews, ANIC, 1; Normanton, C. French, MNHN, 1; 11 miles W. of Paluma, 28.iv.1969, G. F. Bornemissza, ANIC, 8; 17 miles W. of Ravenshoe, 1.iv.1968, E. G. Matthews, ANIC, 1; Serpentine Lagoon via Yeppoon, 26.xi.1968, B. Cantrell, UQ, 1; Townsville, 17.xii.1967, ANIC, 1; Woodstock, 16.iii.1965, G. A. Yapp, ANIC, 1.

## 76. ONTHOPHAGUS AURITUS Erichson

(Figs. 224, 225, 555)

*Onthophagus auritus* Erichson, 1842, p. 156; Blanchard, 1853, p. 98; Harold, 1869, p. 81; Blackburn, 1903, p. 269; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 209.

*Onthophagus micans* Sturm, 1843, p. 107; Harold, 1867, p. 31.

*Onthophagus cereus* Hope, 1846, p. 146; Hope, 1847, p. 282; Harold, 1867, p. 31 (syn.).

*Onthophagus umbraculatus* Hombron and Jacquinot, 1853, Atl. t. 7, fig. 8; Harold, 1868*b*, p. 1026 (syn.).

*Onthophagus lucidicollis* Boheman, 1858, p. 45; Blackburn, 1903, p. 303 (syn.).

Black with a purple or green tinge, evident especially on frons and pronotum, never cupreous, elytra frequently dark maroon, pilosity very pale, antennal clubs yellow to almost black. Total length 6–11 mm.

*Male*

*Head.*–Clypeal margin prolonged medially, reflexed, forming a rounded point, genal angles unevenly rounded. Frontal section of clypeal suture almost straight, forming rounded angles with genal sections. Vertex extended backward into a broad bilobed lamina, each lobe terminating in an erect rounded point, the margin between lobes deeply excised in a V. In minor male these lobes are reduced to a pair of short erect triangular laminae near occiput, or in extreme cases a simple erect arcuate frontal carina. Eyes small, with about 8 facet rows across widest point, separated by about 20 widths, canthus just touching occipital edge. Edges of clypeus and genae shallowly,

transversely or obliquely rugose, rest of head smooth and very finely, sparsely punctate, shiny. Labium excised a little less than halfway to base. *Pronotum.*–Anterior declivity surmounted by 2 approximated, rounded tubercles continued downward to front margin to form a V- or heart-shaped tumosity in front view. Anterior angles quadrate, anterior margin with a second faint angulation near angle in some specimens. Hind edge finely margined. Impunctate on disc, becoming finely punctate inside anterior angles, on anterior declivity, and along all edges. The punctures cupreous in some lights. Surface between punctures smooth, extremely shiny. *Elytra.*–Intervals flat, smooth, very nitid, extremely finely punctate, glabrous except on last interval along epipleural edge, which bears long pale setae. Bases of all intervals except 1st and 5th swollen, middle of 7th and 8th also swollen. Striae simple, with deep round, medium-sized punctures at regular intervals. *Legs.*–Fore tibiae not elongate, without brush of long setae. *Abdomen.*–Pygidium not shagreened, nitid, very densely punctate, bearing a dense pilosity of long pale setae. Aedeagus normal.

*Female*

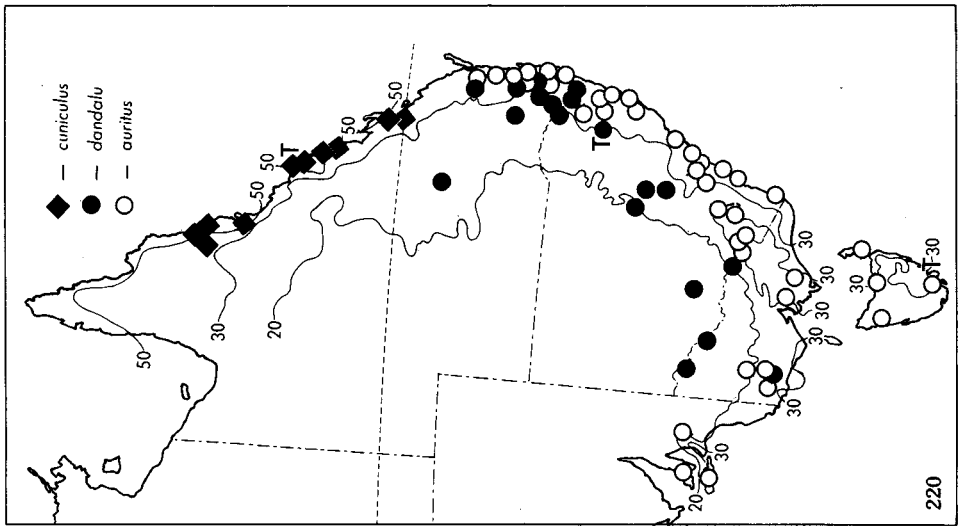
Clypeal margin not prolonged, evenly rounded. Clypeal and genal surfaces more strongly and entirely rugose. Clypeal suture more prominent. Frontal carina prominent, erect, transverse, arcuate or very feebly 3-pointed, in northern specimens feebly bilobate as in minor male. Median gibbosities of pronotum more prominent, flanked by depressions and in major female by another pair of low, lateral tumescences. Otherwise like male.

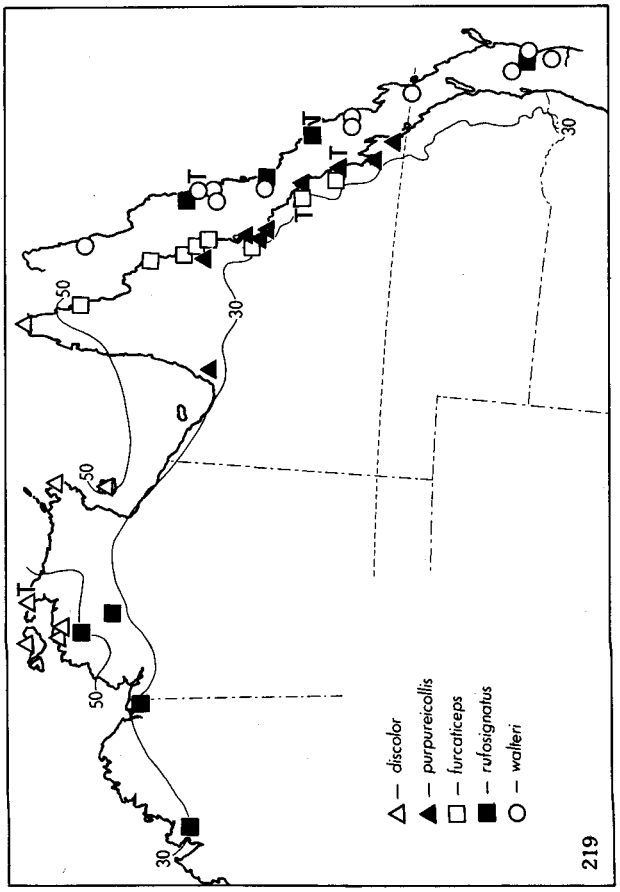
*Type*

Holotype of *auritus*: ♂, Van Diemen's Land, Schayer, ISZ 26878.
Holotype of *micans*: unknown.
Holotype of *lucidicollis*: ♀, Sydney, Waterhouse, NRM 260.
Holotype of *cereus*: Adelaide, lost.
Holotype of *umbraculatus*: ♂, Van Diemen's Land, MNHN (Gen).
All but *micans* and *cereus* seen by the author.

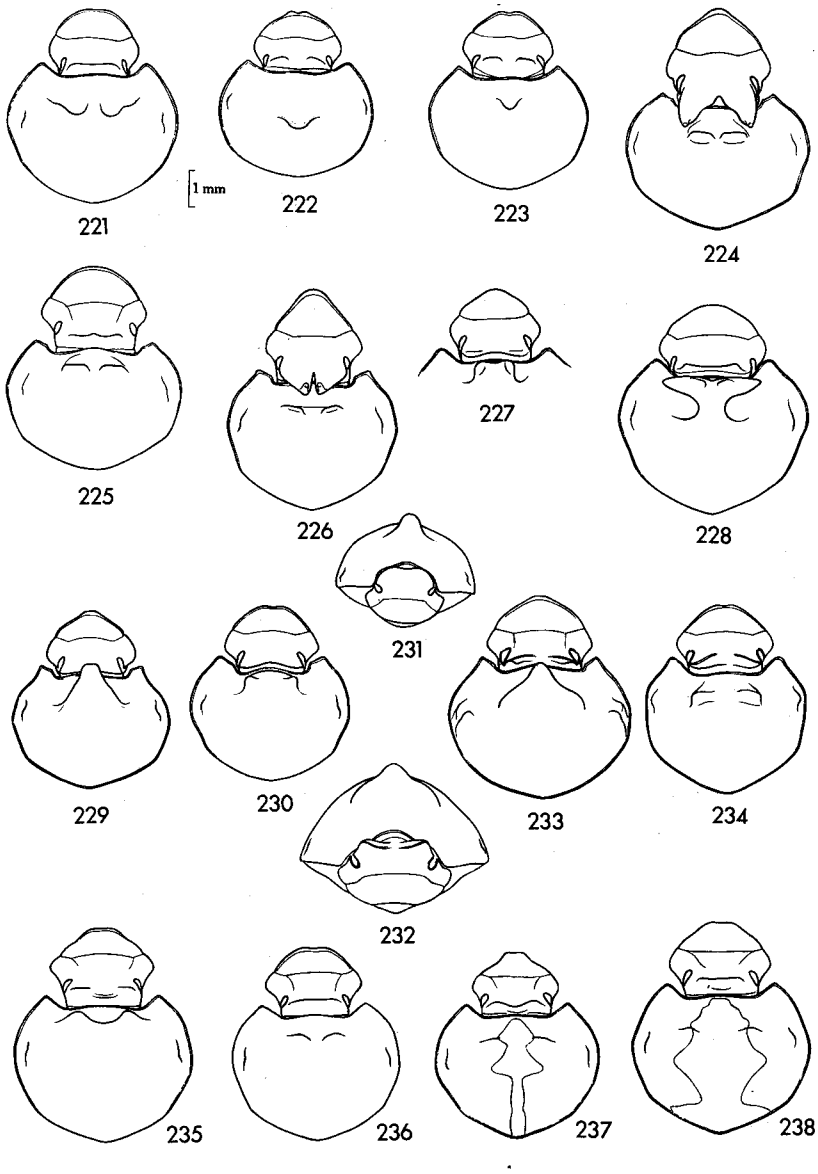
*Remarks*

Geographical variation occurs in the colour of the pronotum and of the antennal clubs, and to a certain extent in average size. In southern populations, from Victoria to about Mittagong, N.S.W., the pronotum is of a dark violet colour, thereafter it becomes increasingly green northward until specimens from northern New South Wales and the Brisbane area have the fore body entirely dark green. Along the coast the green tint extends further south, to the area of Bateman's Bay. Southern specimens also have black antennal clubs, which become grey and finally, in northern specimens, yellow. The transition in antennal club colour occurs further south than that of pronotal colour, since Mittagong specimens, while having violet fore bodies, have yellow antennae. The transition in this area occurs around Bargo, according to Dr. Bornemissza. In body size there is no step cline as in colour variation, but a peak of large size is reached at about the middle of the range, at Marulan, N.S.W., (average 5.3 mm in pronotal width), with progressively smaller-sized individuals to the north and south (4.7 mm at Boolarra, Vic., and 4.6 at Mt. Lindesay, Qld.). However, these size differences could be ecological, rather than geographic, and may depend on available




Figs. 219 and 220.–Known distribution of the *auritus* group in relation to annual rainfall (in.).




Figs. 221–238.–*Onthophagus* spp., fore body: *221*, *O. discolor*, male; *222*, *223*, *O. purpureicollis*: *222*, male; *223*, female; *224*, *225*, *O. auritus*: *224*, male; *225*, female; *226–228*, *O. furcaticeps*: *226*, male; *227*, minor female; *228*, major female; *229–231*, *O. cuniculus*: *229*, male; *230*, female; *231*, male, front view; *232–234*, *O. dandalu*: *232*, male, front view; *233*, male; *234*, female; *235*, *236*, *O. walteri*: *235*, male; *236*, female.
Figs. 237 and 238.–*Onthophagus rufosignatus*, fore body, outlines of pronotal colour pattern indicated: *237*, male; *238*, female.

food. The trends are not as clear-cut as in colour variation. Tasmanian individuals do not fit into the above pattern, being variable in pronotal colour (with green and violet individuals) and intermediate in antennal colour (grey) and size (4.9 mm at Kelso).

*Distribution* (Fig. 220)

Tasmania, the south-east of South Australia, Victoria, eastern New South Wales, and south Queensland to the Blackall Range north of Brisbane, in areas of 30 in. or more annual rainfall, primarily along the coasts but also occurring on the New England and southern tablelands and in the Snowy Mountains, where it was collected on Mt. Kosciusko between 5000 and 7000 ft by Dr. Darlington in December 1931.

In areas well shaded by vegetation, i.e. casuarina–eucalypt woodlands along the coast and sclerophyll forest in highland areas, in sand and loam. Coming predominantly to human excrement and mammal entrails, occasionally found under dead mammals, and one specimen recorded as coming to the male inflorescence of the cycad *Macrozamia*. From August to May throughout most of its range, from December to May in the north. Diurnal.

*Material Examined*

The types and 479 specimens. TASMANIA: Cape Barren I.; Interview R., N. Pieman R.; Kelso; Kingston; Montague Bay. SOUTH AUSTRALIA: Kangaroo I.; Nuriootpa; Yorketown. VICTORIA: Beaconsfield; Boolarra; Corryong; 3 miles S. of Cavendish; Eskdale; Hall's Gap; Hamilton; 3 miles N. of Morwell; Wannon; Yanakie. AUSTRALIAN CAPITAL TERRITORY: Blundell's Flat; Canberra. NEW SOUTH WALES: Ballengarra; Bargo; Bateman's Bay; Bronte; Chatsworth; Cronulla; Donaldson; Dorrigo (3000 ft); Durras Water; 17 miles S. of Eden; French's Forest; George's R.; Glenfield; Gosford; Guyra; Huskisson; Kendall, Burrawan State Forest; Kurnell; 13 miles N. of Marulan; Mascot; Mittagong; Mt. Kosciusko (5000–7000 ft); Murwillumbah; Peddy's R.; Scotts Head; Somersby; Sydney; Tabbimobile; Terrigal; Wahroonga; Wamberal; 17 miles S. of Woodburn; Woodenbong; Wyong; Yaouk. QUEENSLAND: Brisbane; Cunningham's Gap (2500–4000 ft); McPherson Range; Montville, Blackall Range (*c.* 2000 ft); Mt. Lindesay Forest; Tamborine Mountain; Tuchekol.

## 77. ONTHOPHAGUS FURCATICEPS Masters

(Figs. 226–228, 556)

*Onthophagus furcatus* Macleay, 1864 (non Fabricius, 1781), p. 121; Masters, 1886, p. 34 (syn.).

*Onthophagus furcaticeps* Masters, 1886, p. 34 (nom. nov.).

*Onthophagus froggatti* Macleay, 1887, p. 22; Blackburn, 1903, p. 302 (syn.).

*Onthophagus lobicollis* Macleay, 1888, p. 224; Blackburn, 1903, p. 302 (syn.).

Fore body black with green, greenish blue, or violet reflections, rest of body black or dark maroon, pilosity pale, antennal clubs flavous. Total length 7–10 mm.

*Male*

*Head.*—Clypeal margin medially fairly strongly prolonged into a rounded point, giving head a triangular appearance in major male, less or not prolonged in minor male, genal angles rounded. Frontal section of clypeal suture straight, forming moderate angles with genal sections. Vertex extended back into a bilobed lamina which is broad at base and narrowing apically, ending in a pair of long erect approximated processes which are bent forward, margin between lobes a long narrow slit. Eyes small,

with about 7 facet rows across widest point, separated by about 20 widths, canthus complete. Very finely punctate or impunctate, nitid, except edges, which are rugose. Glabrous. Labium excised a little less than one-third of way to base. *Pronotum.*– With a pair of approximated low tubercles in middle at top of anterior declivity, small and transverse in major male, prominent and oblique in minor one. Anterior angles quadrate. Hind edge finely margined. Extremely finely punctate, the punctures well separated, surface smooth, very nitid. Middle of anterior declivity, behind frontal lamina, with a patch of long setae in major male, glabrous in minor one. *Elytra.*– Intervals flat, smooth, very shiny, extremely finely punctate, edges fringed with long setae, dense laterally. Bases of 2nd, 3rd, and 4th intervals and humeri swollen, middle of 7th interval also swollen. Striae simple, superficial, almost effaced on disc, with small, moderately deep punctures at regular intervals. *Legs.*–Fore tibiae not elongate, without apical brush of long setae. *Abdomen.*–Pygidium nitid, very densely punctate, completely covered with long pilosity. Aedeagus normal.

*Female*

Clypeal margin not prolonged medially, head evenly rounded. Clypeal and genal surfaces more strongly and extensively rugose. Vertical carina extended into 2 broad low triangular crests or short points. Pronotum of minor female with a pair of small tubercles near front margin, in medium female with a median double lobe near front margin flanked by a pair of depressions, in major female with a large, transverse anvil-shaped process, the ends of which overhang a pair of concavities. Anterior surface of anvil with a group of long setae, absent in minor female. Otherwise like male.

*Types*

Holotype of *furcatus*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *froggatti*: ♂, Cairns, Qld., MM.
Holotype of *lobicollis*: ♀, Cairns, Qld., MM.
All seen by the author.

*Distribution* (Fig. 219)

The coast of Queensland from Mackay to the Cape York Peninsula, in open sclerophyll forest or in pastures, at human excrement. March–May. Diurnal.

*Material Examined*

The types and 48 specimens. QUEENSLAND: Bamboo Ck. via Miallo, N. of Mossman, 25.iv.1967, D. Colless, ANIC, 1; Cairns, Hacker, SAM, 1; Cairns, A. M. Lea, SAM, 1; Finch Hatton Ck., 27.iii.1968, E. G. Matthews, ANIC, 1; Gillie's Highway, 30.iii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 7; Iron Range, 28.iv.–10.v.1968, G. Monteith, UQ, 5; Little Mulgrave R., Hacker, SAM, 1; Mac Ivor R., French, MNHN, 1; Mossman Gorge, 3.iv.1968, E. G. Matthews, ANIC, 2; Palmerston National Park via Innisfail, 23.iv.1968, G. Monteith, UQ, 2; 9 miles E. and 8 and 11 miles W. of Paluma, 24.iv.1969, G. F. Bornemissza, ANIC, 26.

## 78. ONTHOPHAGUS CUNICULUS Macleay

(Figs. 229–231, 557)

*Onthophagus cuniculus* Macleay, 1864, p. 123; Harold, 1867, p. 35; Harold, 1869, p. 84; Blackburn, 1903, p. 269; Lea, 1923, p. 366; Boucomont and Gillet, 1927, p. 210.

Fore body coppery green or bronze, elytra black, underside and legs black with green reflections, antennal clubs flavous, pilosity pale. Total length 6–10 mm.

*Male*

*Head.*–Clypeal margin medially prolonged and reflexed, forming a rounded lobe in major male, less prominent in minor one, becoming feebly bilobate in smallest specimens, genal angles rounded. Frontal section of clypeal suture finely raised, arcuate or straight, forming rounded angles with genal sections. Frons extended backward into a very short, sinuate recumbent flap covering occipital margin only, not elevated laterally. Eyes small, with about 7 facet rows across widest point, separated by about 13 widths, canthus just touching occipital margin. Most of head finely punctate, very shiny, edges finely and obliquely rugulose. Labium excised about one-third of way to base. *Pronotum.*–With median, evenly tapering, upturned and dorsally flattened process terminating in a rounded, truncate, or feebly bilobate flattened point in major male, flanked by a pair of moderate depressions. In smaller males, the median process becomes shorter, more rounded, and increasingly bilobed. In minor male the process is represented by a pair of low well-separated tubercles as in minor female. Anterior angles prominent, rounded. Hind edge very finely margined. Surface extremely finely punctate, the punctures remote, surface smooth, extremely shiny. *Elytra.*–Intervals flat, smooth, very shiny, extremely finely punctate, glabrous except for anterior half of last interval, which bears numerous long upturned setae. Bases of 2nd, 3rd, and 4th intervals swollen, as are humeri and middle ot 6th and 7th intervals, sutural interval raised posteriorly. Striae superficial, almost effaced on disc, with large deep punctures set at regular intervals, crenulating margins of intervals. *Legs.*–Fore tibiae not elongated. *Abdomen.*–Pygidium extremely densely punctate and entirely covered with long dense pilosity. Parameres with points small, set near base.

*Female*

Clypeal margin not prolonged, evenly rounded. Clypeal and genal surfaces more strongly and extensively rugose, head more strongly punctate. Clypeal suture a little more elevated. Vertical carina as in male, forming a recumbent occipital flap with sinuate margin. Pronotum in major female with median projection consisting of a transverse quadrate lobe with elevated rounded corners and depressed centre, narrowing toward front margin to form a V in front view, flanked by a pair of small depressions. In minor individuals the corners become smaller and more remote, forming a pair of well-separated small tubercles in smallest specimens. Anterior part of pronotum a little more distinctly punctate. Otherwise like male.

*Type*

Holotype ♂, Port Denison (Bowen), Qld., MM. Seen by the author.

*Distribution* (Fig. 220)

The coast of Queensland from the tropic to the Atherton Tableland in areas of high rainfall (50 in. or more annually). One of two species collected on Middle Percy I., 40 miles off the coast near Mackay, by Mr. R. Huppatz. In open pastures and open savannah woodland, in sand or loam. Diurnal, coming to human excrement and cow dung, and particularly mammal entrails. From January to May.

*Material Examined*

The type and 523 specimens. QUEENSLAND: Atherton, 26.iii.1965, 7.iv.1969, G. F. Bornemissza, ANIC, 235; Belmont, 8 miles NW. of Rockhampton, 11.iii.1965, G. F. Bornemissza, ANIC, 1; Cairns, E. Allen, ANIC, 1; Cairns, Edge Hill, 12.v.1967, J. G. Brooks, ANIC, 2; Ingham, 1–3.v.1964, G. F. Bornemissza, ANIC, 57; Maalar, 15.viii.1967, R. J. Elder, ANIC, 2; Mackay, 12.iii.1965, G. F. Bornemissza, ANIC, 2; Malanda, 14.i.1944, K. R. Norris, ANIC, 3; Marmor, 10.iii.1965, G. F. Bornemissza, ANIC, 1; Middle Percy I., 6.i.1970, R. Huppatz, ANIC, 5; Mt. Spec, Jan. 1969, G. Brooks, GB, 1; Proserpine, 13.iii.1965, G. F. Bornemissza, ANIC, 1; 2–17 miles W. of Ravenshoe, 1.iv.1968, E. G. Matthews, ANIC, 11; Sarina, Lotus Ck., 12.iii.1965, G. F. Bornemissza, ANIC, 9; Yungaburra, 7.v.1964, 27.iii.1965, G. F. Bornemissza, ANIC, 199.

## 79. ONTHOPHAGUS DANDALU, sp. nov.

(Figs. 232–234, 558)

Fore body except clypeus green, rarely with cupreous reflections, rest of body and legs black, pilosity pale, antennal clubs flavous. Total length 6–9 mm.

*Male*

*Head.*—Clypeal margin medially prolonged and reflexed, forming a rounded lobe in major male, less prominent in minor one, becoming feebly bilobate in smallest specimens, genal angles rounded. Frontal section of clypeal suture finely raised, feebly arcuate or straight, forming rounded angles with genal sections. Vertical carina extended backward laterally to form a pair of very short flaps covering sides of occiput only, these flaps sometimes raised into a pair of small subquadrate lobes. Median portion of the carina curved forward obliquely to form a pair of low folds usually not meeting in middle, sometimes meeting to form an arcuate raised line, distinctly forward of occipital edge. Eyes small, with 6–8 facet rows across widest point, separated by 11 widths, canthus just touching occipital margin. Entirely densely and coarsely punctate, rugose on edges of clypeus and genae. Glabrous. Labium excised about one-third of way to base. *Pronotum.*—With median prow-like upturned process terminating in a conical point. This process not evenly tapering, widened laterally at base, with the sides somewhat concave. In medium male this process is rounded and slightly emarginate medially, in minor male it is reduced to a pair of transverse gibbosities. Anterior angles prominent, rounded. Hind edge very finely margined. Surface smooth, extremely shiny, glabrous. *Elytra.*—Intervals flat, smooth, very shiny, extremely finely punctate, glabrous except for anterior half of last interval, which bears numerous long upturned setae. Bases of 2nd, 3rd, and 4th intervals swollen, as are humeri and middle of 6th and 7th intervals, sutural interval raised posteriorly. Striae superficial, almost effaced on disc, with large deep punctures set at regular intervals, crenulating margins of intervals. *Legs.*—Front tibiae not elongated, without apical fringe of long setae. *Abdomen.*—Pygidium extremely densely punctate and entirely covered with long dense pilosity. Parameres with points small, set near base.

*Female*

Clypeus not prolonged or reflexed medially. Clypeal surface densely rugose, head a little more densely punctate. Vertical fold consisting of 2 oblique raised lines arising from slightly elevated posterior flaps and running obliquely toward middle, usually not meeting. Pronotal prominences consisting of a pair of prominent transverse

carinae, usually not meeting in middle but leaving only a small median depression between them. A pair of small depressions flanking prominences. Pronotum fairly densely and strongly punctate toward anterior margins, very finely punctate on disc. Otherwise like male.

*Type*

Holotype ♂, Moonbi, N.S.W., 13.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC.

*Remarks*

This species can easily be confused with *cuniculus*, which it closely resembles, but all available specimens can be distinguished on the basis of the characters given in couplet 6 of the key. Also, the two species appear to be allopatric, so that there is little occasion for doubt.

*Distribution* (Fig. 220)

Victoria, probably mostly in the north, through inland New South Wales west of the Great Dividing Range to the McPherson Range on the Queensland border, thereafter inland and northward to Carnarvon Gorge. Not known from coastal areas, where it appears to be replaced by *auritus*. In open areas. October–April.

*Material Examined*

The type and 168 specimens. VICTORIA: 7 miles S. of Hamilton, 11.iv.1951, P. B. Carne, ANIC, 1; Lake Hattah, NMV, 1; Piangil, 20.iv.1952, C. Oke, NMV, 3; Red Cliffs, Jan. 1937, F. E. Wilson, NMV, 3; Rutherglen, 3.ii.1950, J. H. Calaby, ANIC, 1. NEW SOUTH WALES: Brommagem Ck. via Dubbo, 1–15.iv.1962, M. and V. Gregg, AM, 1; Canowindra, Jan. 1956, F. E. Wilson, MCZ, NMV, 9; Cattle Camp Ck., 10 miles W. of Cangai, 5.xii.1965, G. A. Yapp, ANIC, 1; Clarence R., 29.viii.1884, Meyers, NMV, 2; Dandhara Ck., 30 miles W. of Grafton, 11.xi.1964, C. W. Frazier, UNE, 1; Darlington Pt., 13.xii.1966, G. F. Bornemissza, ANIC, 1; v. Dubbo, Oct. 1957, Darlingtons, MCZ, 17; Glenugie, 15 miles S. of Grafton, 10.xii.1965, G. A. Yapp, ANIC, 35; Grafton, 25.i.1959, F. Paul, ANIC, 2; Moonbi, 13.iv.1965, Bornemissza and Yapp, ANIC, 30; Sinclair's Lookout, Glenn Innes–Inverell Rd., 6.xii.1965, G. A. Yapp, ANIC, 1; Tamworth, 10.x.1960, M. Edwards, CNC, 1; 21 miles N. of Tenterfield, 6.xi.1965, G. A. Yapp, ANIC, 6; Wellington, W. W. Froggatt, ANIC, 2; Wellington, 1892, Sibbald, NMV, 1. QUEENSLAND: Amberley, 22.v.1969, Bornemissza and Utech, ANIC, 1; Ballandean, 13.iv.1965, G. F. Bornemissza, ANIC, 3; Brisbane, E. W. Ferguson, ANIC, 1; Canungra, 2.iv.1952, C. Oke, NMV, 2; Carnarvon Gorge, 9.iv.1965, G. F. Bornemissza, ANIC, 12; Elginvale State Forest via Wondai, 17.x.1967, R. A. Yule, UQ, 1; Gatton, 17.xii.1931, GB, 2; Gold Ck. via Brookfield, 6.ii.1963, B. V. Timms, UQ, 1; Gordonvale, 1922, W. C. Dormer, ANIC, 1; Lever's Plateau via Rathdowney, 12.iii.1966, R. A. I. Drew, UQ, 2; Milmerran, 25.vi.1926, J. Macqueen, ANIC, 1; Moolayember Dip, 60 miles N. of Injune, 10.iv.1965, G. F. Bornemissza, ANIC, 7; Mt. Lindesay Forest, 12.iv.1965, Bornemissza and Yapp, ANIC, 1; Palen Ck., 7.xii.1965, G. A. Yapp, ANIC, 5; Stanthorpe, von Wieldt, ANIC, 1; Stanthorpe, Feb. 1919, H. Jarvis, ANIC, UQ, 4; Toowoomba, NMV, 2; no exact locality, ANIC, 2.

## 80. ONTHOPHAGUS WALTERI Macleay

(Figs. 235, 236, 559)

*Onthophagus walteri* Macleay, 1887, p. 223; Blackburn, 1903, p. 270; Lea, 1923, p. 365; Boucomont and Gillet, 1927, p. 217.

Fore body except clypeus green or blue, or maroon with greenish reflections, elytra and rest of body and legs black, maroon, or rufous, antennal clubs flavous. Total length 7–10 mm.

*Male*

*Head.*–Clypeus transverse and reflexed, not appreciably produced, truncate medially, genal margins moderately projecting, subangulate, less so in minor male. Clypeal suture raised, forming a transverse feebly sinuate line across head. Frons with a feeble tumescence in middle, its posterior edge raised into a pair of transverse, rounded or pointed projections which are always separated by a median smooth area. Eyes small, with about 8 facet rows across widest point, separated by 20 widths, canthus incomplete or just touching occipital margin. Finely to moderately punctate, more densely so on sides of clypeus and genae. Labium shallowly emarginate. *Pronotum.*–Anteriorly with a pair of low transverse or conical projections well separated by a median depression. Pronotal surface concave beneath these projections, more so in major male. Some trace of these projections even in smallest male, as transverse carinae. Anterior angles quadrate. Hind edge finely margined. Extremely finely punctate, more distinctly so toward anterior angles, surface smooth, nitid, finely shagreened along anterior edge. Glabrous. *Elytra.*–Intervals feebly convex, finely punctate, nitid, with a dense fringe of setae along entire epipleural edge. Bases of 2nd, 3rd, and 4th intervals a little swollen, as are humeri and middle of 7th interval. Striae finely geminate, complete, impressed, with very small punctures not crenulating edges of intervals. *Legs.*–Fore tibiae with a fringe of setae on distal edge, not a tuft. *Abdomen.*–Pygidium finely shagreened, moderately punctate, with long setae issuing from most of surface but not as dense as in previous species. Aedeagus normal.

*Female*

Clypeal margin not strongly reflexed, very feebly bilobate in unworn specimens. Clypeus and genae coarsely punctate and rugose, rest of head finely punctate. Frontal carina forming a single transverse ridge, nearly straight in dorsal view but with sloping ends, well removed from occipital edge. Pronotum sculptured as in male, but with projections less prominent and sometimes almost disappearing, leaving a semicircular flattened or slightly concave area on front of pronotum, well delimited posteriorly by remnants of projections (somewhat resembling males of *discolor*). Fore tibiae without fringe of setae. Otherwise like male.

*Type*

Holotype ♂, Cairns, Qld., MM. Seen by the author.

*Distribution* (Fig. 219)

The entire coast of Queensland from south of Brisbane to the Cape York Peninsula, in open sclerophyll forest and sandy soil. Trapped with human excrement and mammal intestines. One specimen was found by the author in a fresh mushroom which was still standing. The beetle was tearing its way through the lamellae in the crown, pushing up against the surface skin from underneath (which caused it to be detected). Diurnal. December–May, with one record in September.

*Material Examined*

The type and 28 specimens. QUEENSLAND: Acacia Ridge, 26.ii.1966, I. D. Galloway, UQ, 1; Atherton, 26.iii.1965, G. F. Bornemissza, ANIC, 1; Brisbane, 2.ix.1960, J. McNamee, UQ, 1; Brisbane, 1.xii.1921, UQ, 1; Brisbane, R. Illidge, UQ, 1; Cairns, 1919, Jarvis, ANIC, 2; Cairns, F. P. Dodd, SAM, 1; Claudie R., 17.i.1964, NMV, 1; Finch Hatton Ck., 27.iii.1968, E. G. Matthews,

ANIC, 1; Iron Range, 28.iv.–4.v.1968, G. Monteith, UQ, 1; Kingaroy, 4.ii.1966, H. Ruscoe, UQ, 1; Kuranda, Feb. 1909, G. E. Bryant, BMNH, 1; Kuranda, Jan. 1953, G. Brooks, GB, 2; 23 miles W. of Mackay, 27.iii.1968, E. G. Matthews, ANIC, 3; Mareeba, Feb. 1954, G. Brooks, GB, 1; Mt. Spec, Jan., May 1968, G. Brooks, GB, 3; W. of Ravenshoe (*c.* 3000 ft), Feb. 1958, Darlingtons, MCZ, 1; Rockhampton, UQ, 1; St. Lucia, Dec. 1929, GB, 2; no exact locality, SAM, MNHN, 2.

## 81. ONTHOPHAGUS RUFOSIGNATUS Macleay

(Figs. 237, 238, 560)

*Onthophagus rufosignatus* Macleay, 1864, p. 122; Blackburn, 1903, p. 270; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

*Onthophagus kraatzi* Harold, 1880, p. 349; Gillet, 1925, p. 14 (syn.).

Head black or greenish black, prothorax red with a black or greenish black area of varying width along midline of pronotum, elytra black with the apices, except along sutural interval, red, rarely bases of 3rd and 4th intervals and humeri also red. Pygidium black or greenish black with white pilosity, underside black except most of femora and propleura, which are red. Total length 6–9 mm.

*Male*

*Head.*–Clypeus transverse, with an apical process which is strongly reflexed and subquadrate or feebly bilobate. Genal margins moderately projecting, rounded. Clypeal suture a little raised, frontal section straight, forming obtuse angles with genal sections. Frons slightly tumescent in middle, with a sinuate ridge posteriorly which is elevated laterally and depressed or almost effaced medially. Eyes small, with about 6 facet rows across widest point, separated by about 20 widths, canthus incomplete. Densely punctate, rugose on sides of clypeus and genae. Labium excised about one-third of way to base. *Pronotum.*–Anterior declivity with 2 very shallow depressions on either side of prominent midline, delimited above by a pair of low well-separated transverse ridges projecting slightly at inner ends in major specimens. Anterior angles quadrate. Hind edge finely margined. Very finely and densely punctate, a little more distinctly so along anterior edge, moderately shiny, glabrous. *Elytra.*–Intervals irregularly convex, impunctate, nitid, glabrous except for a few rows of pale setae along epipleural edges. Bases of 2nd, 3rd, and 4th intervals and humeri distinctly swollen, as are middle of 7th and 8th intervals. Sutural interval elevated posteriorly. Striae shallow, distinct at base of disc, elsewhere nearly effaced, marked by rows of well-spaced deep punctures which strongly crenulate margins of intervals. *Legs.*–Fore tibiae a little slender, with a concentration of setae apically forming a loose tuft over spur. *Abdomen.*–Pygidium densely punctate and rugose, with long dense pilosity. Aedeagus with ventral point prolonged.

*Female*

Middle of clypeus not reflexed, feebly bilobate. Clypeus a little longer, densely transversely rugose. Frons with a straight low transverse ridge slightly depressed in middle. Pronotum as in male. Fore tibiae stouter, without seta tuft. Otherwise like male.

*Types*

Holotype of *rufosignatus*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *kraatzi*: ♂, New Guinea, MNHN(Ob).
Both seen by the author.

*Distribution* (Fig. 219)

The coast of Queensland from near Brisbane to Mt. Carbine at least, apparently very rare or localized, westward to the Northern Territory and the Kimberley District of Western Australia, in the 30- to 50-in. annual rainfall band, and New Guinea. In open woodland with sandy soil. In the vicinity of Katherine, N.T., and Kununurra, W.A., the author collected series of specimens concentrated in small areas. Trapped with human excrement bait. January–March.

*Material Examined*

The types and 39 specimens. QUEENSLAND: Balgal Beach, near Paluma, 28.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 2; Blue Water Ck., 20 miles N. of Townsville, 17.iii.1965, G. F. Bornemissza, ANIC, 1; Caloundra, 20.i.1916, H. Hacker, QM, 1; Gordonvale, W. C. Dormer, QM, 2; Mt. Carbine, 5.i.1964, G. Monteith, UQ, 2; Mutarnee, 8 miles N. of Rollingstone, 14.iv.1969, G. F. Bornemissza, ANIC, 1; Tully, Mission Beach, 12.x.1969, R. J. Huppatz, ANIC, 2. NORTHERN TERRITORY: Burnside, 28.iii.1929, T. G. Campbell, ANIC, 1; 20 miles W. of Katherine, 9–10.ii.1968, E. G. Matthews, ANIC, 12. WESTERN AUSTRALIA: Kimberley, H. Davidson, ANIC, 1; King's Sound, Froggatt, ANIC, 2; King's Sound, E. W. Ferguson, ANIC, SAM, 2; 6 miles W. of Kununurra, 22.ii.1968, E. G. Matthews, ANIC, 9.

## XI. *The* LATRO *Group*

Eyes moderate to wide, with 7–9 or 15 facet rows across widest point, separated by 8 or 11–18 widths, canthus incomplete (except in *latro*). Labium very shallowly excised. Dorsal surfaces partly or entirely setose, pronotum with 3 tubercles in a transverse row in both sexes. Pygidium densely setose. Colour partly or entirely green, reddish, or yellowish except in *latro*, which is uniformly piceous or brown. Total length 6–9 mm.

Male with frontoclypeal suture carinate, vertex or frons with a pair of transverse projections or carinae. Fore tibiae not elongated, without distal brush of long setae. Female with single frontal carina or one divided into 2 as in male.

Six species: 82. *latro* Harold; 83. *signaticollis* Frey; 84. *endota*, sp. nov.; 85. *bambra*, sp. nov.; 86. *varianus* Lea; 87. *margaretensis* Blackburn.

Relationship to the *auritus* group is suggested by the metallic colours and long pygidial pilosity of most species of this group. *O. walteri* of the *auritus* group has the same shape and ornamentation of the head as in the present group and could be placed here, but it lacks the three pronotal tubercles which were selected as the principal feature of the *latro* group. Like the *dunningi* group, this group may be entirely mycetophagous, as *latro*, *endota*, *bambra*, and *varianus* have all been collected almost exclusively under mushrooms, while the food preferences of the other species are not known.

All are tropical species from the north of Australia and inhabitants of savannah or savannah woodland (the habitat of *signaticollis* is not known).

## KEY TO SPECIES OF THE *LATRO* GROUP

1. Entirely very strongly punctate and setose, disc of pronotum with very large setigerous punctures ..... 2
   Partly smooth and finely punctate, at least on disc of pronotum, which is smooth and glabrous ..... 3

2(1). Brown or black; eyes wide, with about 15 facet rows across; head entirely setose; both sexes with edge of head evenly curved. N. Qld., N. N.T. ..... 82. *latro* Harold
   Fore body with green reflections; eyes narrow, with 9 facet rows across; head with only a few setae behind frontal carina; male with edge of clypeus medially truncate and reflexed. N. Qld. ..... 83. *signaticollis* Frey

3(1). Entire pronotum, including front, glabrous; pronotum sometimes with large reddish patches on sides; elytra sometimes with reddish or orange patches at both bases and apices. N. N.T. ..... 84. *endota*, sp. nov.
   Front of pronotum, at least, with setigerous punctures; pronotum never with reddish patches; coloured patches on elytra, if present, confined to basal areas ..... 4

4(3). Head entirely glabrous; setigerous punctures of pronotum smaller and confined to areas near anterior and lateral margins, interrupted at middle of latter; setae of pygidium compound, reflecting silvery light; female with frontal carina divided into 2 ridges or points, as in male. N. N.T. ..... 85. *bambra*, sp. nov.
   Head with at least a few setae near eyes (sometimes absent in major male); setigerous punctures of pronotum large, covering all declivity, all of lateral, and part of posterior margins; setae of pygidium simple, yellowish; female with single transverse frontal carina ..... 5

5(4). Basal half of elytra with large yellow or reddish patches; setae of head confined to area near eyes, occasionally absent. N. Qld., N. N.T. ..... 86. *varianus* Lea
   Elytra entirely black or brown; most of frons with erect setae. N. W.A. ..... 87. *margaretensis* Blackburn

## 82. ONTHOPHAGUS LATRO Harold

(Figs. 240, 437, 561)

*Onthophagus latro* Harold, 1877, p. 74; Blackburn, 1903, p. 271; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 213.

Dark brown to piceous, antennal clubs fuscous, pilosity fuscous. Total length 8–9 mm.

*Male*

*Head.*—Clypeal margin evenly rounded, medially not truncate, bilobate, or reflexed. Genal margins rounded, not prominent. Frontal section of clypeal suture cariniform, evenly arcuate, often with a median tubercle, genal sections meeting it at an angle, not cariniform. Frons with a complete transverse carina between eyes, its ends raised into points or a pair of erect rounded lobes. Eyes wide, with about 15 facet rows across widest point, separated by about 10 widths, canthus complete. Clypeus transversely rugose, rest of head moderately punctate, entire head with numerous long fine erect setae (worn off in older individuals). Labium very shallowly emarginate. *Pronotum.*—More or less evenly convex, with a median anterior conical tumescence and a pair of lateral transverse tumescences set back from the median one, the surface slightly concave beneath lateral ones. All 3 projections indistinct but still visible in minor male. Anterior angles quadrate or subquadrate. Hind edge very finely

margined. Entire surface moderately densely and coarsely punctate, the punctures separated by 1–2 diameters, each puncture with an erect, moderately long, fine seta, worn down in older specimens. *Elytra.*–Intervals feebly convex, moderately densely punctate and with numerous moderately long, fine setae arranged in at least 2 rows on each interval. Striae geminate, superficial, nearly impunctate. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium densely punctate with large punctures and feebly rugose, with a dense vestiture of short setae. Points of parameres approximated to base.

*Female*

The single female available to the author does not differ externally from the males except in the frontoclypeal suture, which is more strongly elevated and medially produced into a prominent point.

*Type*

Holotype, Somerset, Qld., Jan. 1875, d'Albertis. Lost.

*Distribution* (Fig. 239)

The Cape York Peninsula from Cairns northward, one record at Hughenden, Qld., far inland to the south, islands of the Gulf of Carpentaria, and the Northern Territory north of the 30-in. isohyet.

Three of the four specimens collected by the author were in shaded groves in otherwise open savannah woodland, with moist stony or sandy soil, while one was in a dry open situation in gravelly soil. All four were collected under decaying mushrooms also being attacked by *endota* and *varianus*. None came to faecal traps set in the same areas.

*Material Examined*

Forty specimens. QUEENSLAND: Cairns, J. A. Anderson, QM, 2; Cairns, 16.ii.1934, GB, 1; Cape York Peninsula, 1968, F. Parker, ANIC, 1; Endeavour River, NMV, 2; Homestead, Silver Plains, 17.iii.1960, J. L. Wassell, ANIC, 1; Hughenden, 1925, Batchelor, QM, 1; Fresh Water Lake, 10 miles N. of Rocky R., via Coen, 17.xii.1964, G. Monteith, UQ, 1; Northcote, E. W. Ferguson, ANIC, NMV, 2; Mareeba, Nov. 1964, P. Macrisol, ANIC, 1; Mutchilba, Jan. 1933, A. D. Selby, NMV, 1. NORTHERN TERRITORY: Adelaide R., 30.i.1968, E. G. Matthews, ANIC, 1; Groote Eylandt, N. B. Tindale, UQ, QM, BMNH, AM, 9; Horn Islet, Sir Edward Pellew Group, 25–31.i.1968, B. Cantrell, UQ, 12; 20 miles W. and 28 miles S. of Katherine, 8–10.ii.1968, E. G. Matthews, ANIC, 3; Mataranka, 1.iii.1967, M. S. Upton, ANIC, 1; Port Darwin, SAM, 1.

## 83. ONTHOPHAGUS SIGNATICOLLIS Frey

(Figs. 241, 562)

*Onthophagus signaticollis* Frey, 1970, p. 150.

Fore body and pygidium green or bronze with green reflections, elytra, underside and legs brown or black, sometimes with green reflections, antennal clubs fuscous, pilosity yellowish or whitish. Total length 9–10 mm.

*Male*

*Head.*–Clypeal margin rhomboidal, middle part truncate or slightly bilobate and reflexed, genal margins rounded and strongly projecting. Clypeal suture cariniform for

its entire length, gently bisinuate. Frons with a pair of transverse pointed erect projections near eyes, separated by a flat area or joined by a low ridge. Eyes moderately narrow, with about 9 facet rows across widest point, separated by about 20 widths, canthus incomplete. Head unevenly punctate with punctures of different sizes, smallest on clypeus, irregularly rugose in middle of frons, nitid, glabrous except for a few setae on posterior surface of frontal projections. Labium very shallowly emarginate. *Pronotum.*–Anterior declivity feebly biconcave with a median vertical convex area, surmounted by 3 strong tubercles of which the middle one is highest and roundly conical, the lateral 2 transverse, each separated by small concave areas. Anterior angles rounded or subquadrate. Hind edge unmargined. Surface very strongly reticulate, with very large, close-set punctures each bearing an erect seta, only anterior concave areas just beneath lateral tubercles less strongly punctate and glabrous. *Elytra.*–Intervals moderately convex, very densely and coarsely punctate, with coarsely reticulate surface and numerous long erect setae. Striae simple, impressed, with numerous very small punctures. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium densely punctate with long, dense pilosity. Aedeagus normal.

*Female*

Clypeus more rounded, feebly bilobate, the apex not reflexed, the surface transversely rugose. Frons with a single, even, strong transverse carina, almost straight, bearing a few setae on both surfaces. Pronotum sculptured like that of male and otherwise like male.

*Type*

Holotype ♂, Endeavour River, Qld., NMV.

*Distribution* (Fig. 239)

Known only from two localities on the east coast of the Cape York Peninsula: Endeavour River at Cooktown, and Iron Range. Ecology unknown.

*Material Examined*

The type and four specimens. QUEENSLAND: Endeavour R., MM, NMV, 3; Iron Range, Jan. 1958, Darlingtons, MCZ, 1.

### 84. ONTHOPHAGUS ENDOTA, sp. nov.

(Figs. 242, 243, 563)

Fore body entirely green or green on disc and midline of pronotum, red on anterior half of sides, elytra black or maroon, with at least the humeri reddish, often entire bases and also apices reddish or orange, leaving only a transverse black fascia across middle of elytra. One specimen entirely orange. Underside black with reddish patches. Pilosity pale. Total length 5–8 mm.

*Male*

*Head.*–Clypeus transverse, margin medially a little prolonged and reflexed, with a short quadrate or feebly bilobate lobe. Genal margins projecting, rounded. Clypeal suture sharply raised, the frontal section evenly arcuate, only feebly angled with genal sections. Frons with a low tumescence in middle, somewhat depressed behind this, its posterior edge raised into 2 transverse well-separated triangular projections near eyes.

In minor male these projections are joined into a single transverse carina. Eyes small, with about 8 facet rows across widest point, separated by about 17 widths, canthus incomplete. Clypeus and genae densely punctate, the punctures large and in transverse rows, forming vermiculate rugosities, frons finely punctate, irregularly wrinkled. Labium very shallowly emarginate. *Pronotum.*–Anterior declivity biconcave, with a median incurved keel, surmounted by 3 lobes, of which middle one may be acute or rounded, the other 2 rounded. Anterior angles quadrate, the apices rounded. Hind edge finely margined. Extremely finely punctate on disc and sides, becoming a little more distinctly punctate, shagreened, and finely rugulose toward anterior margin. Surface smooth, very shiny, very finely shagreened on anterior declivity. Glabrous. *Elytra.*–Intervals feebly, unevenly convex, nitid, finely punctate, bases of 2nd, 3rd, and 4th intervals and humeri a little swollen, as are 7th and 8th intervals in middle. Sutural intervals raised for most of their length, bearing a row of setae along their outer edge at least posteriorly, some scattered setae on posterior part of 3rd and 5th intervals, last interval bearing several dense rows of setae along outer margin. Striae fine, impressed, with small punctures crenulating edges of intervals. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium nitid, very densely punctate and with long dense pilosity consisting of compound setae reflecting a silvery light. Aedeagus normal.

*Female*

Head shaped similarly to that of male, but middle of clypeal margin not prolonged and a little more bilobate. Frons with a single high straight transverse carina remote from occiput. Pronotum with 3 lobes, as in male, but these less prominent. Otherwise like male.

*Type*

Holotype ♂, 28 miles S. of Katherine, 8-10.ii.1968, E. G. Matthews, ANIC.

*Remarks*

Of the 25 specimens available, 12 have the fore body entirely green and the elytra either brown or slightly rufous at the bases and apices, 11 have red patches on the pronotum and orange bands at the bases and apices of the elytra (thus resembling *rufosignatus*), and two are almost entirely or entirely reddish orange in colour. There is no apparent correlation between colour pattern and geographical distribution.

*Distribution* (Fig. 239)

Known only from the vicinity of Adelaide River and Katherine, N.T., in a zone of about 30–50 in. of annual rainfall. It occurs together with *varianus* in this area under and in fresh or decaying mushrooms, in both shaded and open situations in sandy soil. One specimen was found in the daytime inside the crown of a standing mushroom, which it had apparently just begun to attack. This suggests that the beetles attack live mushrooms, and that when they are found under decaying mushrooms this probably means that they have been working for some time. Three specimens out of the 25 came to traps baited with human faeces, the rest were all collected under mushrooms.

*Material Examined*

The type and 24 specimens. NORTHERN TERRITORY: 10 miles N. of Adelaide River, 30.i.1968, E. G. Matthews, ANIC, 1; 20 miles W. and 28 miles S. of Katherine, 8–10.ii.1968, E. G. Matthews, ANIC, 23.

## 85. ONTHOPHAGUS BAMBRA, sp. nov.

(Figs. 244, 245, 564)

Fore body dark bluish green, rest of body and legs black or maroon, bases of elytra sometimes reddish, antennal clubs fulvous or flavous, pilosity silvery white. Total length 6–7 mm.

*Male*

*Head.*—Clypeus transverse, medially a little prolonged and sharply reflexed, distinctly bilobate. Genal margins projecting, rounded. Clypeal suture sharply raised, feebly sinuate across head. Frons with a tumescence in middle, the surface impressed behind this, posteriorly with a pair of low indistinct remote transverse processes not raised into points, separated by a flat area. Eyes small, with 7–8 facet rows across widest point, separated by about 13 widths, canthus incomplete. Clypeus and genae densely but indistinctly punctate, disc of head finely punctate, nitid, glabrous.

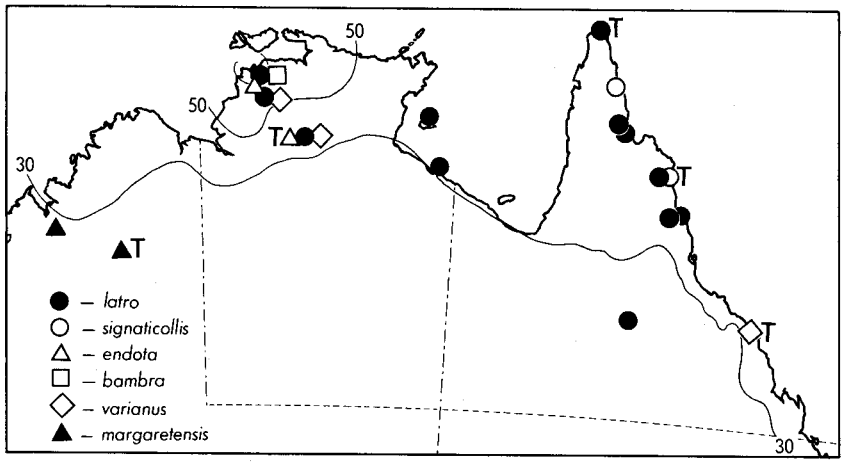
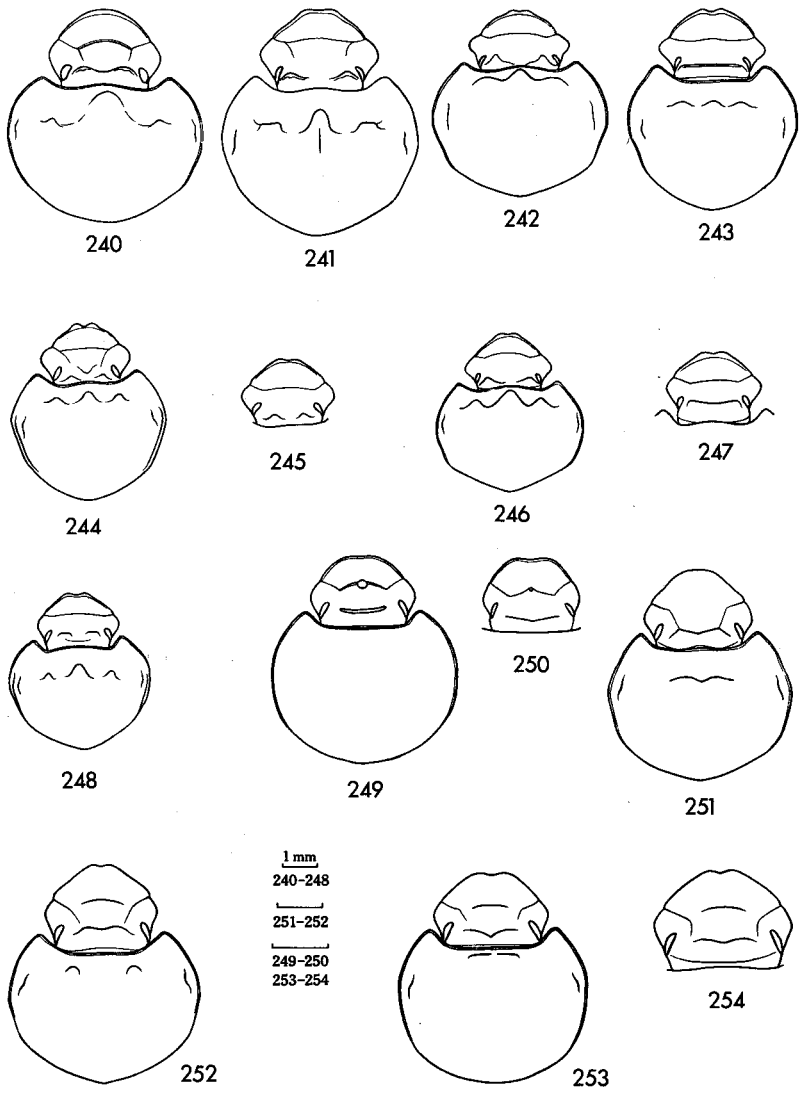



Fig. 239.—Known distribution of the *latro* group in relation to annual rainfall (in.).

Labium shallowly emarginate. *Pronotum.*—Anteriorly biconcave, vertical in major specimens, the concavities separated by an incurved median keel and surmounted by 3 tubercles, of which the middle one is a little more conical, the lateral ones rounded. Anterior angles quadrate, the apices rounded. Hind edge very finely margined. Extremely finely punctate, smooth and nitid on disc and sides, becoming more coarsely punctate, shagreened, and rugulose anteriorly, the anterior declivities, anterior angles, and anterior third or so of lateral edges bearing long setae. *Elytra.*—Intervals feebly and unevenly convex, smooth, nitid, finely to moderately punctate, the bases of all but 5th interval swollen, sutural interval raised posteriorly, with a row of short setae on posterior half, rows of setae also on 3rd, 5th, 7th, and 8th intervals, being densest on last (epipleural) interval and extending around posterior edges. Striae fine, impressed throughout, with numerous small punctures crenulating edges of intervals. *Legs.*—Fore tibiae not elongate, with a fringe of setae along distal edge. *Abdomen.*—Pygidium very densely and coarsely punctate, with long compound pilosity which reflects light when seen from above. Aedeagus normal.




Figs. 240–254.–*Onthophagus* spp.: *240*, *O. latro*, male fore body; *241*, *O. signaticollis*, male fore body; *242*, *243*, *O. endota*, fore body: *242*, male; *243*, female; *244*, *245*, *O. bambra*: *244*, male fore body; *245*, female head; *246*, *247*, *O. varianus*: *246*, male fore body; *247*, female head; *248*, *O. margaretensis*, male fore body; *249*, *250*, *O. geelongensis*: *249*, male fore body, New South Wales; *250*, female head, South Australia; *251*, *252*, *O. yiryoront*, fore body: *251*, male; *252*, female; *253*, *254*, *O. vilis*: *253*, male fore body; *254*, female head.

*Female*

Clypeal margin not medially prolonged or reflexed, the margin bilobate. Clypeal surface rugose. Frons with a pair of posterior erect transverse conical processes well separated by a flat area, replacing the usual frontal carina. Pronotum as in male, with the 3 tubercles a little less prominent. Fore tibiae without apical fringe of setae. Otherwise like male.

*Type*

Holotype ♂, Howard Springs, N.T., 27-29.ii.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 239)

All known specimens are from areas within a radius of about 50 miles from Darwin, in what is the highest rainfall zone of the Northern Territory (about 60 in. per year). They were found in open situations on clay loam or fine hard-packed sand, attacking fresh mushrooms. The beetles tear live mushrooms very rapidly into small pieces, using the forelegs, and bury the pieces in shallow burrows, working in the day time. They thus appear to have the same habits as *endota* and *varianus*, but the latter two species were not found in the Darwin area, first appearing near Adelaide River. This suggests that *bambra* replaces *endota* and *varianus* as a mushroom feeder in the wetter northern zone.

*Material Examined*

The type and six specimens. NORTHERN TERRITORY: Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 3; Humpty Doo, 28–29.i.1968, E. G. Matthews, ANIC, 2; Marrakai Station, 28–31.vii.1929, I. M. Mackerras and T. G. Campbell, ANIC, 1.

## 86. ONTHOPHAGUS VARIANUS Lea

(Figs. 246, 247, 438, 565)

*Onthophagus varianus* Lea, 1923, p. 377; Boucomont and Gillet, 1927, p. 216.

Fore body green or black with greenish reflections, elytra black with large yellow or reddish areas occupying most of basal half, pygidium and underside black or rufopiceous, antennal clubs fulvous. Total length 5-8 mm.

*Male*

*Head.*–Clypeus transverse, the apical margin moderately produced, strongly reflexed, subquadrate or feebly bilobate. Genal margins projecting, subangulate. Clypeal suture finely carinate, almost straight across head. Frons with a low tumescence in middle, a little depressed behind this, with 2 low transverse projections near occipital edge, these projections usually low rounded ridges or small raised lobes, separated by a median flat area. Eyes small, with about 7 facet rows across widest point, separated by about 17 widths, canthus incomplete. Shallowly and moderately densely punctate with large punctures, clypeus rugose in minor male. A few setae present near inner edge of eyes. Labium very shallowly emarginate. *Pronotum.*–Anterior declivity biconcave, medially with a vertical keel, surmounted by 3 approximated lobes, the middle one acute and larger, the lateral ones rounded. Anterior angles quadrate. Hind edge finely margined. Finely and moderately densely punctate on disc and sides, becoming very coarsely punctate toward anterior angles and on anterior declivity, these latter

areas with fairly dense, long setae, the setae also extending back along lateral and most of posterior margins, where they are smaller and inclined forward. Surface smooth on disc, shagreened on pilose areas. *Elytra.*–Intervals feebly convex, nitid, sometimes feebly rugose and finely punctate, the sutural, 3rd, 5th, 7th, and 8th intervals with rows of setae becoming denser laterally, bases of intervals not swollen, sutural interval raised posteriorly. First stria broadly geminate, successive ones more narrowly geminate, feebly punctate, the punctures crenulating margins of intervals. *Legs.*–Fore tibiae not slender, with a sparse fringe of long setae along distal margin. *Abdomen.*–Pygidium densely punctate, with long dense pilosity. Ventral points of parameres approximated to base.

*Female*

Clypeal margin not produced or reflexed, feebly bilobate. Clypeal surface densely vermiculately rugose, clypeal suture sharper, more angled laterally than in male. Frontal carina a single straight sharp transverse ridge, remote from occiput. Setae near inner edges of eyes usually more numerous. Pronotum as in male, but with gibbosities less prominent. Fore tibiae without apical fringe of setae. Otherwise like male.

*Type*

Holotype ♀, Bowen, Qld., SAM 15410. Seen by the author.

*Remarks*

*O. varianus* and *margaretensis* can be differentiated only on the basis of the characters mentioned in couplet 5 of the key, and it is likely that they represent morphs of a single species extending from Queensland to the Kimberleys. More material is needed to resolve this question.

In the series available, all of the specimens have extensive yellow areas at the bases of the elytra, usually extending about halfway along the sides, less along the middle. In one specimen the yellow area invades about two-thirds of the elytral surface. In another specimen, there is a pair of large reddish patches on the pronotum as in *endota*, however in *varianus* the apices of the elytra are never reddish as in that species.

*Distribution* (Fig. 239)

Known only from Bowen, Qld., and the north of the Northern Territory around Adelaide River and Katherine, where it was found together with *endota* and *latro* under mushrooms. All specimens were collected only under mushrooms in sandy or gravelly soil.

*Material Examined*

The type and 18 specimens. NORTHERN TERRITORY: Adelaide River, 30.i.1968, E. G. Matthews, ANIC, 5; 20 miles W. and 28 miles S. of Katherine, 8–10.ii.1968, E. G. Matthews, ANIC, 13.

## 87. ONTHOPHAGUS MARGARETENSIS Blackburn

(Figs. 248, 566)

*Onthophagus margaretensis* Blackburn, 1903, p. 299; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 213.

Fore body except clypeus dark bluish green, rest of body and legs black, antennal clubs flavous, pilosity yellowish. Total length 7 mm.

*Male*

*Head.*–Clypeal margin medially prolonged and bilobate, reflexed, sides straight to genal angles, which are rounded. Clypeal suture sharply carinate, forming a feebly sinuate line across head. Frons with a pair of well-separated transverse carinae between eyes, with a smooth flat area between them. Eyes small, with about 7 facet rows across widest point, separated by about 11 widths, canthus incomplete. Clypeus transversely rugose, rest of head irregularly punctate with very large punctures bearing long erect setae. Labium shallowly emarginate. *Pronotum.*–Anterior feebly biconcave, declivous, the concavities delimited posteriorly by 3 low gibbosities, of which the median is a little more anterior. Anterior angles quadrate. Hind edge unmargined. Anterior declivity and sides before foveae with very large punctures separated by about 1 diameter, bearing long erect setae. Somewhat smaller setigerous punctures invade anterior part of disc, sides, and more than half of posterior margin. Rest of disc very finely punctate, glabrous, nitid. *Elytra.*–Intervals moderately convex, finely and sparsely punctate, smooth, nitid. Odd-numbered intervals on disc with a single or double row of spaced-out long erect setae, intervals 6–8 becoming a little more densely and uniformly setose. Striae fine, with very small punctures not crenulating margins of intervals. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium densely and coarsely punctate, with long, very fine pilosity. Aedeagus with points small, set halfway.

*Female*

Clypeal margin not produced or reflexed, feebly bilobate. Frons with a single transverse carina. Otherwise like male.

*Type*

Holotype ♀, Margaret River, north W.A., SAM. Seen by the author.

*Distribution* (Fig. 239)

The western Kimberleys, W.A. Known only from two specimens. That collected by the author came to a trap baited with human faeces in moderately open woodland with sandy soil. However, the very close relationship between *margaretensis* and *varianus* (see remarks under the latter species) suggests that *margaretensis* may also be a mushroom feeder, since some of these species come to faecal traps occasionally.

*Material Examined*

The type and one specimen. WESTERN AUSTRALIA: 6–10 miles S. of Derby, 27.ii.1968, E. G. Matthews, ANIC, 1.

## XII. *The* VILIS *Group*

Eyes narrow, with 6–9 facet rows across widest point, separated by 12–14 widths, canthus incomplete or just touching occipital edge. Labium excised very shallowly to one-third of way to base. Dorsal surfaces densely setose, the setae short or long. Pygidium entirely densely setose. Colour pale brown, rufopiceous, or green. Total length 4–7 mm.

Male with frontoclypeal suture carinate or effaced; if the latter, then marked by an indistinct transverse ridge. Frons unarmed, with a low transverse carina. Pronotum unarmed or with low carinae or tubercles. Fore tibiae unmodified. Female ornamented as in male.

Three species: 88. *geelongensis* Blackburn; 89. *yiryoront*, sp. nov.; 90. *vilis* Harold.

This group may be artificial and was erected to receive three medium-sized uniformly setose species which could not easily be placed anywhere else. Little or nothing is known of their ecology.

KEY TO SPECIES OF THE *VILIS* GROUP

1. Colour green; middle of clypeal carina raised into a tubercle. S.A., Vic., S. N.S.W. ..... 88. *geelongensis* Blackburn
   Colour brown; middle of clypeal carina, if present, not raised into a tubercle ..... 2
2(1). Pilosity consisting of fairly long, semi-erect curved or hooked setae; pronotum with well-defined carinae or tubercles in both sexes; clypeal suture effaced in male. N. Qld. ..... 89. *yiryoront*, sp. nov.
   Pilosity consisting of short recumbent curved setae, usually reduced to stubble or microtrichia on dorsal surfaces; pronotum unarmed in both sexes or with ill-defined anterior flattened area in male; clypeal suture carinate but incomplete in both sexes. N. Qld. ..... 90. *vilis* Harold

## 88. ONTHOPHAGUS GEELONGENSIS Blackburn

(Figs. 249, 250, 567)

*Onthophagus geelongensis* Blackburn, 1891, p. 34; Blackburn, 1903, p. 271; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212.

*Onthophagus aureoviridanus* Blackburn, 1903, p. 289; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 209. New synonymy.

Green, including legs, or elytra may be rufous with green reflections, clypeus bronzed, antennal clubs fuscous, pilosity yellowish white. Total length 4–6 mm.

*Male*

*Head.*–Clypeus broadly bilobed, medially very shallowly emarginate. Clypeal suture complete, carinate, the frontal section straight, medially strongly elevated into a conical tubercle, genal sections forming obtuse angles with frontal. Vertex with an elevated transverse ridge feebly curved or bent back in middle, ending far from eyes. Eyes small, with 6–7 facet rows across widest point, separated by about 12 widths, canthus incomplete. Densely punctate with large punctures over all of head surface, each puncture with a very long, very fine, straight, erect seta, surface nitid. Labium excised about one-third of way to base. *Pronotum.*–Moderately convex, a little gibbous anteriorly in major male, unsculptured. Anterior angles subquadrate, the apices broadly rounded. Hind edge unmargined. Densely punctate with large round deep punctures separated by about 1 diameter on disc, denser on sides, leaving a bead beneath lateral fossae and, in some specimens, an anterior longitudinal raised median line, impunctate. Each puncture with a very long, very fine erect seta. *Elytra.*–Intervals subcostate, each interval smooth and nitid along middle, along each side rugose with a closely-spaced row of large punctures which in some individuals encroach more or

less into the middle, especially on anterior part of discal intervals. Each puncture with a very long, erect, straight, very fine seta. Striae impressed, geminate, with deep transverse punctures crenulating edges of intervals. *Legs.*–Fore tibiae unmodified, claws long. *Abdomen.*–Pygidium convex, nitid, densely punctate with large round punctures bearing very long, straight, erect, fine setae. Parameres tapering, without process, ends chisel-shaped.

*Female*

Does not differ externally from the male.

*Types*

Holotype of *geelongensis*: ♂, Geelong, Vic., SAM.

Holotype of *aureoviridanus*: ♂, South Australia (specimen labelled "NWA"), Blackburn, BMNH.

Both seen by the author.

*Remarks*

South Australian specimens, named *aureoviridanus* by Blackburn, have darker elytra, the clypeal margin is more bilobate (Fig. 250), the clypeal tubercle is sharper, the suture on either side less carinate, the frontal carina more recurved and finer, and the dorsal surfaces more sparsely punctate than in specimens from other states. This is particularly noticeable on the elytra, where the number of punctures (and therefore setae) on one side of the third interval is 11–12, while in Victorian and New South Wales specimens it is 18–24. In the author's opinion, these differences are of the sort associated with intraspecific geographical variation, and the two forms are therefore synonymized here. If future studies based on more abundant material reveal that two species are involved, then the name *aureoviridanus* is available.

*Distribution* (Fig. 255)

The south-east of South Australia, Victoria, and southern New South Wales along the 20-in. isohyet. Collected by Dr. Bornemissza and Mr. Ferrar under cow dung in moist sandy loam in a *Callitris* association west of Wagga, N.S.W.

*Material Examined*

The types and 12 specimens. SOUTH AUSTRALIA: Mt. Lofty Ranges, A. H. Elston, AM, 1; Murray Bridge, Sept. 1957, Darlingtons, MCZ, 2. VICTORIA: Bellarine, Nov. 1924, E. Nye, BMNH, 1; no exact locality, NMV, 4. NEW SOUTH WALES: Grenfell, E. W. Ferguson, ANIC, 1; 22 miles N. of Wagga, 12.xii.1966, G. F. Bornemissza and P. Ferrar, ANIC, 3.

## 89. ONTHOPHAGUS YIRYORONT, sp. nov.

(Figs. 251, 252, 568)

Fulvous to flavous, antennal clubs flavous. Total length 7 mm.

*Male*

*Head.*–Clypeal margin medially produced into a broad rounded lobe and sharply reflexed, laterally nearly straight, slightly expanded before genal sutures, genal angles subangulate, not prominent. Clypeal suture effaced, marked by a feeble transverse fold, genal sections indistinct. Vertex with a low transverse carina feebly bent back in

middle, slightly raised at the ends, which are far from eyes. Eyes small, with 8–9 facet rows across widest point, separated by about 13 widths, canthus just touching occipital margin. Densely punctate and subasperate on clypeus and genae, nitid, frons and vertex shagreened, sericeous, extremely finely punctate. Clypeus, genae, and area above eyes with several long thin setae. Labium very short, shallowly emarginate, 3rd palpal segment very small. *Pronotum.*–With a produced, bordered transverse double lobe anteriorly, the surface concave beneath it. Anterior angles subquadrate, the apices rounded. Hind edge unmargined. Densely punctate with medium-sized, ill-defined punctures separated by less than 1 diameter, each puncture with a fine, fairly long, semi-erect, curved or hooked seta forming a fine pilosity over entire pronotum except just below anterior ridges. Surface very finely shagreened, matt along base, alutaceous elsewhere. *Elytra.*–Intervals flat, shagreened, matt, with numerous small granules in 2 or 3 rows down interval, a long, fine, erect, curved or hooked seta emerging from behind each granule, forming a dense pilosity over entire elytral surface. Striae superficial, finely geminate, shiny, with numerous extremely small punctures. *Legs.*–Fore tibiae unmodified. Claws small. *Abdomen.*–Pygidium shagreened, sericeous, with numerous small shallow punctures bearing long erect hooked setae covering entire pygidium. Parameres expanded apically, subquadrate, the points small.

*Female*

Clypeal margin medially with less prominent lobe, feebly bilobate but still strongly reflexed. Frontoclypeal suture present, carinate, set on a median tumescence, not complete to genal sutures. Frontal carina as in male but a little higher. Pronotum with a pair of prominent well-separated tubercles anteriorly. Otherwise like male.

*Type*

Holotype ♂, 9 miles E. of El Arish, Qld., 7.iii.1964, I. F. B. Common and M. S. Upton, ANIC.

*Distribution* (Fig. 255)

Collected by Dr. Common and Mr. Upton at Mission Beach east of El Arish in north Queensland either on the edge of the sea or a mile inland in rain forest at light. Known also from Cairns without exact data.

*Material Examined*

The type and two specimens. QUEENSLAND: Cairns, MM, 1; 9 miles E. of El Arish, 7.iii.1964, I. F. B. Common and M. S. Upton, ANIC, 1.

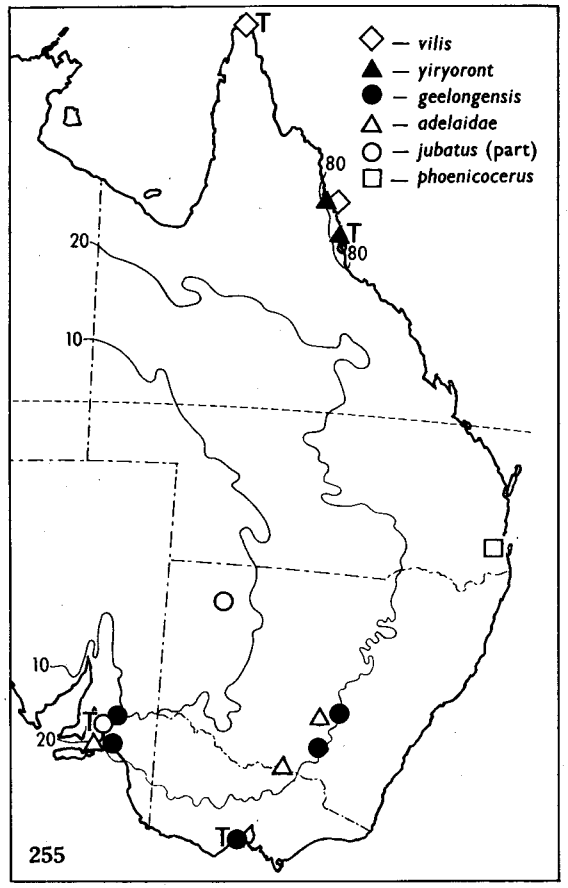
## 90. ONTHOPHAGUS VILIS Harold

(Figs. 253, 254, 569)

*Onthophagus vilis* Harold, 1877, p. 75; Blackburn, 1903, p. 302; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 217.

*Onthophagus microtrichius* Lea, 1923, p. 381; Boucomont and Gillet, 1927, p. 213. New synonymy.

Rufopiceous, legs rufous, antennal clubs flavous. Total length 5.5–7.0 mm.



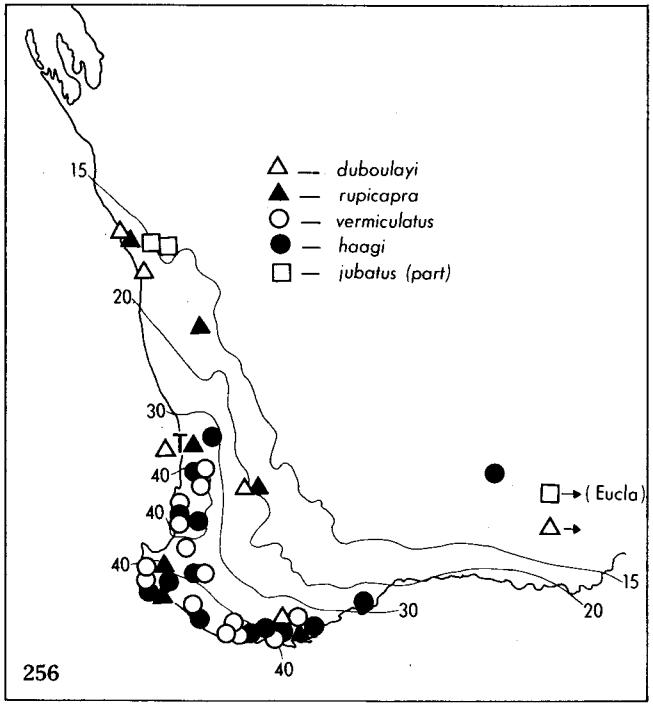
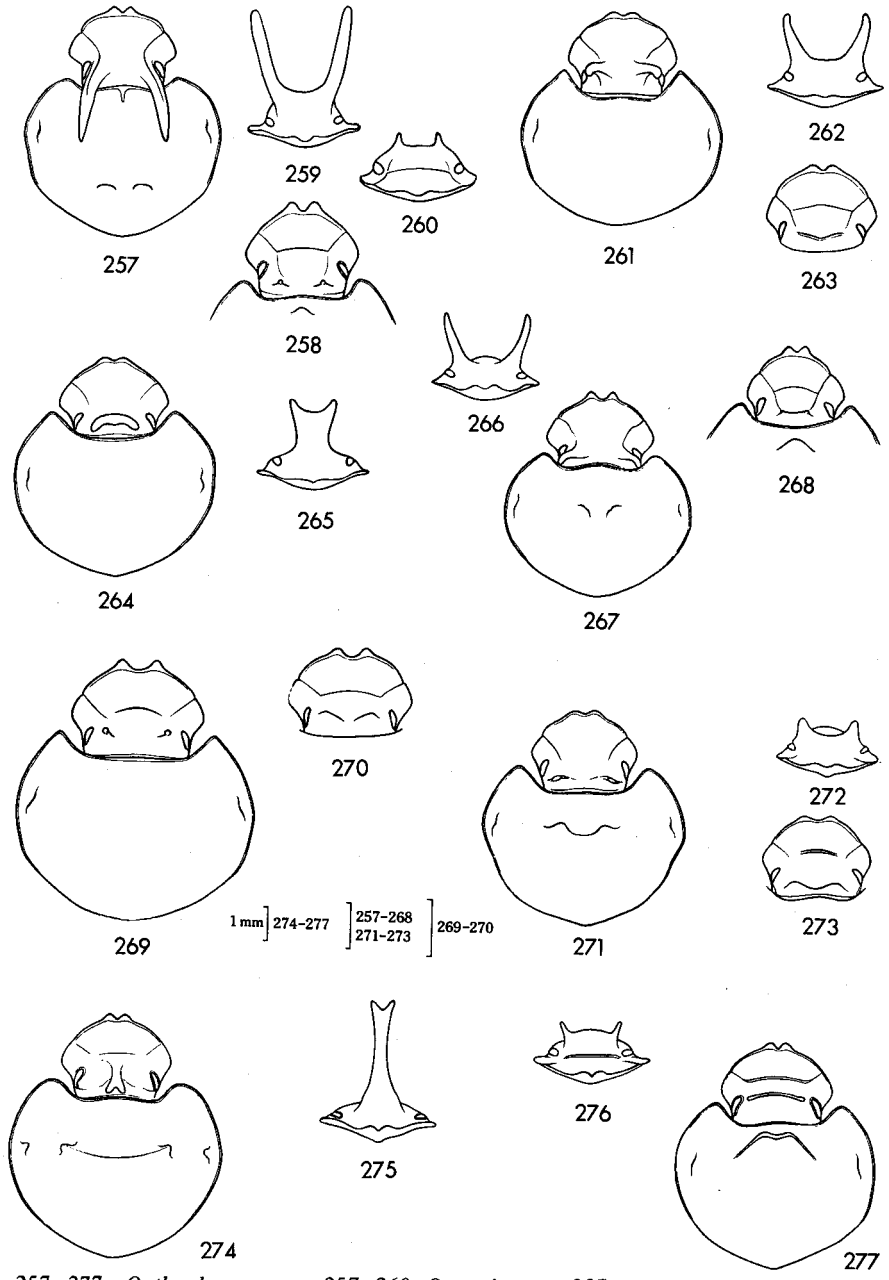




Fig. 255.–Known distribution of the *vilis* group and part of the *adelaidae* group in relation to annual rainfall (in.).
Fig. 256.–Known distribution of the rest of the *adelaidae* group in relation to annual rainfall (in.).




Figs. 257–277.–*Onthophagus* spp.: *257–260*, *O. rupicapra*: *257*, male fore body; *258*, female fore body; *259*, male head, front view; *260*, female head, front view; *261–263*, *O. adelaidae*: *261*, male fore body; *262*, male head, front view; *263*, female head; *264*, *265*, *O. phoenicocerus*, male: *264*, fore body; *265*, head, front view; *266–268*, *O. duboulayi*: *266*, male head, front view; *267*, male fore body; *268*, female fore body; *269*, *270*, *O. jubatus*: *269*, male fore body; *270*, female head; *271–273*, *O. vermiculatus*: *271*, male fore body; *272*, male head, front view; *273*, female head; *274–277*, *O. haagi*: *274*, male fore body; *275*, male head, front view; *276*, female head, front view; *277*, female fore body.

*Male*

*Head.*–Margin evenly rounded, feebly reflexed, very finely margined, middle of clypeus very feebly emarginate, genal angles rounded, not prominent. Clypeal suture with frontal section effaced laterally, medially represented by a fine transverse carina set on a distinct median tumescence. Frons with a fine transverse or open-V-shaped raised line, difficult to see, not reaching eyes and with a small interruption in middle in 1 specimen, complete in the other. Eyes small, with 6–8 facet rows across widest point, separated by about 14 widths, canthus incomplete. Clypeus and genae densely punctate with transverse punctures, frons before carina a little more finely punctate, behind carina very finely punctate, almost impunctate, punctures with extremely short setae, appearing glabrous. Labium short, shallowly excised. *Pronotum.*–With a pair of approximated flattened areas near front margin, the surface vertical beneath them in major male, minor male with surface evenly, feebly convex and unsculptured. Anterior angles quadrate, the apices angulate. Hind edge finely margined. Fairly densely punctate with medium-sized round umbilical punctures separated by 1–2 diameters, each puncture with a short seta, extremely short on disc (perhaps worn), longer, recumbent, and curved on sides and front. Surface very finely rugulose or smooth, alutaceous or nitid. *Elytra.*–Intervals feebly convex, irregularly rugose, nitid, densely punctate with small punctures, each puncture with a short seta, very short on disc (perhaps worn), longer toward apices and sides where there is a dense vestiture of short, recumbent, strongly curved setae. Striae impressed, simple, with closely-spaced small deep punctures scarcely wider than stria and a little transverse. *Legs.*–Fore tibiae unmodified. Claws small. *Abdomen.*–Pygidium finely rugulose, matt, densely punctate with small shallow punctures bearing short, curved, recumbent setae covering all of pygidium. Parameres broadened apically, subquadrate, the points small.

*Female*

Clypeal margin medially slightly bidentate, head otherwise as in male, with strongly raised, incomplete frontoclypeal suture and an open-V-shaped line on frons. Otherwise as in male.

*Types*

Holotype of *vilis*: ♂, Somerset, Qld., Jan. 1875, d'Albertis, MNHN(Ob).
Holotype of *microtrichius*: ♂, Cape York, H. Elgner, SAM I.3783.
Both seen by the author.

*Distribution* (Fig. 255)

Cape York, Qld., from the tip southward as far as Cairns. Habitat and food habits unknown.

*Material Examined*

The types and four specimens. QUEENSLAND: Cairns, SAM, 1; Cape York, SAM, 2; Somerset, Jan. 1875, d'Albertis, MNHN(Ob), 1.

## XIII. *The* ADELAIDAE *Group*

Eyes narrow to moderate, with 3–8 facet rows across widest point, separated by 11–17 widths, canthus variable. Labium excised very shallowly to one-third of way to base. Pronotum usually rugose, granulate, or reticulate, strongly shagreened in

*duboulayi*, densely punctate with deep punctures in *jubatus*, with dense pubescence of short or long setae (very short in *haagi*). Elytra shagreened, dull, with numerous short setae on all intervals, usually granulate, asperate, or costate, in *jubatus* nitid and with uneven surfaces. Pygidium with numerous short setae. Colour grey, black, or bronzed, elytra rufopiceous in *jubatus*. Total length 5–10 mm.

Male with frontoclypeal suture effaced (present medially only in some *jubatus*), with 1 or 2 horns or other projections on frons or vertex, pronotum variable. Fore tibiae variable. Female with transverse carina or crest on frons. Pronotum variable.

Seven species: 91. *rupicapra* Waterhouse; 92. *adelaidae* Hope; 93. *phoenicocerus* Lea; 94. *duboulayi* Waterhouse; 95. *jubatus* Harold; 96. *vermiculatus* Frey; 97. *haagi* Harold.

A group of loosely related species with a basically southern distribution. Four (*rupicapra*, *duboulayi*, *vermiculatus*, and *haagi*) occur in south Western Australia, while the other three (*adelaidae*, *phoenicocerus*, and *jubatus*) occur in south-eastern Australia, with *jubatus* also extending northward and westward to Western Australia. *O. vermiculatus* is a forest species, the remainder probably all inhabit open areas.

## KEY TO SPECIES OF THE *ADELAIDAE* GROUP

1. Elytral intervals flat or unevenly convex, with very small granules or none, without rows of raised lines ..... 2
   Elytral intervals with a median row of prominent shiny raised lines or beads ..... 6

2(1). Head and pronotum covered with conspicuous shiny granules; elytral striae impunctate; major male with very long recurved frontal horns and a pair of small transverse ridges near hind margin of pronotum. S. W.A. ..... 91. *rupicapra* Waterhouse
   Without a granular surface; elytral striae punctate; major male with shorter horns which are not recurved and without posterior pronotal ridges ..... 3

3(2). Pronotal surface very densely reticulate, anterior angles acute ..... 4
   Punctures of pronotal surface more widely spaced, anterior angles rounded or quadrate..... 5

4(3). Male with a pair of divergent horns on vertex; head surface rugose; head and pronotum densely setose. SE. S.A., N.S.W., S. Qld. ..... 92. *adelaidae* Hope
   Male with a single bifurcate horn on vertex; head rugose only on genae; head and pronotum with only a few setae. S. Qld. ..... 93. *phoenicocerus* Lea

5(3). Surfaces strongly shagreened, matt, with bronze reflections; pronotal punctures sometimes of 2 sizes; elytral intervals flat; male with frontoclypeal suture completely effaced; female with arcuate frontal carina laterally raised into small points. S. W.A. ..... 94. *duboulayi* Waterhouse
   Surfaces nitid; fore body black, elytra rufopiceous; pronotal punctures all large and deep; elytral intervals convex, with uneven surface; male with frontoclypeal suture at least partly carinate; female with a pair of oblique ridges on frons. S.A., W. N.S.W., N. W.A., S. W.A. ..... 95. *jubatus* Harold

6(1). Upper surface bronzed, sometimes with green reflections, densely pubescent on pronotum with some setae on head; anterior angles quadrate, pronotum without prominent projections; major male with fore tibiae elongated, and 2 very short transverse horns on vertex. S. W.A. ..... 96. *vermiculatus* Frey
   Entirely black, pronotal pubescence difficult to see, head glabrous; anterior angles broadly rounded, pronotum with projections in major individuals of both sexes; major male with fore tibia unmodified, with a single very long, slender bifurcate horn on frons. S. W.A. ..... 97. *haagi* Harold

## 91. ONTHOPHAGUS RUPICAPRA Waterhouse

(Figs. 257-260, 570)

*Onthophagus rupicapra* Waterhouse, 1894, p. 11; Blackburn, 1903, p. 301; Lea, 1923, p. 355 (as *ruficapra*); Boucomont and Gillet, 1927, p. 216.

*Onthophagus granicollis* Lea, 1924, p. 284; Boucomont and Gillet, 1927, p. 212. New synonymy.

Grey, legs rufopiceous, antennal clubs fuscous. Total length 5.5-8.0 mm.

*Male*

*Head.*—Clypeus foreshortened, clypeal margin medially with 2 approximated angular teeth, small on major individuals. Margin a little expanded at clypeogenal sutures, genal angles rounded, prominent. Clypeal suture with frontal section entirely effaced, genal sections raised, oblique. Frons of major male with a pair of very large, strongly recurved caprine horns emerging near eyes, the surface between them flat. Minor male with the horns vertical and short, erect, sharply conical. Eyes moderate, with 6-8 facet rows across widest point, separated by about 11 widths, canthus complete. Nitid, edges of clypeus and genae rugulose, moderately punctate, frons covered with evenly spaced, large granules, punctures and granules giving rise to long, erect setae. Labium shallowly emarginate. *Pronotum.*—Major male with a long declivity occupying anterior two-thirds of pronotum, the declivity not sharply defined, rounding into disc and sides, its apex surmounted by a pair of approximated sharp transverse ridges which are located on posterior third of midline. Minor male with pronotum much less convex, with the ridges reduced to a pair of indistinct tumescences on either side of midline, and a short prominent rounded transverse median ridge near anterior margin. Anterior angles very broadly rounded, anterior margin sometimes extended inward (backward) into a median point. Hind edge strongly margined. Shagreened, dull, with large rivet-like granules set at regular intervals, each granule giving rise to a very long, erect seta. *Elytra.*—Intervals feebly convex, shagreened, dull, with a double row of small, slightly asperate punctures bearing short erect setae, sutural interval with only 1 row, last interval with many. Striae feebly impressed, very narrowly geminate, impunctate. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium shagreened, with very small, sparse punctures bearing short fine setae. Aedeagus normal.

*Female*

Median lobes of clypeal margin more produced and rounded, clypeal and genal surfaces asperate, frons more densely granulate, vertex as in minor male, with a pair of short erect conical horns. Pronotum as in minor male, with a small shiny transverse ridge on midline near anterior margin, the surface a little concave behind it, granules denser. Otherwise like male.

*Types*

Holotype of *rupicapra*: ♂, Swan River, W.A., BMNH.
Holotype of *granicollis*: ♀, Mt. Barker, W.A., S. Macsorley, SAM.
Both seen by the author.

*Remarks*

Although sharing all important features of form and texture, the minor males and females are ornamented in a very different manner from the major males, and this is

probably why Lea did not associate his *granicollis* (a female which he believed to be a male) with *rupicapra*, described from the major male.

*Distribution* (Fig. 256)

The south-west of Western Australia, primarily between the 15- and 35-in. isohyets. Habitat and food preferences unknown.

*Material Examined*

The types and 13 specimens. WESTERN AUSTRALIA: Augusta, 15.iv.1935, M. F. Hall, WAM, 1; Geraldton, L. J. Newman, WADA, 1; Great Northern Highway, 162-mile post, near Coorow, 14.viii.1955, J. A. L. Watson, WADA, 1; Margaret R. district, 23.vii.1914, L. Glauert, WAM, 1; King George's Sound, ex mus. H. W. Bates, MNHN(Ob), 3; Tutaning, near Pingelly, 32°32′S., 117°05′E., 18.vii.1969, B. Y. Main, ANIC, 2; no exact locality, ex mus. H. W. Bates, MNHN(Ob), 1, ex mus. van Lansberge, MNHN(Ob), 1, Du Boulay, BMNH, 2.

## 92. ONTHOPHAGUS ADELAIDAE Hope

(Figs. 261-263, 571)

*Onthophagus adelaidae* Hope, 1846, p. 146; Hope, 1847, p. 282; Blackburn, 1903, p. 270; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 208.

*Onthophagus hostilis* Harold, 1869, p. 81; Blackburn, 1892, p. 283 (syn.).

Dark grey, antennal clubs fuscous, underside and legs rufopiceous. Total length 5-7 mm.

*Male*

*Head.*—Clypeal margin feebly bidentate medially in major male, more strongly so in minor one, the teeth approximated, subangulate. Rest of head margin a little expanded at clypeogenal sutures, genal angles rounded, not prominent. Clypeal suture with frontal section entirely effaced, genal sections oblique, feebly raised. Frons of major male with a pair of erect strong divergent horns which are slightly curved back apically, set near eyes, the surface between them flat. Minor male with the horns reduced to a pair of small conical projections joined by an indistinct ridge effaced in middle. Eyes narrow, with 6-8 facet rows across widest point, separated by about 12 widths, canthus complete. Very densely and strongly rugose, with numerous punctures each bearing a long erect seta, setae sparsest on genae, densest and longest on frons and along anterior basal half or so of head horns. Labium shallowly excised. *Pronotum.*—Unsculptured, but somewhat flattened anteriorly and strongly convex in major male. Anterior angles acute, the apices angulate. Hind edge distinctly margined. Surface entirely very densely punctate with large punctures which are very closely spaced, producing a reticulate surface, or merging, producing a rugose or occasionally granulate surface, each puncture with a stout erect seta forming a dense, moderately long pubescence over entire pronotum. *Elytra.*—Intervals almost flat, shagreened, dull, with double rows of very small granules (sometimes absent) and very small punctures giving rise to short erect setae. First interval with only 1 row, last with 3 or 4. Striae superficial, narrowly geminate, nitid, with well-separated round punctures a little wider than stria. *Legs.*—Fore tibiae moderately elongated and curved inward, with inner apical angle strongly produced in major male, moderately so in minor male, with a short terminal tuft of setae, absent in minor male. *Abdomen.*—Pygidium shagreened, irregularly punctate with small shallow punctures, with sparse short fine setae on either side of midline. Aedeagus normal.

*Female*

Clypeal margin more expanded, more strongly and roundly bilobate, clypeal suture with frontal section present, strongly carinate and angled in middle. Frons with a short sharp, strongly elevated carina shaped like an open V in most specimens, sometimes feebly arcuated or straight across. Pronotum sometimes with slight median tubercle near anterior margin. Otherwise like male.

*Types*

Lectotype of *adelaidae*: ♂, Adelaide, HM 461 3/3.
Holotype of *hostilis*: ♂, Adelaide, MNHN(Ob).
Both seen by the author.

*Distribution* (Fig. 255)

The Mt. Lofty Ranges of South Australia, eastward and northward, apparently following the 20-in. isohyet, at least to central New South Wales but possibly continuing into western Queensland, since NMV contains a specimen labelled "Queensland". Habitat and food preferences unknown.

*Material Examined*

The types and 29 specimens. SOUTH AUSTRALIA: Adelaide, Griff., NMV, 4; Adelaide, May 1885, Tepper, WAM, 1; Athelstone, Sept. 1904, SAM, 4; Greenhill, 9.x.1886, Tepper, NMV, 1; Mt. Lofty, 5.vi.1884, Tepper, ANIC, 1; Mt. Lofty Ranges, A. H. Elston, AM, 2; Mt. Lofty Ranges, Sept. 1957, Darlingtons, MCZ, 3; no exact locality, ANIC, 2, QM, 2, MM, 4. VICTORIA: No exact locality, MNHN, 1. NEW SOUTH WALES: Grenfell, E. W. Ferguson, ANIC, 2; Mulwala, AM, 1. QUEENSLAND: No exact locality, NMV, 1.

## 93. ONTHOPHAGUS PHOENICOCERUS Lea

(Figs. 264, 265, 572)

*Onthophagus phoenicocerus* Lea, 1923, p. 389; Boucomont and Gillet, 1927, p. 214.

Dark grey, antennal clubs fuscous, underside and legs rufopiceous. Total length 7 mm. The female is unknown.

*Male*

*Head.*—Clypeal margin feebly bilobate, the lobes approximated, rounded. Rest of margin evenly rounded to genal angles, which are rounded, not prominent. Clypeal suture with frontal section entirely effaced, genal sections oblique, finely carinate. Frons with a single transverse erect horn which is apically bifurcate, the distal margin evenly concave. Eyes narrow, with 5 facet rows across widest point, separated by 11 widths, canthus complete. Densely and coarsely punctate, rugose on genae, glabrous except for 1 or 2 setae on genae. Labium shallowly excised. *Pronotum.*—Unsculptured but somewhat flattened anteriorly and strongly convex. Anterior angles acute, the apices subangulate. Hind edge distinctly margined. Very densely punctate with large punctures which are very closely spaced, producing a reticulated surface and tending to be merged into longitudinal rugae. Glabrous. *Elytra.*—Intervals almost flat, shagreened, dull, with very small punctures usually in 2 rows, each puncture with a short erect seta. Striae superficial, geminate, shiny, with well-separated, very small round punctures. *Legs.*—Fore tibiae with inner apical angle produced, with a few longer setae

distally. *Abdomen.*–Pygidium shagreened, matt, with indistinct, very small punctures bearing very short setae. Aedeagus not examined.

*Type*

Holotype ♂, Brisbane, 7.iv.1917, H. Hacker, QM. Unique. Seen by the author.

*Remarks*

The unique type of *phoenicocerus* is a worn specimen and the absence of setae on the head and pronotum may be due to wear. Otherwise the specimen is nearly identical to *adelaidae* and may only be a morph of that species, differing in the form of the male horns. Similar morphs are known in *capella* and *pugnax*.

## 94. ONTHOPHAGUS DUBOULAYI Waterhouse

(Figs. 266–268, 573)

*Onthophagus duboulayi* Waterhouse, 1894, p. 11.

*Onthophagus spissicollis* Lea, 1923, p. 376; Boucomont and Gillet, 1927, p. 216. New synonymy.

Black, head usually with greenish reflections, pronotum with bronze reflections, antennal clubs fuscous. Total length 6–7 mm.

*Male*

*Head.*–Clypeal margin medially strongly bidentate, the teeth rounded, approximated, sides of clypeus a little expanded just before genae, fringe of setae lining inner edge of clypeal margin unusually long and close-set, genal angles subangular, not prominent. Clypeal suture with frontal section completely effaced, genal sections fine, sharp. Frons with a pair of erect slender divergent horns which are slightly curved inward apically and set near eyes, the surface between them flat. Eyes moderate, with 6–8 facet rows across widest point, separated by about 12 widths, canthus incomplete. Surface of frons and clypeus smooth, nitid, finely punctate, becoming more coarsely punctate near edge of clypeus, with a few long erect setae along edges and sides of clypeus, genae coarsely punctate, shagreened, usually with a few long erect setae. Labium shallowly emarginate. *Pronotum.*–Strongly convex, anterior declivity flattened, surmounted near middle of pronotum by a pair of indistinct oblique tumescences in major male, these absent in medium male. Minor male not seen. Anterior angles broadly rounded or acute with rounded apices. Hind edge distinctly and broadly margined. Moderately punctate with medium-sized, shallow round punctures separated by about 2 diameters on disc, sparser on anterior declivity, which has only a few widely scattered punctures in major male. Often there are some very small punctures interspersed among the larger ones on disc. Each puncture with an erect seta, very long and straight on anterior declivity and sides, short and curved back on disc. Surface shagreened, smooth. *Elytra.*–Intervals flat, shagreened, dull, with double rows of very small punctures each bearing a short seta, sutural interval with 1 row, last interval with several. No granules. Striae superficial, narrowly geminate, shiny, with well-separated round punctures a little wider than stria. *Legs.*–Fore tibiae a little elongated, not curved inward, inner apical angle produced into a small tooth, without tuft or brush of long setae. *Abdomen.*–Pygidium shagreened, with small scattered punctures bearing short setae. Aedeagus normal.

*Female*

Head entirely densely rugose and pubescent. Frontal section of clypeal suture present, arcuate, strongly carinate. Frons with a short straight transverse crest raised laterally into a pair of small points, medially concave in 1 female. Pronotum flatter, very densely punctate and subrugose, partly reticulate, pubescent, the punctures of varying diameters, anteriorly with a median angular projection near front margin, base of disc smooth, shagreened.

*Types*

Holotype of *duboulayi*: ♂, Western Australia, Du Boulay, BMNH.
Holotype of *spissicollis*: ♀, Beverley, Mt. Barker, W.A., SAM, I.3774.
Both seen by the author.

*Remarks*

There is a strong individual difference in the shape of the anterior angles, which are usually broadly rounded, but in two males from the vicinity of Geraldton the angles are acute, with the apices rounded.

Blackburn (1903) incorrectly synonymized *duboulayi* with *jubatus*, in which he was followed by Lea (1923) and Boucomont and Gillet (1927). Both Blackburn and Lea evidently did not know to which species the names *duboulayi* and *jubatus* referred, since Lea redescribed *duboulayi* as *spissicollis* and Blackburn redescribed *jubatus* as *henleyensis*. The examination, by the present author, of the four types involved has now cleared up the matter.

*Distribution* (Fig. 256)

The south-west of Western Australia between the 15- and the 35-in. isohyets, eastward along the Bight to Fowler's Bay, S.A. Habitat and food preferences unknown.

*Material Examined*

The types and 19 specimens. SOUTH AUSTRALIA: Fowler's Bay, SAM, 1. WESTERN AUSTRALIA: Champion Bay, ex mus. van Lansberge, MNHN(Gen), 1; Dongarra, 23.viii–19.ix.1935, R. E. Turner, BMNH, 4; Dongarra, 1952, A. Douglas, WAM, 1; Eucla, 16.vi.1902, A. H. Clager, SAM, 1; Geraldton, Sept. 1926, H. J. Carter, ANIC, 1; Mt. Barker, SAM, 1; 7 miles W. of Northampton, 29.x.1952, McIntosh and Calaby, ANIC, 1; Rottnest, June 1954, WADA, 2; Tutaning, near Pingelly, 32°32′S., 117°05′E., 18.vii.1969, B. Y. Main, ANIC, 4; no exact locality, SAM, 1, MNHN(Gen), 1.

## 95. ONTHOPHAGUS JUBATUS Harold

(Figs. 269, 270, 574)

*Onthophagus jubatus* Harold, 1869, p. 81.

*Onthophagus henleyensis* Blackburn, 1891, p. 208; Blackburn, 1903, pp. 270, 293; Lea, 1923, p. 369; Boucomont and Gillet, 1927, p. 212. New synonymy.

Fore body black, elytra, pygidium, underside and legs rufous or rufopiceous, antennal clubs fuscous to nearly black. Total length 2.5–7.0 mm.

*Male*

*Head.*–Clypeal margin medially deeply excised in an arc, the excision flanked by a pair of prominent rounded teeth, rest of margin a little expanded, genal angles prominent, rounded. Clypeal suture with frontal section usually effaced laterally,

represented by a short curved median ridge, occasionally complete to genal sections. Frons with a pair of erect slender conical horns about halfway between midline and eye, the surface feebly concave between them, minor male with the horns reduced to tubercles. Eyes very narrow, with 3-4 facet rows across widest point, separated by about 17 widths, canthus incomplete. Fairly densely punctate with large punctures, feebly to strongly rugose, the punctures bearing erect setae of varying length, the longest around frontal horns. Labium shallowly emarginate in an arc. *Pronotum.*–Strongly convex, somewhat deplanate or a little concave anteriorly in major male. Anterior angles quadrate, the apices angulate. Hind edge distinctly margined. Fairly densely and evenly punctate with very large, deep punctures separated by about 1 diameter, punctures on disc round, those on anterior and lateral declivities reniform and a little asperate, each puncture with a moderately long, recumbent curved seta (usually worn off disc). Surface between punctures nitid on disc, finely shagreened, alutaceous or subnitid on sides. *Elytra.*–Intervals convex, with uneven surface, finely shagreened, alutaceous along sides of intervals, nitid medially, or may be entirely nitid, with an irregular row of punctures running down middle of each interval, each puncture with a very short to moderately long, straight or feebly curved seta. Striae impressed, geminate, with small shallow transverse punctures. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium smooth, nitid or alutaceous, sparsely and evenly punctate with very large, deep umbilical punctures each bearing a short erect seta. Aedeagus normal.

*Female*

Head surface more coarsely punctate and rugose, frontoclypeal suture completely carinate, frons with a pair of low oblique ridges which are usually joined into a single angulate carina. These ridges may be strongly elevated in some specimens. Pronotum less convex, more coarsely punctate. Otherwise like male.

*Types*

Holotype of *jubatus*: ♀, Adelaide, MNHN(Ob).
Holotype of *henleyensis*: ♀, Henley Beach, Adelaide, BMNH.
Both seen by the author.

*Remarks*

This species is unusual among Australian *Onthophagus* both for its extensive range (see below) and the extreme variation in size. The largest specimens are about three times as long as the smallest. The size variation is geographic, the smallest specimens being those collected by the author near Derby, W.A., which measure 2.5-4.0 mm in length. Next in size comes the specimen from Wanaaring, in western New South Wales, which measures 4.5 mm, while those from near Adelaide measure 5-7 mm. A specimen from near Geraldton, W.A., is 6 mm long. The smaller specimens have longer setae on the elytra, and there is variation in punctuation, surface texture, and length of the frontoclypeal carina in the male. Nevertheless, all specimens share the basic characteristics of the species, such as the distinctive shape of the head, very coarse punctuation, distribution of setae, colour, and form of the male genitalia.

*Distribution* (Figs. 255 and 256)

The north of Western Australia, south Western Australia near Geraldton and at Eucla on the Bight, South Australia, and western New South Wales. In the Introduction

this species was placed in pattern 9, northern grasslands, which includes five species of which only *cruciger* extends to South Australia with *jubatus*, and only *jubatus* extends to the south of Western Australia.

The three specimens collected by the author were found in the daytime in cow dung and wallaby pellets, in open or semi-wooded areas with sandy soil.

*Material Examined*

The types and 18 specimens. SOUTH AUSTRALIA: Cranmore Park, 23.x.1933, Fuller, ANIC, 1; Murray River, SAM, 3; no exact locality, QM, 1. NEW SOUTH WALES: 30 miles W. of Wanaaring, 29.x.1949, E. F. Riek, ANIC, 1. WESTERN AUSTRALIA: 8 miles S. of Derby, 23.ii.1968, E. G. Matthews, ANIC, 1; Eucla, 1882, R. Tate, SAM, 1; Geraldton and Mullewa, Lea, WAM, 2; Kojarena, 18 miles W. of Geraldton, Sept. 1926, H. J. Carter, ANIC, 1; Langey Crossing, Fitzroy R., 35 miles S. of Derby, 23.ii.1968, E. G. Matthews, ANIC, 2. No data, ex mus. van Lansberge (probably Adelaide), MNHN, 5.

## 96. ONTHOPHAGUS VERMICULATUS Frey

(Figs. 271–273, 575)

*Onthophagus vermiculatus* Frey, 1970, p. 152.

Bronze-black, sometimes greenish, underside and legs black with green reflections, antennal clubs fuscous. Total length 5–8 mm.

*Male*

*Head.*—Clypeal margin medially feebly bidentate, laterally a little expanded before genal sutures, genal angles subangular, not prominent. Clypeal suture with frontal section entirely effaced, genal sections raised, oblique. Vertex with a pair of low transverse subangular or rounded projections joined by an indistinct ridge, minor male with a single bisinuate transverse carina as in female. Eyes moderate, with 6–7 facet rows across widest point, separated by about 17 diameters, canthus just touching occipital margin. Strongly rugose, impunctate, finely shagreened, nitid, with a few sparse erect setae on clypeus and genae, and concentrated in a small group just by inner edge of eye. Labium excised about one-third of way to base. *Pronotum.*—Entirely very strongly rugose on disc and reticulate elsewhere, except at base of midline, which is smooth and shagreened. Crests of rugae and reticulum nitid, troughs and punctures shagreened and dull. With a dense vestiture of short to very short erect setae. Major male with a small depression in middle near anterior margin flanked by a pair of low tumescences, rest of pronotal surface somewhat uneven, with mild depressions and ridges. Anterior angles quadrate, the points subangular. Hind edge finely margined. *Elytra.*—Intervals nearly flat, shagreened, dull, with a shiny costa running down middle of each interval, this costa more or less interrupted into a series of short ridges or beads. With numerous very small punctures bearing very short setae, generally in 2 rows on most intervals. Striae superficial, finely geminate, not very shiny, with numerous very small impressed punctures. *Legs.*—Fore tibiae elongate, slender, a little bent inward, with inner apical angle strongly produced into a point. An apical tuft of moderately long setae present in major male only. *Abdomen.*—Pygidium shagreened, dull, with numerous short recumbent setae on either side of middle. Aedeagus normal.

*Female*

Clypeal margin a little more produced medially, clypeogenal suture present as an arcuate rounded ridge, effaced laterally. Frons with a strong carina raised laterally into angles, or a single V-shaped carina. Pronotum without median anterior depression, but with irregular surface as in male. Otherwise like male.

*Type*

Holotype ♀, vicinity Perth, Dec. 1953, Demarz, MGF. Not seen by the author.

*Distribution* (Fig. 256)

The south-west of Western Australia in areas of 35 in. or more of rainfall annually, that is, from the Darling Ranges south of Perth southward and eastward to Albany. This is a forest-inhabiting species associated especially with the jarrah forests of the Darling Ranges and the south-west tip on sandy soils, and the karri forests of the south coast on heavy reddish or brown soils. In the latter situation it is the only species of *Onthophagus* occurring, since *evanidus* (another forest species) drops out in the karri forest. *O. vermiculatus* will emerge from forests and exploit cow dung only in the vicinity of Walpole, where the annual rainfall is about 60 in., and where *ferox*, a species of drier pastures, does not occur. *O. vermiculatus* is diurnal, coming to bait in the late morning, and apparently strictly coprophagous, not being found under carrion. It exploits kangaroo droppings by penetrating the pellets and remaining inside, shredding the interior without burying any of the food. In cow dung it is also usually found in the dung rather than under it. All records are from September to November, with one in April.

*Material Examined*

138 specimens. WESTERN AUSTRALIA: Albany, Brewer, MNHN, 3; Arumvale, near Augusta, 21.x.1967, E. G. Matthews, ANIC, 2; 6 miles N. of Australind, 7.xi.1967, E. G. Matthews, ANIC, 2; Bridgetown, Sept., L. J. Newman, WADA, 2; Donnybrook, Apr., L. J. Newman, WADA, 4; 4 miles E. of Jarrahdale, 11.x.1967, E. G. Matthews, ANIC, 10; King George's Sound, MNHN, 2; Lake Preston, 7.xi.1967, E. G. Matthews, ANIC, 3; Margaret R., Oct. 1931, P. J. Darlington, MCZ, 47; Margaret R., 20.x.1967, E. G. Matthews, ANIC, 12; Pemberton, Oct. 1931, P. J. Darlington, MCZ, 3; Porongurups, 3.xi.1967, E. G. Matthews, ANIC, 4; Torbay, 31.x.1967, E. G. Matthews, ANIC, 6; 6 miles W., 9 miles E., and 12 miles N. of Walpole, 28–30.x.1967, E. G. Matthews, ANIC, 17; Warren National Park, 20.x.1967, E. G. Matthews, ANIC, 10; Whittaker's Mill, near Dwellingup, 13.x.1967, E. G. Matthews, ANIC, 6; no exact locality, MNHN, 5.

## 97. ONTHOPHAGUS HAAGI Harold

(Figs. 274–277, 576, 577)

*Onthophagus haagi* Harold, 1867, p. 36; Harold, 1869, p. 81; Blackburn, 1903, p. 270; Lea, 1923, p. 367; Boucomont and Gillet, 1927, p. 212.

Black, antennal clubs black. Total length 8–10 mm.

*Male*

*Head.*—Clypeus foreshortened, margin medially with a pair of angular or rounded teeth, laterally not expanded at genal suture, genal angles rounded, prominent. Clypeal suture with frontal section entirely effaced, genal sections indistinct in major male,

oblique. Frons of major male with a very high, erect bifurcate horn, minor male with a high transverse quadrate crest with elevated lateral points. Eyes moderately wide, with 7–8 facet rows across widest point, separated by about 12 diameters, canthus complete. Clypeus and genae transversely rugulose, frons smooth, nitid, head entirely impunctate and glabrous. Labium excised about one-third of way to base. *Pronotum.*–Major male with a strongly elevated anterior declivity surmounted by a pair of sharp points which are located halfway along pronotal length and widely separated, joined by an evenly recurved, rounded ridge. Minor male with anterior declivity less high and the points much further forward, approximated, and subangulate. Anterior angles broadly rounded. Hind edge strongly margined. Densely rugose and reticulate, anterior declivity of major male smooth, impunctate, nitid, anterior angles smooth with numerous punctures. Anterior declivity of minor male smooth and finely shagreened, sericeous, and densely punctate. With extremely short setae on sides of pronotum, difficult to see. *Elytra.*–Intervals flat, shagreened, dull, the surface slightly irregular, each interval with a shiny median costa which is broken up into a row of short ridges and beads, with an irregular row of small punctures on either side of this costa, these bearing very short, fine setae. Last interval more densely punctate, irregularly rugose and granulate. Striae superficial, fine, shiny, with very small punctures closely set. *Legs.*–Fore tibiae only a little elongated, with inner apical angle strongly produced into a point, no tuft of long setae. *Abdomen.*–Pygidium shagreened, sericeous, with slightly irregular surface, numerous small punctures bearing very short, fine setae. Aedeagus normal.

*Female*

Median lobes of clypeal margin more prominent, frontoclypeal suture present, evenly arcuate, strongly carinate. Frons with a high quadrate crest in major female, somewhat procurved and the ends raised into prominent points, the margin between these convex. Minor female with the crest lower and only slightly raised at ends, the margin straight. Head surface very strongly transversely rugose everywhere except on vertex, which is smooth. Pronotum with a median, dorsally flattened, margined prominence which is bilobate in major female (like minor male), simply rounded in minor one. Otherwise like male.

*Type*

Holotype, Western Australia, Thorey and Haag. Not seen. A minor male of this species in MNHN(Ob), ex musaeo Harold, bears the "Haagi Harold t." (holotype) label and agrees with the description, but it is labelled "Queensland" and therefore is probably not the type, as Harold was aware that this is a Western Australian species.

*Distribution* (Fig. 256)

The south-west of Western Australia in areas of 35 in. or more annual rainfall, but extending east of Albany to Bremer Bay, where the rainfall is about 30 in., and to Norseman (one specimen), where is is about 10 in. It thus coincides closely with *vermiculatus* in geographical distribution, but has different ecological requirements. *O. haagi* is a species of open forests and shaded pastures, while *vermiculatus* occurs in denser forests. Some overlap is seen in forests of intermediate density on the Darling Ranges. In pastures, on the other hand, it partly overlaps with *ferox*, but the latter

is a species occurring in drier situations and has a much wider geographical range. Furthermore, *haagi* is a distinctly necrophagous species, unlike the others, and will frequently be found under dead kangaroos, monitors, and skinks lying at roadsides. It also comes abundantly to possum and macropod droppings and human excrement. It is diurnal and immediately buries the food. It was found only in sandy soil. One record in May, the rest from September to November.

*Material Examined*

129 specimens. WESTERN AUSTRALIA: 13 miles W. of Albany, 31.x.1967, E. G. Matthews, ANIC, 3; Bedfordale, 10.ix.1957, D. G. Shedley, WADA, 5; 10 miles W. of Bremer Bay, 4.xi.1967, E. G. Matthews, ANIC, 3; Bridgetown, L. J. Newman, WADA, 3; Byford, watershed of Winngong R., 19.viii.1969, M. Archer, WAM, 1; Cheyne Beach, 6.xi.1967, E. G. Matthews, ANIC, 16; Deep Dene, Karridale, 21.v.1963, L. M. O'Halloran, ANIC, 1; Denmark, 1950, R. P. MacMillan, WAM, 1; 14 miles N. of Denmark, 1.xi.1967, E. G. Matthews, ANIC, 2; Irwin Inlet, 1.viii.1932, R. Pinniger, WAM, 1; 4 miles E. of Jarrahdale, 11.x.1967, E. G. Matthews, ANIC, 11; Kalgan, UQ, 3; Lake Preston, 7.xi.1967, E. G. Matthews, ANIC, 4; Margaret River, Oct. 1931, P. J. Darlington, MCZ, 20; Mt. Barker, E. W. Ferguson, ANIC, 2; 3 miles W. of Mundaring Weir, 9.viii.1969, B. Dell, WAM, 1; 30 miles SW. of Nannup, 23.x.1967, E. G. Matthews, ANIC, 12; Norseman district, NMV, 1; 4 miles S. of Northcliffe, 27.x.1967, E. G. Matthews, ANIC, 3; Tallanalla, 19.x.1967, E. G. Matthews, ANIC, 2; Torbay, 31.x.1967, E. G. Matthews, ANIC, 3; no exact locality, ANIC, 1, ex mus. van Lansberge and H. W. Bates, MNHN, 20.

## XIV. *The* PERPILOSUS *Group*

Eyes narrow, with 5-9 facet rows across widest point, separated by 11-23 widths, canthus incomplete. Labium usually excised very shallowly, almost halfway to base in *incanus*. At least a few long setae on dorsum of head, sides of pronotum, and elytra, often entirely setose. Pygidium with long setae. Colour black or greenish, elytra may be reddish. Total length 4-7 mm.

Male with frontoclypeal suture carinate, vertex with a transverse flap laterally extended into lobes or short points, never horns (*incanus* with a simple carina). Pronotum with a median fold or short ridge near anterior margin (except in *wakelbura* and some *gangulu*), or pair of low tubercles in *incanus*. Fore tibiae elongated, slender, the inner apex prolonged into a point about as long as fore spur, without any tuft or brush of long setae. Female with transverse frontal carina, pronotum as in corresponding male.

Seven species: 98. *incanus* Macleay; 99. *perpilosus* Macleay; 100. *tamworthi* Blackburn; 101. *gangulu*, sp. nov.; 102. *villosus* Macleay; 103. *wakelbura*, sp. nov.; 104. *fletcheri* Blackburn.

The species in this group are primarily inland forms which remain largely to the west (or dry side) of the 30-in. isohyet in eastern and northern Australia. Within the 20- to 30-in. rainfall belt the species form a more or less allopatric sequence from south-east to north-west in the following order: *tamworthi*, *fletcheri*, *perpilosus*, *wakelbura*, *gangulu*, and *villosus*, with *incanus* (which only marginally belongs to this group) broadly overlapping the ranges of the last three named. The ecology of these species is largely unknown.

## KEY TO SPECIES OF THE *PERPILOSUS* GROUP

1. Surfaces strongly rugose, very densely pubescent throughout (except when worn), pygidial pubescence silvery, pronotum in both sexes with a pair of low tubercles anteriorly on either side of midline. N. Qld., N. W.A. ..... 98. *incanus* Macleay
   Surfaces smooth between punctures, pubescence less dense, that of pygidium not silvery, pronotum without a pair of tubercles ..... 2

2(1). Anterior part of pronotum with a small median transverse fold ..... 3
   Pronotum without any such fold, unsculptured ..... 6

3(2). All dorsal surfaces with long setae, including disc of pronotum and entire length of all elytral intervals; lateral lobes of frontal carina of major male raised into a pair of short points. S. Qld. ..... 99. *perpilosus* Macleay
   At least a small area in middle of pronotal disc and most of second elytral interval glabrous; lateral lobes of frontal carina of major male rounded or quadrate, or with a pair of strong erect horns ..... 4

4(3). Most of dorsal surfaces covered with long pilosity, but leaving middle of disc of pronotum and most of second elytral interval glabrous. N.S.W. ..... 100. *tamworthi* Blackburn
   Most of dorsal surfaces glabrous, the long setae confined to head, anterolateral parts of pronotum, and sides of elytra ..... 5

5(4). Median fold of pronotum with rounded edge, not very prominent; clypeal margin feebly excised or not at all; major male with frontal carina laterally forming quadrate lobes; colour usually all black. C. Qld. ..... 101. *gangulu*, sp. nov.
   Median fold of pronotum with sharp edges, prominent. Clypeal margin distinctly bilobate; major male with frontal carina laterally forming a pair of stout erect horns; elytra usually reddish. N. W.A. ..... 102. *villosus* Macleay

6(2). Elytra red or maroon, devoid of setae except along lateral and posterior edges. S. Qld. ..... 103. *wakelbura*, sp. nov.
   Entirely black, elytra with a few setae on discal portions of 3rd and 5th intervals as well as on edges. N.S.W. ..... 104. *fletcheri* Blackburn

### 98. ONTHOPHAGUS INCANUS Macleay

(Figs. 279, 280, 578)

*Onthophagus incanus* Macleay, 1888, p. 904; Blackburn, 1903, p. 301; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 213.

*Onthophagus leaniensis* Paulian, 1937, p. 341. New synonymy.

Black with green or bronze reflections, elytra reddish in western specimens, pilosity pale golden, pygidial pubescence silver. Total length 4–7 mm.

*Male*

*Head.*—Clypeal margin medially very feebly emarginate or not at all, feebly expanded on either side of middle, a little convex just before genal sutures, genal angles hardly projecting. Clypeal suture carinate, medially subangulate, forming moderate angles at genal sections. Frons with a raised sinuate transverse carina sloping to hind margin near eyes. Carina not raised into angles or pushed back into flaps. Eyes very narrow, with about 6 facet rows across widest point, separated by about 11 widths, canthus incomplete. Densely punctate, rugose on the clypeus, each puncture with a long fine erect seta. Labium excised almost halfway to base. *Pronotum.*—With a pair of low tubercles anteromedially on either side of midline, which is depressed between them. Minor male with tubercles indistinct. Anterior angles quadrate, the apices angulate. Hind edge finely margined. Very densely punctate with large punctures,

strongly rugose and pilose over entire surface, the setae long and fine, surface nitid. *Elytra.*–Intervals strongly rugose, nitid, sometimes with a raised line down middle of each interval, most intervals with a double row of large punctures bearing a long curved or hooked seta, all intervals fully pilose except at extreme base. Striae superficial, with close-set punctures crenulating edges of intervals. *Legs.*–Fore tibiae elongated, slender, with inner apical angle drawn out into a long spine-like point, as long as spur in largest individuals. A few scattered long setae apically. *Abdomen.*–Pygidium very densely punctate, asperate, each puncture bearing a long seta reflecting silvery light when seen from above. Parameres with the points elongated, transversely flattened.

*Female*

With edges of head less angulate. Front tibiae not modified. Otherwise like male.

*Types*

Holotype of *incanus*: ♀, King's Sound, W.A., MM.
Holotype of *leaniensis*: ♂, Chillagoe, Qld., Hacker, DEI.
Both seen by the author.

*Remarks*

All Queensland specimens seen are entirely black with green or bluish green reflections, while those from the Kimberley District frequently have reddish elytra, particularly noticeable at the time of collecting. The Queensland specimens are also a little more coarsely punctate and rugose.

*Distribution* (Fig. 278)

The Kimberley District of Western Australia, where it is abundant, and Queensland, primarily in inland regions. While the distribution appears disjunct, it is likely that the species follows a belt lying roughly between the 20- and 30-in. isohyets across northern Australia. In the Northern Territory and western Queensland this region has not been thoroughly investigated.

*O. incanus* is found in open situations in a variety of soils, including sand, sandy loam, and even clay pan. It occurs in cow dung and particularly in macropod droppings, and to a lesser extent at human faeces. In the Kimberleys it seemed to be strictly coprophagous, however in Queensland it was found by the author on two occasions under a dead kangaroo and under discarded pelts. It flies in the daytime, and was observed in the area of Fitzroy Crossing coming rapidly to wallaby pellets, penetrating the pellet from underneath where it comes in contact with the ground, and shredding it from the inside. Generally there was only one individual in each pellet, but virtually every pellet examined contained one *incanus*. All records are from January to June.

*Material Examined*

The types and 427 specimens. QUEENSLAND: Ballandean; Belmont, 8 miles NW. of Rockhampton; 10 miles N. of Bowen; Cape R.; Carnarvon Gorge; Carpentaria Downs; Charters Towers; Chillagoe; 30 miles N. of Injune; Lotus Ck., Sarina; 50 miles S. of Mackay; Marlborough; 10 miles W. of Marlborough; Marmor; Mingela; 42 miles S. of Mt. Garnet; Rodds Bay; 9 miles S. of Rolleston; Taroom; Thomson Ck., 120 miles N. of Clermont. WESTERN AUSTRALIA: Camballin, Fitzroy Barrage Dam; 6–35 miles S. of Derby; 37–59 miles W. of Fitzroy Crossing; King's Sound; Kununurra; 6–18 and 60 miles W. of Kununurra.

## 99. ONTHOPHAGUS PERPILOSUS Macleay

(Figs. 281, 282, 579)

*Onthophagus perpilosus* Macleay, 1871, p. 181; Blackburn, 1903, p. 280; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214.

Green, or black with green reflections, or entirely black, antennal clubs greyish brown, pilosity pale. Total length 4-6 mm.

*Male*

*Head.*–Clypeal margin medially bilobate, the lobes rounded in major male, angulate in minor one, rest of margin evenly arcuate, incised at genal sutures, genal angles rounded. Clypeal suture carinate, the frontal section curved or angled forward, genal sections forming strong angles with it. Vertex with a sharply raised, sinuate carina laterally drawn out into a pair of acute recumbent points. In smaller male points become quadrate and in minor one they disappear altogether. Eyes very narrow, with 5 facet rows across widest point, separated by about 15 widths, canthus incomplete. Coarsely punctate, the punctures separated by about 1 diameter on frons, closer together on clypeus. Each puncture with a long erect seta, surface shagreened. Labium shallowly excised. *Pronotum.*–With a median anterior transverse fold, indistinct in minor male, the surface behind it not depressed. Anterior angles subacute, the points angulate. Hind edge finely margined. Entirely punctate with large punctures separated by about 1 diameter, each puncture with a long erect curved seta. Number of punctures, per 0.5 sq mm, in middle of pronotal disc varies from 25 (small punctures) to 20 (large punctures) in different individuals. Surface shagreened. *Elytra.*–Intervals flat, smooth, shagreened, with 2 rows of large setigerous punctures running their entire length (more on last interval), elytra therefore entirely covered with long erect setae. Striae superficial, finely geminate, with small close-set punctures, superficial in some individuals, deep-set in others. *Legs.*–Fore tibiae elongate, slender, with inner apical angle strongly drawn out into a point about as long as fore spur, this point absent in minor male. Spur very short. *Abdomen.*–Pygidium shagreened, moderately to densely punctate with large punctures each bearing a long erect seta. Parameres shortened, the points strongly transversely widened.

*Female*

Clypeus medially more prominently bilobate, the lobes subangulate. Frontoclypeal suture more strongly carinate. Vertical carina without points, consisting of a beaded line or rounded ridge bowed forward in middle, laterally curved back to hind edge. Fore tibia not elongate and without apical point, fore spur longer. Otherwise like male.

*Type*

Holotype ♂, Gayndah, Qld., AM K 28239. Seen by the author.

*Remarks*

There is some morphological difference between the green individuals seen, which have smaller denser punctures and consequently a denser and finer pilosity, and the black individuals, which are more coarsely and sparsely punctate and also somewhat shinier. The latter are similar to *tamworthi* in appearance. These differences do not

justify separation into two species, in the author's opinion, nor do they seem to be correlated with geographical distribution on the basis of the material available.

*Distribution* (Fig. 278)

Southern Queensland, primarily in inland localities west of the Great Dividing Range, corresponding to an area enclosed by the 20- and 30-in. annual isohyets. Collected by Dr. Bornemissza in a very dry open pasture with loam soil.

*Material Examined*

The type and 43 specimens. QUEENSLAND: Amberley, 22.v.1969, Bornemissza and Utech, ANIC, 10; Bulimba River, 12.vi.1921, UQ, 1; Dalby, F. H. Hobler, UQ, 1; Gayndah, AM, 1; 30 miles N. of Injune, 10.iv.1965, G. F. Bornemissza, ANIC, 16; Miles, 10.i.1939, N. Geary, AM, 1; Milmerran, 25.vi.1926, J. Macqueen, AM, ANIC, 5; Milmerran, 9.xii.1968, H. Burton, UQ, 6; Oakey, 11.iv.1965, G. F. Bornemissza, ANIC, 1; Roma, F. H. Taylor, ANIC, 1.

## 100. ONTHOPHAGUS TAMWORTHI Blackburn

(Figs. 283, 284, 580)

*Onthophagus tamworthi* Blackburn, 1903, p. 292; Lea, 1923, p. 370; Boucomont and Gillet, 1927, p. 216.

Black, usually with greenish reflections, antennal clubs dark grey. Total length 6–7 mm.

*Male*

*Head.*—Clypeal margin medially bilobate, the lobes angular, rest of margin rounded, slightly excised at clypeogenal sutures, genal angles rounded. Frontal section of clypeal suture carinate, procurved, strongly angled with genal sections, which are less raised. Vertex with carina evenly procurved, laterally rounded, not drawn out into horns or angles. Eyes narrow, with 6–9 facet rows across widest point, separated by about 12 widths, canthus incomplete. Densely punctate with large punctures, each bearing a long erect seta, surfaces shagreened. Labium excised about one-fourth of way to base. *Pronotum.*—Anteromedially with a transverse procurved fold, not very prominent, usually extended laterally a little by low ridges, the surface not depressed behind it. Anterior angles quadrate, the apices rounded. Hind edge very finely margined. Densely punctate with large punctures separated by 1–2 diameters, densest just behind transverse fold and along anterior margin, each puncture with a long recumbent curved seta except in middle of disc, which is glabrous. Surface smooth, nitid, shagreened only along sides and anterior margin, and posteriorly in median longitudinal sulcus. *Elytra.*—Intervals very feebly convex, surface a little uneven, shagreened, with rows of large punctures along both edges of 3rd and 5th intervals, 1st (sutural) with 1 row beginning about halfway down, 2nd interval devoid of setae except for a few at posterior end, 4th interval glabrous anteriorly, thereafter with 1 row, lateral intervals with numerous setae along their entire length. Striae moderately impressed, finely geminate, with numerous very small punctures not crenulating edges of intervals. *Legs.*—Fore tibiae elongated, slender, with inner apical angle strongly drawn out into a point about as long as spur, reduced in minor male. Fore spur very short. *Abdomen.*—Pygidium shagreened, moderately densely punctate with large punctures each bearing a long erect seta. Aedeagus normal.

*Female*

Clypeal margin more strongly bilobate medially, laterally more convex, fronto-clypeal suture more carinate, vertical carina more strongly raised, evenly arcuate, a little more anterior. Front tibiae not modified. Otherwise like male.

*Type*

Holotype ♂, Tamworth, N.S.W., Lea, BMNH. Seen by the author.

*Distribution* (Fig. 278)

New South Wales, primarily in the northern half west of the Great Dividing Range, which seems to form the eastern limit of its distribution. The western limit is not well defined, but it appears to lie near the 15-in. isohyet. Habitat preferences and food habits unknown.

*Material Examined*

The type and 36 specimens. NEW SOUTH WALES: Armstrong, 1939, GB, 2; Bogan R., Sept. 1933, J. Armstrong, AM, NMV, 3; Collarenebri, 9.xi.1911, SAM, 2; Dubbo, Brommagem Ck., 1–15.iv.1962, M. & V. Gregg, AM, 6; Havenstein, ANIC, 1; Kosciusko, Feb. 1926, H. J. Carter, ANIC, 1; Narromine, H. J. Carter, NMV, 1; 24 miles S. of Nyngan on Trangie Rd., 24.iv.1969, Feehan–Keraitis, ANIC, 18; 21 miles N. of Tenterfield, 6.xii.1965, G. A. Yapp, ANIC, 1; Watercourse, Moree, Nov. 1933, A. Musgrave, AM, 1.

## 101. ONTHOPHAGUS GANGULU, sp. nov.

(Figs. 285, 286, 581)

Black, occasionally faint greenish reflections on fore body, elytra rufopiceous, at least on humeri, antennal clubs grey or black, pilosity yellowish. Total length 5–7 mm.

*Male*

*Head.*–Clypeal margin medially slightly widened, reflexed, rounded or slightly truncate in major male, slightly bilobate in minor one, feebly emarginate at clypeo-genal suture, genal angles rounded. Clypeal suture completely raised, strongly bent at genal sections. Vertex with a posterior sinuate carina or flap extended backward into a pair of quadrate lobes laterally in major male, a simple transverse procurved carina in minor one. Eyes moderate, with about 7 facet rows across widest point, separated by about 15 widths, canthus incomplete. Densely and very coarsely punctate, slightly rugose on clypeus and frons, with a close-set row of small setae along middle of inner edge of clypeal margin, a few long setae on either side at base of clypeus, and a group of very long setae on frons on inner side of eyes. Labium excised about one-third of way to base. *Pronotum.*–With a rounded median fold just behind anterior margin, present in all but smallest specimens, otherwise unsculptured. Anterior angles quadrate, the apices angular. Hind edge very finely margined. Fairly densely punctate with moderate punctures, these separated by 2–4 diameters, surface finely shagreened, alutaceous. Anterior and lateral edges of pronotum with long curved setae, except just before median fold, densest behind anterior angles. *Elytra.*–Intervals flat, very finely and sparsely punctate, and shagreened. With a few moderately long setae as follows: a row of 5–6 on posterior part of sutural interval, a row of 1–3 on posterior

end of 5th, a row of 3–5 on posterior part of 7th interval, and a sparse fringe along entire lateral edges of elytra. Striae superficial, simple or very finely geminate, with small shallow punctures not crenulating edges of intervals. *Legs.*—Fore tibiae elongated, the inner apical edge strongly produced into a point and bearing long setae, not forming a brush, the point and long setae absent in minor male. Fore spur short. *Abdomen.*—Pygidium shagreened, moderately punctate, each puncture bearing a long stout erect seta. Parameres with the points strongly transversely widened.

*Female*

Middle of clypeal margin feebly bilobate and reflexed. Inner edge of clypeal margin with a fringe of long setae less closely spaced than in male, other cephalic setae sparser. Vertical carina strong, medially procurved, may be a little produced laterally into lobes in largest specimens. Pronotum as in male, but with smaller median ridge. Fore tibiae not elongate, the inner apical edge not at all produced, without long setae, fore spur longer. Otherwise like male.

*Type*

Holotype ♂, Belmont, 8 miles NW. of Rockhampton, Qld., 11.iii.1965, G. F. Bornemissza, ANIC.

*Distribution* (Fig. 278)

Queensland, approximately at the tropic. It seems to replace the more southern *perpilosus* in the 20- to 30-in. rainfall belt here, reaching the coast at Rockhampton. Collected by Dr. Bornemissza under cow dung in open situations on heavy clay or clay loam soils.

*Material Examined*

The type and nine specimens. QUEENSLAND: Belmont, 8 miles NW. of Rockhampton, 11.iii.1965, G. F. Bornemissza, ANIC, 46; Carnarvon Gorge, 9.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 16; Marlborough, 27.v.1968, Bornemissza and Utech, ANIC, 28; Marmor, 10.iii.1965, G. F. Bornemissza, ANIC, 2; Rockhampton, Fairmaire Coll., MNHN, 1; Rodds Bay, 21.v.1969, Bornemissza and Huppatz, ANIC, 1.

## 102. ONTHOPHAGUS VILLOSUS Macleay

(Figs. 287, 288, 582)

*Onthophagus villosus* Macleay, 1888, p. 902; Blackburn, 1903, p. 302; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 217.

Fore body black, elytra rufous, often darker across middle, underside and pygidium rufopiceous or black, femora rufous, antennal clubs grey or black, pilosity pale. Total length 5–7 mm.

*Male*

*Head.*—Clypeal margin medially strongly bilobate, laterally a little convex, genal margins rounded. Frontoclypeal suture complete, carinate, strongly angled with genal sections. Vertex with a pair of stout erect flattened horns posteriorly, these a little divergent and joined by a sharp straight carina. Minor male without the horns, only the carina remaining. Eyes moderate, with about 7 facet rows across widest point,

separated by about 13 widths, canthus incomplete. Densely and coarsely punctate, the punctures unequal in size, with a close-set row of setae along middle of inner edge of clypeal margin, behind lobes. Very long, sparse setae present on clypeus, genae, and above eyes at bases of horns. Labium excised about one-third of way to base. *Pronotum.*–With a sharp procurved crest anteromedially delimiting a shallow depression just behind it. This crest present even in minor male. Anterior angles quadrate, the points rounded. Hind edge finely margined. Moderately punctate with fairly large punctures, these separated by 2–3 diameters, denser near anterior angles. Surface nitid except for depression behind crest, middle of basal area, and inside of lateral foveae, which are shagreened. Most of anterior and lateral surfaces of pronotum with long to very long curved setae. *Elytra.*–Intervals feebly convex, very finely and sparsely punctate, and shagreened. With moderately long, recumbent curved setae as follows: a row of 4–6 on posterior part of sutural interval (sometimes 1 also on anterior part); a row of 3–5 on posterior part of 3rd interval (sometimes also 1–2 on anterior part); 2–8 on posterior part of 5th; 1 or 2 rows of setae along entire length of 7th and 8th intervals, densest on latter. Striae superficial, geminate, with impressed punctures slightly crenulating edges of intervals. *Legs.*–Fore tibiae elongated, the inner apical edge strongly produced into a point as long as spur in major male, with long setae not forming a distinct apical brush. The point entirely absent in minor male. Fore spur short, blunt. *Abdomen.*–Pygidium finely shagreened, moderately punctate, each puncture bearing a long, stout, erect seta. Parameres shortened, the points greatly widened.

*Female*

Middle of clypeal margin slightly more roundedly bilobate. Inner edge of clypeal margin with setae less densely spaced, cephalic setae sparser, concentrated near eyes. Frontal carina low, straight, transverse, without horns although the ends are raised in major individuals. Pronotum as in male, but with depression behind median crest less pronounced. Fore tibiae not elongated, the inner apical edge not at all produced, without long setae, spur longer. Otherwise like male.

*Type*

Holotype ♂, King's Sound, W.A., MM. Seen by the author.

*Distribution* (Fig. 278)

The Kimberley District of Western Australia. Found in open areas with hard-packed, sandy soil, coming to cow dung in small numbers but primarily to fresh carrion. Hundreds of individuals were seen coming to two dead chickens on the road near Kununurra in full daylight, of which a sample of 73 was collected. This was the only species coming to this carrion, and the beetles were continuously arriving in such numbers that there could be no doubt that this was their preferred type of food.

*Material Examined*

The type and 84 specimens. WESTERN AUSTRALIA: Camballin, Fitzroy Barrage Dam, 29.ii.1968, J. A. L. Watson, ANIC, 2; Fitzroy Crossing, 26.ii.1968, E. G. Matthews, ANIC, 1; King's Sound, Froggatt, ANIC, 1; K.R.S., Wyndham, Feb. 1954, WADA, 1; Kununurra, 13–22.ii.1968, E. G. Matthews, ANIC, 6; 18 miles W. of Kununurra, 22.ii.1968, E. G. Matthews, ANIC, 73.

## 103. ONTHOPHAGUS WAKELBURA, sp. nov.

(Figs. 289, 290, 583)

Fore body, pygidium, and underside black, elytra red or maroon, the odd-numbered intervals sometimes darkened, rarely entirely piceous, femora rufopiceous, antennal clubs grey, pilosity yellowish. Total length 5–6 mm.

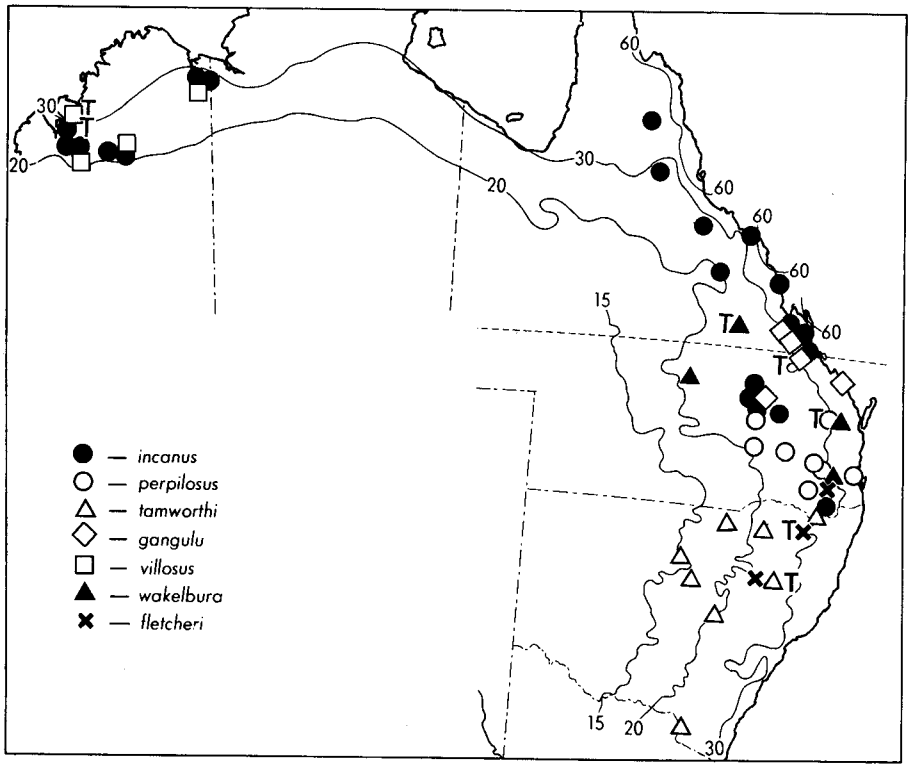
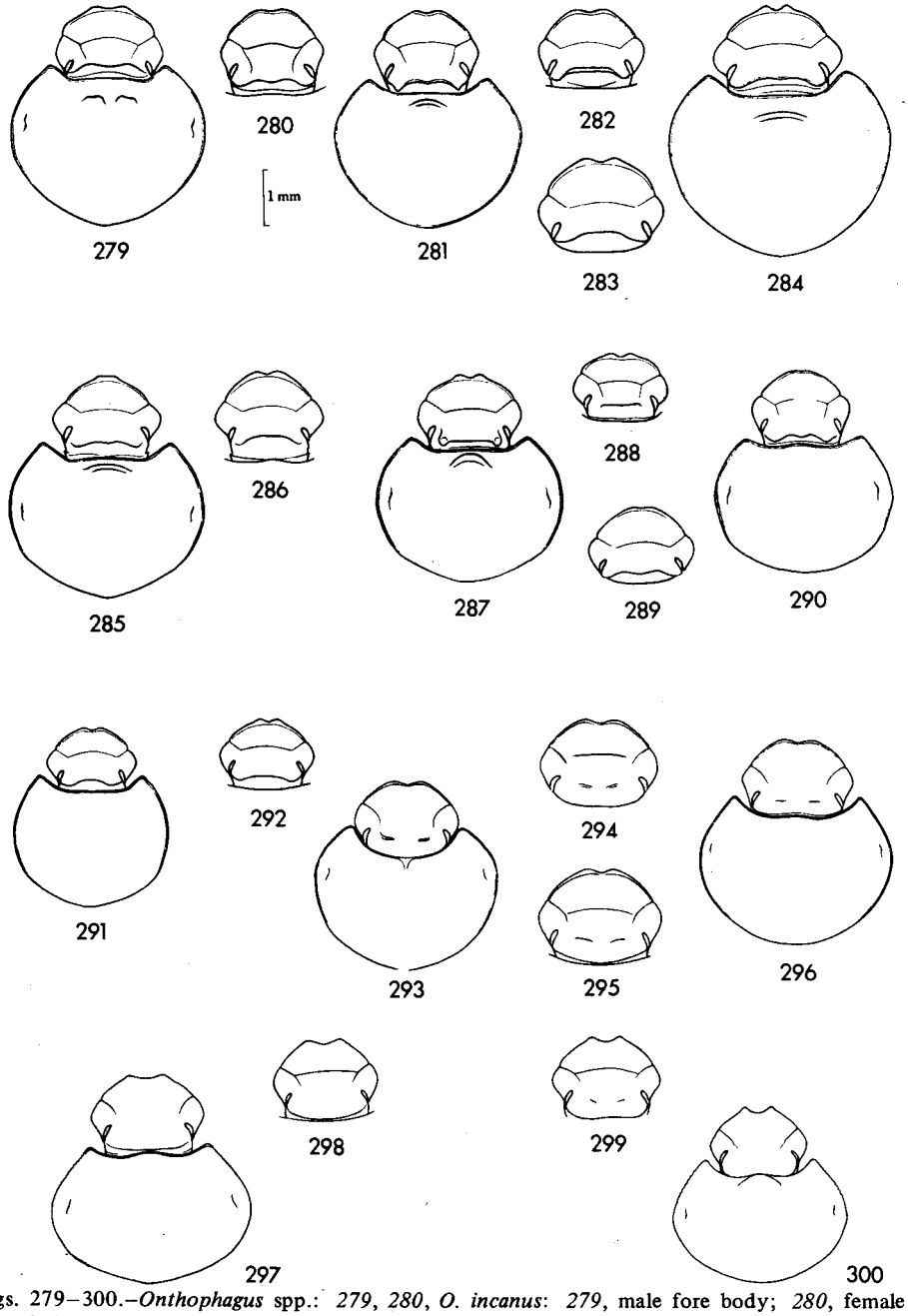



Fig. 278.—Known distribution of the *perpilosus* group in relation to annual rainfall (in.).

*Male*

*Head.*—Clypeal margin medially very slightly truncate or excised, almost evenly curved, slightly indented at clypeogenal suture, genal angles rounded. Clypeal suture completely carinate (occasionally effaced in middle), strongly angled at genal sections. Vertex prolonged backward into a short flap slightly extended at sides into a pair of rounded or angular lobes, the margin sinuate between these. In minor male this flap is reduced to a beaded line retaining a bisinuate form. Eyes very narrow, with 5 facet rows across widest point, separated by 23 widths, canthus incomplete. Densely and very coarsely punctate, with a close-set row of small setae along inside of clypeal margin, and with numerous long erect setae on all of head except centre of frons. Surface finely shagreened, shiny. Labium shallowly excised. *Pronotum.*—Devoid of median fold or any other sculpturing. Anterior angles quadrate, the apices angular. Hind edge not margined. Fairly densely punctate with moderate punctures, these




Figs. 279–300.–*Onthophagus* spp.: *279*, *280*, *O. incanus*: *279*, male fore body; *280*, female head; *281*, *282*, *O. perpilosus*: *281*, male fore body; *282*, female head; *283*, *284*, *O. tamworthi*: *283*, female head; *284*, male fore body; *285*, *286*, *O. gangulu*: *285*, male fore body; *286*, female head; *287*, *288*, *O. villosus*: *287*, male fore body; *288*, female head; *289*, *290*, *O. wakelbura*: *289*, female head; *290*, male fore body; *291*, *292*, *O. fletcheri*: *291*, male fore body; *292*, female head; *293*, *294*, *O. nammuldi*: *293*, male fore body; *294*, female head; *295*, *296*, *O. pexatus*: *295*, female head; *296*, male fore body; *297*, *298*, *O. squalidus*: *297*, male fore body; *298*, female head; *299*, *300*, *O. longipes*: *299*, female head; *300*, male fore body.

separated by 2–4 diameters, surface smooth or extremely finely shagreened, nitid, with sparse, very long curved setae near anterior angles and along lateral edges. *Elytra.*–Intervals feebly convex, smooth, nitid, very finely and sparsely punctate, glabrous except for a few curved setae at hind end of 1st, 3rd, and 5th intervals and some scattered setae along entire length of 8th interval. Striae moderately impressed, finely geminate on disc, with small distinct impressed punctures slightly crenulating edges of intervals. *Legs.*–Fore tibiae slender, inner apical edge produced into a point shorter than fore spur, a few long setae here. Minor male with fore tibiae unmodified. Fore spur short, broad. *Abdomen.*–Pygidium shagreened, moderately punctate with large punctures each bearing a long stout erect seta. Parameres normal, the points widened.

*Female*

Clypeal margin more or less bilobate, frons with a beaded bisinuate ridge or low carina as in minor male, fore tibiae not elongate and without apical point, fore spur longer, pygidium more sparsely punctate. Otherwise like male.

*Type*

Holotype ♂, 10 miles S. of Capella, Qld., 7.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC.

*Distribution* (Fig. 278)

Inland Queensland between the southern border and the tropic, west as far as the 20-in. isohyet. The large series in MNHN without exact data may have been collected at Gayndah and sent by Macleay. There is one specimen in BMNH labelled "Adelaide, S.A." but this is probably erroneous. Collected by Dr. Bornemissza in heavy black clay near Capella.

*Material Examined*

The type and 57 specimens. QUEENSLAND: 10 miles S. of Capella, 7.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 15; Gatton, Apr. 1951, L. E. Dye, UQ, 1; Gatton, 3.iii.1951, S. G. Grimmett, UQ, 1; Gayndah, L. Fairmaire, MNHN, 2; Mitchell District, Barcoo R., C. Donnell, BMNH, 1; Peack Downs, near Capella, L. Fairmaire, MNHN, 1; no exact locality, MNHN, 36.

## 104. ONTHOPHAGUS FLETCHERI Blackburn

(Figs. 291, 292, 584)

*Onthophagus fletcheri* Blackburn, 1903, p. 298; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212.

Black, antennal clubs fuscous. Total length 6–7 mm.

*Male*

*Head.*–Clypeal margin medially slightly excised in a shallow V and feebly bilobate, head margin slightly emarginate at clypeogenal suture, genal margins rounded. Clypeal suture carinate, the frontal section procurved or angulate, strongly angled with genal sections. Vertex with a transverse flap-like carina which is medially procurved and laterally slightly prolonged into a pair of low rounded lobes, not angulate or drawn out into horns. Eyes very narrow, with about 5 facet rows across widest point,

separated about 14 times, canthus incomplete. Moderately densely punctate, the punctures of different sizes, surface smooth or subrugose, sometimes very shagreened, alutaceous. Most punctures on clypeus, and those above and medial to eyes, as well as a few on genae, bearing long erect setae. Middle of clypeus sometimes with an indistinct median longitudinal ridge. Labium very shallowly excised. *Pronotum.*–Entirely devoid of prominences or depressions, although there may be an indistinct median transverse fold near anterior margin in major male. Anterior angles quadrate, the apices angulate. Hind edge very finely margined or unmargined. Coarsely and fairly densely punctate, the punctures separated by about 2 diameters. Surface between punctures smooth, very shiny except for small shagreened patches in anterior angles and posterior midline, or entirely very finely shagreened. Long sparse erect setae present in rows along anterior and lateral edges of pronotum, most of surface glabrous. *Elytra.*–Intervals flat, smooth, shiny, sometimes finely shagreened along edges, or entirely very finely shagreened, very sparsely punctate. The punctures moderately large and bearing a long erect seta, distributed as follows: 1–4 on posterior part of sutural interval, 0–1 at end of 2nd, 3–7 well spaced along 3rd, 3–5 well spaced along 5th, 8–12 along the length of 7th, and 18–27 along epipleural edge on 8th. Striae superficial, very finely geminate with deeply impressed punctures which distinctly crenulate edges of intervals. *Legs.*–With slender elongate fore tibiae with inner apical edge produced, a few long apical setae but no distinct brush. Fore spur very short. *Abdomen.*–Pygidium shagreened, with coarse sparse punctures bearing relatively short setae on either side of midline. Parameres shortened, the points widened.

*Female*

Clypeal margin medially more strongly bilobate. Hind edge of frons with a strong, transverse, feebly sinuate carina more anteriorly situated than that of male, not produced into a pair of lobes. Pronotum more coarsely punctate. Fore tibiae not modified. Otherwise like male.

*Type*

Holotype ♂, Inverell, N.S.W., Fletcher, BMNH. Seen by the author.

*Distribution* (Fig. 278)

The western slopes of the Great Dividing Range in northern New South Wales and southern Queensland. Ecology unknown.

*Material Examined*

The type and 13 specimens. NEW SOUTH WALES: Mullaly (1000 ft), Dec. 1929, H. J. Carter, ANIC, 2; Mullaly, Jan. 1957, F. E. Wilson, NMV, 4. QUEENSLAND: Toowoomba, H. J. Carter, NMV, 1; Wyreema (1000–2000 ft), SAM, 2; Wyreema, O. W. Tiegs, QM, 4.

## XV. *The* PEXATUS *Group*

Eyes very narrow, with 3–6 facet rows across widest point, separated by 20–23 widths, canthus complete. Labium excised very shallowly. Dorsal surfaces generally dull. Pronotum with short setae over entire surface. Elytra with stubble or moderately long bristles. Pygidium with short stout setae evenly spaced, few punctures. Colour grey, sometimes with a bronze sheen. Total length 4–8 mm.

Male with frontoclypeal suture effaced, frons and vertex without any horns, usually entirely smooth or may have a pair of short transverse ridges on vertex. Pronotum entirely unsculptured in both sexes. Fore tibia of male elongated, with distal brush of long setae. Female with very low frontal ridge or none at all.

Four species: 105. *nammuldi*, sp. nov.; 106. *pexatus* Harold; 107. *squalidus* Lea; 108. *longipes* Paulian.

A well-defined, closely interrelated group of species occurring in south-eastern Australia. They can be arranged in a sequence according to vegetation density of habitat, *pexatus* occupying open areas, *nammuldi* and *squalidus* woodlands, and *longipes* denser forests.

KEY TO SPECIES OF THE *PEXATUS* GROUP

1. Pronotal punctures moderate, separated by 2–3 diameters; clypeal emargination subangulate; vertex with a pair of short transverse ridges; major male with fore tibiae not very slender or elongated; female with frontoclypeal suture incomplete, not joining genal sutures ..... 2

   Pronotal punctures very large, very closely placed forming a reticulate surface; clypeal emargination arcuate in male; major male with the fore tibiae very slender and elongated; female with frontoclypeal suture complete ..... 3

2(1). Elytral intervals with several rows of small shiny granules at bases of setae; dorsal surfaces grey, matt; vertical ridges sharp, distinct; head (in fresh specimens) with erect setae over entire surface, strongly rugose in female. S. N.S.W. ..... 105. *nammuldi*, sp. nov.

   Elytral intervals without granules. Dorsal surfaces with a bronze sheen; vertical ridges indistinct; head with setae restricted to sides of frons and clypeus, moderately rugose in female. S.A., Vic., N.S.W. ..... 106. *pexatus* Harold

3(1). Elytral intervals with several rows of small shiny granules at bases of setae; pronotal setae very short, forming stubble, often worn on disc. Vic., N.S.W., S. Qld. ..... 107. *squalidus* Lea

   Elytral intervals without granules, smooth between setae; pronotal setae moderately long, curved, forming a vestiture tending to hold a layer of soil. Vic., N.S.W. ..... 108. *longipes* Paulian

## 105. ONTHOPHAGUS NAMMULDI, sp. nov.

(Figs. 293, 294, 585)

Dark grey (faint bronze reflections on head in young individuals), antennal clubs fuscous. Total length 5.5–7.0 mm.

*Male*

*Head.*—Clypeal margin medially emarginate in a very shallow V, rest of head evenly rounded to genal angles, which are rounded. Clypeal suture with frontal section completely effaced, genal sections finely raised, oblique. Vertex with a pair of distinct sharp transverse raised lines on either side of midline between eyes, otherwise flat. Eyes very narrow, with about 5 facet rows across widest point, separated by about 15 widths, canthus just touching edge of occiput. Anterior half of clypeus rugose, rest of head smooth, shagreened, very matt, finely and indistinctly punctate. In fresh specimens entire head surface is covered with well-spaced stout erect bristles. These are absent in worn specimens. Labium incised about one-fourth of way to base.

*Pronotum.*—Most individuals with a faint median longitudinal raised line on anterior

part of pronotum, median longitudinal sulcus barely visible posteriorly, otherwise unsculptured. Anterior angles acute, the apices angulate, lateral edges not serrate, without setae. Hind edge unmargined. Evenly punctate with small to medium-sized, shiny shallow punctures separated by 2-3 diameters, surface very densely shagreened, matt, each puncture with a short semi-erect curved seta. *Elytra.*—Intervals almost flat, very finely and densely shagreened, matt, with double rows of small punctures on discal intervals bearing recumbent curved setae of moderate length, 1st and 6th intervals with 1 row only, last interval with several rows near humeri. Each seta arising just behind a small shiny granule (observe in light coming from front). Striae indistinct, geminate, narrow, a little shinier than intervals, with very small punctures. *Legs.*—Fore tibia not slender or elongate, but with a long brush of setae apically, the inner apical angle strongly produced into a point. Fore spur short. *Abdomen.*—Pygidium shagreened, matt, with very small, sparse punctures bearing short curved bristles evenly spaced on either side of midline. Parameres elongated with strong downwardly directed points.

*Female*

Clypeal margin a little more strongly emarginate medially, a little more broadened on either side of emargination, clypeal surface very strongly rugose, rest of head surface rugose and strongly punctate. Clypeal suture with frontal section present, elevated, but not joining genal sections laterally. Fore tibia unmodified. Otherwise like male.

*Type*

Holotype ♂, Durras Lake, N.S.W., 26.ii.1969, G. F. Bornemissza, ANIC.

*Remarks*

The existence of this species was first noted by Dr. Bornemissza, who observed a difference in ecological distribution between two *pexatus*-like forms in the Durras Lake area. The true *pexatus* remained in open areas subject to insolation, while the other form, the present species, occurred in fully shaded forests. With this ecological clue available, the two forms were examined morphologically and found to be recognizably different, although very closely related.

*Distribution* (Fig. 301)

Presently known only from Durras Water, north of Bateman's Bay, N.S.W., where it replaces *pexatus* in forests. Coprophagous.

*Material Examined*

The type and 10 specimens. NEW SOUTH WALES: Durras Lake, 24.xii.1964, 26.ii.1969, G. F. Bornemissza, ANIC, 10.

## 106. ONTHOPHAGUS PEXATUS Harold

(Figs. 295, 296, 586)

*Onthophagus pexatus* Harold, 1869, p. 86; Blackburn, 1903, p. 269; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214.

Dark grey with a slight bronze sheen, antennal clubs dark fuscous. Total length 4-6 mm.

*Male*

*Head.*–Clypeal margin medially emarginate in a very shallow V, rest of head margin evenly rounded to genal angles, which are rounded. Clypeal suture with frontal section completely effaced, genal sections a little raised, oblique. Frons with a pair of faint transverse ridges on either side of midline between eyes, otherwise flat. Eyes very narrow, with 4–6 facet rows across widest point, separated by about 23 widths, canthus complete. Anterior half of clypeus rugose and nitid, rest of head smooth, shagreened, matt, finely and indistinctly punctate. A patch of short stout bristles on inside of eye and a few on sides of clypeus (may be absent). Labium shallowly emarginate. *Pronotum.*–Entirely unsculptured, median longitudinal sulcus absent. Anterior angles acute, the apices angulate. Lateral edges not serrate, without setae. Hind edge unmargined. Evenly punctate with small to medium-sized punctures separated by 2–3 diameters, surface very finely and densely shagreened, sericeous or matt, the punctures a little shinier, each puncture with a short recumbent curved seta. *Elytra.*–Intervals almost flat, very finely and densely shagreened, sericeous, with double rows of small punctures on discal intervals bearing recumbent curved setae of moderate length, 1st and 6th intervals with 1 row only, last interval with several rows near humeri. No granules. Striae distinct, geminate, shiny, with very small punctures. *Legs.*–Fore tibiae not slender or elongate, but with a long brush of setae apically even in minor male, the inner apical angle strongly produced into a point. Fore spur short. *Abdomen.*–Pygidium shagreened, matt, with small punctures bearing short curved bristles evenly spaced on either side of midline. Parameres elongated, with sharp, downwardly directed points.

*Female*

Clypeal margin a little more strongly emarginate medially, a little more broadened on either side of emargination. Clypeal surface more strongly rugose, clypeal suture with frontal section present, elevated, but not joining genal sections laterally. Fore tibiae without apical brush, inner apical angle not produced, spur larger. Otherwise like male.

*Type*

Holotype ♀, Adelaide, MNHN(Ob). Seen by the author.

*Distribution* (Fig. 301)

Widespread throughout the mountains and tablelands of New South Wales and Victoria in the 20- to 30-in. rainfall belt, generally following the Great Dividing Range. It reaches the sea, following these isohyets, along the southern coast from Adelaide to Melbourne, and again, unexpectedly, near Bateman's Bay, N.S.W., according to Dr. Bornemissza, perhaps as the result of recent movement following deforestation by man. Otherwise, it is strictly a tableland species in New South Wales. It occurs in dry, fully open areas at various types of excrement. It has been collected in every month from August to May except January.

*Material Examined*

The type and 374 specimens. SOUTH AUSTRALIA: Adelaide; Kangaroo I. VICTORIA: Bacchus Marsh; Boolarra; 8 miles SSE. of Doctor's Flat; Eltham; 1 mile E. of Eskdale; Melton; 3 miles N. of Morwell; 11 miles E. of Nathalia; 2 miles SE. of Omeo; 7 miles E. of Port

Campbell; Rutherglen; Wannon. AUSTRALIAN CAPITAL TERRITORY: Black Mountain; Blundell's Flat; Bull's Head; Canberra; Mt. Franklin; Tidbinbilla. NEW SOUTH WALES: Acacia Plateau; Armidale; 19 miles NE. of Boorowa; Cabbage Tree Ck., Nelligen; 6 miles S. of Candelo; Canowindra; 28 miles E. of Glen Innes; Jenolan Caves; Jindabyne; 13 miles N. of Marulan; Megan, Bellingen Valley; Moonbi; Shoalhaven R., Braidwood; Tumbarumba; Wallendbeen; 14 miles NE. of Yass.

## 107. ONTHOPHAGUS SQUALIDUS Lea

(Figs. 297, 298, 587)

*Onthophagus squalidus* Lea, 1923, p. 391; Boucomont and Gillet, 1927, p. 216.

Dark grey, antennal clubs fuscous. Total length 5-8 mm.

*Male*

*Head.*–Clypeal margin medially arcuately excised, slightly projecting on either side of excision, rest of head margin evenly rounded to genal angles, which are rounded. Clypeal suture with frontal section entirely effaced, genal sections fine, not raised, oblique. Vertex without any carinae, with a trace of a median depression in minor male. Eyes very narrow, with 4-6 facet rows across widest point, separated by about 20 widths, canthus complete. Entirely densely punctate with large shallow punctures, subrugose on clypeus, forming a reticulated surface in minor male. Surface shagreened inside and outside of punctures, dull, a patch just inside each eye with short stout erect bristles (absent in worn specimens), sometimes a few bristles also on genae. Labium very shallowly excised in an arc. *Pronotum.*–Without any sculpturing. Anterior angles acute, the apices angulate. Side margins of pronotum finely serrate. Hind edge unmargined. Entirely very densely punctate with large shallow punctures forming a reticulum, inside of the punctures granulate and usually holding a layer of soil. Each puncture with a short stout bristle together forming a short stubble over entire pronotal surface, best seen in young specimens. In worn specimens stubble is confined to sides. *Elytra.*–Intervals flat, shagreened, matt, with 2 or 3 rows of small shiny granules evenly distributed over entire surface, giving it a riveted appearance, with numerous short bristles emerging just behind granules and forming double rows on each discal interval, more on lateral ones. Apical ends of intervals 3-5 somewhat callose. Striae superficial, indistinct, geminate, a little shinier than intervals, impunctate. *Legs.*–Fore tibia of major male slender, elongate, with a brush of long setae apically, inner apical angle prolonged into a short point. Minor male with fore tibiae unmodified. *Abdomen.*–Pygidium strongly shagreened, matt, impunctate, with evenly distributed short stout bristles over entire surface on either side of midline. Parameres shortened, points small, near base.

*Female*

Clypeal surface more rugose, head more densely punctate, frontal section of clypeal carina present, nearly straight, raised. Fore tibiae not modified, fore spur longer. Otherwise like male.

*Type*

Holotype ♀, National Park, Lamington, Qld., Dec. 1919, H. Hacker, QM. Seen by the author.

*Remarks*

The holotype of *squalidus*, described as a male by Lea, is a worn female. The setae are nearly worn off the elytra, but the small elytral granules are a distinctive feature of this species (shared with *nammuldi*) and are clearly visible.

*Distribution* (Fig. 301)

The east coast from extreme eastern Victoria to Sydney, westward on to the Southern Tableland at least to Canberra and Marulan, north of Sydney confining itself to highland localities as far as the McPherson Range on the Queensland border. It is thus basically a coastal form in the south, apparently replacing *pexatus* which occurs largely inland, although the two species coexist in some areas. Northward it becomes montane like *pexatus*. It is more of a woodland form than the latter species, and was collected by the author in eucalypt-casuarina woodland with loose dry sandy soil, at human excrement. October-January and March-May.

*Material Examined*

The type and 171 specimens. VICTORIA: Darby Saddle, 13.v.1963, G. F. Bornemissza, ANIC, 1; Mt. Drummer, E. of Cann River, 13.i.1968, E. G. Matthews, 3. AUSTRALIAN CAPITAL TERRITORY: Blundell's Flat, Mar. 1964, G. F. Bornemissza, ANIC, 1; Canberra, CSIRO, Mar., Dec., 1964, G. F. Bornemissza, ANIC, 141. NEW SOUTH WALES: Durras Lake, 24.xii.1964, G. F. Bornemissza, ANIC, 8; 5 miles S. of Eden, 13.i.1968, E. Matthews, ANIC, 3; 13 miles N. of Marulan, 14.iv, 18.v, 22.x.1964, G. F. Bornemissza, ANIC, 10; Moonbi, 13.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 2; Putty, 14.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 1; Sinclair's Lookout, Glen Innes–Inverell Rd., 6.xii.1965, G. A. Yapp, ANIC, 1; Sydney, Deane, UQ, 1. QUEENSLAND: National Park, Dec. 1919, H. Hacker, QM, 1 (cotype).

## 108. ONTHOPHAGUS LONGIPES Paulian

(Figs. 299, 300, 588)

*Onthophagus longipes* Paulian, 1937, p. 344.

Brownish grey, antennal clubs fuscous. Total length 5.0–6.5 mm.

*Male*

*Head.*–Clypeal margin medially excised in an arc, distinctly projecting on either side of excision, rest of clypeal margin almost straight, genal angles rounded. Clypeal suture with frontal section entirely effaced, genal sections fine, not raised, oblique. Frons without any carina or depression. Eyes very narrow, with about 4 facet rows across widest point, separated by about 23 widths, canthus complete. Densely punctate with large shallow punctures, subrugose on edge of clypeus, surface finely shagreened inside and outside punctures, alutaceous, most of posterior part of frons with short stout curved bristles, a few bristles also on genae and clypeus. Labium barely excised. *Pronotum.*–A small median gibbosity near anterior margin present in major male only, other specimens unsculptured. Anterior angles acute, the apices angulate or rounded, lateral edges finely serrate, with a row of bristles. Hind edge unmargined. Very densely punctate with large, very shallow ocellate punctures forming an indistinct, slightly asperate reticulum over entire pronotum, surface finely shagreened, alutaceous or matt, each puncture with a moderately long, stout curved bristle often holding a layer of fine soil, often leaving a shiny median area. *Elytra.*–Intervals flat, densely

shagreened, matt, without granules but with slight asperation, with numerous short curved setae forming double rows on most of discal intervals, more basally and on sides of elytra. Intervals 3–5 apically somewhat callose. Striae superficial, indistinct, geminate, not shiny, impunctate. *Legs.*—Fore tibiae of major male slender, elongate, apically with a brush of long setae, inner apical angle produced into a short point, minor male with tibiae unmodified. Fore spur short. *Abdomen.*—Pygidium strongly shagreened, matt, with evenly spaced, short bristles on either side of midline. Sternites shagreened, with short bristles. Parameres shortened, the points small, near base.

*Female*

Clypeal margin more strongly emarginate and produced, clypeal surface more rugose, head surface more strongly punctate or rugose. Frontal section of clypeal suture present, almost straight, slightly raised. Frons with a pair of indistinct short oblique ridges on either side of a shallow depression. Pronotum a little unevenly convex in major specimens. Fore tibiae not modified, spur longer. Otherwise like male.

*Type*

Holotype ♂, Esmeralda (Emerald?), Vic., Kraatz, DEI. Seen by the author.

*Distribution* (Fig. 301)

The southern coast of Victoria from Melbourne to Wilsons Promontory, reappearing near Canberra and on the eastern escarpment south of Wollongong, N.S.W., in forests. *O. longipes* appears to be a dense-forest vicariant of *squalidus*, to which it is closely related. At rabbit entrails, human excrement, cow dung (set as bait in forest), and one specimen collected by Dr. Bornemissza at possum droppings. December–May.

*Material Examined*

The holotype and 18 specimens. VICTORIA: Boolarra, 28.iv.1963, 4, 11.v.1963, G. F. Bornemissza, ANIC, 3; 30 miles S. of Fish Creek, Jan. 1962, C. Watts, CNC, 6; Gunyah, 11.v.1963, G. F. Bornemissza, ANIC, 5. AUSTRALIAN CAPITAL TERRITORY: Blundell's Flat, Mar. 1964, G. F. Bornemissza, ANIC, 1. NEW SOUTH WALES: Barrengarry Mountain, 29.xii.1967, E. G. Matthews, ANIC, 1; Macquarie Pass, 29.xii.1967, E. G. Matthews, ANIC, 2.

## XVI. *The* QUADRIPUSTULATUS *Group*

Eyes very narrow, with 3–5 facet rows across widest point, separated by about 20 widths, canthus incomplete. Labium excised very shallowly to one-third of way to base. Pronotum glabrous, surfaces usually nitid. Elytra glabrous with a few setae below humeri, or with microtrichia. Pygidium with short stout setae. Colour black, bronzed, or greenish, 4 species with red areas on elytra. Total length 2.5–5.0 mm.

Male with frontoclypeal suture variable, a carina on vertex more or less elevated into 2 lobes or angles, often preceded by a median depression. No horns. Pronotum entirely unsculptured. Fore tibiae elongated, with distal brush of long setae. Female with feeble recurved frontal ridge, pronotum unsculptured.

Seven species: 109. *evanidus* Harold; 110. *fabricii* Waterhouse; 111. *waterhousei* Boucomont and Gillet; 112. *quadripustulatus* Fabricius; 113. *kokereka*, sp. nov.; 114. *blackburni* Shipp; 115. *cruciger* Macleay.

A homogeneous group of small species occurring throughout Australia. All are inhabitants of open areas except *evanidus*, which lives in the forests of south Western Australia.

## KEY TO SPECIES OF THE *QUADRIPUSTULATUS* GROUP

1. Groups of stout setae present near anterior angles of pronotum at least; head and pronotum usually bronzed or greenish ..... 2
   Dorsal surfaces of head and prothorax entirely devoid of stout setae and black ..... 3

2(1). Dorsal surface of head with at least a few stout erect setae; often with greenish or cupreous reflections; elytra without red humeri; elytral intervals often partly or wholly shagreened. S. W.A. ..... 109. *evanidus* Harold
   Head dorsally without stout erect setae; bronze-black with reddish humeri; elytral intervals shiny. N. W.A., N. N.T., N. Qld. ..... 110. *fabricii* Waterhouse

3(1). Pronotum densely punctate with moderately large punctures, these separated by 1 diameter or less; elytral intervals entirely shagreened, or shagreened along edges and irregularly costate or rugose along middle; covered with microtrichia; major male with angles of vertical carina strongly elevated and approximated. SE. S.A., N.S.W., S. Qld. ..... 111. *waterhousei* Boucomont and Gillet
   Pronotum more sparsely punctate with smaller punctures, these separated by 2–5 diameters; elytral intervals not shagreened or rugose, shiny, glabrous; major male with angles of vertical carina low and remote ..... 4

4(3). Male with clypeal margin medially almost straight or very feebly sinuate, frontoclypeal suture effaced ..... 5
   Male with clypeal margin medially excised or bidentate, frontoclypeal suture present, beaded or carinate ..... 6

5(4). Elytra with red patches, at least on humeri, and entirely glabrous. N. N.S.W., Qld., N. W.A. ..... 112. *quadripustulatus* Fabricius
   Entirely black, usually with a few stout setae below humeral calli. N.S.W., S. Qld. ..... 113. *kokereka*, sp. nov.

6(4). Pronotum entirely black, fairly densely punctate, the punctures separated by 1–2 diameters. Elytra largely black. S.A., Vic., N.S.W. ..... 114. *blackburni* Shipp
   Pronotum with at least anterior angles red, more sparsely punctate, the punctures separated by 3–4 diameters; elytra largely red. Qld., N.T., N. W.A. ..... 115. *cruciger* Macleay

### 109. ONTHOPHAGUS EVANIDUS Harold

(Figs. 303, 304, 589)

*Onthophagus evanidus* Harold, 1869, p. 86; Blackburn, 1903, p. 304; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 211.

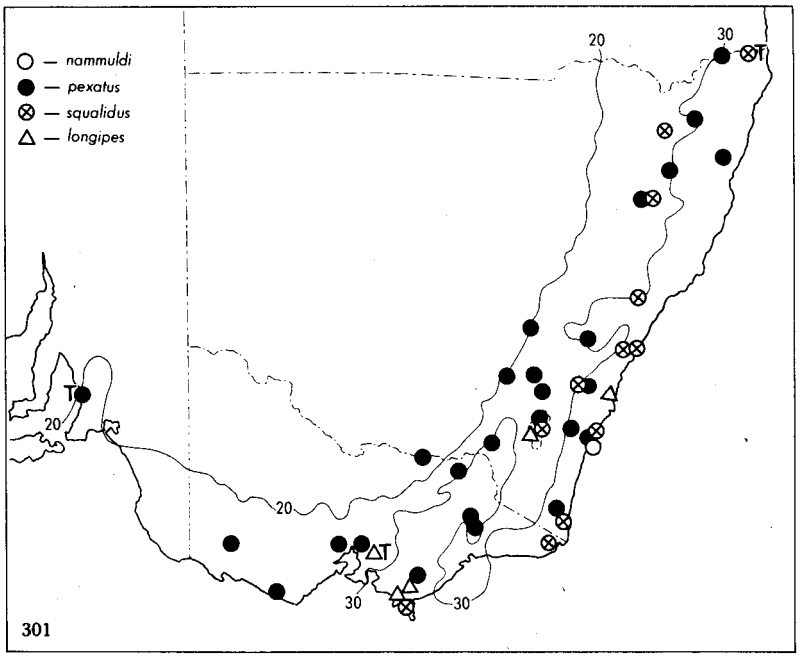
*Onthophagus negatorius* Blackburn, 1903, p. 297; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214. New synonymy.

*Onthophagus cupreopunctatus* Lea, 1923, p. 384; Boucomont and Gillet, 1927, p. 211. New synonymy.

Fore body greenish or cupreous (southern specimens), or bronze-black (northern specimens), rest of body black, or middle of elytral intervals may be greenish, antennal clubs fuscous. Total length 3–5 mm.

*Male*

*Head.*—Clypeal margin feebly emarginate medially in a shallow rounded or slightly angulate excision, rest of head margin evenly rounded to genal angles, which are subangulate, not prominent. Clypeal suture with frontal section completely effaced, genal sections raised, oblique. Frons medially with deep fovea bounded posteriorly by a high recurved carina which is elevated laterally into a pair of strongly raised, angulate lobes in major male, or low rounded lobes in minor male. Eyes extremely narrow,



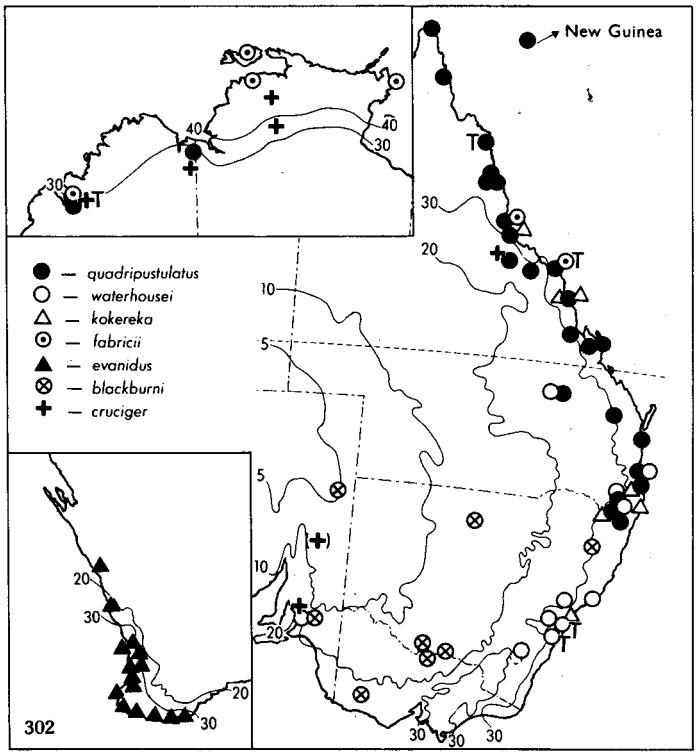




Fig. 301.–Known distribution of the *pexatus* group in relation to annual rainfall (in.).
Fig. 302.–Known distribution of the *quadripustulatus* group in relation to annual rainfall (in.).

with 3–4 facet rows across widest point, separated by about 17 widths, canthus incomplete. Clypeus anteriorly strongly rugose, with large punctures, becoming smooth and with smaller punctures posteriorly and on frons, genae with large punctures. Area on both sides of eyes with strong erect bristles, extending over genae and, especially in minor male, across frons. Labium shallowly excised. *Pronotum.*–Unsculptured, moderately convex. Anterior angles acute, the apices angulate. Hind edge very finely margined. With moderate punctures separated by about 2 diameters (southern specimens) or large punctures separated by about 1 diameter (northern specimens), the latter leaving a small impunctate area in middle of disc. Area inside anterior angles with strong bristles extending in a line along lateral margins. *Elytra.*–Intervals rugulose or subcostate, especially laterally, occasionally flat discally, shagreened, dull (almost smooth and nitid in some southern specimens), costae when present shinier, with numerous rather large punctures each bearing an extremely short seta. Some longer setae on last interval, posterior part of sutural interval, and sometimes a few on 3rd interval. Intervals 1 and 3–5 apically a little raised. Striae superficial, geminate, impunctate. *Legs.*–Fore tibiae elongate, slender apically with a long brush of setae, reduced to a few setae in minor male, inner apical angle not produced into a point. Spur short. *Abdomen.*–Pygidium very finely shagreened, nitid or alutaceous, with moderate punctures bearing short, inclined setae laterally. Aedeagus normal.

*Female*

Clypeal surface strongly vermiculately rugose. Frontal section of clypeal suture present, strongly raised, rest of head very coarsely punctate and usually vermiculately or reticulately rugose, with erect scattered setae usually present on clypeus as well as frons and genae. Frons with a pair of oblique ridges usually separated, but sometimes joining into a single V-shaped ridge. Fore tibiae unmodified. Otherwise like male.

*Types*

Holotype of *evanidus*: ♀, Tasmania, Dayr. H., MNHN(Ob).
Holotype of *negatorius*: ♀, Donnybrook, W.A., Lea, BMNH.
Holotype of *cupreopunctatus*: ♂, New South Wales, SAM I.15421.
All seen by the author.

*Remarks*

The types of *evanidus* and *cupreopunctatus* evidently bear incorrect locality labels. The unique type of *evanidus* is a female of the northern (Geraldton) populations of this species, although clearly labelled "Tasmania". The series of 4 *cupreopunctatus* is labelled "N.S.W." with no locality, date, or collector mentioned, and although Lea states that they are "very different" from *negatorius*, they are in fact typical of the southern form of this species.

Southern specimens, from just north of Perth southward, are green or cupreous on the pronotum and nitid because of the relatively small size of the punctures. There may be greenish stripes running down the middle of the elytral intervals. The elytra are also shinier because of the finer shagreening of the surfaces. Northern specimens, from the Geraldton area, are not at all greenish, but of a dull bronze colour on the fore body and appear much less shiny because of the larger and more closely spaced pronotal punctures and strongly shagreened elytral surfaces. No other differences

could be observed. That these forms represent a single species is shown by the presence of an intermediate specimen from the Hill River west of Moora, which possesses dull elytra, as in the northern form, but small pronotal punctures and a very faintly greenish pronotum.

*Distribution* (Fig. 302)

The south-west of Western Australia along the coast from Geraldton to Albany. The bulk of the material is from Perth to Albany in the zone of 30 in. or more of annual rainfall, while the Geraldton series, collected by Dr. Darlington in 1931 and representing a distinct geographical race (see above), is from an area of less than 20 in. of annual rainfall.

The author encountered *evanidus* abundantly throughout the jarrah forests of south Western Australia. The largest numbers occurred in intermittently- to well-shaded, relatively dense jarrah forest on the Darling Range (30–40 in. rainfall). The species also occurred in jarrah–karri forest and other forests of moderate density, but dropped out in the very dense karri and red tingle forests near Pemberton and Walpole in areas of 50–60 in. of annual rainfall, where *vermiculatus* is the only *Onthophagus* present. On the other hand, *evanidus* also drops out in open woodland and entirely unshaded pasture areas, where only *haagi* and *ferox* are found. All areas in which this species was found had sandy soil.

*O. evanidus* seems to be predominantly coprophagous, only one specimen having been collected under a dead skink. The rest came to human excrement, cow dung, and reptile entrails. The species flies in the daytime and has been collected only from September to November.

*Material Examined*

The types and 122 specimens. WESTERN AUSTRALIA: Albany; Arumvale; 6 miles N. of Australind; 3 miles SSE. of Badgingarra Pool, Hill R.; Bunbury; 8 miles N. of Busselton; Cape Leeuwin; Geraldton; 8 miles W. of Harvey; 4 miles E. of Jarrahdale; King George's Sound; Lake Preston; Margaret R.; 30 miles SW. of Nannup; Pemberton; Perth; Porongurups; Rottnest I.; Tallanalla; Torbay; 12 miles N. of Walpole; Whittaker's Mill near Dwellingup; William Bay; Yallingup.

## 110. ONTHOPHAGUS FABRICII Waterhouse

(Figs. 305, 306, 590)

*Onthophagus humeralis* Macleay, 1888, p. 903 (non Raffray, 1877); Blackburn, 1903, p. 306; Boucomont and Gillet, 1927, p. 212.

*Onthophagus fabricii* Waterhouse, 1894, p. 10 (nom. nov.); Blackburn, 1903, p. 305; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 211.

*Onthophagus humator* Shipp, 1895, p. 179. New synonymy.

*Onthophagus strabonis* Lea, 1923, p. 391; Boucomont and Gillet, 1927, p. 216. New synonymy.

Fore body bronze-black, spot below pronotal fovea sometimes reddish, elytra black with humeral callus and edges suffused with red, legs rufous, antennal clubs grey. Total length 2.5–4.5 mm.

*Male*

*Head.*—Clypeal margin medially very shallowly emarginate in an arc, rest of clypeal margin evenly rounded to genal suture, where it is slightly excised, genal angles

rounded. Clypeal suture with frontal section entirely effaced, genal sections moderately raised, oblique. Vertex of major male with a strong transverse ridge raised into 2 rounded points which are somewhat approximated, the area before ridge slightly depressed. Minor male with simple transverse carina a little further forward on frons. Eyes narrow, with 4–5 facet rows across widest point, separated by about 15 diameters, canthus incomplete. Surface smooth, nitid, sparsely punctate with small punctures, more coarsely punctate along edges, not rugose, minor male with larger punctures. Glabrous. Labium excised one-third of way to base. *Pronotum.*–Completely unsculptured. Anterior angles quadrate, the apices angular. Hind edge unmargined. Surface smooth, nitid, evenly punctate with small punctures separated by 3–4 diameters in major male, 2–3 in minor one, lateral edges with a row of short curved setae, a little more concentrated anteriorly. *Elytra.*–Intervals almost flat, nitid, a little uneven laterally, with small punctures spaced about as on pronotum, each puncture with a minute seta usually not visible, lateral intervals with distinct short setae anteriorly, sometimes absent. Striae impressed, simple, with well-spaced deep punctures a little wider than stria. *Legs.*–Fore tibiae slender, elongated in major male, with a long terminal brush of setae, the inner apical angle quadrate, not prolonged. Minor male with tibiae unmodified. Spur short. *Abdomen.*–Pygidium shagreened, the surface somewhat irregular, with rows of well-spaced moderate punctures bearing short recumbent setae on either side of midline. Parameres short, with a strong claw-like point.

*Female*

Clypeal margin expanded on either side of median excision, clypeal surface transversely rugose, frontoclypeal suture marked by a strongly raised line joining genal sutures. Frons with a single open-V-shaped ridge in middle. Head more strongly punctate. Fore tibiae unmodified. Otherwise like male.

*Types*

Holotype of *fabricii*: ♀, Port Bowen, Qld., BMNH.
Holotype of *humeralis*: ♂, King's Sound, W.A., MM.
Holotype of *strabonis*: ♂, Groote Eylandt, N.T., N. B. Tindale, SAM I.15407.
All seen by the author.

*Remarks*

The type of *fabricii* is a small, somewhat teneral female and only the presence of setae on the sides of the pronotum (also mentioned by Waterhouse) indicates it to be this species rather than *quadripustulatus*. Normally the bronze cast of *fabricii* and its reduced red areas also serve to distinguish it from the very closely related *quadripustulatus*. The name *humator* was proposed by Shipp to replace the preoccupied *humeralis* and therefore has no type. It was treated as a synonym of *humeralis* Macleay by Boucomont and Gillet, evidently through a lapse. Lea's *strabonis* is a dark male of this species, with only a trace of reddish colour at the humeri.

*Distribution* (Fig. 302)

The Kimberley District of Western Australia, the north of the Northern Territory, and the coast of Queensland at Ingham and Bowen. It is far less abundant than the closely related *quadripustulatus* in Queensland but replaces the latter along the north coast of Australia. Collected by the author in buffalo and cow dung in the daytime in open areas subject to intermittent shade, in sandy soil.

*Material Examined*

The types and 20 specimens. QUEENSLAND: Ingham, Forrest Beach, 1.v.1964, G. F. Bornemissza, ANIC, 5. NORTHERN TERRITORY: Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 4; Snake Bay, Melville I., 4–6.ii.1968, E. G. Matthews, ANIC, 1; Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 8. WESTERN AUSTRALIA: Barrior Range, King's Sound, MM, 2.

## 111. ONTHOPHAGUS WATERHOUSEI Boucomont and Gillet

(Figs. 307, 308, 439, 591)

*Onthophagus nanus* Waterhouse, 1894 (non Harold, 1871), p. 12; Blackburn, 1903, p. 271; Lea, 1923, p. 355.

*Onthophagus waterhousei* Boucomont and Gillet, 1927, p. 217 (nom. nov.).

*Onthophagus subocelliger* Blackburn, 1903, p. 299; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 216. New synonymy.

Black, antennal clubs fuscous. Total length 3–5 mm.

*Male*

*Head.*–Clypeal margin medially excised in a shallow arcuate emargination, genal margins rounded. Clypeal suture with frontal section effaced. Vertex with a high transverse bilobate carina. A median depression before this carina, preceded by a low tumosity. In major male the 2 lobes of carina are angulate, approximated, and separated by a V-shaped emargination. With less development, lobes become rounded, sinuate, and lower. Minor male with low V-shaped carina situated further forward on frons and no depression. Eyes extremely narrow, with 3–4 facet rows across widest point, separated by about 20 widths, canthus incomplete. Middle of frons and clypeus impunctate or very finely punctate, becoming moderately punctate on sides of clypeus and on vertical carina, coarsely punctate on genae. Minor male with head entirely coarsely punctate. Glabrous. Labium shallowly emarginate. *Pronotum.*–Without any prominences or depressions, anteriorly a little more gibbous in major male. Anterior angles subquadrate, the apices angular. Hind edge unmargined. Surface entirely densely and coarsely punctate, the punctures separated by about 1 diameter or less. Surface between punctures very finely shagreened, dull to sericeous, distinctly shagreened posteromedially. *Elytra.*–Intervals feebly convex to almost flat on disc, either entirely smooth and shagreened, matt (in northern specimens), or marginally shagreened and medially vermiculately rugose and nitid, especially on lateral intervals, which are subcostate (in southern specimens). Intervals 1, 3, 4, and 5 posteriorly somewhat raised and rugose, forming low costae at distal declivity. Finely and irregularly punctate, each puncture with a minute recumbent seta, together forming a fine stubble over entire elytral surface, seen best in oblique light. Usually a few longer setae below humeral calli. Striae superficial, geminate, shiny, with extremely small punctures not crenulating edges of intervals. *Legs.*–Anterior tibiae elongate, slender, with an apical brush of long setae in major male, the inner apical angle somewhat produced. In minor male tibiae are unmodified. *Abdomen.*–Pygidium densely and coarsely punctate, with groups of recumbent short bristles on either side of midline. Parameres foreshortened, triangular, points with small truncate projection.

*Female*

With median clypeal emargination more accented by slight prominence of margin on either side of it (clypeus slightly bilobate). Clypeal suture complete, its frontal section distinct, carinate. Middle of frons with short open-V-shaped ridge. Head more coarsely punctate. Pronotum more coarsely punctate, elytral intervals more rugose. Fore tibiae not elongated. Otherwise like male.

*Types*

Holotype of *nanus*: ♂, Sydney, BMNH.
Holotype of *subocelliger*: ♂, Northern Territory, BMNH.
Both seen by the author.

*Remarks*

The locality "Northern Territory" for *subocelliger* may be erroneous, as the specimens under that name in BMNH are typical *waterhousei*, probably from South Australia. MNHN contains a female of this species labelled "*parvus* Blanchard" in Harold's handwriting, indicating that this is the species which Harold believed to be *parvus*, the type of which has been lost. However, the original description of *parvus* does not fit the present species and Harold's interpretation cannot be accepted.

As mentioned in the description, the specimens from the southern part of the range (South Australia and Australian Capital Territory) are more rugose and costate on the elytra, and tend to have a few more stout bristles under the humeri. There are no bristles at all on the head and pronotum, however, and this continues to distinguish *waterhousei* from the closely related *evanidus* of Western Australia.

*Distribution* (Fig. 302)

The Mt. Lofty Ranges near Adelaide, the Southern Tablelands of New South Wales, the vicinity of Sydney and the Blue Mountains, the New England Tableland, and south Queensland. It is not yet known from Victoria. The known localities suggest a southern montane distribution at rainfall levels of about 30 in. annually. In semi-wooded areas at excrement baits. September, and January–April.

*Material Examined*

The types and 56 specimens. SOUTH AUSTRALIA: Mt. Lofty Ranges, S. H. Curnow, SAM, 1; no exact locality, MM, 2. AUSTRALIAN CAPITAL TERRITORY: Canberra, 10.iii.1964, G. F. Bornemissza, ANIC, 3. NEW SOUTH WALES: Blue Mountains, Jan. 1909, G. E. Bryant, BM, 2; Bolivia, 13.iv.1965, G. F. Bornemissza, ANIC, 4; Illawarra, Nov. 1909, G. E. Bryant, BM, 1; North Rocks, 9.ix.1941, CNC, 2; Putty, 14.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 1; Pymble, Feb. 1935, K. K. Spence, AM, 6; Ryde, 15.ix.1940, J. O. Campbell, CNC, 3; Sydney, H. J. Carter, QM, 1; Sydney, E. W. Ferguson, ANIC, 3; Sydney, A. Lüddemann, 1929, MNHN, 2; Sydney, Waterhouse (type series), BMNH, 5; no exact locality, AM, MNHN, 7. QUEENSLAND: Ballandean, 13.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 1; Brisbane, 7.ii.1917, H. Hacker, QM, 1; Carnarvon Gorge, 9.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 1; Dunwich, 27.ii.1968, H. Burton, UQ, 8; Fletcher, Sutton, ANIC, 1; Stanthorpe, E. Sutton, ANIC, 1.

## 112. ONTHOPHAGUS QUADRIPUSTULATUS (Fabricius)

(Figs. 309, 310, 592)

*Scarabaeus quadripustulatus* Fabricius, 1775, p. 27; Fabricius, 1781, p. 31; Olivier, 1789, p. 175.

*Onthophagus quadripustulatus* (Fabricius), Waterhouse, 1894, p. 10; Blackburn, 1903, p. 272; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

*Scarabaeus bipustulatus* Fabricius, 1775, p. 30; Olivier, 1789, p. 174. New synonymy.

*Onthophagus bipustulatus* (Fabricius), Harold, 1867, p. 34; Blackburn, 1903, p. 272; Blackburn, 1906, p. 263; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 209.

*Onthophagus albertisi* Harold, 1877, p. 71; Boucomont and Gillet, 1927, p. 215 (syn.).

*Onthophagus minusculus* Macleay, 1888, p. 903; Blackburn, 1903, p. 305; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 213. New synonymy.

Fore body black, elytra black with a square red area occupying anterior third of 5th–8th intervals, often also part of 4th, red colour usually extending posteriorly along last interval to occupy apical edges of elytra. Red colour often confined to anterior part of elytra only, in extreme cases only to the immediate humeral area. Antennal clubs dark grey. Total length 3.5–4.5 mm.

*Male*

*Head.*–Clypeal margin medially very feebly sinuately emarginate, rest of head margin evenly rounded except for slight excision at genal suture, genal angles rounded. Clypeal suture with frontal section effaced (except in 1 specimen), but a faint transverse fold present, visible only in oblique light. Vertex with a sharp transverse ridge near occiput in major male, the ridge laterally raised into low angles which are well separated, nearer to eyes than to middle. Smaller male with the angles lower, more approximated and rounded, minor male with only a low short recurved ridge. Eyes narrow, with about 5 facet rows across widest point, separated by about 15 widths, canthus incomplete. Surface smooth, nitid, moderately densely punctate with small punctures, larger in minor male. Glabrous. Labium shallowly emarginate. *Pronotum.*–Unsculptured. Anterior angles quadrate, the apices angular. Hind edge very finely margined. Surface smooth, mirror-like, evenly punctate with small punctures separated by 3–5 diameters. Glabrous. *Elytra.*–Intervals almost flat, nitid, with sparse minute punctures bearing extremely minute setae usually not visible. Otherwise glabrous. Striae impressed, simple, with well-spaced deep transverse punctures crenulating edges of intervals. *Legs.*–Fore tibiae slender, elongated in major male, with slender terminal brush of long setae, inner apical angle not produced. Tibiae unmodified in minor male. Spur short. *Abdomen.*–Pygidium very finely shagreened, shiny, with rows of well-spaced moderate punctures bearing short recumbent setae on either side of midline. Parameres short, with projecting point.

*Female*

Clypeal margin expanded on either side of median excision, clypeal surface transversely rugose. Frontoclypeal suture marked by a carinate line. Frons with a low, open-V-shaped ridge near middle, the surface a little depressed before it. Head more coarsely punctate. Fore tibiae not modified. Otherwise like male.

*Types*

Holotype of *quadripustulatus*: ♂, New Holland [Endeavour River, Qld., June–Aug. 1770, Joseph Banks], BMNH(Banks).

Holotype of *bipustulatus*: ♀, same data, BMNH(Banks).

Holotype of *minusculus*: ♀, King's Sound, W.A., MM.

Holotype of *albertisi*: New Guinea, d'Albertis, Civic Museum of Genoa.

All but the last seen by the author.

*Remarks*

Specimens from the north of the range (north Queensland) tend to be dark, the red areas being reduced to small spots on the humeri and the apical border being black. This form strongly resembles *fabricii*. On the other hand, the few specimens available from the Kimberleys, in north Western Australia, tend to have large areas of vivid red on the elytra, the black being reduced to a sharply defined cruciform pattern down the sutures and across the middle. This form resembles *cruciger*, which, however, has red areas on the pronotum as well. The Kimberley specimens of *quadripustulatus* were named *minusculus* by Macleay. There is no evidence at present that *minusculus* is specifically distinct from *quadripustulatus*, but more material of the former is needed before we can be sure.

The type of *bipustulatus* is a small, very faded (or teneral) female of the same species as the male type of *quadripustulatus.*

*Distribution* (Fig. 302)

New Guinea and the entire length of the Queensland coast from Cape York to just south of the New South Wales border, inland to the 25-in. isohyet. The southernmost record is Gibraltar Range National Park, east of Glen Innes, N.S.W. In the north-west it is known from the Kimberleys on the basis of three specimens only: the type of *minusculus* from King's Sound, a female collected by the author near Kununurra, and a female simply labelled "Kimberley, N.W.A." in ANIC. The New Guinea record is based on the synonymization of *albertisi* Harold by Boucomont and Gillet (1927, p. 215). No New Guinea specimens have been seen by the present author.

This species occurs in open areas – pastures, savannah woodlands, and open forests, on a variety of soils. It comes to cow dung, human faeces, mammal entrails, and dead mammals (one record of the latter). September and October (four records) and February–June with a peak in April (24 records). Probably diurnal.

*Material Examined*

The types and 169 specimens. NEW SOUTH WALES: Bolivia, 13.iv.1965, G. F. Bornemissza, ANIC, 3; Gibraltar Range National Park, 5.xii.1967, E. G. Matthews, ANIC, 1. QUEENSLAND: Amberley; 40 miles SW. of Ayr; Atherton; Ballandean; Beaudesert; Belmont, 8 miles NW. of Rockhampton; Blue Water Ck.; 10 miles N. of Bowen; Brisbane; Cann R.; Carnarvon Gorge; Charters Towers; Eidsvold; Gillie's Highway; Hidden Valley; Ingham, Forrest Beach; 30 miles N. of Injune; Iron Range; Lockerbie; Mackay; 23 miles W. of Mackay; Marlborough; 10 miles W. of Marlborough; Mt. Molloy Rd., 7 miles N. of Mareeba; Noosa; Paluma Heights; W. of Ravenshoe; Serpentine Lagoon via Yeppoon; Stamford; Upper Mulgrave R. via Gordonvale. WESTERN AUSTRALIA: Kimberley, ANIC, 1; Kununurra, 20.ii.1968, E. G. Matthews, ANIC, 1.

## 113. ONTHOPHAGUS KOKEREKA, sp. nov.

(Figs. 311, 312, 440, 593)

Black, antennal clubs fuscous. Total length 3.5–5.0 mm.

*Male*

*Head.*–Clypeal margin medially straight or almost imperceptibly emarginate, rest of head margin evenly rounded, genal margins rounded. Clypeal suture with frontal section effaced, genal sections a little raised, oblique. Frons with a median depression, its occipital edge with a feebly raised, recurved or slightly angulate carina which is

laterally slightly elevated into a pair of low rounded lobes in major male, reduced to a pair of low transverse tumosities on vertex in minor male. Eyes narrow, with about 5 facet rows across widest point, separated by about 20 widths, canthus incomplete. Head very finely punctate, becoming moderately punctate on genae. Surface smooth, nitid. Glabrous. Labium excised about one-third of way to base. *Pronotum.*–Unsculptured. Anterior angles quadrate, the apices angulate. Hind edge finely margined. Evenly, fairly sparsely punctate with fine to moderate punctures separated by 2–4 diameters. Glabrous. Surface smooth, very shiny. *Elytra.*–Intervals almost flat, very finely punctate, nitid, glabrous except for a few setae below humeral calli. Striae superficial, geminate, with well-spaced moderately impressed punctures slightly wider than stria and crenulating edges of intervals a little. *Legs.*–Fore tibiae elongate, slender, with a long fine apical brush of setae, inner apical angle moderately produced in major male, subquadrate in minor one. *Abdomen.*–Pygidium finely shagreened, alutaceous, irregularly punctate with small punctures, with numerous short stout setae on either side of midline. Parameres foreshortened, points long, claw-like.

*Female*

Clypeal margin medially expanded into 2 small lobes. Clypeal surface vermiculately rugose, head surface strongly punctate. Frontoclypeal suture carinate. Frons with a low sharp recurved ridge preceded by a shallow depression. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, Somersby, N.S.W., 9.iv.1964, G. F. Bornemissza, ANIC.

*Distribution* (Fig. 302)

From near Gosford, N.S.W., to Magnetic I. near Townsville, Qld., inland to the 30-in. isohyet. A few specimens were collected by the author at cow dung, at the faeces of an insectivorous marsupial, and at marsupial entrails. It occurs in open areas.

*Material Examined*

The type and 21 specimens. NEW SOUTH WALES: Sinclair's Lookout, Glenn Innes–Inverell Rd., 6.xii.1965, G. A. Yapp, ANIC, 3; Somersby, 9.iv.1964, G. F. Bornemissza, ANIC, 2; 17 miles S. of Woodburn, 6.xii.1967, E. G. Matthews, ANIC, 1. QUEENSLAND: Dunwich, 27.ii.1969, H. Burton, UQ, 1; Finch Hatton Ck., 27.iii.1968, E. G. Matthews, ANIC, 3; Lever's Plateau via Rathdowney, 12.iii.1966, H. E. McCosker, UQ, 1; Mackay, 12.iii.1965, G. F. Bornemissza, ANIC, 1; Magnetic I., July 1925, F. H. Taylor, ANIC, 5; Moolayember Dip, 60 miles N. of Injune, 10.iv.1965, G. F. Bornemissza, ANIC, 1; Tamborine, 29.x.1933, GB, 1; no exact locality, ANIC, 1.

## 114. ONTHOPHAGUS BLACKBURNI Shipp

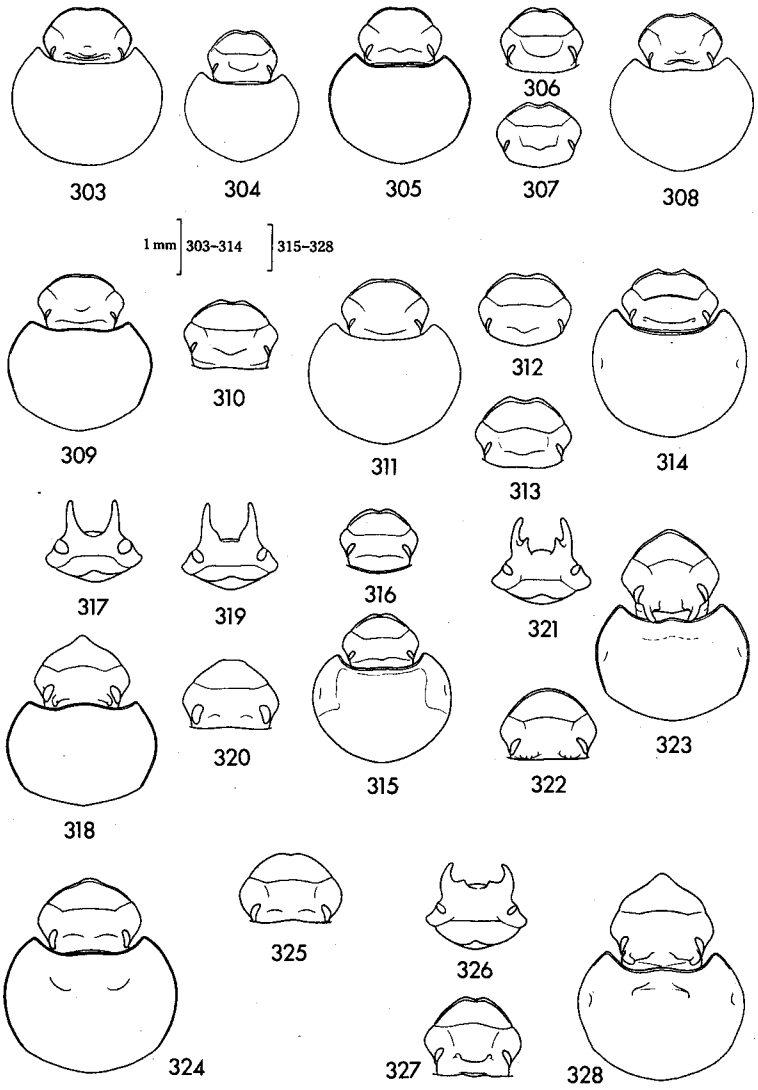
(Figs. 313, 314, 441, 594)

*Onthophagus nitidior* Blackburn, 1891 (non Bates, 1887), p. 209; Blackburn, 1903, p. 271; Fuller, 1934, p. 18.

*Onthophagus blackburni* Shipp, 1895 (nom. nov.), p. 179; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

*Onthophagus zietzi*, Blackburn, 1903, p. 283; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 217. New synonymy.

*Onthophagus hornianus* Paulian, 1937, p. 342. New synonymy.




Figs. 303–328.–*Onthophagus* spp.: *303*, *304*, *O. evanidus*, fore body; *303*, male; *304*, female; *305*, *306*, *O. fabricii*: *305*, male fore body; *306*, female head; *307*, *308*, *O. waterhousei*: *307*, female head; *308*, male fore body; *309*, *310*, *O. quadripustulatus*: *309*, male fore body; *310*, female head; *311*, *312*, *O. kokereka*: *311*, male fore body; *312*, female head; *313*, *314*, *O. blackburni*: *313*, female head; *314*, male fore body; *315*, *316*, *O. cruciger*: *315*, male fore body, outline of colour pattern shown; *316*, female head; *317–320*, *O. propinquus*: *317*, male head, front view, Northern Territory; *318*, male fore body; *319*, male head, front view, Queensland; *320*, female head; *321–323*, *O. monteithi*: *321*, male head, front view; *322*, female head; *323*, male fore body; *324*, *325*, *O. semimetallicus*: *324*, male fore body; *325*, female head; *326–328*, *O. wagamen*: *326*, male head, front view; *327*, female head; *328*, male fore body.

Black, humeri usually with a red spot and apical edges of elytra may be reddish. Some specimens entirely black. Antennal clubs fuscous. Total length 3.5–5.0 mm.

*Male*

*Head.*—Clypeus short, margin medially shallowly emarginate in an arc, feebly bidentate, slightly excised at clypeogenal suture, genal margins rounded. Clypeal suture entire, carinate, the frontal section feebly procurved, strongly angles with genal sections. Vertex bounded posteriorly by a sharp transverse carina which is laterally raised into a pair of well-separated prominent transverse tubercles or short horns, the edge between these, when seen from front or back, evenly arcuate. Eyes extremely narrow, with 3–4 facet rows across widest point, separated by about 30 widths, canthus just touching

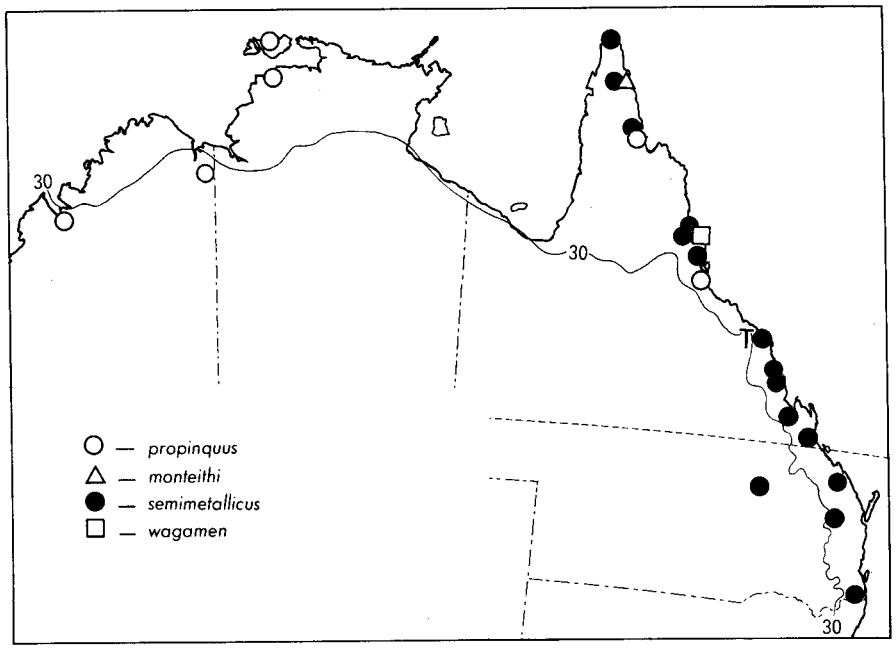



Fig. 329.—Known distribution of the *propinquus* group in relation to the 30-in. isohyet.

edge of occiput. Surface densely and coarsely punctate, tending to be transversely rugose on clypeus and frons. Glabrous. Labium very shallowly excised. *Pronotum.*—Entirely unsculptured, anteriorly a little swollen in major male. Anterior angles quadrate, the apices angulate. Hind edge finely margined. Surface coarsely and fairly densely punctate, the punctures separated by 1–2 diameters, each puncture with an extremely short seta, usually not visible. Surface between punctures smooth, nitid. *Elytra.*—Intervals flat, nitid, finely to moderately punctate, the punctures with microtrichia. Occasionally punctures on last interval near epipleura bear longer setae. Striae superficial, geminate, with well-spaced impressed moderate punctures slightly crenulating edges of intervals. *Legs.*—Fore tibiae elongated, slender, bearing an apical brush of a few long setae. Unmodified in minor male. *Abdomen.*—Pygidium coarsely, fairly densely punctate, with short setae on either side of midline. Parameres foreshortened, triangular, points normal.

*Female*

Clypeal margin more distinctly bidentate. Frons with a strong sinuate transverse carina between eyes. Fore tibia unmodified. Otherwise like male.

*Types*

Holotype of *nitidior*: ♂, South Australia, BMNH.
Holotype of *zietzi*: ♂, Lake Calabonna, S.A., SAM.
Holotype of *hornianus*: ♂, Australia, Kraatz, DEI.
All seen by the author.

*Remarks*

Southern specimens are entirely black and therefore resemble *kokereka*. *O. blackburni* may be told from *kokereka* by the more densely punctate pronotum, by the slightly more visible elytral microtrichia, and in the male by the presence of the fronto-clypeal suture in *blackburni* and its emarginate clypeus. Northern specimens of *blackburni* (from northern New South Wales) have conspicuous red humeri and reddish elytral apices, thus resembling *quadripustulatus*, from which they may be told by the same cephalic and pronotal characters which separate *blackburni* from *kokereka*.

The type of *zietzi* is a typical male of the present species of the all-black colour phase, while the two specimens serving as types of *hornianus* in DEI are both males, one with red humeri and the other entirely black.

*Distribution* (Fig. 302)

Inland South Australia, westward across western and northern Victoria to northern New South Wales west of the divide, in areas from 30 to as little as 5 in. of annual rainfall. Evidently a xerophilic species able to live in scrub and mallee country. Two specimens collected by Dr. P. B. Carne were found in sheep pellets; Fuller (1934) reports this species from carrion in the Australian Capital Territory; otherwise the food habits are unknown.

*Material Examined*

The types and 19 specimens. SOUTH AUSTRALIA: no exact locality (cotype of *nitidior*), BMNH, 1. VICTORIA: 11 miles E. of Nathalia, 14.xii.1965, G. F. Bornemissza, ANIC, 1; Wannon, 26.ix.1947, P. B. Carne, ANIC, 2. NEW SOUTH WALES: 31 miles S. of Deniliquin, 14.xii.1966, G. F. Bornemissza and P. Ferrar, ANIC, 1; Moonbi, 13.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 9; Mulwala, AM, 1. No locality data, SAM, DEI, 4.

## 115. ONTHOPHAGUS CRUCIGER Macleay

(Figs. 315, 316, 595)

*Onthophagus cruciger* Macleay, 1888, p. 902; Blackburn, 1903, p. 272; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

Head black, pronotum black at least on centre and base of disc and along basal margin, leaving rest of surface red. Black may invade all of disc leaving anterior edge and sides red, or at a maximum may reach anterior edge and most of sides, leaving only anterior angles red. Elytra red with varying extent of black pigment, as follows: at a minimum, anterior half of sutural interval and a small spot across 5th–7th intervals on apical third, and extreme basal edge of elytron, black; in more melanic

individuals black pigment spreads from spot inward to suture and outward to epipleuron, and to apex along suture, forming a cross. Pygidium black, the edge red in least melanic individuals. Underside of hind body black, underside of prothorax red, legs rufous. Antennal clubs fuscous. Total length 3.5–4.0 mm.

*Male*

*Head.*—Clypeus short, the margin broad and feebly bilobate medially, laterally a little expanded before clypeogenal sutures in all but north Western Australian specimens, genal angles rounded, prominent in those with incised clypeogenal edges. Clypeal suture with frontal section present, beaded but not carinate, feebly angled with genal sections. Vertex with a sharp transverse feebly bisinuate ridge which may be elevated laterally into a pair of rounded crests in major male, the crests equidistant between midline and eyes. Eyes narrow, with about 4 facet rows across widest point, separated by about 13 widths, canthus incomplete. Finely and evenly punctate, surface smooth, alutaceous, glabrous. Labium shallowly emarginate. *Pronotum.*—Unsculptured, not very convex. Anterior angles quadrate, the apices subangular. Hind edge unmargined. Moderately densely, evenly punctate with very small punctures separated by 3–4 diameters, surface smooth or very finely shagreened, nitid or alutaceous, glabrous. *Elytra.*—Intervals flat or almost so, smooth, nitid, sparsely punctate with extremely small punctures, entirely glabrous. Striae superficial, sutural one broad, geminate, rest narrow, simple, with very small, shallow round punctures slightly crenulating edges of intervals. *Legs.*—Fore tibia slender, elongated, with a long, thin apical brush of setae in major male. Spur small. *Abdomen.*—Pygidium smooth, nitid, with moderately dense, medium-sized punctures bearing very short, recumbent setae on either side of midline (worn off in older individuals). Parameres normal.

*Female*

Clypeal margin more prominently and angularly bidentate and reflexed. Clypeal surface transversely rugulose in some specimens, clypeal suture carinate. Vertical carina as in male but less prominent. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♀, King's Sound, W.A., MM. Seen by the author.

*Distribution* (Fig. 302)

A remarkably extended range from the Kimberley District of Western Australia inland across the Northern Territory to inland Queensland, thence south to South Australia. The South Australian records are old and unfortunately not exact: two specimens in MM are labelled "Interior S.A.", which could refer to what is now the Northern Territory, and one in MNHN says "Adelaide". If correct, these data suggest an extensive central distribution similar to that of *jubatus*.

The three specimens collected by the author were all in or under wallaby pellets in open situations. The species did not come to human faecal traps or to cow dung in the same area.

*Material Examined*

The type and 11 specimens. SOUTH AUSTRALIA: Adelaide, H. W. Bates coll., MNHN, 1; Interior, MM, 2. QUEENSLAND: Charters Towers, 5.iv.1965, G. F. Bornemissza and

G. A. Yapp, ANIC, 4. NORTHERN TERRITORY: Burnside, 2.v.1929, T. G. Campbell, ANIC, 1; 2 miles W. of Katherine, 9.ii.1968, E. G. Matthews, ANIC, 2. WESTERN AUSTRALIA: Kununurra, 13.ii.1968, E. G. Matthews, ANIC, 1.

## XVII. *The* PROPINQUUS *Group*

Eyes narrow to wide, with 7–12 facet rows across widest point, separated by 9–15 widths, canthus variable. Labium excised very shallowly to one-third of way to base. Pronotum and elytra glabrous. Pygidium glabrous (except in *propinquus*), with numerous shallow umbilical or ocellate punctures. Colour black or rufopiceous. Total length 3.5–7.0 mm.

Male with edge of clypeus medially prolonged into a small lobe or rounded angle, with frontoclypeal suture carinate. Vertex with a pair of horns or low tubercles. Pronotum usually unsculptured, or with small tubercles. Fore tibiae unmodified. Female with a pair of small tubercles on vertex, pronotum usually unsculptured.

Four species: 116. *propinquus* Macleay; 117. *monteithi*, sp. nov.; 118. *semimetallicus* Lea; 119. *wagamen*, sp. nov.

Species of tropical Australia, *semimetallicus* being widespread in Queensland in shaded savannah woodland or other semi-open areas, the remaining three species being rain forest or monsoon forest forms.

### KEY TO SPECIES OF THE *PROPINQUUS* GROUP

1. Eyes very wide, with 10–12 facet rows across widest point, separated by about 7 widths; pygidium with at least a few short setae; major male with head horns conical or a little swollen basally. N. Qld., N. N.T., N. W.A. ..... 116. *propinquus* Macleay
   Eyes narrower, with 7–10 facet rows, separated by 9–13 diameters; pygidium glabrous; major male with supplementary carina or prong at base of head horns, or without horns ..... 2

2(1). Elytral intervals densely punctate, laterally rugulose; pygidial surface basally shagreened, dull, punctures very shallow, indistinct; major male with head horns double, a short supplementary prong inside main horn at base; female with vertical tubercles posterior, near hind edge of head. N. Qld. ..... 117. *monteithi*, sp. nov.
   Elytral intervals finely to moderately punctate, not rugose; pygidial surface between punctures shiny, punctures distinct, impressed; major male without double horns; female with vertical tubercles, if present, remote from hind edge of head ..... 3

3(2). Pronotum finely punctate, often with a slight violet tinge contrasting with black elytra; clypeal suture angulate; eyes moderately wide, separated by 9 diameters; major male without horns, with vertical tubercles; pronotum of both sexes without tumescences, but with anterior declivity slightly biconcave in major male. Qld. ..... 118. *semimetallicus* Lea
   Pronotum with moderate punctures, black; clypeal suture bisinuate or almost straight; eyes narrow, separated by 13 diameters; major male with well-separated horns, with a supplementary carina issuing from base of horn inwardly; female with 2 approximated tubercles joined by a low recurved carina; pronotum of major individuals of both sexes with median tumescence or tubercles. N. Qld. ..... 119. *wagamen*, sp. nov.

### 116. ONTHOPHAGUS PROPINQUUS Macleay

(Figs. 317–320, 596)

*Onthophagus propinquus* Macleay, 1888, p. 901; Lea, 1923, p. 355.

*Onthophagus acuticeps* Macleay, 1888, p. 903; Blackburn, 1903, p. 302; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 208. New synonymy.

*Onthophagus helmsi* Blackburn, 1903, p. 290; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212. New synonymy.

Black, sometimes with a slight purplish tinge to fore body, antennal clubs rufous. Total length 3.5-6.0 mm.

*Male*

*Head.*—Clypeal margin medially extended into a rounded point, more or less prominent according to individual size, rest of head margin evenly rounded to genal angles, which are rounded. Clypeal suture not strongly carinate, with frontal section evenly arcuate, strongly angled with genal sections. Frons with a pair of erect conical subparallel horns arising between eyes, the horns not joined by a transverse carina. Inside of bases of horns a little swollen in Queensland major male. Minor male with a pair of transverse tubercles. Eyes broad, with 10-12 facet rows across widest point, separated by about 7 widths, canthus incomplete. Head impunctate or almost so on disc, some distinct punctures along outer edge of clypeus, surface smooth, nitid. Labium incised less than one-third of way to base. *Pronotum.*—Front surface very slightly gibbous or very faintly bituberculate medially, with an anteromedian flattened area in Queensland specimens, in Kimberley specimens with small lateral tuberosities flanking median one. Anterior angles quadrate, the apices angular. Hind edge finely margined. Surface moderately coarsely punctate, the punctures separated by 2-3 diameters on disc, becoming finely punctate on anterior declivity. Glabrous. *Elytra.*—Intervals feebly to moderately convex, fairly densely and finely punctate, nitid, glabrous. Striae impressed, geminate, with moderate punctures crenulating margins of intervals. *Legs.*—Fore tibiae not elongate, without seta tuft. *Abdomen.*—Pygidium densely, coarsely, and shallowly punctate, the punctures ocellate, with at least a few short setae on sides. Surface between punctures very finely shagreened, nitid. Aedeagus normal.

*Female*

Clypeal margin medially not prolonged, truncate or very slightly emarginate. Clypeal surface with strong transverse rugosities. Frontoclypeal suture carinate. Frons with a pair of transverse tubercles between eyes, remote from hind edge, separated by a concavity. Pronotum less gibbous. Otherwise like male.

*Types*

Holotype of *propinquus*: ♂, King's Sound, W.A., MM.
Holotype of *acuticeps*: ♂, King's Sound, W.A., MM.
Holotype of *helmsi*: ♀, Kimberley, W.A., Helms, BMNH.
All seen by the author.

*Remarks*

The Queensland specimens differ from the Northern Territory and Kimberley ones in a number of minor features, as follows: the eyes are a little narrower (10-11 facets versus 11-12), the horns of the major male are a little expanded basally, the pronotum is more flattened anteriorly and does not have the slight median gibbosity seen in the western specimens, the elytral intervals are flatter, more finely punctate, the elytral striae are wider and more distinctly geminate, and the pygidium has fewer

setae. Specimens from the extreme west, in the Kimberleys, have the pronotum indistinctly quadrituberculate. Although the Queensland forms are probably specifically distinct from the western ones, it is best at this time not to add to the nomenclatorial burden by formally naming them until the situation is better understood.

The type of *acuticeps* is a small male and that of *helmsi* a female of *propinquus*. Blackburn (1903, p. 306) was incorrect in considering *propinquus* a synonym of *bicornis*.

*Distribution* (Fig. 329)

The Kimberley District of Western Australia, the area around Darwin, and north Queensland at Ingham and Silver Plains. Near Darwin and on Melville I. the author found this species to be restricted to the densest and wettest forest type. The series of 97 specimens collected at Howard Springs was in very dense swamp forest with heavy clay soil, partly flooded at the time. On Melville I. *propinquus* occurred only in monsoon forest, a type of dense forest not containing eucalypts and not subject to burning, in sandy soil. Near Ingham, Qld., Dr. Bornemissza found it in small numbers in both open and shaded situations, but mostly in wet sclerophyll forest. All specimens came to traps baited with human faeces.

*Material Examined*

The types and 141 specimens. QUEENSLAND: Claudie R. near Mt. Lamond, 1.vi.1966, D. K. McAlpine, AM, 1; Ingham, Forrest Beach, 1–9.v.1964, G. F. Bornemissza, ANIC, 9; Silver Plains H.S., 29.x.1964, J. L. Wassell, ANIC, 1. NORTHERN TERRITORY: Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 97; Humpty Doo, 28–29.i.1968, E. G. Matthews, ANIC, 1; Lee Pt., Darwin, 28.i.1968, E. G. Matthews, ANIC, 1; Snake Bay, Melville I., 4–6.ii.1968, E. G. Matthews, ANIC, 25. WESTERN AUSTRALIA: King's Sound, MM, 4; Kununurra, 13–22.ii.1968, E. G. Matthews, ANIC, 1; no exact locality, ANIC, 1.

## 117. ONTHOPHAGUS MONTEITHI, sp. nov.

(Figs. 321–323, 597)

Black, antennal clubs flavous. Total length 5–7 mm.

*Male*

*Head.*—Clypeal margin medially produced into a rounded reflexed point, reduced in minor male, rest of margin evenly convex to genal angles, which are rounded, not prominent. Frontal section of clypeal suture not carinate, feebly procurved, strongly angled with genal sections. Frons with a pair of posterior double horns moderately inclined backward, consisting of a long outer prong and a shorter inner prong only slightly elevated above the common base, minor male with the horns reduced to a pair of low transverse tubercles on posterior edge of head, not joined by a carina. Eyes narrow, with about 8 facet rows across widest point, separated by about 10 widths, canthus complete. Surface finely to moderately punctate, nitid. Labium shallowly excised. *Pronotum.*—Anterior declivity feebly biconcave in major male, unsculptured. Anterior angles subacute, the apices angular. Posterior edge finely margined. Evenly, moderately densely and coarsely punctate, the punctures separated by about 1 diameter, except in middle of anterior declivity of major male, which is more finely and remotely punctate. Glabrous. *Elytra.*—Intervals convex, densely and

coarsely punctate, laterally rugose, glabrous. Striae impressed, geminate, the punctures large, shallow, crenulating the intervals. *Legs.*–Fore tibiae not elongate. *Abdomen.*–Pygidium shagreened, dull, the punctures dense, indistinct, shallow, ocellated. Aedeagus normal.

*Female*

Edge of clypeus evenly rounded, very slightly truncate apically. Surface of clypeus strongly transversely rugose, clypeal suture carinate. Vertex with a pair of erect pointed transverse tubercles near hind edge of head, not joined by a carina, a deep pit in surface of frons just before these tubercles. Pronotum with a pair of approximated anteromedian tubercles, absent in minor female. Otherwise like male.

*Type*

Holotype ♂, Iron Range, Cape York Peninsula, Qld., 28.iv-4.v.1968, G. Monteith, QM T 6905.

*Remarks*

The author is pleased to dedicate this species to Mr. Geoff Monteith of the University of Queensland.

*Distribution* (Fig. 329)

Known only from the type locality near Iron Range, Cape York Peninsula, Qld. Collected by Mr. Monteith in rain forest at human excrement.

*Material Examined*

The type and 22 specimens. QUEENSLAND: Iron Range, 28.iv–17.v.1968, G. Monteith, UQ, ANIC, 22.

## 118. ONTHOPHAGUS SEMIMETALLICUS Lea

(Figs. 324, 325, 598)

*Onthophagus semimetallicus* Lea, 1923, p. 383; Boucomont and Gillet, 1927, p. 216.

Fore body black with a slight violet tinge (sometimes pure black), rest of body black, antennal clubs fuscous. Total length 5-7 mm.

*Male*

*Head.*–Clypeal margin medially extended into a small rounded lobe and reflexed in major male, in minor male tending to be feebly bilobate with an arcuate emargination between lobes, rest of head margin evenly rounded to genal angles, which are rounded. Clypeal suture straight or feebly arcuate and carinate for its frontal section, angled forward and less carinate for the genal sections. Frons with a pair of transverse raised tubercles or short ridges between eyes, separated by a median flat area, the tubercles reduced and approximated in minor individuals, but always present. Eyes moderately narrow, with 8-10 facet rows across widest point, separated by about 11 diameters, canthus incomplete or just touching occipital edge. Head finely, densely punctate, nitid, punctures denser in minor male, frons and edge of clypeus feebly rugose. Labium very shallowly emarginate. *Pronotum.*–Anterior declivity feebly biconcave. Anterior angles quadrate, the apices angulate. Hind edge finely margined.

Surface smooth, nitid, entirely moderately densely punctate with fine punctures, smallest on middle of anterior declivity, largest near anterior angles. *Elytra.*—Intervals feebly convex, very finely punctate, nitid, glabrous. Striae strongly impressed, geminate, with moderate punctures slightly crenulating edges of intervals. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium densely punctate with shallow ocellate punctures, glabrous, surface between punctures very finely shagreened, alutaceous. Aedeagus normal.

*Female*

Clypeal margin medially feebly emarginate, not produced, clypeal surface strongly transversely rugose. Head otherwise like that of male, with transverse frontal tubercles. Pronotum with 2 very shallow concavities near anterior margin, as in minor male. Otherwise like male.

*Type*

Holotype ♂, Bowen, Qld., SAM I.15411. Seen by the author.

*Distribution* (Fig. 329)

Widespread throughout the entire coastal region of Queensland in open sclerophyll forest. It may occur in open pastures, but is much more frequent in shaded situations and tends to be replaced in pastures by the superficially similar *jangga.* Trapped with human faecal bait, from March to June.

*Material Examined*

The type and 420 specimens. QUEENSLAND: Atherton; Bowen; Carnarvon Gorge; Coen; Finch Hatton; Gayndah; 30 miles N. of Gin Gin; Hidden Valley, 15 miles W. of Paluma; Ingham, Forrest Beach; Iron Range; Leichardt Downs, Salisbury Plains; Lockerbie; Lotus Ck., Sarina; Marlborough; Moolayember Dip, 60 miles N. of Injune; Palen Ck.; 11 miles W. of Paluma; Ravenshoe; Rockhampton; Rocky R., Cape York; 14 miles NW. of Sarina; Tully; Upper Mulgrave R.

## 119. ONTHOPHAGUS WAGAMEN, sp. nov.

(Figs. 326–328, 599)

Black, antennal clubs flavous. Total length 5–7 mm.

*Male*

*Head.*—Clypeal margin medially prolonged into a prominent reflexed point in major male, reduced in minor male, rest of clypeal margin convex. Genal margins rounded. Clypeal suture nearly straight, genal sections only feebly angled with frontal section, the latter cariniform. Vertex extended backward into a bilobate lamina, each lobe with a more or less developed inner angle delimiting a median arcuate emargination, and a strong curved horn along outer edge. In minor male the inner angles disappear and the well-separated horns are reduced to tubercles and joined by an indistinct ridge. Eyes narrow, with 7–8 facet rows across widest point, separated by about 15 widths, canthus just touching occipital edge. Finely punctate, sparsely so on disc, more densely so along edge, nitid. Labium incised about one-third of way to base. *Pronotum.*—With a feebly biconcave anterior declivity medially surmounted by a pair of well-separated low tubercles delimiting an indistinct transverse ridge,

reduced in minor male. Anterior angles subacute, the apices angulate. Hind edge finely margined. Surface fairly densely punctate, the punctures moderate, separated by about 1 diameter, middle of anterior declivity more finely punctate, surface nitid, glabrous. *Elytra.*–Intervals feebly convex, moderately punctate, nitid, glabrous. Striae strongly impressed, geminate, with moderate punctures crenulating edges of intervals. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium with shallow umbilical punctures basally, these becoming smaller and more remote apically, glabrous. Surface between punctures nitid, smooth. Aedeagus normal.

*Female*

Clypeal margin feebly bilobate, clypeal surface transversely rugose. Clypeal suture medially a little more procurved, carinate, genal sections as in male, short, not strongly angled. Vertex with a pair of low conical horns between eyes, more approximated than in male, joined by a low indistinct recurved arcuate ridge. Frons before this depressed. Pronotum as in minor male, very feebly biconcave and with indistinct transverse median ridge anteriorly or a pair of well-separated tubercles in major specimens. Otherwise like male.

*Type*

Holotype ♂, 9 miles W. of Millaa Millaa, Qld., 1.iv.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 329)

Known only from the vicinity of Millaa Millaa, Atherton Tableland, Qld., at 1500–2500 ft altitude. Collected by the author in rain forest or a similar wet forest type, in clay or clay-loam soil with human excrement bait.

*Material Examined*

The type and 40 specimens. QUEENSLAND: Millaa Millaa (2500 ft), Apr. 1932, P. J. Darlington, MCZ, 28; 9 miles W. of Millaa Millaa, 1.iv.1968, E. G. Matthews, ANIC, 4; Palmerston National Park, 1.iv.1968, E. G. Matthews, ANIC, 7; Palmerston National Park via Innisfail, 23–24.iv.1968, B. Cantrell, UQ, 2.

## XVIII. *The* MUTATUS *Group*

Eyes narrow, with 5–9 facet rows across widest point, separated by 9–23 diameters, canthus variable. Labium excised shallowly to more than one-third of way to base. Dorsal surfaces glabrous or with short setae over all of surface. Pygidium with numerous short setae. Colour black or with fore body greenish. Total length 2.5–8.0 mm.

Male with frontoclypeal suture variable, with a pair of erect subparallel straight horns or transverse ridges on vertex, pronotum unarmed. Fore tibiae not modified. Female with tubercles on vertex (a carina in *frenchi* and *jangga*), pronotum unarmed.

Seven species: 120. *compositus* Lea; 121. *togeman*, sp. nov.; 122. *frenchi* Blackburn; 123. *jangga*, sp. nov.; 124. *mutatus* Harold; 125. *sydneyensis* Blackburn; 126. *yungaburra*, sp. nov.

This is a loose, rather poorly defined group of species sharing primarily a similar armament in the male. There are three northern species – *togeman*, *jangga*, and *yungaburra* – inhabiting respectively dry savannah, wet pasture, and rain forest, and

four south-eastern species occupying open areas or sclerophyll woodland. There is an unexpectedly close taxonomic relationship between *sydneyensis*, a southern species, and *yungaburra*, a rain forest species known only from the Atherton Tableland.

KEY TO SPECIES OF THE *MUTATUS* GROUP

1. Pronotum very densely punctate, the punctures separated by less than 1 diameter, reticulate, with microtrichia; elytral intervals shagreened along the edges, usually with shiny median raised line, striae contrastingly shiny. N. N.S.W., S. Qld. ..... 120. *compositus* Lea
   Pronotum more sparsely punctate, the punctures separated by 1–4 diameters, without microtrichia; elytral intervals either nitid or matt but without median rugose line and striae not contrasting ..... 2
2(1). Elytra covered with short setae, striae consisting of double elevated lines; dorsal surfaces matt. N. N.T. ..... 121. *togeman*, sp. nov.
   Elytra glabrous, striae normal; dorsal surfaces nitid ..... 3
3(2). Pronotum coarsely punctate, the punctures separated by 1–2 diameters; eyes small, with about 5 facet rows across; horns of male joined by a fine carina. N.S.W. ..... 122. *frenchi* Blackburn
   Pronotum finely punctate, the punctures separated by 2–3 diameters; horns of male not joined by a carina ..... 4
4(3). Male with frontoclypeal suture carinate; total length 4.5–8.0 mm ..... 5
   Male with frontoclypeal suture effaced; total length 3.5–6.5 mm ..... 6
5(4). Fore body dark green; head margin a little expanded just before clypeogenal suture; female without frontal carina. Tas., Vic., S. N.S.W. ..... 124. *mutatus* Harold
   Entirely black; head margin evenly rounded; female with frontal carina. N. Qld. ..... 123. *jangga*, sp. nov.
6(4). Colour rufous; pronotum extremely finely punctate, the punctures separated by more than 3 diameters; female with vertex devoid of tubercles; maximum length 5 mm. N. Qld. ..... 126. *yungaburra*, sp. nov.
   Colour darker; pronotum with larger punctures separated by as little as 2 diameters; female with a pair of tubercles on vertex; maximum length 6.5 mm. Vic., N.S.W., S. Qld. ..... 125. *sydneyensis* Blackburn

## 120. ONTHOPHAGUS COMPOSITUS Lea

(Figs. 332, 333, 600)

*Onthophagus compositus* Lea, 1923, p. 390; Boucomont and Gillet, 1927, p. 210.

Black with a slight bronze reflection on fore body, antennal clubs fuscous. Total length 6–8 mm.

*Male*

*Head.*—Clypeal margin medially very feebly emarginate in a wide angle, rest of head margin evenly rounded, the genal angles rounded. Clypeus entirely margined, with a complete row of setae along inner edge of margin. Clypeal suture with frontal section present, complete, finely raised, strongly angled with genal sections. Vertex with a pair of stout short erect conical horns beside each eye, reduced to pyramidal tumescences in minor male, where horns may be joined by an indistinct open-V-shaped ridge. Eyes narrow, with 6–7 facet rows across widest point, separated by about 15 widths, canthus complete. Very densely and coarsely punctate over the entire surface, glabrous. Labium shallowly emarginate. *Pronotum.*—Unsculptured. Anterior angles

subacute, the apices angulate. Hind edge unmargined. Very densely, coarsely punctate, entire surface reticulated, each puncture with a very short seta forming a fine stubble visible only in oblique light. *Elytra.*–Intervals flat, shagreened, matt, usually with an irregular shiny rugose line running down the middle of interval and sutural edge (may be absent on discal intervals, in which case there is a line of punctures running down middle). With very small punctures bearing very short bristles forming a fine stubble visible only in oblique light, otherwise glabrous. Striae superficial, broad, geminate, contrastingly shiny, with very small shallow punctures. *Legs.*–Fore tibiae not elongated or slender, without brush. *Abdomen.*–Pygidium shagreened, dull or alutaceous, densely but shallowly punctate, with only a few bristles confined to edges. Aedeagus normal.

*Female*

Clypeal margin medially a little bilobate, vertex with a shiny raised line shaped like a very open V, sometimes indistinct. No horns. Otherwise like male.

*Type*

Holotype ♂, Stanthorpe, Qld., von Weildt, QM. Seen by the author.

*Distribution* (Fig. 330)

Along the eastern escarpment of New South Wales on the eastern edges of the Southern and New England Tablelands as far as the southern edge of Queensland, at altitudes of 2000–3500 ft. It does not seem to occur extensively on the tablelands themselves. It inhabits dry open areas. The behaviour of this species was studied by Bornemissza (1971*a*), who showed that it has the habit of rapidly burying whole marsupial droppings in a shallow pit, apparently to preserve their moisture, then digging the main burrow from this pit. The species has been collected primarily at human excrement in the months of October, December, April, and May.

*Material Examined*

The type and 184 specimens. NEW SOUTH WALES: Clyde Mountain, 20.iv.1964, G. F. Bornemissza, ANIC, 1; Gibraltar Range National Park, 5.xii.1967, E. G. Matthews, ANIC, 1; 13 miles N. of Marulan, 4.iv, 23.iv, 18.v, 15.x, 22.x.1964, G. F. Bornemissza, ANIC, 166; Moonbi, 13.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 12; Peddy's R., 14.iv.1964, G. F. Bornemissza, ANIC, 2. QUEENSLAND: Wyberba, Apr. 1938, Sutton, ANIC, 2.

## 121. ONTHOPHAGUS TOGEMAN, sp. nov.

(Figs. 334, 335, 601)

Black, antennal clubs fuscous. Total length 5.5–7.0 mm.

*Male*

*Head.*–Clypeal margin medially very feebly emarginate, rest of head margin evenly rounded, genal angles rounded or subangulate. Clypeal suture with frontal section distinct, raised, feebly arcuate, genal sections strongly angled with it. Vertex with a transverse raised ridge near each eye, the ridge subangular in major male, rounded in the others, descending toward middle, not meeting opposite ridge, leaving a median flat spot. Eyes moderately wide, with about 8 facet rows across widest point, separated by about 12 widths, canthus complete. Fairly densely punctate with

medium-sized punctures tending to run together to form rugosities on anterior part of clypeus, surface very finely shagreened, moderately shiny, glabrous. Labium excised about one-third of way to base. *Pronotum.*–Unsculptured. Anterior angles subacute, the apices angulate. Hind edge unmargined. Evenly punctate with medium-sized punctures separated by 3–4 diameters, surface shagreened, matt or a little sericeous, glabrous. *Elytra.*–Intervals feebly convex, with slightly irregular surface, shagreened, matt, with numerous small punctures each bearing a short semi-erect seta, usually 2 rows of setae on each interval. Striae a little elevated, distinctly geminate, with very small punctures not crenulating edges of intervals. *Legs.*–Fore tibiae not modified. *Abdomen.*–Pygidium smooth, shagreened, matt, with a few very small punctures bearing short setae on sides. Aedeagus normal.

*Female*

Clypeal margin medially bilobate, clypeal surface strongly vermiculately rugose, rest of head subrugose before frontal ridge. Frons medially depressed, with a recurved transverse ridge, not sharply defined, behind depression. Otherwise like male.

*Type*

Holotype ♂, 20 miles W. of Katherine, N.T., 10.ii.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 330)

The north of the Northern Territory in relatively dry savannah woodland areas with 30–50 in. of annual rainfall, in sand patches set among outcrops of shale and laterite. Not found in extensive areas of sand, although because of the small samples involved this may not be an accurate picture of the distribution. At human excrement and under a dead wallaby.

*Material Examined*

The type and 31 specimens. NORTHERN TERRITORY: 1–17 miles N. of Adelaide River, 12.ii.1968, E. G. Matthews, ANIC, 15; 20 miles W. of Katherine, 9–10.ii.1968, E. G. Matthews, ANIC, 15; 10 miles N. of Pine Creek, 11.ii.1968, E. G. Matthews, ANIC, 1.

## 122. ONTHOPHAGUS FRENCHI Blackburn

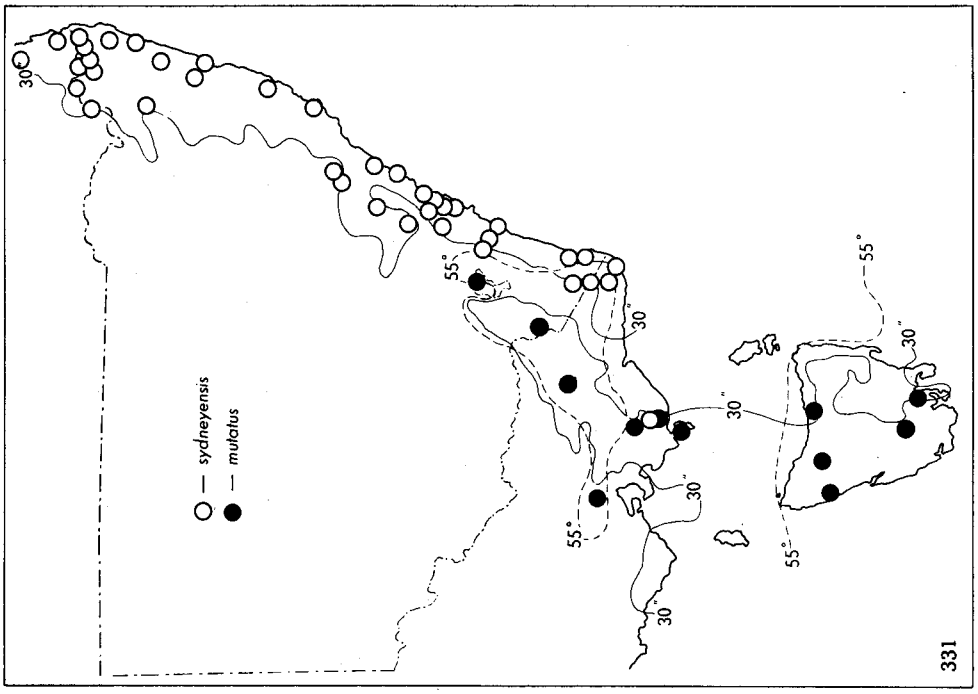
(Figs. 336, 337, 602)

*Onthophagus frenchi* Blackburn, 1903, p. 293; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212.

Black, fore body with slight bronze or violet tinge, antennal clubs fuscous. Total length 6–7 mm.

*Male*

*Head.*–Clypeal margin medially with very shallow emargination, rest of head margin evenly rounded, genal angles rounded. Clypeal suture complete, beaded, the frontal section almost straight, strongly angled with genal sections. Vertex with a pair of erect subconical horn-like tubercles situated laterally near eyes, joined by a fine low transverse carina. Eyes narrow, with about 5 facet rows across widest point, separated by about 13 widths, canthus incomplete. Coarsely punctate, the punctures tending to run together in oblique grooves on frons and clypeus, glabrous. Labium



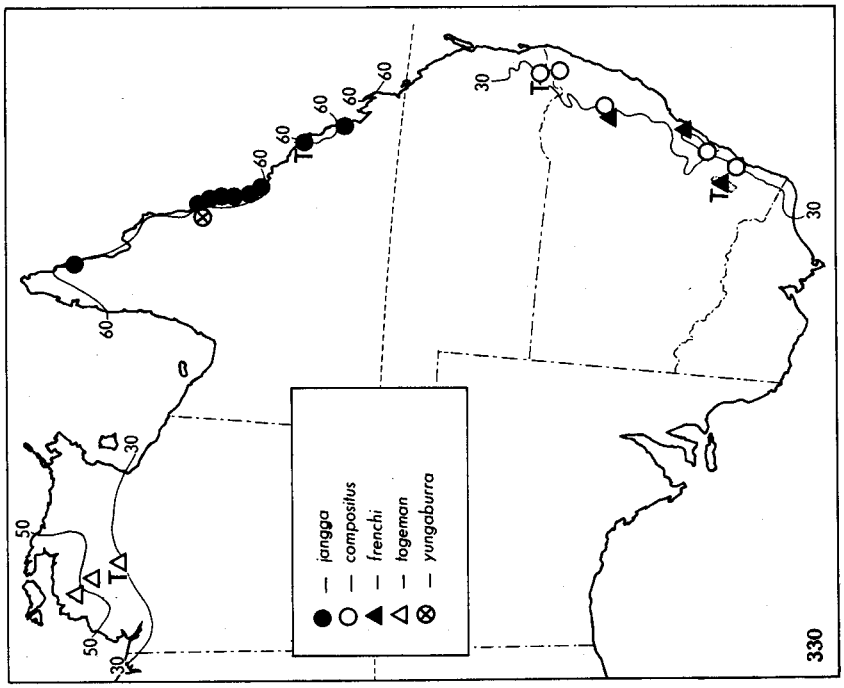
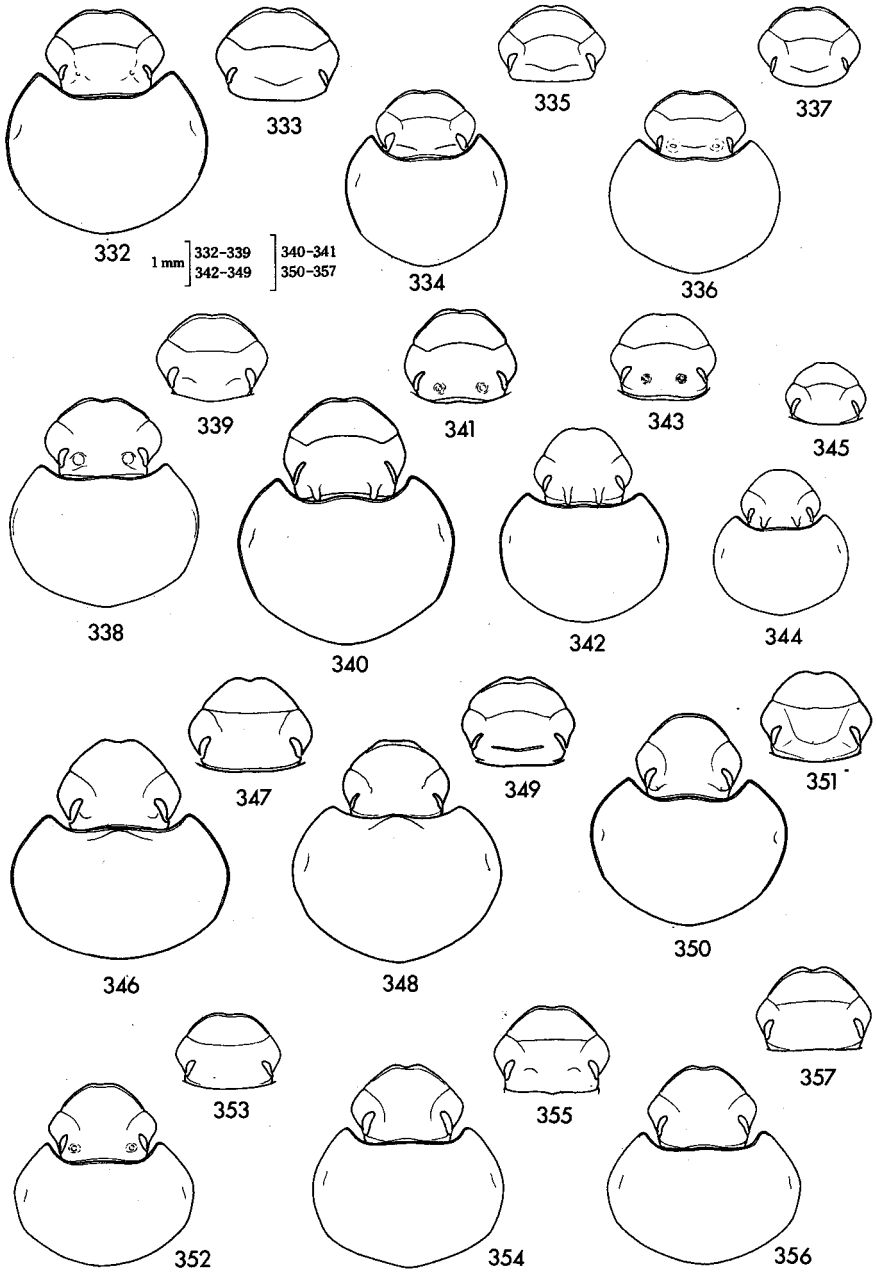




Fig. 330.–Known distribution of part of the *mutatus* group in relation to annual rainfall (in.).
Fig. 331.–Known distribution of the rest of the *mutatus* group in relation to annual rainfall and mean temperature.




Figs. 332–357.–*Onthophagus* spp., male fore body and female head: *332, 333, O. compositus*; *334, 335, O. togeman*; *336, 337, O. frenchi*; *338, 339, O. jangga*; *340, 341, O. mutatus*; *342, 343, O. sydneyensis*; *344, 345, O. yungaburra*; *346, 347, O. arrilla*; *348, 349, O. posticus*; *350, 351, O. incornutus*; *352, 353, O. mulgravei*; *354, 355, O. millamilla*; *356, 357, O. turrbal.*

excised less than one-third of way to base. *Pronotum.*—Unsculptured. Anterior angles subacute, the apices angulate. Hind edge finely margined. Surface coarsely punctate, the punctures separated by 1–2 diameters, surface between punctures smooth, finely shagreened in anterior angles and on median pronotal area, glabrous. *Elytra.*—Intervals feebly convex, shagreened (more distinctly so along margins), moderately and irregularly punctate with small shallow punctures, glabrous. Striae superficial, geminate, with well-spaced medium-sized shallow punctures slightly crenulating edges of intervals. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium shagreened, shallowly and indistinctly punctate, glabrous. Aedeagus normal.

*Female*

Clypeal margin a little more bilobate than in male. Frontal section of clypeal carina more prominent. Vertex without horns, with a low recurved or slightly angulate transverse carina behind middle. Head surface more coarsely punctate, vermiculately rugose on clypeus. Otherwise like male.

*Type*

Holotype, Queanbeyan, N.S.W., BMNH. Seen by the author.

*Distribution* (Fig. 330)

Known from Queanbeyan, N.S.W., and Cotter Dam, A.C.T., both near Canberra, the North Shore of Sydney, and Quirindi, near Tamworth, N.S.W. Only seven specimens have been collected. Habitat and food preferences unknown.

*Material Examined*

The type and six specimens. AUSTRALIAN CAPITAL TERRITORY: Cotter Murrumbidgee Bridge, 28.ii.1949, P. B. Carne, ANIC, 2. NEW SOUTH WALES: Belmore, North Shore, Taylor, AM, 2; Quirindi, 1.xi.1908, G. E. Bryant, BMNH, 2.

### 123. ONTHOPHAGUS JANGGA, sp. nov.

(Figs. 338, 339, 442, 443, 603)

Black, antennal clubs flavous or rufous. Total length 6–8 mm.

*Male*

*Head.*—Clypeal margin medially very feebly bilobate, rest of head margin evenly rounded, genal angles rounded. Short setae on inside of clypeal margin confined to middle. Clypeal suture with frontal section effaced but represented by a transverse ridge, genal sections distinct, oblique. Vertex with a pair of short erect transverse or conical horns next to eyes, surface between horns slightly depressed, without a carina. Eyes moderately wide, with about 8 facet rows across widest point, separated by about 14 widths, canthus complete. Head densely punctate with small punctures, surface alutaceous or nitid, glabrous. Labium excised about one-third of way to base. *Pronotum.*—With 2 small flattened areas on anterior declivity near margin in major male, otherwise pronotum unsculptured. Anterior angles quadrate or subacute, the apices angulate. Hind edge finely margined. Moderately densely punctate, the punctures very small and separated by 2–3 diameters, more finely and sparsely punctate on anterior declivity, surface between punctures alutaceous or nitid, glabrous. *Elytra.*—Intervals feebly convex, very finely punctate, alutaceous or nitid, glabrous. Striae

feebly impressed, fine, the punctures a little wider than stria, crenulating edges of intervals. *Legs.*–Fore tibiae unmodified, but with small tuft of short setae on apical edge outside spur. *Abdomen.*–Pygidium shagreened, subnitid, with numerous very small shallow punctures, glabrous. Parameres with elongate apices, slender.

*Female*

Clypeal margin a little more bilobate, clypeal surface densely and irregularly rugose. Frontoclypeal suture distinct, raised. Frons with a median depression and a pair of low oblique ridges behind it. Pronotum without anterior depressions near margin. Fore tibia without seta tuft. Otherwise like male.

*Type*

Holotype ♂, Upper Mulgrave River, Qld., 2.iv.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 330)

Tropical Queensland in the wettest parts of the coast, in areas of 60 in. or more annual rainfall, in open pastures and open casuarina and eucalypt woodlands, tending to be replaced by *semimetallicus* in more shaded situations. Collected primarily at human excrement, but occasionally at cow dung and mammal entrails. November–June.

*Material Examined*

The type and 367 specimens. QUEENSLAND: Atherton, 7.v.1964, G. F. Bornemissza, ANIC, 4; Atherton, 26.iii.1965, R. Elder, UQ, 1; Cairns, 1.v.1955, K. R. Norris, ANIC, 1; Cann R., 3.v.1964, G. F. Bornemissza, ANIC, 39; Cape Weymouth, Cape York, Wassell, ANIC, 2; Cardwell, MNHN, 1; Cardwell Range, 9 miles N. of Ingham, 2.v.1964, G. F. Bornemissza, ANIC, 154; Cooktown, Nov. 1967, A.E., GB, 1; Crystal Ck., 23 miles SSE. of Ingham, 9.xii.1968, E. B. Britton and S. Misko, ANIC, 1; Finch's Bay, Cooktown, 7.vi.1951, A. Musgrave, AM, 1; Hambledon, Nov. 1921, Pemberton, BMNH, 1; Hidden Valley, 15 miles W. of Paluma, 30.v.1969, G. F. Bornemissza, ANIC, 19; Ingham, 1–2.v.1964, G. F. Bornemissza, ANIC, 10; Kairi, 2.v.1955, K. R. Norris, ANIC, 1; Mary Ck., 16°33′S., 145°12.5′E., 5.xii.1968, E. B. Britton and S. Misko, ANIC, 1; Millstream Falls, Ravenshoe, 7.i.1964, G. Monteith, UQ, 1; Mt. Spec, Jan. 1968, Jan. 1969, G. Brooks, GB, 3; Palmerston National Park (1000 ft), 6.xi.1966, E. B. Britton, ANIC, 1; Paluma, 20.iii.1965, G. F. Bornemissza, ANIC, 5; Port Denison, MM, 2; Ravenshoe (3000 ft), Apr. 1932, P. J. Darlington, MCZ, 1; 2–6 miles W. of Ravenshoe, 1.iv.1968, E. G. Matthews, ANIC, 10; 14 miles W. of Sarina, 8.v.1955, K. R. Norris and I. F. B. Common, ANIC, 1; Sunday Ck., 2.v.1964, G. F. Bornemissza, ANIC, 59; Tully, 3.v.1964, G. F. Bornemissza, ANIC, 4; Upper Mulgrave R., 2.iv.1968, E. G. Matthews, ANIC, 1; Yungaburra, 7.v.1964, 27.iii.1965, G. F. Bornemissza, ANIC, 11.

## 124. ONTHOPHAGUS MUTATUS Harold

(Figs. 340, 341, 604)

*Onthophagus hirculus* Erichson, 1842, p. 157 (non Mannerheim, 1829).

*Onthophagus mutatus* Harold, 1859, p. 224 (nom. nov.); Blackburn, 1903, p. 270; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214.

Fore body dark green, rarely black, elytra black or dark brown, underside and legs black, antennal clubs fuscous. Total length 4.5–7.5 mm.

*Male*

*Head.*–Somewhat pentameral, clypeal margin medially broadly bilobate, laterally a little prominent just before clypeogenal suture, genal angles posterior, rounded, not

at all prominent, margins between angles straight. Clypeal suture with frontal section present, finely carinate, feebly procurved, strongly angled with genal sections. Vertex of major male with a pair of long, erect, nearly straight cylindrical horns rounded at the apices and parallel or a little convergent, minor male with the horns shorter and transversely conical, pointed. Area between horns flat. Eyes narrow, with about 7 facet rows across widest point, separated by about 23 widths, canthus incomplete. Very finely and evenly punctate, surface smooth, nitid, glabrous. Labium deeply incised, a little more than one-third of way to base. *Pronotum.*—Strongly convex anteriorly in major male, the anterior declivity planate, forming with discal surface a rounded transverse median fold in some cases. Minor male with surface less convex, declivity not planate. Anterior angles quadrate, the apices rounded. Hind edge finely margined. Evenly punctate with small punctures separated by 2–4 diameters, surface smooth, nitid, glabrous. *Elytra.*—Intervals flat, smooth, nitid, moderately punctate with extremely small punctures, glabrous except for a few (1–12) small setae under humeri, often absent. Striae superficial, fine, simple, with numerous small punctures a little wider than stria. *Legs.*—Fore tibia not elongated, the inner apical angle subquadrate. *Abdomen.*—Pygidium smooth, nitid, with moderately dense, medium-sized, shallow punctures bearing numerous short recumbent setae on either side of midline. Parameres with projecting points strongly transversely widened.

*Female*

Clypeus more broadly margined, the edge not convex near clypeogenal suture, the surface more densely and coarsely punctate and transversely rugose, frontoclypeal suture more strongly carinate. Vertex with a pair of transversely conical, pointed or angular ridges not joined by a carina, the points about equidistant between eyes and midline. Pronotum less convex, anteriorly with a small double tumescence near margin flanked by a pair of feeble concavities. Fore tibia with inner apical angle obtuse, the spur larger. Otherwise like male.

*Type*

Holotype ♂, Van Diemen's Land, Schayer, ISZ 26880. Seen by the author.

*Distribution* (Fig. 331)

Western Tasmania and eastern Victoria northward along the Australian Alps to the Australian Capital Territory in colder areas with about 30 in. of annual rainfall or more. It appears to be kept separate from the closely related *sydneyensis*, which also occurs in areas of more than 30 in. of rainfall, by temperature. *O. mutatus* keeps more or less to the cold side of the 55°F annual isotherm except on the southern Victorian coast (Fig. 331). In the Australian Alps, *mutatus* climbs to 5000 ft, where it was collected by Dr. Darlington on Mt. Kosciusko and Mt. Hotham. It occurs in sandy soil in open or semi-wooded situations and is diurnal.

All specimens collected by Dr. Bornemissza came to human excrement or rabbit entrails. A series collected in Tasmania by Mr. Mollison came to thylogale (pademelon) dung, while other collection records specify wallaby and wombat droppings. There are no records at cow dung.

All records are from October to December and again from February to May, thus showing the two-season pattern also seen in *australis* and many other southern species.

*Material Examined*

The type and 292 specimens. TASMANIA: Florentine Valley; Guildford; Hobart; Interview R. area, N. Pieman R.; Kelso; Maydena; Mt. Wellington. VICTORIA: Boolarra; Darby Saddle; Gould; Gunyah; Mt. Hotham (5000 ft); Mt. Macedon. AUSTRALIAN CAPITAL TERRITORY: Blundell's Flat; Bull's Head; Canberra, CSIRO; 4 miles NW. of Mt. Gingera. NEW SOUTH WALES: Mt. Kosciusko (5000–7000 ft).

## 125. ONTHOPHAGUS SYDNEYENSIS Blackburn

(Figs. 342, 343, 444, 445, 605)

*Onthophagus sydneyensis* Blackburn, 1903, p. 296; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 216.

*Onthophagus monticola* Paulian, 1937, p. 343. New synonymy.

Entirely black, often with bronze cast on fore body, rarely greenish, elytra black or rufopiceous, antennal clubs fuscous or flavous (in northern specimens). Total length 3.5–6.5 mm.

*Male*

*Head.*–Clypeal margin medially very feebly emarginate, rest of head margin evenly rounded, genal angles rounded, not prominent. Clypeal suture with frontal section entirely effaced or represented by an indistinct ridge, genal sections fine, short, oblique. Vertex with a pair of stout erect conical horns, parallel or very slightly divergent (convergent in a few cases). No carina between horns. Eyes moderately narrow, with 7–9 facet rows across widest point, separated by about 10 widths, canthus incomplete. Very finely punctate, the punctures well separated. Surface smooth, nitid, glabrous. Labium deeply emarginate, a little less than halfway to base. *Pronotum.*–Unsculptured, strongly convex anteriorly, the declivity planate and almost vertical in major male, less convex with more rounded declivity in minor male. Anterior angles quadrate, the apices angulate. Hind edge finely margined. Evenly, finely punctate, the punctures separated by 2–5 diameters, surface smooth, nitid, glabrous. *Elytra.*–Intervals feebly convex, smooth, nitid, fairly densely punctate with small punctures, glabrous except for anterior part of last interval along epipleural margin, which bears 2 or 3 rows of short setae. Striae feebly impressed, fine, simple, with numerous small shallow punctures feebly crenulating edges of intervals. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium smooth, nitid in most specimens, or finely shagreened and alutaceous in northern specimens, fairly densely punctate with small deep punctures bearing a few short recumbent setae near edges. Parameres with projecting points strongly transversely widened.

*Female*

Clypeal surface densely punctate and reticulately rugose. Clypeal suture with frontal section present, carinate, evenly arcuate. Vertex with a pair of low conical tubercles, sharply pointed in major female, rounded and indistinct in minor one, the points nearer to midline than to eyes. No carina between them. Pronotum less convex, anteriorly not planate. Otherwise like male.

*Types*

Holotype of *sydneyensis*: ♀, Sydney, A. M. Lea, BMNH.
Holotype of *monticola*: ♂, Tam Mts. (Tamborine Mountain, Qld.?), Kraatz, DEI. Both seen by the author.

*Remarks*

Northern specimens (from the McPherson Range and southern Queensland) have yellow antennal clubs and a finely shagreened pygidium, the remaining specimens having amber or grey antennal clubs and nitid pygidium. The type of *monticola* and a series of six paratypes in DEI and MNHN are all *sydneyensis* of the northern form, apparently from Tamborine Mountain.

*Distribution* (Fig. 331)

From Gippsland northward along the coast of New South Wales to Mt. Glorious and nearby Mt. Nebo north of Brisbane. Inland it extends to the eastern edges of the tablelands and mountain ranges to altitudes of about 2000 ft in the south and nearly 4000 ft in the north, keeping within the zone of not less than 30 in. of annual rainfall and more than 55° F annual mean temperature.

*O. sydneyensis* occurs in sclerophyll woodlands of average density. In more open areas it is restricted to shaded patches. It does not enter dense forest. All collecting localities possessed sandy soil. The species is diurnal and comes to marsupial droppings, human faeces, and cow dung from October to May, with some evidence of activity peaks in December and April.

*Material Examined*

The types and 656 specimens. VICTORIA: Boolarra; 13–23 miles N. of Cann River; Gunyah; Mallacoota; Mt. Drummer. NEW SOUTH WALES: Acacia Plateau; Barrengarry Mountain; 5 miles N. of Bateman's Bay; 15 miles S. of Bombala; Bulahdelah State Forest; Clyde Mountain; 10 miles S. of Coffs Harbour; Colong; Comboyne; Donaldson State Forest; Durras Water; 3–7 miles N. and 10 miles S. of Eden; Gallagher's Camp; 28 miles E. of Glen Innes; Grafton; Macquarie Pass; 13 miles N. of Marulan; Mittagong; 16 miles N. of Mittagong; Mt. Cambewarra; Mt. Tomah; 12 miles N. of Murwillumbah; Putty; Shoalhaven R.; Somersby; Tooloom Plateau via Woodenbong; Upper Allyn R.; Whian Whian State Forest, near Lismore; Wollongong, Mt. Keira; 17 miles S. of Woodburn; 4 miles W. and 6 miles E. of Woodenbong. QUEENSLAND: Moggill; Mt. Glorious; Mt. Lindesay Forest; Mt. Nebo; Mt. Tamborine.

## 126. ONTHOPHAGUS YUNGABURRA, sp. nov.

(Figs. 344, 345, 606)

Rufous, antennal clubs flavous. Total length 3.5–5.5 mm.

*Male*

*Head.*—Margin rounded, straightened or very slightly emarginate medially, genal angles rounded, not prominent. Clypeal suture with frontal section effaced (marked by a very indistinct ridge in minor male), genal sections strongly oblique. Vertex with a pair of stout parallel erect conical horns, relatively short (0.4–0.5 mm) even in major male, reduced to small tubercles in minor male. No carina between horns. Eyes narrow, with 6–7 facet rows across widest point, separated by about 9 widths, canthus incomplete. Extremely finely punctate, the punctures well separated, surface smooth, nitid, glabrous. Labium deeply emarginate, a little more than one-third of way to base. *Pronotum.*—Unsculptured, moderately convex anteriorly, anterior declivity not planate. Anterior angles quadrate, the points angulate. Hind edge very finely margined. Extremely finely punctate, the punctures well separated, surface smooth, nitid, glabrous. *Elytra.*—Intervals flat, smooth, nitid, fairly densely punctate

with extremely small punctures, glabrous except for anterior part of last interval along epipleural margin, which bears 2 or 3 rows of short setae. Striae superficial, fine, simple, with numerous small shallow punctures wider than stria. *Legs.*–Fore tibia not elongated, the inner apical angle quadrate. *Abdomen.*–Pygidium smooth, nitid, fairly densely punctate with small shallow punctures bearing a few short recumbent setae near edges. Parameres with projecting points strongly transversely widened.

*Female*

Clypeal surface densely punctate with moderate punctures, not rugose. Clypeal suture with frontal section present, carinate, evenly arcuate, curved into genal sections. Fore tibiae with inner apical angle obtuse. Otherwise like male.

*Type*

Holotype ♂, Yungaburra, Qld., 7.v.1964, G. F. Bornemissza, ANIC.

*Remarks*

This species is very close to *sydneyensis* and has the same genital parameres. The characters distinguishing the two species (couplet 6 of the key) are quite superficial, nevertheless there can be no doubt that two separate species are involved because of the great difference in ecological and geographical distribution, *yungaburra* being a tropical forest species some 900 miles removed from the nearest *sydneyensis* locality.

*Distribution* (Fig. 330)

Known only from the vicinity of Yungaburra, Qld., on the Atherton Tableland. Collected by Dr. Bornemissza in May 1964, March 1965, and April 1969, in rain forest at marsupial entrails and human excrement.

*Material Examined*

The type and 47 specimens. QUEENSLAND: Yungaburra, 7.v.1964, 27–28.iii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 47.

## XIX. *The* POSTICUS *Group*

Eyes narrow to moderate, with 5–9 facet rows across widest point, separated by 9–18 widths, canthus incomplete or just touching occipital edge. Labium excised shallowly to almost halfway to base. Pronotum glabrous, smooth. Elytra with microtrichia (glabrous in *arilla*). Pygidium with short setae (glabrous in *arilla*). Colour green with pale brown markings on elytra in 4 species, entirely rufopiceous in *turrbal*, and black with red humeral spots in *arrilla*. Total length 4–8 mm.

Male with frontoclypeal suture effaced, vertex unarmed or with small tubercles near eyes (a carina in minor *posticus*). Pronotum unsculptured or with anterior median tumescence. Fore tibiae elongated, with distal brush of long setae and inner apical angle acute. Female with vertex unarmed except in *posticus*, which has a transverse carina, pronotum unsculptured.

Six species: 127. *arrilla*, sp. nov.; 128. *posticus* Erichson; 129. *incornutus* Macleay; 130. *mulgravei* Paulian; 131. *millamilla*, sp. nov.; 132. *turrbal*, sp. nov.

The three closely related species *posticus*, *incornutus*, and *mulgravei* replace each other along the coast from south to north, the first two inhabiting open areas, the last rain forest. The remaining three are wet sclerophyll or rain forest species from southern Queensland and the Atherton Tableland.

KEY TO SPECIES OF THE *POSTICUS* GROUP

1. Dorsal surfaces nitid, devoid of setae or microtrichia, pygidium glabrous; colour ebony black with small red spot behind each humerus. S. Qld., N. N.S.W. ..... 127. *arrilla*, sp. nov.
   Dorsal surfaces sericeous or alutaceous, with numerous microtrichia on elytra and often setae on last interval, pygidium with short setae; colour not as above ..... 2

2(1). Male with a median anterior tumescence on pronotum; minor male and female with a transverse carina on vertex; even-numbered intervals of elytra usually pale reddish brown, odd-numbered ones green (may be entirely green). Tas., SE. S.A., Vic. ..... 128. *posticus* Erichson
   Both sexes with pronotum evenly convex; vertex without a transverse carina; even-numbered elytral intervals not, or not entirely, pale ..... 3

3(2). Eighth elytral interval setose for its entire length, some setae on apices of other intervals as well; male with a small tubercle on vertex near each eye; clypeal carina of female forming a continuous line across head ..... 4
   Eighth elytral interval glabrous or with setae confined to anterior half, remaining intervals glabrous; male with vertex entirely smooth; clypeal carina of female angled where frontal and genal sections join ..... 5

4(3). Pronotum and pygidium entirely dark green or brown; pronotal punctures separated by many times their diameter. N. N.S.W., Qld. ..... 129. *incornutus* Macleay
   Lateral edges of pronotum and pygidium yellow, the latter usually with 3 dark spots; pronotal punctures separated by 1–2 diameters. N. Qld. ..... 130. *mulgravei* Paulian

5(3). Fore body greenish or bronzed, elytra rufopiceous with rufous apices, southern specimens with setae on 8th elytral interval. Qld. ..... 131. *millamilla*, sp. nov.
   Entirely piceous or rufopiceous; elytra without setae. S. Qld. ..... 132. *turrbal*, sp. nov.

## 127. ONTHOPHAGUS ARRILLA, sp. nov.

(Figs. 346, 347, 607)

Ebony black with a small transverse red spot running across 3 intervals behind each humerus (sometimes absent), legs rufopiceous, antennal clubs pale brown. Total length 6–7 mm.

*Male*

*Head.*—Clypeal margin medially a little produced, feebly bilobate or truncate, reflexed, rest of head margin gently curved to genal angles, which are subangulate. Clypeal suture with frontal section entirely effaced, genal sections almost effaced, indistinct. Frons flat, vertex a little concave medially, laterally with a pair of low oblique tubercles near inner margin of eyes, absent in minor male. Eyes moderate, with 8–9 facet rows across widest point, separated by about 9 widths, canthus incomplete. Densely punctate with extremely small, indistinct punctures, except along edges, where punctures are small and distinct, glabrous, surface smooth, sericeous. Labium excised about one-third of way to base. *Pronotum.*—Feebly convex, with a small median tumescence near anterior margin, absent in minor male. Anterior angles subacute, the apices angulate. Hind edge unmargined. Moderately densely, evenly punctate with very small punctures, glabrous, surface smooth, nitid. *Elytra.*—Intervals flat,

smooth, nitid, with numerous extremely small punctures, glabrous. Striae superficial, very fine, simple, with small impressed punctures. *Legs.*–Fore tibiae elongate, slender, inner apical angles acute, with a dense brush of long setae, much longer than spur, distal face of apical tooth also with a tuft of shorter setae. Spur very small. Claws small. *Abdomen.*–Pygidium smooth, alutaceous, with numerous very small punctures, glabrous. Parameres dorsally prolonged into a broad lobe, points small, retracted near base.

*Female*

Clypeal margin more distinctly bidentate. Clypeal surface transversely rugose. Clypeal suture complete, beaded, forming single, slightly recurved transverse line without angles between frontal and genal sections. Pronotum without median anterior tumescence. Fore tibiae not modified. Otherwise like male.

*Type*

Holotype ♂, 4 miles W. of Woodenbong, N.S.W., 9.xii.1967, E. G. Matthews, ANIC.

*Distribution* (Fig. 358)

The McPherson Range on the Queensland–New South Wales border in rain forest and wet sclerophyll forest with loam and clay soils, at low altitudes. Trapped with human faeces.

*Material Examined*

The type and 16 specimens. NEW SOUTH WALES: 12 miles N. of Murwillumbah, 7.xii.1967, E. G. Matthews, ANIC, 1; 4 miles W. and 6 miles E. of Woodenbong, 8–9.xii.1967, E. G. Matthews, ANIC, 9. QUEENSLAND: Mt. Tamborine, 7.xii.1967, E. G. Matthews, ANIC, 6.

## 128. ONTHOPHAGUS POSTICUS Erichson

(Figs. 348, 349, 608)

*Onthophagus posticus* Erichson, 1842, p. 154; Harold, 1869, p. 87; Blackburn, 1903, p. 272; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

*Onthophagus flavolineatus* Blanchard, 1853, p. 97; Harold, 1867, p. 31 (syn.).

*Onthophagus leechi* Frey, 1959, p. 622; Frey, 1962, p. 622 (syn.).

Fore body green, elytra usually with odd-numbered intervals dark green, even-numbered ones pale fulvous. In pale specimens the odd-numbered intervals are only partly dark, while in dark specimens the elytra may be almost entirely green, the pale areas being confined to the apices. Pygidium, underside, and femora dark green, tibiae rufopiceous with green reflections, antennal clubs fuscous. Total length 5.5–8.0 mm.

*Male*

*Head.*–Clypeal margin medially widened and strongly reflexed, forming a broadly rounded lobe which in some specimens is slightly produced. Clypeal suture with frontal section effaced (indicated in minor male by a short ridge near middle of head), genal sections finely carinate near margins, prolonged backward nearly to vertex. Frons flat, vertex flat and unarmed in major male, in minor male with distinct transverse

carina. Eyes small, with 5–6 facet rows across widest point, separated by about 18 widths, canthus incomplete. Finely punctate with very small punctures on base of head, these becoming larger and more crowded on edges of clypeus and genae, glabrous, surface shagreened and matt on base of head, becoming smooth and nitid on apical half or so. Labium excised a little more than one-third of way to base. *Pronotum.*–With a prominent median tumescence near anterior margin in major male, this reduced but still evident in minor one, rest of surface unsculptured. Anterior angles quadrate, the apices angulate. Hind edge very finely margined. Densely, evenly punctate with small punctures separated by 2–3 diameters, glabrous, surface smooth, finely shagreened, alutaceous, middle of base sericeous. *Elytra.*–Intervals flat, smooth, shagreened, sericeous, appearing impunctate, actually with extremely minute punctures and microtrichia, difficult to see. Last interval with clearly visible short straight setae on anterior half of interval. Striae superficial, finely geminate, impunctate. *Legs.*–Fore tibiae of major male moderately slender and elongated, the inner apical angle a little dentiform and the edge bearing a thick brush of long setae, much longer than spur, which is small. Minor male with fore tibia shorter and brush greatly reduced, spur larger. Claws moderate. *Abdomen.*–Pygidium smooth, shagreened, sericeous, with scattered small punctures bearing short straight recumbent setae. Aedeagus normal.

*Female*

Clypeal margin medially widened and reflexed, but less so than in male, distinctly bilobate. Clypeal surface transversely rugose. Clypeal suture with frontal section present, strongly carinate. Vertex with a distinct carina slightly bent back in middle. Pronotum without median anterior tumescence, but with slight concavities on either side of middle near anterior margin. Pronotal punctures larger. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype of *posticus*: ♂, Van Diemen's Land, Schayer, ISZ 27125.
Holotype of *flavolineatus*: ♂, Tasmania, MNHN(Ob).
Holotype of *leechi*: Auckland, New Zealand, California Academy of Sciences.
The first two, but not the third, seen by the author.

*Remarks*

A specimen of this species in MNHN(Ob), ex musaeo Harold, bears the name *flavolineatus* Blanchard on a round pink label transfixed vertically on the pin (a characteristic feature of Blanchard specimens, according to M. Descarpentries). It is considered by the present author to be the type of *flavolineatus* and was so marked.

A series of ten specimens collected by B. Mollison at Greens Beach, near Kelso, in northern Tasmania, and all specimens from South Australia, including Kangaroo I., are all of the darkest (nearly all green) phase of this species, seldom seen elsewhere. Most other specimens, including those from Flinders I., are of the normal colour phase with a slight admixture of paler specimens not correlated with geography.

*Distribution* (Fig. 358)

Eastern Tasmania, the south-east of South Australia, and the southern half of Victoria, in open situations. Collected at cow dung and wombat droppings (B. Mollison),

and trapped with rabbit entrails and human faeces (G. Bornemissza). Active in August and September, then again from February to May.

Introduced (apparently accidentally) into New Zealand, where Hudson (1934, p. 170) says of it: "Found in fields and other cultivated places, but generally speaking extremely rare, although Mr. W. W. Smith reported it as common in Taranaki, where it occurred under the dry bark of eucalyptus. Evidently introduced from Australia."

*Material Examined*

The types and 386 specimens. TASMANIA: Beaconsfield; Flinders I.; Greens Beach; Hobart Town (C. Darwin); Kelso; Parattah; Perth. SOUTH AUSTRALIA: Kangaroo I.; Kingston. VICTORIA: Ballarat; 7 miles SSE. of Benalla; Boolarra; 6 miles NW. of Caramut; Dunkeld; Eltham; Gunyah; 8 miles SE. of Hamilton; 13 miles SE. of Macarthur; 7 miles NNE. of Maindample; 3 miles NW. of Morwell; 4 miles WSW. of Traralgon; Wannon; 9 miles S. of Yanakie; 10 miles NW. of Yea.

## 129. ONTHOPHAGUS INCORNUTUS Macleay

(Figs. 350, 351, 446, 447, 609)

*Onthophagus incornutus* Macleay, 1871, p. 181; Blackburn, 1903, p. 304; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 213.

*Onthophagus semihirtus* Frey, 1963, p. 541. New synonymy.

Dark green above and on pygidium, the pronotum sometimes with bronze reflections, the elytra sometimes brown, bases of elytral intervals sometimes reddish, the red markings shorter on odd-numbered intervals, or reddish spots present only on humeri, or entirely absent from base. Apices of elytra with reddish markings. Pygidium sometimes with reddish border. Underside black, apices of femora sometimes with reddish edges, tibiae rufous, antennal clubs fuscous or rufous. Total length 4–7 mm.

*Male*

*Head.*—Clypeal margin medially produced into a truncate lobe which is strongly reflexed, rest of head margin nearly straight to genal angles, which are angulate. Clypeal suture with frontal section entirely effaced. Frons flat or slightly swollen in middle. Vertex with a small tubercle near each eye. Eyes fairly small, with about 9 facet rows across widest point, separated by about 12 widths, canthus incomplete or just touching occipital margin. Moderately densely punctate with very small punctures, sides of clypeus with larger punctures, glabrous, surface smooth, finely shagreened, sericeous. Labium excised nearly halfway to base. *Pronotum.*—Evenly, feebly convex, unsculptured. Anterior angles subacute, the apices angulate. Hind edge unmargined. Moderately densely, evenly punctate with very small punctures separated by many times their diameter, glabrous, surface smooth, finely shagreened, sericeous. *Elytra.*—Intervals nearly flat, smooth, shagreened, sericeous, with numerous extremely small punctures with very minute trichia, difficult to see, except along entire length of last interval, which bears 3–5 rows of curled recumbent cilia, a few also present on apical part of 7th, and sometimes 6th, interval. Striae superficial, fine, simple, with extremely small, shallow punctures. *Legs.*—Fore tibiae elongated, slender, the inner apical angle a little produced and bearing a dense brush of long setae, much longer than fore spur, distal face of apical tooth also with a tuft of much shorter setae. Spur small, curved out. Claws small. *Abdomen.*—Pygidium smooth, shagreened, with numerous very small punctures bearing short recumbent setae. Aedeagus normal.

*Female*

Clypeal margin medially not reflexed, distinctly bilobate or bidentate, clypeal surface strongly transversely rugose, clypeal suture with frontal section present, strongly beaded, joining genal sections very near edges and forming with them a single transverse ridge. Rest of head more coarsely punctate, vertex devoid of tubercles, but indistinctly swollen in some specimens. Fore tibiae unmodified. Otherwise like male.

*Types*

Holotype of *incornutus*: ♂, Gayndah, Qld., AM K 28230. Seen by the author.
Holotype of *semihirtus*: Herberton, Qld., MGF. Not seen.

*Remarks*

Specimens of *semihirtus* were sent by Dr. Frey and compared with the holotype of *incornutus* by the present author, who found them to be conspecific.

Specimens from New South Wales and from Carnarvon Gorge, Qld., tend to be uniformly dark, with few or no rufous markings on the elytra. Most specimens from the Atherton Tableland are also dark with rufous elytral apices, but 27% of these have elytral markings similar to those of *mulgravei*, with reddish areas along the bases as well.

*Distribution* (Fig. 358)

The Sydney–Newcastle region, an extensive area in southern Queensland, and the Atherton Tableland. The species thus has an unusually extended range. It occurs in pastures and other open areas at cow dung and human excrement, but is seldom collected. One specimen, a male, was collected by Mr. J. H. Calaby clinging to the anal fur of a wallaby, *Macropus dorsalis* (Gray), in the Mt. Lindesay region, being the only *Onthophagus* with normal (non-prehensile) claws so collected. If anything, the claws of *incornutus* are unusually small.

*Material Examined*

The type and 53 specimens. NEW SOUTH WALES: North Rocks, 9,27.ix.1941, CNC, 2; Quakers Hill, H. Davidson, ANIC, 5; 8 miles NNW. of Stroud, 3.xii.1948, P. B. Carne and E. B. Britton, ANIC, 4; near Sydney, Oct. 1943, P. J. Darlington, MCZ, 1; 4 miles W. of Woodenbong, 9.xii.1967, E. G. Matthews, ANIC, 6. QUEENSLAND: Atherton, 7.v.1964, 7.v.1969, G. F. Bornemissza, ANIC, 1; Bulburin State Forest, 27–29.v.1960, E. A. Bernays, UQ, 1; Carnarvon Gorge, 9.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 4; Daintree, Upper Stewart Ck., 9.x.1969, R. J. Huppatz, ANIC, 2; Gayndah, AM, 1; Herberton, 11.ii.1962, H. Demarz, MGF, 4; Howard, 10.iii.1965, G. F. Bornemissza, ANIC, 5; Kolan Ck., Miriam Vale, 10.iii.1965, G. F. Bornemissza, ANIC, 1; Mt. Lindesay foothills, 24.iv.1960, J. H. Calaby and K. Keith, ANIC, 1; Serpentine Lagoon via Yeppoon, 26.xii.1968, B. Cantrell, UQ, 1; Yungaburra, 7.v.1964, 27–28.iii.1965, G. F. Bornemissza, ANIC, 14.

## 130. ONTHOPHAGUS MULGRAVEI Paulian

(Figs. 352, 353, 610)

*Onthophagus mulgravei* Paulian, 1937, p. 343.

Fore body dark green or bronzed, lateral edges of pronotum yellowish or reddish, bases of elytral intervals reddish or yellowish, these areas shorter on odd-numbered intervals, apices of elytra yellowish except 5th interval and sometimes a transverse dark

area along edge, pygidium and abdominal sternites yellow, usually with 3 dark spots on pygidium and dark anterior border on sternites, rest of underside rufous or rufopiceous with apical two-thirds of middle and hind femora, and anterior half of fore femora, yellow. Rest of legs rufous. Antennal clubs flavous or pale brown. Total length 5–6 mm.

*Male*

*Head.*—Clypeal margin medially reflexed and produced into a small truncate lobe. Rest of head margin almost straight to genal angles, which are angulate. Clypeal suture with frontal section entirely effaced. Frons with a slight median tumescence, vertex with a small tubercle near each eye. Eyes fairly small, with about 9 facet rows across widest point, separated by about 10 widths, canthus incomplete. Moderately punctate with extremely small punctures, glabrous, surface smooth, shagreened, sericeous. Labium excised almost halfway to base. *Pronotum.*—Evenly, feebly convex, unsculptured. Anterior angles subquadrate, the apices acute. Hind edge unmargined. Densely punctate with small punctures separated by 1–2 diameters, glabrous, surface smooth, shagreened, sericeous, with extremely small punctures bearing very minute setae, difficult to see, except along entire length of last interval, which bears 3 or 4 rows of recumbent curved cilia, these also present on apices of 6th and 7th intervals. Striae superficial, fine, simple, with extremely small punctures. *Legs.*—Fore tibiae elongate, slender, the inner apical angle a little produced and bearing a dense brush of long setae, much longer than spur. Distal face of apical tooth also with a tuft of much shorter setae. Spur small, curved out. Claws small. *Abdomen.*—Pygidium smooth, shagreened, with numerous very small punctures bearing short recumbent setae. Aedeagus normal.

*Female*

Clypeal margin medially expanded into 2 feeble lobes, clypeal surface strongly transversely rugose, clypeal suture with frontal section present, beaded, joining genal sections near edge, forming a transverse sinuate line. Rest of head more coarsely punctate, vertex a little swollen but without tubercles. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, Mulgrave River, Qld., H. Hacker, DEI. Seen by the author.

*Remarks*

Specimens from Iron Range and the tip of Cape York Peninsula may have the pygidium and abdominal sternites entirely yellow, or at least have the dark pigment greatly reduced in extent in comparison with more southern specimens.

*O. mulgravei* is very close to *incornutus* and there is some doubt as to whether it is a separate species. Some specimens of *incornutus* from Yungaburra are very similar to *mulgravei* in colour and punctuation. However, specific separation is indicated by the ecological differences between the two (see below).

Of the available specimens, 62% have patches of fine soil or excrement clinging to the elytra. These patches usually occur in the middle of the elytron and are oval in shape, the elytral surface being depressed beneath them. Under magnification nothing unusual could be seen on the soil-holding surface other than its depression.

It is likely that the numerous microtrichia present all over the elytra are minutely hooked and their ability to hold fine particles is enhanced when the integumental surface is depressed. In any case, these patches, when present, are a very characteristic feature of *mulgravei*, not seen in any other species.

*Distribution* (Fig. 358)

From the Atherton Tableland, Qld., and its eastern approaches northward to Cape York, in rain forest with both clay and sand soil. This contrasts with the closely related *incornutus*, which is found in open areas from the Atherton Tableland southward. Nocturnal (G. Monteith). All specimens were collected at human faeces.

*Material Examined*

The type and 44 specimens. QUEENSLAND: Daintree, Upper Stewart Ck., 9.x.1969, R. J. Huppatz, ANIC, 4; Iron Range, 28.iv.–10.v.1968, G. Monteith, UQ, 13; L. Barrine, 5.v.1964, G. F. Bornemissza, ANIC, 1; Lockerbie, 10–15.vi.1969, G. Monteith, UQ, 2; Mossman Gorge, 3.iv.1968, E. G. Matthews, ANIC, 3; Mossman Gorge, 10.viii.1968, B. Cantrell, UQ, 1; Upper Mulgrave R., 2.iv.1968, E. G. Matthews, ANIC, 10; 3 miles S. of Musgrave, 14.ix.1969, R. J. Huppatz, ANIC, 6; Tully, Garner Beach, 12.x.1969, R. J. Huppatz, ANIC, 4.

## 131. ONTHOPHAGUS MILLAMILLA, sp. nov.

(Figs. 354, 355, 448, 449, 611)

Fore body fuscous with greenish reflections, elytra rufous with paler apices and sometimes a red spot on each humerus, underside rufopiceous, legs rufous, antennal clubs flavous. Total length 5–6 mm.

*Male*

*Head.*–Clypeal margin medially feebly bilobate and narrowly reflexed, rest of head margin nearly straight to genal angles, which are angulate. Clypeal suture with frontal section entirely effaced, genal sections finely carinate. Frons and vertex nearly flat, entirely devoid of tubercles. Eyes narrow, with 6–7 facet rows across widest point, separated by about 8 widths, canthus almost touching occipital edge. Fairly densely punctate with small punctures, glabrous, surface smooth, finely shagreened, alutaceous. Labium shallowly emarginate. *Pronotum.*–Feebly, evenly convex, unsculptured. Anterior angles quadrate, the apices angulate. Hind edge very finely margined. Densely punctate with small punctures separated by about 2 diameters, glabrous, surface very finely shagreened, alutaceous. *Elytra.*–Intervals flat, smooth, shagreened, alutaceous, with numerous extremely small punctures bearing very minute trichia, difficult to see, last interval without longer setae (northern form) or with numerous short curved cilia confined to anterior half of interval (southern form). Striae superficial, fine, simple, with very small shallow punctures. *Legs.*–Fore tibiae elongate, slender, the inner apical angle a little produced, bearing a dense brush of very long setae, apical tooth without a distinct tuft of shorter setae. Spur small, curved out. *Abdomen.*–Pygidium smooth, shagreened, sericeous, with numerous small punctures, those on sides bearing very short, recumbent setae. Parameres dorsally prolonged into a broad lobe, the points small, retracted near base.

*Female*

Clypeal margin expanded and a little more bidentate, clypeal surface transversely rugose. Clypeal suture with frontal section present, beaded, joining genal sections near margins at distinct angle. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, 9 miles W. of Millaa Millaa, Qld., 1.iv.1968, E. G. Matthews, ANIC.

*Remarks*

Specimens from Mt. Glorious in south Queensland have a reddish spot on the humerus and distinct setae on the anterior part of the last elytral interval, absent in those from the Atherton Tableland.

*Distribution* (Fig. 358)

Known only from the Atherton Tableland and from Mt. Glorious, near Brisbane, in dense montane forest with sandy loam soil. Trapped with human excrement.

*Material Examined*

The type and 14 specimens. QUEENSLAND: Heale's Lookout, Gillies Highway, 7.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 3; 9 miles W. of Millaa Millaa, 1.iv.1968, E. G. Matthews, ANIC, 7; Mt. Glorious, 8.iv.1968, E. G. Matthews, ANIC, 4.

## 132. ONTHOPHAGUS TURRBAL, sp. nov.

(Figs. 356, 357, 450, 451, 612)

Rufopiceous or black with rufous edges, antennal clubs fuscous. Total length 4.0–6.5 mm.

*Male*

*Head.*–Clypeal margin medially shallowly emarginate, not strongly reflexed, rest of head margin evenly rounded to genal angles, which are angulate. Clypeal suture with frontal section entirely effaced, genal sections finely carinate. Frons and vertex nearly flat, devoid of tubercles. Eyes narrow, with about 7 facet rows across widest point, separated by about 9 widths, canthus just touching occipital edge. Moderately densely punctate with small punctures, glabrous, surface shagreened, sericeous. Labium shallowly excised. *Pronotum.*–Feebly, evenly convex, unsculptured. Anterior angles subacute, the apices angulate. Hind edge very finely margined. Densely punctate with small punctures separated by about 2 diameters, glabrous, surface smooth, shagreened, sericeous. *Elytra.*–Intervals smooth, flat, shagreened, sericeous, with numerous extremely small punctures bearing very minute trichia, difficult to see. Last interval with longer setae. Striae superficial, of moderate width, simple, shiny, with extremely small shallow punctures. *Legs.*–Fore tibiae elongate, slender, with inner apical angle quadrate or a little acute, bearing a dense brush of long setae which are terminally hooked in fresh specimens. Spur small, curved out. Claws small. *Abdomen.*–Pygidium smooth, shagreened, matt, with numerous extremely small punctures, those of sides bearing very short, recumbent setae. Parameres dorsally prolonged into a broad lobe, points small, retracted near base.

*Female*

Clypeal margin expanded and bidentate, clypeal surface transversely rugose. Clypeal suture with frontal section present, beaded, joining genal sections near margins at distinct angle. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, Mt. Tamborine, Qld., 7.xii.1967, E. G. Matthews, ANIC.

*Remarks*

This species does not have any trace of green or bronze and the elytra are completely glabrous except for the microscopic trichia characteristic of the *incornutus* complex of species. As in *mulgravei*, these trichia hold a layer of fine soil, but unlike the latter species this soil is not concentrated in patches but occurs as a thin film over the entire elytron. This film gives the specimens a dirty appearance and is most difficult to remove even by mechanical means. From the closely related *millamilla* from Mt. Glorious *turrbal* may be told by the absence of cilia and red humeri on the elytra.

*Distribution* (Fig. 358)

Known only from Mt. Tamborine, south of Brisbane, in rain forest with clay soil. Trapped with marsupial entrails and human excrement.

*Material Examined*

The type and 42 specimens. QUEENSLAND: Mt. Tamborine, 7.xii.1967, E. G. Matthews, ANIC, 42.

## XX. *The* RUBESCENS *Group*

Eyes narrow to wide, with 3–15 facet rows across widest point, separated by 4–20 widths, canthus incomplete or just touching occipital edge. Labium excised very shallowly to nearly halfway to base. Pronotum glabrous, nitid (a few lateral setae in *symbioticus*). Elytra glabrous or with short setae on last interval. Pygidium with at least a few short setae. Colour black or rufous. Total length 2.3–5.2 mm.

Male with frontoclypeal suture variable, vertex and pronotum unarmed, although a frontal carina may be present. Fore tibiae not modified except in *tuckonie*, which has a prolonged inner apical angle in major male. Female usually with a low frontal carina which is situated well forward. Pronotum unsculptured.

Eight species: 133. *rubescens* Macleay; 134. *koebelei* Blackburn; 135. *symbioticus* (Arrow); 136. *waminda*, sp. nov.; 137. *parrumbal*, sp. nov.; 138. *manya*, sp. nov.; 139. *tuckonie*, sp. nov.; 140. *wilgi*, sp. nov.

The species of this group are not all interrelated, being placed together largely on the basis of small size and general absence of dorsal setae. Included is one of the prehensile species with hypertrophied claws, *symbioticus*, which seems to be most closely related to *koebelei*. The members of this group inhabit varied biotopes, *rubescens*, *koebelei*, *symbioticus*, and *manya* being found in savannah woodland, *parrumbal* in denser forest, and *waminda*, *tuckonie*, and *wilgi* in rain forest. All are tropical species.

## KEY TO SPECIES OF THE *RUBESCENS* GROUP

1. Both sexes with 2 transverse carinae or low ridges on head (clypeal and frontal) ..... 2
Both sexes with only 1 transverse carina on head, or none; if 2 carinae are present (in female only), then clypeal one is incomplete, not reaching genal sutures ..... 5

2(1). Elytra with microtrichia, without setae (appearing glabrous); bicoloured, the fore body largely black, the elytra largely red; small, total length 2.3–3.2 mm. N. Qld., N. N.T., N. W.A. ..... 133. *rubescens* Macleay
Elytra with distinct setae on last interval; unicoloured; larger, total length 3.5–4.5 mm ..... 3

3(2). Claws hypertrophied, prehensile; hind spur terminally bifurcate; setae present on lateral edges of pronotum. N. Qld., N.T. ..... 135. *symbioticus* (Arrow)
Not as above ..... 4

4(3). Eyes very wide, with about 15 facet rows across widest point, separated by about 4 widths. N. N.S.W., Qld. ..... 134. *koebelei* Blackburn
Eyes narrower, with 5–6 facet rows across, separated by about 11 widths. N. Qld. ..... 136. *waminda*, sp. nov.

5(1). Head margin semicircular, evenly rounded anteriorly; eyes moderately wide, separated by about 10 widths; outer edge of last elytral interval with a row of setae along its entire length. N. Qld., N. N.T. ..... 137. *parrumbal*, sp. nov.
Head margin medially more or less emarginate or excised; eyes narrower, separated by 20 or more widths; last elytral interval either glabrous or with scattered setae on anterior part only ..... 6

6(5). Major male with pronotum strongly convex, with median anterior depression; fore body slightly violet, elytra pure black; female with 2 transverse carinae on head, of which clypeal does not reach genal sutures; eye canthus not touching edge of occiput. S. Qld. ..... 138. *manya*, sp. nov.
Pronotum not strongly convex, without depression, colour not as above; female with clypeal carina only, reaching genal sutures near margin of head; eye canthus touching edge of occiput ..... 7

7(6). Basic colour black, often with more or less red on elytra; male with middle part of fronto-clypeal carina present and inner apical angle of fore tibia prolonged; major male with hind tibia prolonged beyond tarsal insertion. N. N.S.W., S. Qld. ... 139. *tuckonie*, sp. nov.
Basic colour flavous to rufous, elytra not more reddish; male with frontoclypeal carina entirely effaced and apex of fore or hind tibiae not prolonged. N. Qld. ..... 140. *wilgi*, sp. nov.

### 133. ONTHOPHAGUS RUBESCENS Macleay

(Figs. 360, 361, 452, 613)

*Onthophagus rubescens* Macleay, 1888, p. 903; Blackburn, 1903, p. 305; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

*Onthophagus imponderosus* Lea, 1923, p. 392; Boucomont and Gillet, 1927, p. 212. New synonymy.

Fore body black, pronotum usually reddish along the anterior and lateral margins, elytra red, rarely suffused with black pigment, pygidium red or black, legs flavous or rufous, antennal clubs fuscous. Total length 2.3–3.2 mm.

*Male*

*Head.*—Transversely oval in outline, clypeal margin not excised. Clypeal suture with frontal section present, beaded, feebly bisinuate, and joined to genal sections very near margin. Frons with a short transverse beaded ridge situated about halfway between clypeal suture and occiput. Eyes moderately narrow, with 4–5 facet rows

across widest point, separated by about 20 widths, canthus incomplete. Moderately densely punctate with small punctures, densest on vertex and finest on clypeus, surface smooth, nitid, glabrous. Labium shallowly emarginate. *Pronotum.*–Moderately convex, unsculptured. Evenly punctate with fairly coarse punctures separated by 1–2 diameters, glabrous, surface smooth, nitid. Anterior angles quadrate, the apices rounded. Hind edge finely margined. *Elytra.*–Intervals flat, a little uneven, nitid, with a row of very small punctures running along both edges of intervals, with extremely fine stubble, barely visible in oblique light. Striae shallow, geminate, with shallow punctures a little wider than stria and crenulating edges of intervals. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium smooth, nitid, with moderately large punctures separated by 1–2 diameters, laterally bearing very short, recumbent setae. Parameres exceptionally long, not tapering.

*Female*

Does not differ from the male.

*Types*

Holotype of *rubescens*: ♂, King's Sound, W.A., MM.

Holotype of *imponderosus*: ♂, Groote Eylandt, N.T., N. B. Tindale, SAM I. 15409.

Both seen by the author.

*Distribution* (Fig. 359)

The Kimberley District of Western Australia, the north of the Northern Territory, and north Queensland. This species was collected by the author in open sandy areas at human excrement. In the Kimberleys it occurs together with *consentaneus* in some of the most exposed situations, but unlike the latter it also penetrates areas of higher vegetation density in the north around Darwin, where (at least at the time of collecting) it was relatively scarce.

*Material Examined*

The types and 61 specimens. QUEENSLAND: Atherton, 7.v.1969, G. F. Bornemissza and P. Ferrar, ANIC, 1; Balgal Beach, near Paluma, 28.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 1; Tully, Mission Beach Rd., 12.x.1969, R. J. Huppatz, ANIC, 2; Yungaburra, 27.iii.1965, G. F. Bornemissza, ANIC, 1. NORTHERN TERRITORY: 15–27 miles S. of Darwin, 29.i.1968, E. G. Matthews, ANIC, 3; 20 miles W. and 24 miles S. of Katherine, 8–10.ii.1968, E. G. Matthews, ANIC, 7; Snake Bay, Melville I., 4–6.ii.1968, E. G. Matthews, ANIC, 1. WESTERN AUSTRALIA: 6–10 miles S. of Derby, 27.ii.1968, E. G. Matthews, ANIC, 29; Kununurra, 13–22.ii.1968, E. G. Matthews, ANIC, 5; 6–18 and 60 miles NW. of Kununurra, 14,18,22.ii.1968, E. G. Matthews, ANIC. 11.

## 134. ONTHOPHAGUS KOEBELEI Blackburn

(Figs. 362, 363, 614)

*Onthophagus koebelei* Blackburn, 1903, p. 291; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 213.

Rufopiceous, antennal clubs flavous. Total length 3.5–4.5 mm.

*Male*

*Head.*—Margin broadly rounded, slightly incurved at middle of clypeus, genal angles advanced, rounded, not prominent. Clypeal suture with frontal section present, finely carinate, strongly procurved, joining genal sections at strong angle far from margin. Frons with a short fine transverse ridge situated about halfway between clypeal carina and occiput. Eyes very wide, reniform, with about 15 facet rows across widest point, separated by about 4 widths, canthus incomplete. Moderately densely punctate with small deep punctures, glabrous, surface smooth, nitid, rugulose on clypeus. Labium excised about one-fourth of way to base. *Pronotum.*—Not very convex, unsculptured. Anterior angles quadrate, the points angular. Hind edge very finely margined. Moderately densely and evenly punctate with small punctures separated by 2–3 diameters, glabrous, surface smooth, nitid. *Elytra.*—Intervals feebly convex to almost flat, smooth, nitid, moderately punctate with extremely small punctures, glabrous except for 1 or 2 rows of setae along last interval. Striae impressed, simple, with numerous extremely small punctures barely crenulating edges of intervals. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium smooth, nitid, with moderately dense, small, deep punctures laterally bearing short recumbent setae. Parameres with points downturned, transversely flattened.

*Female*

Clypeal margin a little more deeply incised. Head surface more densely punctate, clypeus more rugose. Otherwise like male.

*Type*

Holotype ♀, north Queensland, Koebele, BMNH. Seen by the author.

*Distribution* (Fig. 359)

The entire coast of Queensland from Cape York to just below the New South Wales border, inland to about the 25-in. isohyet. Collected rarely as isolated individuals. Habitat and food habits unknown.

*Material Examined*

The type and 16 specimens. NEW SOUTH WALES: 4 miles W. of Casino, E. B. Britton, ANIC, 1. QUEENSLAND: Beenleigh, S. T. Danforth, MCZ, 1; Boothill Ck., 80 miles S. of Mackay, 24.v.1968, G. Monteith, UQ, 3; Bowen, BM, 1; Bowen, A. Simson, SAM, 1; Canungra, 22.xi.1943, A. Blomberg, AM, 1; Colosseum Ck., 10 miles S. of Miriam Vale, 20.xii.1966, B. Cantrell, UQ, 1; Glen Aplin, 26.i.1963, R. J. Elder, UQ, 1; Moolayember Dip, 60 miles N. of Injune, 10.iv.1965, G. F. Bornemissza, ANIC, 1; Oakabin, M. Wagener, 20.i.1961, UQ, 1; Peack Downs, Fairmaire, MNHN, 1; Silver Plains, 20.xii.1958, J. L. Wassell, ANIC, 1; Townsville, F. H. Taylor, ANIC, 1; Yeppoon, 2.i.1965, I. F. B. Common, ANIC, 1.

## 135. ONTHOPHAGUS SYMBIOTICUS (Arrow), new combination

(Figs. 13, 364, 365, 615)

*Macropocopris symbioticus* Arrow, 1920, p. 437; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 218.

Rufopiceous, anterior edge of pronotum, humeri, and apices of elytra more reddish, elytra sometimes with slight greenish tinge, legs rufous, antennal clubs flavous

to fulvous. Total length 3.8–4.5 mm (Queensland), 4.3–5.2 mm (Northern Territory, New Guinea).

*Male*

*Head.*—Margin feebly and broadly bilobate and reflexed medially, laterally feebly curved to genal angles, which are rounded, not prominent. Clypeal suture complete, consisting of a single bisinuate carina across head, not strongly procurved medially or angled with genal sections. Frons of Queensland specimens with a pair of short low ridges, somewhat oblique, situated about halfway between clypeal carina and occiput, of Northern Territory and New Guinea specimens with a complete, nearly straight transverse carina here. Eyes moderately wide, with 9–12 facet rows across widest point, separated by 7–8 widths, canthus incomplete. Fairly densely punctate with small deep punctures, glabrous, surface smooth, nitid, clypeus very slightly rugulose. Labium excised about halfway to base. *Pronotum.*—Feebly convex, unsculptured. Anterior angles subquadrate, the apices rounded. Hind edge very finely margined. Rather densely and evenly punctate with deep medium-sized punctures separated by 1–2 diameters, glabrous except for several rows of short curved setae along antero-lateral edges. *Elytra.*—Intervals feebly convex, smooth, nitid, densely punctate with medium-small punctures forming 2 or 3 rows on each interval, glabrous except for 2 or 3 rows of short curved setae along entire length of last interval and also along posterior half of 7th interval in most specimens. Striae impressed, simple, with close-set deep punctures wider than stria and crenulating edges of intervals. *Legs.*—Fore tibiae unmodified. Fore spur large, wide, abruptly bent inward near tip and somewhat spatulate in fresh specimens. Hind spur bifurcate near tip. Claws prehensile, lower edge of last tarsal segment not prolonged, bearing 5 pairs of long bristles, pulvillus evident. *Abdomen.*—Pygidium convex, nitid, densely punctate with small deep punctures bearing inwardly-directed short setae, usually worn off from middle of pygidium. Aedeagus normal.

*Female*

Head as in male, but with the frontal ridges tending to be joined together in a single open-V-shaped or nearly transverse carina. Fore spur more tapering. Otherwise like male.

*Type*

Holotype ♂, Cairns, Qld., July, Dr. Illingworth, BMNH. Seen by the author.

*Remarks*

This is one of the species which has independently evolved the prehensile claws which enable it to cling to the fur of wallabies. The other species which have evolved this adaptation are all in the *glabratus* group. However, the last tarsal segment of *symbioticus* is quite different from that seen in the other prehensile species, as the lower edge of this segment is not greatly prolonged to serve as an apposing "thumb", and the pulvillus remains fully developed. The apposing function is served by a series of stout bristles arranged in pairs along the lower surface of the last tarsal segment. The host's hair is usually gripped between the claws and the second pair of these bristles (Fig. 13), but presumably the other bristles can also serve. This gripping mechanism is far more efficient than that seen in the *glabratus* group, judging by the

frequency with which dead specimens of *symbioticus* are seen still gripping hairs torn from the wallaby host. The modified fore and hind tibial spurs may also aid in clinging, and this species appears to be better adapted for this habit, and more dependent on it, than the other prehensile species. It is seldom collected off the host.

*O. symbioticus* is similar to *koebelei*, sharing most morphological features with that species but differing in the claws, spurs, the size of the eyes, and the density of punctuation and pronotal setae. The aedeagus is as in *koebelei.*

The Northern Territory and New Guinea specimens of *symbioticus* differ from the Queensland ones in being larger, having the eyes a little wider, and the frontal carina complete in the male (instead of being divided into two).

*Distribution* (Fig. 359)

North Queensland from Cairns to Cape York, the Northern Territory south of Darwin, and western Papua. Of the available specimens, 94% were collected around the cloacal opening of wallabies, *Macropus agilis* (Gould) being the only species named. Some or all of the remaining specimens were collected at light; none have been recorded to occur in dung.

Mr. B. L. Bolton, who collected large numbers of *symbioticus* from agile wallabies 60 miles south of Darwin, found a heavy infestation of the wallabies, up to 80 beetles per host, in January and lesser but still considerable numbers in April (the beginning and end of the wet season), with fewer beetles of this species during the dry season in July and October. *O. symbioticus* shares its wallaby hosts with *muticus* and *parvus.* Some additional information on what little is known of the biology of the prehensile species is presented at the beginning of the present work.

*Material Examined*

The type and 553 specimens. QUEENSLAND: Bamaga, 30.iii.1964, I. F. B. Common and M. S. Upton, ANIC, 1; Cairns, ANIC, UQ, 6; 10 miles S. of Cooktown, 13.ii.1967, J. H. Calaby, ANIC, 2; Iron Range, 11–17.v.1968, G. Monteith, UQ, 2; Lockerbie, 6–10.vi.1969, G. Monteith, UQ, 3; Silver Plains, Homestead, 20.xii.1958, 22.xii.1959, 21.xi.1964, J. L. Wassell, ANIC, 23; Silver Plains, Massey Ck., 13.xii.1964, G. Monteith, UQ, 6. NORTHERN TERRITORY: 70 miles S. of Darwin, 10.i.1968, B. L. Bolton, ANIC, 9; Tortilla Flats, 60 miles S. of Darwin, Apr. 1967, B. L. Bolton, ANIC, ±500. NEW GUINEA: Western Division of Papua, Dec. 1967, I. L. Owen, ANIC, 1.

## 136. ONTHOPHAGUS WAMINDA, sp. nov.

(Figs. 366, 367, 616)

Rufopiceous to black, antennal clubs pale fuscous. Total length 3.5–4.5 mm.

*Male*

*Head.*—Clypeal margin medially very feebly incurved, rest of margin rounded to genal angles, which are subangulate, not prominent. Clypeal suture with frontal section carinate, procurved, joining genal sections at an angle far from margin. Frons with a straight or feebly sinuate transverse carina situated a little closer to clypeal carina than to occiput. Eyes moderately narrow, with 5–6 facet rows across widest point, separated by about 13 widths, canthus incomplete. Evenly, fairly densely punctate with small punctures, becoming densely punctate on clypeus, glabrous, surface smooth, nitid, feebly rugulose on clypeus. Labium incised about one-fourth of way

to base. *Pronotum.*–Moderately convex, unsculptured. Anterior angles quadrate, the points subangular. Hind edge finely margined. Evenly punctate with small punctures separated by 3–4 diameters, glabrous, surface smooth, nitid. *Elytra.*–Intervals feebly convex, smooth, nitid, with spaced-out, extremely small punctures arranged in 2 irregular rows down each interval. Glabrous except for scattered short setae down last interval. Striae impressed, simple, with frequent small deep punctures crenulating edges of intervals. *Legs.*–Fore tibiae not modified. *Abdomen.*–Pygidium smooth, nitid, with fairly numerous small deep punctures bearing short recumbent setae. Parameres short, the points small, near base.

*Female*

Head a little more densely punctate. Otherwise like male.

*Type*

Holotype ♂, Palmerston National Park, Qld., 1.iv.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 359)

The south-eastern edge of the Atherton Tableland, Qld., in dense rain forest with clay soil. At human excrement bait.

*Material Examined*

The type and 34 specimens. QUEENSLAND: Millaa Millaa, Apr. 1932, P. J. Darlington, MCZ, 5; Palmerston National Park, 1.iv.1968, E. G. Matthews, ANIC, 3; Palmerston National Park via Innisfail, 23.iv.1968, G. Monteith, UQ, 2; The Boulders via Babinda, 4.iv.1968, E. G. Matthews, ANIC, 3; Tully, 12.x.1969, R. J. Huppatz, ANIC, 2; Yungaburra, 27.iii.1965, 7.v.1969, G. F. Bornemissza, ANIC, 19.

## 137. ONTHOPHAGUS PARRUMBAL, sp. nov.

(Figs. 368, 369, 617)

Rufopiceous, edges of pronotum and elytra rufous, as are humeri, antennal clubs flavous. Total length 4.1–5.2 mm.

*Male*

*Head.*–Margin semicircular between genal angles, middle of clypeal margin slightly reflexed, genal angles subangulate, not prominent. Clypeal suture with frontal section effaced except for a slightly elevated median transverse ridge. Frons with a pair of very small transverse ridges on either side of middle, visible only in oblique light. Eyes moderately wide, with about 8 facet rows across widest point, separated by about 12 widths, canthus incomplete. Extremely finely punctate, glabrous, surface smooth, nitid. Labium very shallowly excised. *Pronotum.*–Moderately convex, unsculptured. Anterior angles quadrate, the apices subangulate. Hind edge unmargined. Disc extremely finely punctate, punctures becoming a little larger toward anterior angles, surface glabrous, smooth, very nitid. *Elytra.*–Intervals moderately convex, smooth, nitid, with numerous extremely small punctures, glabrous except for last interval, which bears a single or double row of short setae along its entire length on outer edge. Striae impressed, simple, with numerous very small, deep punctures only a little wider than stria. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium smooth, nitid, densely and evenly punctate with deep medium-sized punctures each bearing a short seta, forming a short vestiture over entire pygidium. Parameres square, the points small.

*Female*

Clypeal carina complete but feeble, slightly more prominent medially, feebly procurved. Frontal ridges very feeble or absent. Head a little more densely punctate, clypeus very feebly rugulose. Otherwise like male.

*Type*

Holotype ♂, Balgal Beach, near Paluma, Qld., 28.iv.1969, G. F. Bornemissza and P. Ferrar.

*Distribution* (Fig. 359)

Known from Melville I. and an island in the Sir Edward Pellew Group, N.T., and the Paluma area of north Queensland. The specimen collected by the author was found under a decayed fungus in dense monsoon forest on Melville I., while the series collected by Dr. Bornemissza was found in woodland near a beach and in smaller numbers further inland in coastal savannah woodland in shaded situations, at human excrement bait.

*Material Examined*

The type and 21 specimens. QUEENSLAND: Balgal Beach, 28.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 13; Mutarnee, 8 miles N. of Rollingstone, 14.iv.1969, Bornemissza and Ferrar, ANIC, 3; 8 miles W. of Paluma, 24.iv.1969, Bornemissza and Ferrar, ANIC, 1; Rollingstone, 28.iv.1969, Bornemissza and Ferrar, ANIC, 2. NORTHERN TERRITORY: Horn Islet, Pellew Group, 25–31.i.1968, B. Cantrell, UQ, 1; Snake Bay, Melville I., 4–6.ii.1968, E. G. Matthews, ANIC, 1.

## 138. ONTHOPHAGUS MANYA, sp. nov.

(Figs. 370, 371, 453, 454, 618)

Fore body dark brown with slight violet tinge, elytra, pygidium and rest of body black, legs rufous, antennal clubs fuscous. Total length 3.6–4.2 mm.

*Male*

*Head.*–Clypeal margin medially reflexed and obtusely bidentate, margin between teeth angular, rest of margin almost straight to genal angles, the latter rounded, not prominent. Clypeal suture with frontal section entirely effaced. Frons with shallow median depression bounded posteriorly by a pair of very slight oblique swellings, otherwise unsculptured. Eyes narrow, with 3–4 facet rows, separated by more than 20 widths, canthus incomplete. Evenly and fairly densely punctate with small to medium-sized punctures, surface smooth or feebly rugulose, nitid, glabrous. Labium shallowly excised. *Pronotum.*–Strongly convex, in major male with a shallow median anterior depression, absent in minor male. Anterior angles quadrate, the apices angular. Hind edge unmargined. Evenly punctate with small to very small punctures separated by 3–5 diameters, surface smooth, nitid, glabrous. *Elytra.*–Intervals feebly convex, smooth, nitid, extremely finely punctate, glabrous. Striae impressed, simple, narrow, with very small, deep punctures. *Legs.*–Fore tibiae unmodified. Spur large. *Abdomen.*–Pygidium smooth, nitid, with numerous small deep punctures laterally bearing short, recumbent setae. Parameres with points large, aquiline, flattened.

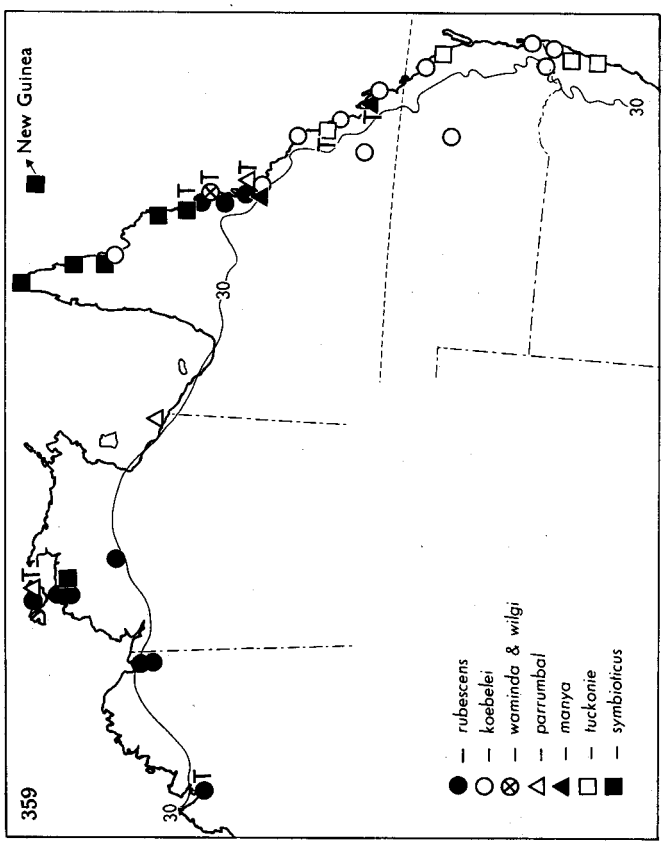
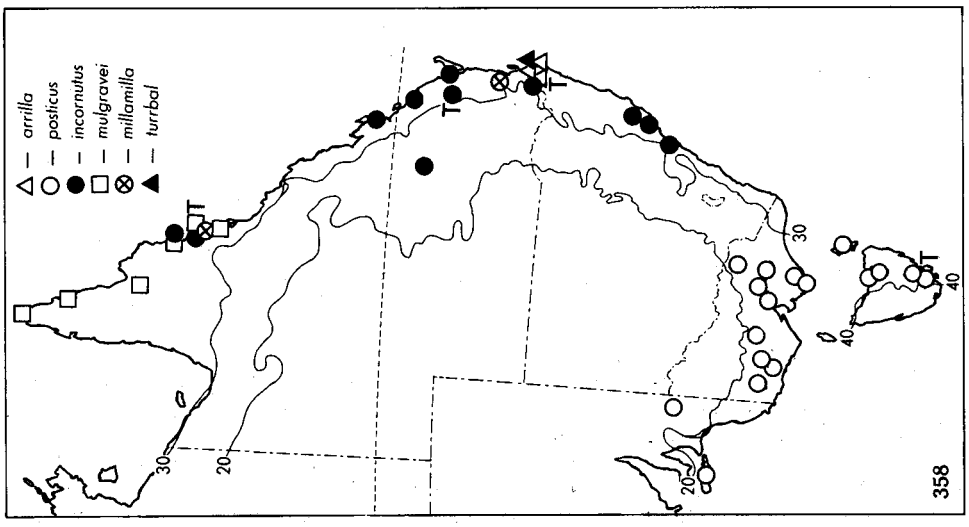
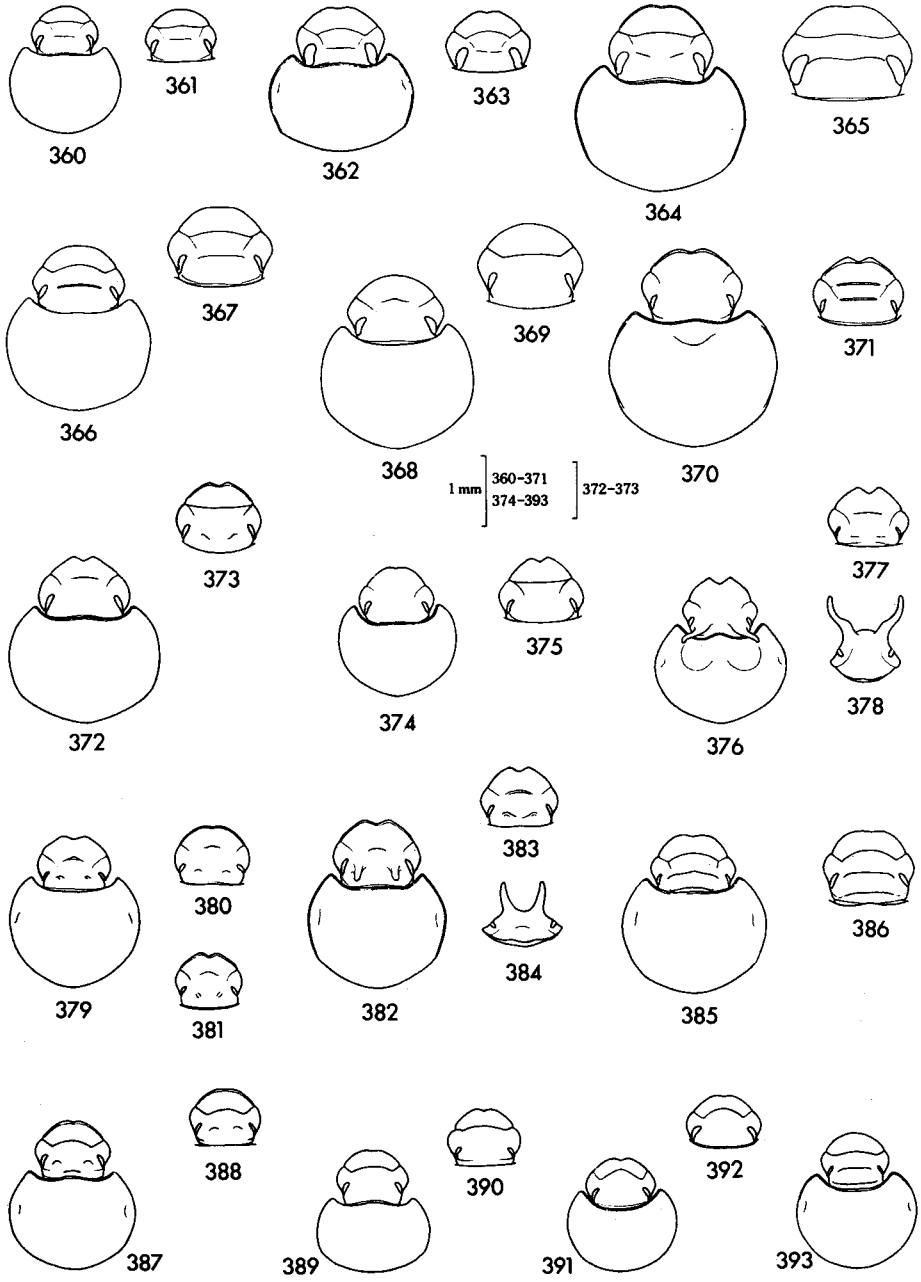



Fig. 358.–Known distribution of the *posticus* group in relation to annual rainfall (in.).
Fig. 359.–Known distribution of the *rubescens* group in relation to the 30-in. isohyet.






Figs. 360–375.–*Onthophagus* spp., male fore body and female head: *360*, *361*, *O. rubescens*; *362*, *363*, *O. koebelei*; *364*, *365*, *O. symbioticus*; *366*, *367*, *O. waminda*; *368*, *369*, *O. parrumbal*; *370*, *371*, *O. manya*; *372*, *373*, *O. tuckonie*; *374*, *375*, *O. wilgi*.

Figs. 376–393.–*Onthophagus* spp.: *376–378*, *O. rubicundulus*: *376*, male fore body; *377*, female head; *378*, male head, front view; *379–381*, *O. ocelliger*: *379*, male fore body, Northern Territory; *380*, male head, Queensland; *381*, female head; *382–384*, *O. asper*: *382*, male fore body; *383*, female head; *384*, male head, front view; *385*, *386*, *O. bicarinaticeps*: *385*, male fore body; *386*, female head; *387*, *388*, *O. dummal*: *387*, male fore body; *388*, female head; *389*, *390*, *O. lamgalio*: *389*, male fore body; *390*, female head; *391*, *392*, *O. yeyeko*: *391*, male fore body; *392*, female head; *393*, *O. gidju*, male fore body.

*Female*

Clypeal margin medially a little more prominently dentate, surface of clypeus transversely rugose. Clypeal suture with frontal section present, straight, beaded, incomplete, not quite joining genal sections. Frons with a transverse beaded line paralleling frontoclypeal suture but shorter, situated a little nearer to clypeal suture than to occiput. Pronotum less convex. Otherwise like male.

*Type*

Holotype ♂, Marlborough, Qld., 11.iii.1965, G. F. Bornemissza, ANIC.

*Distribution* (Fig. 359)

Known from the vicinity of Marlborough and Paluma, Qld., in open savannah woodland with loose sandy soil. At human excrement bait.

*Material Examined*

The type and 11 specimens. QUEENSLAND: Marlborough, 11.ii.1965, G. F. Bornemissza, ANIC, 5; Hidden Valley, near Paluma, 28.iv.1969, G. F. Bornemissza, ANIC, 6.

## 139. ONTHOPHAGUS TUCKONIE, sp. nov.

(Figs. 22, 372, 373, 618)

Fore body black, rufopiceous, or rufous, elytra generally rufous at the bases and apices, suffused with dark pigment in between, or may be black with well-defined red humeral spots, or may be entirely rufous or entirely black, pygidium and underside usually black, may be rufous, legs rufous or rufopiceous, antennal clubs fuscous. Total length 3.3–5.0 mm.

*Male*

*Head.*—Clypeus a little prolonged and distinctly bidentate, the teeth and median emargination angular, margin laterally almost straight to genal angles, the latter rounded. Clypeal suture with frontal section effaced laterally, present medially as a short transverse ridge. Frons and vertex entirely unsculptured. Eyes moderately narrow, with 6–7 facet rows across widest point, separated by about 25 widths, canthus just touching edge of occiput. Moderately punctate with small punctures, finest on vertex, coarsest on clypeus, glabrous, surface smooth, nitid, except on clypeus, which is rugulose. Labium shallowly emarginate. *Pronotum.*—Not strongly convex, unsculptured. Anterior angles subacute, the apices angulate. Hind edge very finely margined. Moderately densely punctate with small punctures finest on disc, coarsest on anterior angles, separated by 2–4 diameters. Numerous extremely small punctures interspersed among the others. Glabrous. Surface smooth, nitid. *Elytra.*—Intervals flat, smooth, nitid, with numerous extremely small punctures, glabrous. Striae shallow, simple, with shallow to deep punctures crenulating edges of intervals. *Legs.*—Fore tibiae with inner apical angle prolonged into a process as long as spur in major male, shorter in minor one. Hind tibia with inner apical angle very greatly prolonged into a curved process almost as long as tarsus in major male, the spur shortened and situated about halfway along this process. In minor male, the apex is only a little prolonged and the spur is apical and longer. Hind femur of major male very slender for basal two-thirds, then abruptly angularly expanded on hind edge, unmodified in minor male.

*Abdomen.*–Pygidium smooth, nitid, fairly densely punctate with small punctures bearing short recumbent setae. Parameres very short, blunt, the points small, distal.

*Female*

Clypeal surface more strongly rugose. Clypeal suture complete, forming a fine ridge almost straight across head, frontal section joining genal sections very near margin. Vertex with an indistinct V-shaped swelling. Legs unmodified. Otherwise like male.

*Type*

Holotype ♂, Eungella National Park, Qld., 25.iii.1968, E. G. Matthews, ANIC.

*Remarks*

The colour variations mentioned in the description are not geographic, as the series from Eungella contains all of them. The extraordinary development of the hind leg (seen only in major male) is unique among Australian *Onthophagus.*

*Distribution* (Fig. 359)

From Eungella National Park near the central Queensland coast, to Dorrigo National Park in northern New South Wales, in dense tropical montane rain forest with heavy clay soil, or (north of Gin Gin) on the edge of a small dense woodland patch with loam soil. Apparently highly localized and rare except in the Eungella rain forest, where it and *mamillatus* are the only *Onthophagus* known to occur. Trapped at human faecal bait.

*Material Examined*

The type and 41 specimens. NEW SOUTH WALES: Dorrigo National Park, 2.xii.1967, E. G. Matthews, ANIC, 2; Gibraltar Range National Park, 5.xii.1967, E. G. Matthews, ANIC, 1. QUEENSLAND: Eungella National Park, 25.iii.1968, E. G. Matthews, ANIC, 29; Finch Hatton Ck., 40 miles W. of Mackay, 27.iii.1968, E. G. Matthews, ANIC, 3; 30 miles N. of Gin Gin, 23.iii.1968, E. G. Matthews, ANIC, 6.

## 140. ONTHOPHAGUS WILGI, sp. nov.

(Figs. 374, 375, 620)

Flavous to rufous, sometimes with darker pigment suffusing elytra (except basal and sutural borders) and disc of pronotum (except midline basally), legs rufous, antennal clubs pale brown. Total length 2.8–3.8 mm.

*Male*

*Head.*–Clypeus a little produced, the margin medially very feebly bidentate, laterally slightly convex to genal sutures, genal angles rounded, not prominent. Clypeal suture with frontal section entirely effaced. Frons and vertex entirely smooth. Eyes moderately narrow, with 5–6 facet rows across widest point, separated by about 20 widths, canthus just touching edge of occiput. Evenly, fairly densely punctate with extremely small punctures, surface smooth, nitid, glabrous. Labium very shallowly emarginate. *Pronotum.*–Not strongly convex, entirely unsculptured. Anterior angles subquadrate, the apices usually rounded, sometimes angular. Hind edge very finely margined. Evenly, rather sparsely punctate with extremely small punctures, surface

smooth, nitid, glabrous. *Elytra.*—Intervals flat, smooth, nitid, sparsely punctate with extremely small punctures, glabrous except for scattered setae on anterior part of last elytral interval. Striae indistinct, almost effaced, with very small, shallow punctures. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium smooth, nitid, with small, fairly numerous, evenly spaced punctures each bearing a short recumbent seta. Parameres small, the points short, distal.

*Female*

Clypeus more prominently bidentate. Clypeal surface irregularly rugose, clypeal suture with frontal section present, carinate, feebly recurved, joining genal sections very near margin. Otherwise like male.

*Type*

Holotype ♂, 9 miles W. of Millaa Millaa, Qld., 1.iv.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 359)

The dense, high rainfall forest at the south-eastern edge of the Atherton Tableland, Qld., in red-clay soil, apparently with the same geographical and ecological distribution as *waminda.* Trapped at human faecal bait.

*Material Examined*

The type and 17 specimens. QUEENSLAND: Millaa Millaa, Apr. 1932, P. J. Darlington, MCZ, 2; 9 miles W. of Millaa Millaa, 1.iv.1968, E. G. Matthews, ANIC, 9; Palmerston National Park, 1.iv.1968, E. G. Matthews, ANIC, 6.

## XXI. *The* ASPER *Group*

Eyes very narrow, with 3–4 facet rows across widest point, separated by 16–20 widths. Labium shallowly excised. Pronotum with large, ocellate or umbilical, setigerous punctures over entire surface. Elytra and pygidium densely setose. Colour brown or black, usually with pale markings on elytra. Total length 2.5–5.0 mm.

Male with frontoclypeal suture effaced or incomplete, represented by cariniform middle section only, frons with a pair of horns or tubercles. Pronotum unarmed or with median tubercle in *rubicundulus.* Fore tibiae unmodified. Female with low tubercles or ridges on frons, pronotum unarmed.

Three species: 141. *rubicundulus* Macleay; 142. *ocelliger* Harold; 143. *asper* Macleay.

Three small and highly distinctive species from northern Australia, in open areas or forest (*rubicundulus*).

### KEY TO SPECIES OF THE *ASPER* GROUP

1. With very large, shallow, ocellate punctures on dorsal surfaces and pygidium; setae strongly curved, tending to hold soil; elytral intervals flat; male with frontoclypeal suture entirely effaced, major male with long curved horns on vertex and a median anterior tumescence on pronotum (minor male with a shiny tubercle here). Qld., N. N.S.W. ..... 141. *rubicundulus* Macleay

   Dorsal punctures smaller, umbilical; setae less curved, not holding soil; odd-numbered elytral intervals convex; male with frontoclypeal suture present as a short median ridge, major male with short straight horns or tubercles, pronotum unarmed ..... 2

2(1). Elytra largely or entirely dark, the odd-numbered intervals convex but not costate; setae of pronotum often clavate or squamate; clypeal margin of male medially feebly excised; frons with at most a pair of low conical processes; pronotum usually without an anterior median smooth raised ridge; female with short and strongly oblique frontal tubercles. N. Qld., N. N.T., N. W.A. ..... 142. *ocelliger* Harold

Elytra usually pale with darker mottling, the odd-numbered intervals subcostate; setae of pronotum cylindrical or fusiform; clypeal margin in both sexes fairly deeply, angularly excised; frons of major male with distinct horns; pronotum with a median anterior raised bead often extended back into a smooth median ridge to middle of disc; female with transverse, feebly oblique frontal ridges. Qld. ..... 143. *asper* Macleay

## 141. ONTHOPHAGUS RUBICUNDULUS Macleay

(Figs. 376-378, 621)

*Onthophagus rubicundulus* Macleay, 1871, p. 180; Blackburn, 1903, p. 302; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215.

Reddish brown with paler areas around edges of head and pronotum, elytra with pale spots at bases of 2nd and 4th intervals, on humeral calli, about halfway down 7th interval, and near the apices of 2nd, 6th, and 7th intervals, antennal clubs pale brown, pilosity pale. Total length 3.0-4.5 mm.

*Male*

*Head.*—Clypeal margin with 2 angular projections, the margin between them arcuately excised, rest of margin evenly rounded, a little incised at clypeogenal sutures, genal angles rounded, somewhat prominent. Clypeal suture with frontal section entirely effaced, genal sections fine, oblique, curved. Vertex of major male with a pair of long curved divergent horns, minor male with a pair of sharp angular transverse ridges. Eyes very narrow, with 3-4 facet rows across widest point, separated by about 20 widths, canthus incomplete. Base and middle of head smooth, shagreened, impunctate or finely punctate, edges more coarsely punctate, rugulose, numerous hooked setae scattered over most of head. Labium shallowly emarginate. *Pronotum.*—Medially prominent anteriorly and concave on either side in major male, in minor male with a prominent shiny median tubercle near anterior margin, no concavities. Anterior angles subacute, the apices rounded. Hind edge finely margined. Surface strongly shagreened and covered with very large, shallow, ocellate punctures set close together, the punctures absent on anterior concavities of major male, which are smooth and shiny. Each puncture with a fairly long, somewhat flattened, recumbent curved seta tending to hold soil. *Elytra.*—Intervals nearly flat, strongly shagreened, with 1 row of ocellate punctures bearing strongly curved setae as on pronotum, last interval with more than 1 row. Striae superficial, very wide, geminate, with very shallow punctures distinctly wider than striae. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium shagreened, with very shallow ocellate punctures bearing short curved setae. Parameres with points downturned, acute.

*Female*

Frontoclypeal suture partly present as a fine transverse ridge, not joining genal sutures. Surface of clypeus transversely rugose, nitid. Vertex with a pair of small transverse ridges in place of male horns. Middle of anterior edge of pronotum with a small tubercle, as in minor male but smaller. Otherwise like male.

*Type*

Holotype ♂, Gayndah, Qld., AM K 28240–3. Seen by the author.

*Distribution* (Fig. 394)

The McPherson Range on the New South Wales–Queensland border northward, apparently very disjunctly, to the Atherton Tableland, in mesic and wet sclerophyll forest, not in rain forest. The two areas where the author collected this species had heavy loam or clay-loam soils which adhered to the beetles. A specimen from Lamington National Park bears the notation "ex leaf mould open forest". Previously known from southern Queensland, this species is here recorded for the first time from much further north, on the Atherton Tableland, on the basis of two females which turned up unexpectedly in the author's traps near Millaa Millaa. Trapped with human excrement bait.

*Material Examined*

The type and 11 specimens. NEW SOUTH WALES: Acacia Plateau (3000 ft), H. Davidson, ANIC, 5; 12 miles N. of Murwillumbah, 7.xii.1967, E. G. Matthews, ANIC, 1. QUEENSLAND: Gayndah, AM, 2; Lamington National Park, 2.vi.1958, F. A. Perkins, UQ, 1; 9 miles W. of Millaa Millaa, 1.iv.1968, E. G. Matthews, ANIC, 2.

## 142. ONTHOPHAGUS OCELLIGER Harold

(Figs. 379–381, 622)

*Onthophagus ocelliger* Harold, 1877, p. 75; Blackburn, 1903, p. 302; Blackburn, 1907, p. 233; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 214.

Bronze-black, elytra dark brown, usually with apical edges yellowish, area just above humeri often with a reddish or yellowish spot, occasionally other pale markings near bases and elsewhere on elytra, pygidium brown, underside black, legs rufopiceous, pilosity pale, antennal clubs fuscous. Total length 3.0–4.5 mm.

*Male*

*Head.*–Clypeal margin medially feebly excised, rest of head margin rounded, slightly angled out at clypeogenal sutures in eastern specimens, genal angles rounded, not prominent. Clypeal suture with frontal section effaced except for short, sharply raised median portion, genal sections indistinct, oblique. Frons with a pair of low conical projections about equidistant between eye and midline, otherwise flat. Eyes very narrow, with 3–4 facet rows across widest point, separated by about 16 widths, canthus incomplete. Surface entirely strongly asperate, with numerous punctures each bearing a long erect thickened seta. Labium shallowly emarginate. *Pronotum.*–With a median anterior smooth area which is not raised into a tubercle and not extended back into a ridge, although there may be another smooth area in centre of pronotum. Anterior angles quadrate, the apices rounded. Hind edge finely margined. With numerous large round umbilical punctures separated by less than 1 diameter, each puncture bearing a recumbent curved thickened seta which may be clavate, especially on disc, surface very finely shagreened, nitid. *Elytra.*–Odd-numbered intervals slightly convex, other intervals flat, shagreened, alutaceous, with rows of setigerous punctures which are asperate, being set behind small ridges or granules, 3rd and usually 5th interval with 2 rows of setae inclined roof-like over them, remaining intervals with

1 row, setae stout, slightly curved, usually clavate on sides of elytra. Striae superficial, very broad, geminate, with round punctures slightly wider than stria. *Legs.*–Fore tibiae not modified. *Abdomen.*–Pygidium elongated, shagreened, with large shallow ocellate punctures bearing long, stout, blunt or clavate setae. Aedeagus normal.

*Female*

Clypeal margin more deeply, angularly emarginate, head surface more densely asperate, frons with a pair of shiny, slightly oblique, rounded tubercles in place of male conical projections. Pygidium shorter. Otherwise like male.

*Type*

Holotype ♀, Somerset, Qld., d'Albertis, I-1875, MNHN(Ob). Seen by the author.

*Remarks*

Blackburn (1907) maintained the separation between *ocelliger* and *asper* and the present author agrees with him. The two forms are very closely related, but are here treated as separate species because the Queensland populations can generally be placed in one form or the other using the characters given in the key. In the zone of contact (around Townsville), the two forms are clearly separable. However, in the Northern Territory, where *asper* is not known to occur, specimens of *ocelliger* tend toward *asper* morphologically in having a more deeply emarginate clypeus, more pale markings on the elytra, and the setae often not clavate. Two specimens from south of Darwin are in fact indistinguishable from *asper.*

*Distribution* (Fig. 394)

North Queensland from Townsville to Cape York, west to Derby, W.A., in areas of 30 in. or more of annual rainfall. Collected in open sclerophyll forest with sandy soil. The great majority of specimens came to human excrement, the species almost never having been found on herbivore dung except for four specimens collected at buffalo dung near Howard Springs, N.T. Near Katherine, N.T., four specimens were found under a decayed snake on the road. Flies during the day. Collected from January to May.

*Material Examined*

The type and 201 specimens. QUEENSLAND: Blue Water Ck., N. of Townsville; Cairns; Ingham, Forrest Beach; Landsdown, CSIRO Field Station; Mutchilba; Paluma; 2–17 miles W. of Ravenshoe; Townsville. NORTHERN TERRITORY: Bathurst I.; Berri Springs; 15–27 miles S. of Darwin; Howard Springs; Katherine; 20–28 miles S. and 16–20 miles W. of Katherine; Snake Bay, Melville I. WESTERN AUSTRALIA: 8 miles S. of Derby; Kununurra; 60 miles NW. of Kununurra; Wyndham.

## 143. ONTHOPHAGUS ASPER Macleay

(Figs. 382–384, 623)

*Onthophagus asper* Macleay, 1864, p. 125; Blackburn, 1903, p. 272; Blackburn, 1907, p. 233; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 209.

*Onthophagus patruelis* Harold, 1886, p. 147; Blackburn, 1903, p. 306 (syn.).

Fore body black, sometimes with greenish reflections, some specimens with reddish markings along hind edge of pronotum, elytra pale brown or fulvous with

interrupted black markings on most intervals, pygidium pale brown to black, underside black, legs rufous, pilosity pale, antennal clubs fuscous with pale pubescence. Total length 3.5–5.0 mm.

*Male*

*Head.*- Clypeal margin medially excised in a broad V, slightly produced on either side, rest of margin unevenly rounded to eyes, genal angles not prominent. Clypeal suture with frontal section effaced laterally, medially indicated by a short transverse ridge, genal sections oblique. Frons with a pair of stout erect conical horns arising near eyes in major male, in smaller individuals the horns reduced to a pair of tubercles equidistant between each other and eyes. Eyes very narrow, with 3–4 facet rows across widest point, separated by about 18 widths, canthus incomplete. Reticularly rugose, with large close-set punctures covering all of head surface except in major male, where middle of frons and vertex are impunctate and smooth. Each puncture with a long stout erect seta. Labium shallowly emarginate. *Pronotum.*–With a smooth shiny tubercle near middle of anterior margin (sometimes absent), often extended back into a smooth irregular raised line on anterior half of pronotum, followed by a shallow median longitudinal depression, otherwise unsculptured. Anterior angles quadrate, the apices rounded. Hind edge strongly margined. With numerous large round punctures separated by less than 1 diameter, each puncture with a long, slightly curved, recumbent seta of uniform diameter or squamate and broadened near the base and tapering. Surface shagreened, nitid or sericeous. *Elytra.*–Odd-numbered intervals more or less costate, remaining intervals flat, all shagreened, costate ones shinier. Costate intervals except sutural with 2 rows of setae inclined roof-like over them, remaining intervals with 1 row, setae stout, curved, long, broadened basally or of uniform diameter, inclined. Punctures asperate, their anterior edges raised into small ridges or granules. Striae superficial, very broad, shiny, geminate, with round punctures a little wider than stria. *Legs.*–Fore tibiae not slender or elongate. *Abdomen.*–Pygidium shagreened, with very large, shallow, ocellate punctures separated by about 1 diameter, each puncture with a semi-erect stout bristle. Pygidium unusually long. Aedeagus normal.

*Female*

Head strongly rugose and punctate (as in minor male), frontoclypeal ridge a little longer, but not complete to genal sections except in some cases. Vertex with a pair of approximated, slightly oblique ridges. Fore spur larger. Pygidium shorter. Otherwise like male.

*Types*

Holotype of *asper*: ♀, Port Denison (Bowen), Qld., MM.
Holotype of *patruelis*: ♀, Queensland, MNHN(Ob).
Both seen by the author.

*Distribution* (Fig. 394)

Queensland from Gayndah to Charters Towers, mostly in inland localities where the annual rainfall is less than 30 in. It is replaced by the closely related *ocelliger* in areas of more than 30 in. of rainfall north of Townsville. *O. asper* is found in cow dung more frequently than *ocelliger*, but it is not common. November, and March–April.

*Material Examined*

The types and 41 specimens. QUEENSLAND: Balgal Beach, near Paluma, 28.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 2; 10 miles N. of Bowen, 14.iii.1965, G. F. Bornemissza, ANIC, 2; Charters Towers, 5.iv.1965, G. F. Bornemissza, ANIC, 18; Gayndah, MM, 3; Marlborough, 11.iii.1965, G. F. Bornemissza, ANIC, 3; Peack Downs, Fairmaire, MNHN, 4; 9 miles S. of Rolleston, 8.iv.1965, G. A. Yapp, ANIC, 1; Serpentine Lagoon via Yeppoon, 26.xi.1968, B. Cantrell, UQ, 2; Springsure, 24.xi.1930, Mackerras, ANIC, 6.

## XXII. *The* BICARINATICEPS *Group*

Eyes moderately narrow, with 4–7 facet rows across widest point, separated by 12–16 widths, canthus incomplete. Labium shallowly excised. Dorsal surfaces and pygidium entirely densely setose. Colour brown or black with lighter markings on elytra. Total length 2.2–5.0 mm.

Male with frontoclypeal suture cariniform, with carina or pair of tubercles on frons, no horns. Pronotum unsculptured. Fore tibiae unmodified. Female with frontal tubercles or carina, or unarmed, pronotum unsculptured.

Five species: 144. *bicarinaticeps* Lea; 145. *gidju*, sp. nov.; 146. *dummal*, sp. nov.; 147. *yeyeko*, sp. nov.; 148. *lamgalio*, sp. nov.

Five small, setose species from northern Australia, but with *bicarinaticeps* extending to New South Wales. All occur in open areas or open woodland except *lamgalio*, which is a rain forest species. *O. gidju* is mycetophagous and also the smallest Australian *Onthophagus*.

### KEY TO SPECIES OF THE *BICARINATICEPS* GROUP

1. Frons with a complete transverse carina in both sexes, paralleling clypeal carina, occipital margin forming a 3rd, less prominent, carina across head ..... 2
   Frons with carina interrupted into 2 short ridges, or absent; occiput not margined ..... 3

2(1). Pronotum moderately densely punctate, the punctures separated by 1–3 diameters; elytra dark rufous or black, setae inclined over middle of intervals in the manner of a roof, or very long; total length 2.5–4.5 mm. N.S.W., Qld., N. N.T., N. W.A. ..... 144. *bicarinaticeps* Lea
   Pronotum very densely punctate, the punctures separated by less than 1 diameter; elytra pale fulvous or brown, setae parallel, short, reclined backwards; total length 2.2–2.5 mm. N. Qld., N. N.T. ..... 145. *gidju*, sp. nov.

3(1). Vertex with 2 remote ridges or transverse tubercles in both sexes; elytra with pale reddish spots at bases of odd-numbered intervals; pygidium with 3 vertical black bars on a yellowish background, or the base black and apex yellow; dorsal setae longer, forming a dense vestiture; total length 4–5 mm. N. Qld. ..... 146. *dummal*, sp. nov.
   Frons and vertex entirely unarmed; elytra dark basally (humeri may be rufous); pygidium uniformly coloured; dorsal setae very short, forming a sparser stubble; total length 2.5–3.5 mm ..... 4

4(3). Apical borders of elytra yellow; frontoclypeal suture strongly procurved, hence clypeus shortened. N. Qld., N. N.T. ..... 147. *yeyeko*, sp. nov.
   Elytra entirely dark; frontoclypeal suture slightly procurved, clypeus of normal length. N. Qld. ..... 148. *lamgalio*, sp. nov.

## 144. ONTHOPHAGUS BICARINATICEPS Lea

(Figs. 385, 386, 624)

*Onthophagus bicarinaticeps* Lea, 1923, p. 385; Boucomont and Gillet, 1927, p. 209.
*Onthophagus pauperculus* Frey, 1963, p. 542. New synonymy.

Fore body, pygidium, and underside black, elytra and legs reddish, antennal clubs fuscous. Total length 2.5–4.5 mm.

*Male*

*Head.*—Clypeal margin medially straight or very feebly concave, laterally rounded, slightly incised at clypeogenal sutures, genae broadly rounded, slightly prominent. Clypeal suture with frontal section carinate, procurved, long, genal sections indistinct, short. Frons with a long procurved transverse carina more or less paralleling clypeal carina. Middle half of occiput margined, producing a 3rd transverse procurved carina less prominent than first 2. Eyes narrow, with about 4 facet rows across widest point, separated by about 12 widths, canthus incomplete. Moderately densely punctate with large punctures over entire surface except behind occipital carina, punctures smaller and denser along edge of clypeus. Each large puncture with a moderately long, stout, erect seta. Labium shallowly emarginate. *Pronotum.*—Unsculptured. Anterior angles quadrate, the apices rounded. Hind edge finely margined. Moderately densely and evenly punctate with large deep punctures separated by 2–3 diameters, each puncture with a long fine erect seta, surface between punctures smooth, nitid. *Elytra.*—Intervals convex, smooth, nitid, with closely-spaced setigerous punctures along edges of each interval (1 row only on sutural interval). Setae are long, fine, erect and, in northern specimens, inclined roof-like over midline of corresponding interval, in southern specimens setae are not so inclined, are recurved, and longer. Striae impressed, finely geminate, with closely spaced transverse punctures which crenulate edges of intervals. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium smooth, nitid, with large, deep punctures separated by about 1 diameter, bearing long fine erect setae. Aedeagus normal.

*Female*

Sexual dimorphism in this species is confined to the last abdominal sternite.

*Types*

Holotype of *bicarinaticeps*: ♂, New South Wales, SAM I.15408. Seen by the author.

Holotype of *pauperculus*: ♂, Cooktown, Qld., MGF. Not seen by the author.

*Remarks*

Specimens from New South Wales and south Queensland to Carnarvon Gorge have a markedly longer pilosity, and that of the elytra is not inclined roof-like over the intervals. Furthermore, the setae are apically somewhat hooked, and the punctures and setae denser. The elytra are also darker brown or black in these southern specimens. In the author's opinion, these differences are not sufficient to recognise a separate northern species. Lea (1923), in the original description, mentions seeing a specimen from Cairns. Specimens from Lockerbie, on Cape York, have the reddish

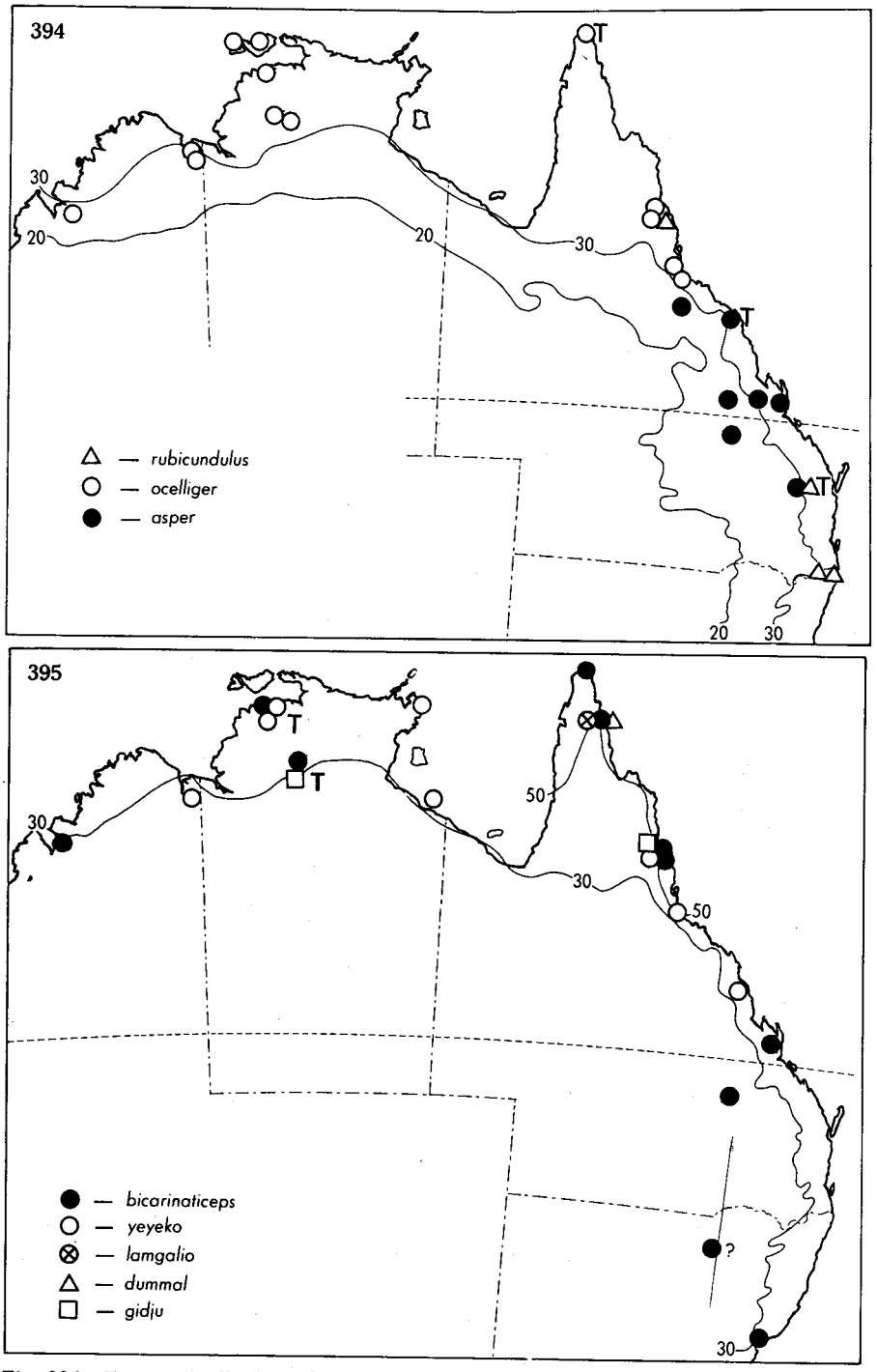



Fig. 394.–Known distribution of the *asper* group in relation to annual rainfall (in.).
Fig. 395.–Known distribution of the *bicarinaticeps* group in relation to annual rainfall (in.).

colour concentrated around the edges of the elytra. The reddest elytra, of a vivid uniform red-maroon colour, are to be seen in the Northern Territory and Kimberley specimens. These are also the smallest, averaging 3.36 mm, while those from Cape York average 3.81 mm in total length.

The type of *pauperculus* was not seen, but the description agrees with that of *bicarinaticeps.*

*Distribution* (Fig. 395)

The north-east of New South Wales north to Cape York and west to Derby, W.A. Only four specimens from New South Wales are available. The species is diurnal and occurs in open situations in sand or loam. It was collected by the author only in herbivore excrement, particularly buffalo dung, in which it remained embedded, and marsupial pellets which it penetrated and shredded from the inside. None was collected in the human faecal traps abundantly set in the same areas. January–June.

*Material Examined*

The type and 43 specimens. NEW SOUTH WALES: Cryon Park, H. Davidson, ANIC, 1; Moss Bay, 5.iii.1892, W. Froggatt, ANIC, 1; Somersby, 2.iv.1964, G. F. Bornemissza, ANIC, 1. QUEENSLAND: Bamaga, Jan. 1958, Darlingtons, MCZ, 1; Belmont, 8 miles NW. of Rockhampton, 11.iii.1965, G. F. Bornemissza, ANIC, 1; Cairns (cotypes), 1921, J. F. Illingworth, SAM, 2; Carnarvon Gorge, 9.iv.1965, G. F. Bornemissza and G. A. Yapp, ANIC, 1; Iron Range, 28.iv–4.v.1968, G. Monteith, UQ, 3; Lockerbie, 6–10.vi.1969, G. Monteith, UQ, 12; Yungaburra, 7.v.1969, G. F. Bornemissza and P. Ferrar, ANIC, 1. NORTHERN TERRITORY: Berri Springs, 29.i.1968, E. G. Matthews, ANIC, 1; Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 13; Humpty Doo, 28–29.i.1968, E. G. Matthews, ANIC, 3; 2–4 miles E. of Katherine, 8.ii.1968, E. G. Matthews, ANIC, 1. WESTERN AUSTRALIA: 20–35 miles S. of Derby, 23.ii.1968, E. G. Matthews, ANIC, 1.

## 145. ONTHOPHAGUS GIDJU, sp. nov.

(Figs. 393, 625)

Head black with rufous clypeus, pronotum black with anterior and lateral borders rufous, elytra pale brown, pygidium and underside rufous or rufopiceous, legs fulvous, antennal clubs flavous. Total length 2.2–2.5 mm.

*Male*

*Head.*–Margin evenly arcuate between genal angles or medially straight, genal angles rounded, not prominent. Clypeal suture complete, carinate, transversely sinuate, the genal sections not strongly oblique, short. Frons with a single long transverse feebly arcuate carina more or less paralleling clypeal carina, edge of occiput with an indistinct ridge forming a 3rd, more feeble, transverse carina. Eyes narrow, with about 4 facet rows across widest point, separated by about 16 widths, canthus incomplete. Moderately densely punctate with deep punctures over entire surface between carinae, each puncture bearing a short erect straight seta, surface between punctures smooth, nitid. Labium shallowly emarginate. *Pronotum.*–Not sculptured. Anterior angles quadrate, the apices rounded. Hind edge finely margined. Entirely densely punctate with large deep ocellate punctures separated by about 1 diameter, each puncture with a short, fine, feebly curved, recumbent seta. *Elytra.*–Intervals flat, finely shagreened,

alutaceous, with 2 rows of small, fairly closely set punctures bearing short straight fine recumbent setae. Sutural also with 2 rows of setae, last interval with more. Striae superficial, fine, with small shallow punctures only a little wider than stria. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium smooth, nitid, with moderately large, deep punctures separated by 1–2 diameters and bearing very short, straight setae. Aedeagus normal.

*Female*

Differs from male only in form of last abdominal sternite.

*Type*

Holotype ♂, 28 miles S. of Katherine, N.T., 8–10.ii.1968, E. G. Matthews, ANIC.

*Remarks*

This species is very closely related to *bicarinaticeps*, differing only in the relatively superficial (but constant) characters stated in couplet 2 of the key. Specific separation is indicated by the mycetophagous habits of this species (see below).

*Distribution* (Fig. 395)

Known from 28 miles south of Katherine, N.T., and Mareeba, Qld. In the former area it was found where a dense patch of acacias created shaded conditions favouring the growth of mushrooms. *O. gidju* was collected only under small fragments of fresh mushrooms which had been shredded by the larger mycetophagous species *latro*, *varianus*, and *endota*, which were also active in the area. It did not occur under faeces or in faecal traps extensively set in the same area. The collecting method for the unique Queensland specimen is not specified.

*Material Examined*

The type and nine specimens. QUEENSLAND: Mareeba, Feb. 1952, G. Brooks, GB, 1. NORTHERN TERRITORY: 28 miles S. of Katherine, 8–10.ii.1968, E. G. Matthews, ANIC, 8.

## 146. ONTHOPHAGUS DUMMAL, sp. nov.

(Figs. 387, 388, 626)

Black or fuscous, pronotum with pale brown markings on anterior angles and below lateral fovea, sometimes indistinctly along posterior margin, elytra reddish brown with paler spots at bases of odd-numbered intervals and on either side of humeral calli, apical edges of elytra yellow, pygidium yellowish with 3 vertical black stripes, sometimes the entire base black, underside black, sternites with yellowish borders, legs yellowish with darker areas, antennal clubs fuscous. Total length 4–5 mm.

*Male*

*Head.*–Clypeal margin broadly rounded and very slightly emarginate medially, genal margins evenly rounded, not prominent. Clypeal suture with frontal section present, evenly procurved, finely carinate, genal sections oblique, indistinct. Vertex with a pair of short rounded well-separated transverse ridges, the area between them flat. Eyes narrow, with about 5 facet rows across widest point, separated by about 14 widths, canthus incomplete. Densely punctate and transversely rugose over entire surface, densely covered with short curved setae everywhere except on vertical ridges.

Labium shallowly emarginate. *Pronotum.*–Unsculptured. Anterior angles quadrate, the apices angular. Hind edge unmargined, with a double row of very small, close-set setae forming a fringe across entire basal edge. *Elytra.*–Entirely densely punctate, with large deep punctures separated by about 1 diameter, each puncture with a fairly short, curved seta forming a dense vestiture over entire elytral surfaces, those on odd-numbered intervals longer than rest. Striae superficial, broadly geminate, with large shallow transverse punctures wider than stria. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium nitid, densely punctate, with small deep punctures and a dense vestiture of short, curved setae. Aedeagus normal.

*Female*

Clypeal margin a little more expanded and reflexed, transverse ridges of vertex less prominent and a little oblique. Otherwise like male.

*Type*

Holotype ♂, Iron Range, Cape York Peninsula, Qld., 11-17.v.1968, G. Monteith, QM T 6902.

*Distribution* (Fig. 395)

Known only from material collected by Mr. Monteith at Iron Range, Qld., in wallaby droppings in open forest.

*Material Examined*

The type and four specimens. QUEENSLAND: Iron Range, 5–17.v.1968, G. Monteith, UQ, ANIC, 4.

## 147. ONTHOPHAGUS YEYEKO, sp. nov.

(Figs. 391, 392, 455, 627)

Rufopiceous with front edge of head, front edge of pronotum, and sometimes humeri, rufous. Hind edges of elytra and pygidium yellow or fulvous, legs rufous, antennal clubs flavous. Total length 2.5–3.5 mm.

*Male*

*Head.*–Clypeus feebly bilobate, medially very shallowly emarginate, the edges laterally almost straight to genal angles, which are subangulate, not prominent. Clypeal suture with frontal section wide, strongly procurved (clypeus therefore very short), genal sections indistinct, oblique. Frons and vertex without tubercles or carinae. Eyes moderately wide, with about 7 facet rows across widest point, separated by about 13 diameters, canthus incomplete. Evenly, densely punctate with moderate punctures separated by about 1 diameter, some punctures with short stout erect setae on middle of frons (sometimes forming a cruciform pattern there), along inner edges of eyes, and in a continuous arcuate line across middle of genae and along front of frontoclypeal carina, and a few more further forward on clypeus. Surface between punctures smooth, nitid. Labium shallowly excised. *Pronotum.*–Unsculptured. Anterior angles quadrate, the apices angulate. Hind edge unmargined. Evenly and fairly densely punctate with moderate punctures separated by 1–2 diameters, each puncture with an extremely short seta. Surface between punctures smooth, nitid. *Elytra.*–Intervals almost flat, very finely shagreened, alutaceous, with 1 or 2 somewhat

irregular rows of closely spaced punctures bearing extremely short setae, generally 1 row on 1st interval, 2 on 2nd, 3rd, 5th, and 7th (becoming 1 row posteriorly), 1 on 4th and 6th (except at bases), and about 3 on 8th at base. Striae impressed, fine, with only traces of punctures. *Legs.*–Fore tibiae with inner apical angle quadrate, apical edge transversely truncate. *Abdomen.*–Pygidium convex, finely shagreened, alutaceous, with numerous small punctures bearing extremely short setae. Aedeagus normal.

*Female*

Apical edge of front tibiae oblique, the inner angle obtuse, spur larger. Pygidium much shorter and less convex. Otherwise like male.

*Type*

Holotype ♂, Kununurra, W.A., 13–22.ii.1968, E. G. Matthews, ANIC.

*Distribution* (Fig. 395)

The East Kimberleys, the north of the Northern Territory, and north Queensland from Ravenshoe to Mackay. It was most abundant around Darwin, where it was seen to be a day flier coming to bovine and human excrement. It was also trapped in numbers at human faecal bait around Kununurra, W.A. It occurs in fully open situations or open woodland, in sandy soil.

*Material Examined*

The type and 59 specimens. QUEENSLAND: Balgal Beach, near Paluma, 28.iv.1969, G. F. Bornemissza and P. Ferrar, ANIC, 1; Finch Hatton Ck., 40 miles W. of Mackay, 27.iii.1968, E. G. Matthews, ANIC, 1; 11 miles W. of Paluma, 28.iv.1969, G. F. Bornemissza, ANIC, 2; 2–17 miles W. of Ravenshoe, 1.iv.1968, E. G. Matthews, ANIC, 1. NORTHERN TERRITORY: Berri Springs, 29.i.1968, E. G. Matthews, ANIC, 3; 15–27 miles S. of Darwin, 29.i.1968, E. G. Matthews, ANIC, 1; Horn Islet, Sir Edward Pellew Group, 15–21.ii.1968, B. Cantrell, UQ, 1; Howard Springs, 27–29.i.1968, E. G. Matthews, ANIC, 16; Humpty Doo, 28–29.i.1968, E. G. Matthews, ANIC, 1; Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 2. WESTERN AUSTRALIA: Kununurra, 13–22.ii.1968, E. G. Matthews, ANIC, 30.

## 148. ONTHOPHAGUS LAMGALIO, sp. nov.

(Figs. 389, 390, 456, 628)

Rufopiceous, front edge of head and pronotum rufous, legs rufous or rufopiceous, antennal clubs flavous. Total length 3.1–3.4 mm.

*Male*

*Head.*–Clypeal margin medially very shallowly emarginate, laterally feebly arcuate, slightly indented at clypeogenal suture, genal angles subangulate, not prominent. Clypeal suture with frontal section wide, moderately procurved, genal sections indistinct, oblique. Frons and vertex without tubercles or carina. Eyes narrow, with 5–6 facet rows across widest point, separated by about 14 widths, canthus incomplete. Evenly, fairly densely punctate with small punctures separated by 2–3 diameters, some punctures with short erect setae scattered over all of head surface. Labium very shallowly emarginate. *Pronotum.*–Unsculptured. Anterior angles quadrate, the apices angulate. Hind edge unmargined. Evenly, moderately sparsely punctate with small punctures separated by 2–3 diameters, each puncture with a very short, erect, curved seta.

Surface between punctures smooth and nitid. *Elytra.*–Intervals almost flat, smooth, nitid, with 1 row of fairly closely spaced punctures with short semi-erect curved setae on each interval, becoming 2 rows at base of 3rd interval and middle of 5th, 3 rows on last interval at base. Striae impressed, fine, simple, with closely spaced round punctures a little wider than stria and appearing umbilical. *Legs.*–Fore tibiae with inner apical angle quadrate, apical edge transversely truncate. Spur small. *Abdomen.*–Pygidium convex, smooth, nitid, with moderate deep punctures arranged in oblique rows, bearing very short setae. Parameres short, with small perpendicular points.

*Female*

Apical edge of front tibiae oblique, the inner angle obtuse, spur larger. Pygidium shorter and less convex. Otherwise like male.

*Type*

Holotype ♂, Iron Range, Cape York Peninsula, Qld., 28.iv–4.v.1968, G. Monteith, UQ T 6904.

*Remarks*

At first confused with *yeyeko*, this species differs from the latter not only in colour, as stated in the key, but in the shape of the parameres (Figs. 455 and 456), slightly in the shape of the head and the frontoclypeal carina, the texture of the integument (*lamgalio* being more shiny), and very slightly in punctuation. There is also an important ecological difference in that *lamgalio* is a nocturnal rain forest species while *yeyeko* is a diurnal savannah species, in spite of there being only a very slight difference in the size of the eyes.

*Distribution* (Fig. 395)

Known only from material collected by Mr. Monteith at Iron Range, Qld., at human excrement in rain forest at night.

*Material Examined*

The type and four specimens. QUEENSLAND: Iron Range, 28.iv–17.v.1968, G. Monteith, UQ, ANIC, 4.

## XXIII. *The* PLANICOLLIS *Group*

Eyes moderately wide, with 10–16 facet rows across widest point, separated by 4.5–9.0 widths. Labium shallowly excised. Pronotum with long setae at least on sides. Elytra with setae arranged in rows. Pygidium with long erect bristles (except in *yunkara*). Colour brown or black, may have paler markings on elytra. Tarsi very long and slender, the segments nearly cylindrical. Total length 6–10 mm.

Male with frontoclypeal suture variable, vertex armed or not. Pronotum variable. Fore tibiae unmodified except in *planicollis*, where they are atrophied. Abdominal sternites medially greatly foreshortened, the first 5 sternites together only a little longer than 6th along midline. Female unarmed, the sternites normal.

Four species: 149. *clypealis* Lea; 150. *yunkara*, sp. nov.; 151. *planicollis* Harold; 152. *macleayi* Blackburn.

While superficially quite dissimilar, all the species of this group have very slender legs and tarsi and greatly compressed abdominal sternites in the male. Also, the third segment of the labial palpi is minute in all of them, although this feature is shared with a few species in other groups. It is likely that all four species are related and represent a group of tropical origin with one temperate member (*macleayi*). All the species are rare and almost nothing is known of their ecology.

KEY TO SPECIES OF THE *PLANICOLLIS* GROUP

1. Frontoclypeal suture present in both sexes; male with 2 small reclined horns on vertex; elytra with numerous short recumbent curved setae. N. N.T., N. Qld. ..... 149. *clypealis* Lea
   Frontoclypeal suture effaced in both sexes; head unarmed, or with a median clypeal process; elytra with relatively few setae ..... 2
2(1). Male with middle of clypeal margin produced into a long slender upturned process; pronotum with 2 strong conical projections; pygidium glabrous; female unknown. N. Qld. ..... 150. *yunkara*, sp. nov.
   Clypeal margin not produced; pronotum unarmed; pygidium with long bristles ..... 3
3(2). Pronotum of both sexes very feebly convex, the hind edge unmargined, the disc bearing long erect bristles; elytra without pale markings; fore tibiae of male without outer teeth or spur. N. Qld. ..... 151. *planicollis* Harold
   Pronotum more convex, especially in male, the hind edge finely margined, the disc glabrous; elytra with lateral and apical borders pale; fore tibiae of male normal. N. N.S.W., S. Qld. ..... 152. *macleayi* Blackburn

## 149. ONTHOPHAGUS CLYPEALIS Lea

(Figs. 397, 398, 628)

*Onthophagus clypealis* Lea, 1923, p. 380; Boucomont and Gillet, 1927, p. 210.

Black with faint bronze tinge on pronotum; bases of some or all of elytral intervals inside humeri, and posterior lateral and apical edges yellowish, legs and pygidium rufopiceous, antennal clubs flavous. Total length 6–8 mm.

*Male*

*Head.*—Semicircular, clypeal edge evenly rounded, medially a little reflexed, finely margined, genal angles rounded, not prominent. Clypeal suture with frontal section far back, short, strongly procurved, subcarinate, genal sections very indistinct. Frons concave behind frontoclypeal ridge, with a pair of short stout semi-reclined horns arising on inner side of eyes. Eyes moderate, with about 10 facet rows across widest point, separated by about 7 widths, canthus incomplete. Densely punctate and irregularly rugose on genae and clypeus, surface nitid, a few long recumbent setae over entire head surface except middle of frons. Labium shallowly emarginate, 2nd segment of palpus slender, about 3 times as long as wide, 3rd segment minute.
*Pronotum.*—Moderately convex, anterior declivity somewhat retuse and a little flattened in major male, with a feeble median tumescence. Anterior angles quadrate, the apices rounded. Hind edge unmargined or very finely margined. Moderately densely and evenly punctate with small punctures separated by 3–5 diameters, with a few larger punctures along anterior and lateral edges bearing long recumbent curved setae. Surface smooth, nitid. *Elytra.*—Intervals moderately convex, finely shagreened, alutaceous,

with 1 or 2 rows of slightly asperate punctures bearing short recumbent curved setae fairly closely spaced over entire elytral surface. Striae superficial, geminate, with numerous impressed punctures a little wider than stria. *Legs.*–Fore tibiae unmodified. Tarsi very long, slender, and cylindrical. *Abdomen.*–Sternites medially greatly foreshortened, pygidium convex, finely shagreened, alutaceous, with sparse large punctures interspersed with numerous very small ones, large ones with long erect bristles. Aedeagus normal.

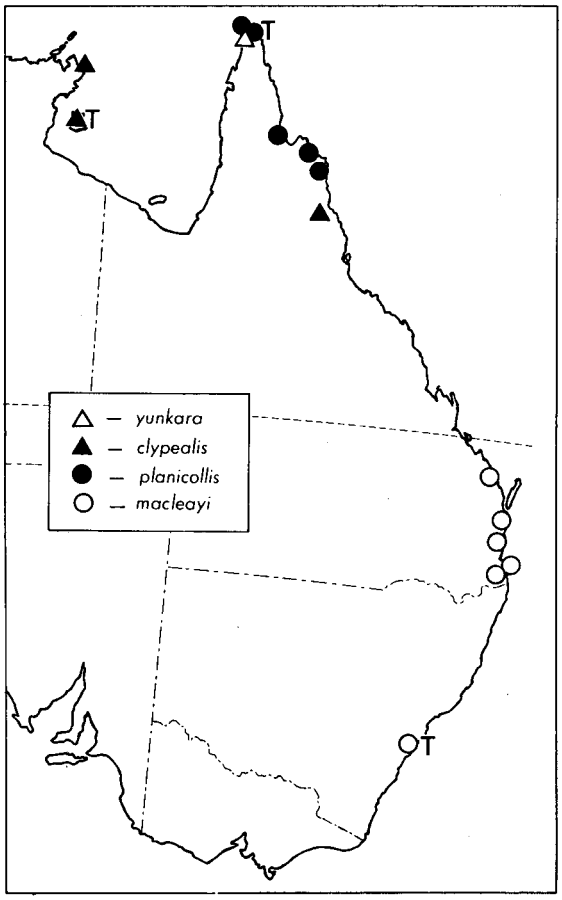



Fig. 396.–Known distribution of the *planicollis* group.

*Female*

The 2 females examined are entirely dark, with only a trace of reddish markings at elytral apices. Clypeal margin a little broader, very feebly bilobate. Frons without horns, vertex with a sharp margin feebly raised laterally into a pair of angles. Pronotum less convex, without retuse front or median tumescence. Abdominal sternites not foreshortened, pygidium short, convex. Otherwise like male.

*Type*

Holotype ♂, Groote Eylandt, N.T., N. B. Tindale, SAM I.15399. Seen by the author.

*Distribution* (Fig. 396)

Groote Eylandt and the Gove Peninsula on the western edge of the Gulf of Carpentaria, and the Atherton Tableland, Qld. Collected by the author in open eucalypt woodland in sandy soil at human excrement bait.

*Material Examined*

The type and four specimens. QUEENSLAND: Mutchilba, Jan. 1933, A. D. Selby, NMV, 1. NORTHERN TERRITORY: Yirrkala, Arnhem Land, 1.ii.1968, E. G. Matthews, ANIC, 3.

## 150. ONTHOPHAGUS YUNKARA, sp. nov.

(Figs. 399, 630)

Rufopiceous, legs rufous, antennal clubs flavous. Total length 9–10 mm. The female is unknown.

*Male*

*Head.*—Clypeal margin medially prolonged into a slender, very long upturned process with a rounded apex, rest of margin reflexed and evenly curved to genal angles, which are rounded. Clypeal suture with frontal section entirely effaced, genal sections finely carinate. Frons and vertex smooth, unarmed, occipital edge sharply raised into a bisinuate carina paralleling pronotal margin. Eyes moderate, with about 13 facet rows across widest point, separated by about 8 widths, canthus incomplete. Unevenly punctate with large round punctures, densest along edges, some punctures along edges of genae and clypeus with strong semi-erect bristles, clypeal process with a fringe of bristles inserted on sides of upper surface. Head surface nitid. Labium narrowing apically, moderately incised, 2nd palpal segment very slender, more than 3 times as long as wide. *Pronotum.*—With a strong rounded median anterior prominence terminating in a pair of cones. Anterior angles broadly rounded. Hind edge unmargined. Indistinctly punctate with shallow punctures of 2 sizes intermixed on disc, glabrous except for a row of a few bristles on lateral margins, surface shagreened, sericeous. *Elytra.*—Intervals flat, shagreened, sericeous, with minute indistinct punctures bearing setae of 2 sizes: numerous extremely small microtrichia, almost invisible, and a row of widely-spaced small hooked setae visible when surface has been cleaned, unevenly distributed over most of intervals. Striae superficial, geminate, crenulated, with very shallow round punctures a little wider than stria. *Legs.*—Fore tibiae unmodified. Spur small. Tarsi exceptionally long and slender, the segments almost cylindrical. *Abdomen.*—Sternites greatly shortened medially. Pygidium somewhat swollen, shagreened, impunctate, glabrous. Aedeagus normal.

*Type*

Holotype ♂, Bamaga, Cape York, Qld., Jan. 1958, Darlingtons, MCZ.

*Remarks*

The two available specimens have the elytra covered with a film of fine clay, difficult to remove and apparently held on by the microtrichia.

*Distribution* (Fig. 396)

Known only from the tip of Cape York Peninsula, Qld. The ecology is unknown.

*Material Examined*

The type and one specimen. QUEENSLAND: Bamaga, Jan. 1958, Darlingtons, ANIC, 1.

## 151. ONTHOPHAGUS PLANICOLLIS Harold

(Figs. 400, 401, 631)

*Onthophagus planicollis* Harold, 1880, p. 350; Blackburn, 1903, p. 304; Lea, 1923, p. 368; Boucomont and Gillet, 1927, p. 215.

Brown, legs rufous, antennal clubs flavous. Total length 8–9 mm.

*Male*

*Head.*—Semicircular, clypeal margin medially slightly truncate, genal angles rounded, not prominent. Head margin very thin. Clypeal suture with frontal section effaced, genal sections sharp, moderately oblique. Frons and vertex entirely unarmed, flat, occiput slightly swollen on each side, forming low ridges. Eyes very wide, with about 16 facet rows across widest point, separated by about 4.5 widths, canthus very incomplete. Moderately punctate with large and small punctures, large ones bearing long erect bristles sparsely set over most of head surface. A fringe of 5–7 especially long bristles along each side of occipital edge. Surface smooth, nitid. Labium shallowly emarginate, 2nd palpal segment twice as long as wide, 3rd minute. *Pronotum.*—Unarmed, very feebly convex. Anterior angles subacute, the apices rounded. Hind edge unmargined. Moderately punctate with punctures of 2 sizes, the small ones without setae, the large ones with long erect bristles, these rather sparse. Surface smooth, nitid. *Elytra.*—Even-numbered intervals flat, odd-numbered ones slightly convex, finely shagreened, alutaceous, all but 2nd interval with a single row of widely spaced, erect bristles. Second row may have 1 or 2 bristles at extreme anterior and posterior ends. Striae superficial, narrow, with numerous very small, indistinct punctures. *Legs.*—Fore tibiae slender, with the teeth greatly reduced, represented by a mere undulation of outer margin, inner apical angle greatly prolonged into a strong point, spur absent. Tarsi very long and slender, cylindrical. *Abdomen.*—Sternites medially greatly foreshortened. Pygidium correspondingly large, convex, very finely shagreened, dull, sparsely punctate with large punctures bearing long erect setae. Margin very narrow. Aedeagus normal.

*Female*

Clypeus medially more broadly margined and very feebly produced and bilobate. Frontoclypeal suture effaced as in male. Fore tibiae unmodified, fore spur present. Abdominal sternites not shortened, pygidium smaller, not very convex.

*Type*

Holotype ♂, Somerset, Qld., d'Albertis, MNHN(Ob). Seen by the author.

*Distribution* (Fig. 396)

The east coast of Cape York Peninsula, Qld., from Cape Bedford (north of Cooktown) to some islands of Torres Strait (hence perhaps occurring in New Guinea). The ecology is unknown.

*Material Examined*

The type and 19 specimens. QUEENSLAND: Cape Bedford, BMNH, 1; Lockerbie, Jan. 1958, Darlingtons, MCZ, 1; Moa I., Torres Straits, J. W. Schomberg, SAM, 2; N. Cape York, Jan. 1958, Darlingtons, MCZ, 1; Prince of Wales I., 27.i.1937, Wind, MCZ, 1; Red I. Point, 29.iii.1964, I. F. B. Common and M. S. Upton, ANIC, 1; Silver Plains via Coen, 21.xi.1964, J. H. L. Wassell, UQ, 1; Silver Plains via Coen, 11.xii.1964, G. Monteith, UQ, 1; Stewart R., 1.ii.1927, Hale and Tindale, SAM, QM, AM, BMNH, 10.

## 152. ONTHOPHAGUS MACLEAYI Blackburn

(Figs. 402, 403, 632)

*Onthophagus macleayi* Blackburn, 1903, p. 289; Blackburn, 1906, p. 263; Boucomont and Gillet, 1927, p. 213.

Brown, posterior lateral and apical borders of elytra and pygidium paler, legs rufous, antennal clubs flavous. Total length 6–9 mm.

*Male*

*Head.*—Clypeal margin broadly reflexed, the surface behind it concave, medially produced and truncate in major male, feebly to distinctly bilobate in minor one, rest of head margin evenly rounded, genal angles rounded, not prominent. Clypeal suture with frontal section entirely effaced, genal sections indistinct, oblique. Frons and vertex entirely unarmed, flat. Eyes wide, with about 13 facet rows across widest point, separated by about 9 widths, canthus very incomplete. Moderately punctate with punctures of various sizes, subrugose along genae and edges of clypeus, frons smooth between punctures, nitid, with short erect setae present on genae, edges of clypeus, and in 2 slightly oblique rows along occipital edge and inner edges of eyes. Minor male with head entirely setose. Labium shallowly emarginate, 2nd palpal segment twice as long at wide, 3rd minute. *Pronotum.*—With a pair of low tumescences and a shallow median depression on anterior half, strongly convex in major male, less so in minor one, which has only a median anterior flattened area. Anterior angles quadrate, the apices rounded. Hind edge very finely margined. Moderately densely and evenly punctate with small punctures separated by 2–4 diameters, with several large punctures along anterior and lateral edges and sides of pronotum, these large punctures bearing long erect recurved setae. Surface between punctures smooth, nitid. *Elytra.*—Intervals subcostate, shagreened, dull, each with a low median shiny raised line tending to disintegrate into separate short ridges and disappear posteriorly, even-numbered intervals with these lines shorter or absent. Minor individuals may not have raised lines at all. Posterior half or two-thirds of odd-numbered intervals on disc and sides with single rows of well-spaced stout short semi-erect and curved bristles. Lateral intervals with bristles along their entire length, 2 or 3 rows on 8th. Striae superficial, geminate, with small transverse punctures at frequent intervals, slightly wider than stria. *Legs.*—Fore tibiae not elongated, the apical edge truncate, inner apical angle quadrate. Tarsi long and slender, subcylindrical. *Abdomen.*—Sternites greatly compressed medially. Pygidium finely shagreened, sericeous, with well-spaced punctures bearing long erect bristles, sometimes also minute non-setigerous punctures present. Margin very fine. Parameres elongated, tapering.

*Female*

Clypeal margin medially bilobate. Frontoclypeal suture also effaced, as in male. Head more densely punctate and setose, reticulately rugose, but leaving a smooth transverse occipital band. Pronotum less convex, with an anterior median flattened area as in minor male. Fore tibia with apical edge strongly oblique, spur longer. Abdominal sternites not shortened, pygidium swollen. Otherwise like male.

*Type*

Holotype ♀, Sydney, BMNH. Seen by the author.

*Distribution* (Fig. 396)

The north coast of New South Wales and the coast of south Queensland to Bundaberg. Blackburn (1906) reports seeing specimens from north Queensland. Most records are from the Moreton Bay area, the last record from Sydney dating from 1913. All exact localities except one (Mt. Tamborine) are directly on the coast, indicating that this species is in some way adapted to littoral habitats. Otherwise the ecology is unknown.

*Material Examined*

The type and 35 specimens. NEW SOUTH WALES: Iluka (near Yamba), 5.xi.1965, M. S. Upton, ANIC, 1; Sydney, Apr. 1913, E. H. Zeak, SAM, 1. QUEENSLAND: Bribie I., Moreton Bay, H. Hacker, QM, 1; Brisbane, 10.x.1917, H. Hacker, QM, 1; Brisbane, Perkins, BMNH, 1; Brisbane, 10.iii.1960, H. Dodd, UQ, 1; Brown Lake, Stradbroke I., 9.vi.1964, A. E. May, UQ, 1; Bundaberg, Perkins, BMNH, 17; Caloundra, 23.ii.1963, R. Shepherd, UQ, 1; Dunwich, Stradbroke I., 27.iv.1963, G. Monteith, UQ, 2; Mt. Tamborine, Dec. 1919, H. Pottinger, QM, 1; Noosa National Park, 13.iii.1963, G. Monteith, UQ, 3; Stradbroke I., 17.ix.1915, H. Hacker, QM, 1; no exact locality, SAM, BMNH, 3.

## XXIV. *The Ungrouped Species*

There are thirteen species which could not be placed in any of the previous groups and which could not be united among themselves into groups of more than two species each. Several show affinity with some of the species previously treated but could not be placed in the same group with them without overly diluting the characteristics of that group. These species are treated here and may be said to represent one species-group each, except for the three pairs *pillara-gulmarri*, *granulatus-bornemisszai*, and *blackwoodensis-flavoapicalis*, each of which represents one group. *O. depressus* is an introduced African species.

Thirteen species: 153. *wombalano*, sp. nov.; 154. *pillara*, sp. nov.; 155. *gulmarri* sp. nov.; 156. *granulatus* Boheman; 157. *bornemisszai*, sp. nov.; 158. *rubrimaculatus* Macleay; 159. *bunamin*, sp. nov.; 160. *consentaneus* Harold; 161. *gandju*, sp. nov.; 162. *victoriensis* Blackburn; 163. *blackwoodensis* Blackburn; 164. *flavoapicalis* Lea; 165. *depressus* Harold.

### KEY TO UNGROUPED SPECIES

1. Very densely covered with short, very stout, blunt bristles arising from shallow horseshoe-shaped punctures on dorsal surfaces; anterior angles tapering to an acute point; female with very long posterior abdominal sternite. N.S.W. ..... 165. *depressus* Harold
   Not as above ..... 2

2(1). Dorsal surfaces with a satiny lustre and a symmetrical variegated pattern of light greenish sinuate lines on a dark maroon base; front edge of labium with a perpendicular fringe of setae. N. Qld. ..... 153. *wombalano*, sp. nov.
Not as above ..... 3

3(2). Eyes very wide, with 17–20 facet rows across, separated by 2.5–3 times their width ..... 4
Eyes very much narrower, with at most 13 facet rows across, separated by at least 8 times their width ..... 5

4(3). Male with a pair of horns on vertex, clypeal margin evenly rounded, pronotum unarmed, fore tibia with inner apical angle not produced; female with clypeal margin evenly rounded. N. Qld. ..... 154. *pillara*, sp. nov.
Male with vertex unarmed, clypeal margin medially produced into a point or bidentate, pronotum with a median flattened area produced backward into a point or angle, fore tibia with inner apical angle produced into a point; female with clypeal margin bidentate. N. Qld. ..... 155. *gulmarri*, sp. nov.

5(3). Elytra with conspicuous, shiny granules and long setae; male with slender fore tibiae and upturned median clypeal lobe ..... 6
Without granules; setae, if present, shorter; males with unmodified tibiae and without clypeal lobe ..... 7

6(5). Head and pronotum largely green; pronotum granulate; elytra evenly convex; male with a V-shaped ridge on middle of retuse part of pronotum; female with distinct transverse carina on frons. Vic., N.S.W., S. Qld. ..... 156. *granulatus* Boheman
Head and pronotum largely pale brown; pronotum punctate; 5th elytral interval costate, sharply delimiting a flat discal area from plane sloping sides; male with a smooth area on middle of retuse part of pronotum; female without any frontal carina, with a pair of small remote tubercles. N.S.W. ..... 157. *bornemisszai*, sp. nov.

7(5). Humeri and sides of elytra red, or if elytra occasionally all black, then fore body green ..... 8
No red on elytra; fore body not green ..... 9

8(7). Fore body green; clypeal margin broadly bilobate; male with frontoclypeal suture strongly carinate, frontal carina laterally elevated into a pair of horns, pronotum anteriorly gibbous; female with clypeal suture strongly angulate. N. Qld. N. N.T., N. W.A. ..... 158. *rubrimaculatus* Macleay
Fore body black; clypeal margin evenly rounded; male without frontoclypeal suture, frontal carina not raised into horns, pronotum evenly convex; female with clypeal suture feebly bisinuate. N. Qld. ..... 159. *bunamin*, sp. nov.

9(7). Median lobe of metasternum with a strong gibbosity; unarmed, both sexes alike; black with yellow antennal clubs. NW. N.S.W., Qld., N.T., N. W.A. ...160. *consentaneus* Harold
Median lobe of metasternum normal; either armed or with some sexual dimorphism; brown or bronzed, or if black, then antennal clubs also black ..... 10

10(9). Clypeal margin evenly rounded; both sexes with a tubercle or small transverse ridge on middle of pronotum, usually preceded by a shallow depression. Surfaces strongly rugose. N. Qld. ..... 161. *gandju*, sp. nov.
Clypeal margin excised and bidentate; pronotum unarmed; surfaces not rugose ..... 11

11(10). Black, antennal clubs black; major male with a pair of horns and 3 shorter prongs on vertex; minor male and female with a transverse carina on vertex. SE. S.A., Vic., N.S.W. ..... 162. *victoriensis* Blackburn
Brown or bronzed with paler elytral apices, antennal clubs yellow or brown; vertex of both sexes unarmed ..... 12

12(11). Frons with a median tubercle in both sexes; hind edge of pronotum margined. NW. Vic., SE. S.A. ..... 163. *blackwoodensis* Blackburn
Frons unarmed; hind edge of pronotum unmargined. S. W.A. ..... 164. *flavoapicalis* Lea

## 153. ONTHOPHAGUS WOMBALANO, sp. nov.

(Figs. 18, 404, 405, 633)

Dark maroon, velutine, with a symmetrical variegated pattern of pale green reflections, pattern shifting somewhat when beetle is moved, legs rufous, antennal clubs fuscous. Total length 7–8 mm.

*Male*

*Head.*–Clypeal margin medially prolonged, sharply truncated and reflexed, margin almost straight to genal suture, then sharply angled again, genal angles very feeble, rounded. Clypeal suture with frontal section indistinct, very feebly carinate, genal sections finely carinate. Frons and vertex smooth, unarmed, but occipital edge laterally a little drawn back into a pair of very feeble, rounded lobes on either side of midline. Eyes moderate, with about 11 facet rows across widest point, separated by about 8 widths, canthus complete. Clypeal surface densely punctate with small shallow punctures, rest of head impunctate, smooth, satiny, glabrous. Labium shallowly excised, fringe setae projecting directly downward, 3rd palpal segment very minute. *Pronotum.*–Middle of pronotum raised into a pair of indistinct approximated tubercles, anterior declivity with indistinct flattened areas. Anterior angles quadrate, the apices subangulate. Hind edge unmargined. Evenly punctate with very small shallow punctures nearly invisible on disc, glabrous, surface shagreened, satiny. *Elytra.*–Surface a little uneven, with 2 slight depressions on sides, intervals very feebly convex, smooth, impunctate, satiny. Striae shallow, fine, simple, with well-spaced, very small round punctures. *Legs.*–Fore tibiae unmodified. Spurs very long, acute. Claws large. *Abdomen.*–Pygidium sericeous, smooth, with 2 patches of small punctures on either side bearing short, fine, obliquely recumbent setae, centre and apex of pygidium glabrous. Aedeagus normal.

*Female*

Clypeal surface rugose, frontoclypeal suture beaded, vertex with 2 very faint transverse ridges, occiput with lobes as in male, pronotum evenly convex. Otherwise like male.

*Type*

Holotype ♂, Iron Range, Cape York Peninsula, Qld., 6–17.v.1968, G. Monteith, QM T 6907.

*Remarks*

The extraordinary satiny lustre and variegated reflected pattern on the dorsal surfaces of this species are unique among Australian *Onthophagus*. They appear to be brought about by flattened scale-like granules producing an effect similar to that of a lepidopterous wing surface. The structure of the edge of the labium, with its perpendicular seta fringe, is unusual although shared with some unrelated species. The claws are unusually large but not evidently prehensile.

*Distribution*

Known only from the vicinity of Iron Range, Qld., where it was collected by Mr. Monteith in rain forest at human faeces. Noted by him to be nocturnal.

*Material Examined*

The type and three specimens. QUEENSLAND: Iron Range, Cape York Peninsula, 6–17.v.1968, G. Monteith, UQ, ANIC, 3.

## 154. ONTHOPHAGUS PILLARA, sp. nov.

(Figs. 406, 407, 634)

Rufopiceous, antennal clubs flavous. Total length 5–7 mm.

*Male*

*Head.*–Clypeal margin a little reflexed, head margin evenly rounded to genal angles, which are rounded, not prominent. Clypeal suture with frontal section entirely effaced, genal sections indistinct. Vertex with a pair of horns arising near inner margins of eyes and strongly inclined backward, very long, slender, and cylindrical in major male, short and conical in minor one. No carinae. Eyes very wide, with about 17 facet rows across widest point, separated by about 3 widths, canthus incomplete. Densely punctate with very small, shallow punctures, glabrous, surface smooth, alutaceous. Labium shallowly incised. *Pronotum.*–Very feebly convex, unsculptured. Anterior angles subacute, the apices angulate. Hind edge unmargined. Densely punctate with very small, shallow, indistinct punctures, glabrous, surface smooth, alutaceous. *Elytra.*–Intervals almost flat, smooth, impunctate, alutaceous, glabrous. Striae impressed, subgeminate, with closely spaced, deeper punctures about twice as wide as stria. *Legs.*–Fore tibiae with small teeth, not elongated, inner apical angle not produced, with long setae. Fore spur long, slender. *Abdomen.*–Pygidium finely shagreened, alutaceous, indistinctly punctate with numerous small shallow punctures, glabrous. Parameres short, with acute, downwardly directed points.

*Female*

Head shaped as in male. Clypeal surface rugose. Clypeal suture present, beaded, forming a complete, straight or slightly recurved ridge across head. Vertex unarmed. Front tibia with relatively short teeth similar to male, without long setae on inner apical angle. Otherwise like male.

*Type*

Holotype ♂, The Crater near Herberton, Qld., 15.xii.1961, McAlpine and Lossin, AM K 68782.

*Distribution*

Known only from the type locality. Probably a nocturnal rain forest species.

*Material Examined*

The type and five specimens. QUEENSLAND: The Crater near Herberton, 15.xii.1961, McAlpine and Lossin, AM, ANIC, 5.

## 155. ONTHOPHAGUS GULMARRI, sp. nov.

(Figs. 408, 409, 635)

Rufopiceous, antennal clubs flavous. Total length 5–7 mm.

*Male*

*Head.*–Clypeal margin produced medially into a single reflexed rounded point in major male, into a bidentate point in minor male. Genal angles rounded, not prominent. Clypeal suture with frontal section effaced, genal sections indistinct, not carinate. Frons and vertex unarmed, smooth. Eyes very large, with about 20 facet rows across widest point, separated by about 2.5 widths, canthus incomplete. Densely punctate with very small punctures, more visible around the eyes, glabrous, surface smooth, alutaceous. Labium shallowly emarginate. *Pronotum.*–Feebly convex with median flattened area delimited posteriorly by a V-shaped ridge raised apically into a point. Point near hind margin in major male, near middle of pronotum and much reduced in minor male, preceded only by small oval flattened area. Anterior angles quadrate, the apices angular. Hind edge finely margined. Densely punctate with indistinct, very small punctures, glabrous, surface alutaceous, smooth in minor male, finely rugulose on flattened area in major male, smooth elsewhere. *Elytra.*–Intervals almost flat, smooth, impunctate, alutaceous, glabrous. Striae impressed, subgeminate, with closely spaced deeper punctures about twice as wide as stria. *Legs.*–Fore tibiae not slender or elongate, the inner apical angle produced into a point, distal edge with long setae. Spur long. *Abdomen.*–Pygidium shagreened, with numerous very small shallow punctures, glabrous. Parameres short, with acute, downwardly directed point.

*Female*

Clypeal margin medially bidentate, the teeth close together. Clypeal surface rugose. Clypeal suture carinate, forming a complete, slightly recurved ridge across head. Pronotum unsculptured. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♂, 17 miles S. of Atherton, Qld., 19.iii.1964, I. F. B. Common and M. S. Upton, ANIC.

*Distribution*

The Atherton Tableland, Qld., probably in montane rain forest. All specimens appear to have been collected at light.

*Material Examined*

The type and three specimens. QUEENSLAND: 17 miles S. of Atherton (3000 ft), 19.iii.1964, I. F. B. Common and M. S. Upton, ANIC, 1; L. Barrine (2300 ft), 18.iv.1932, Australia Harvard Expedition, MCZ, 1; Millaa Millaa (2500 ft), 1.iv.1932, Australia Harvard Expedition, MCZ, 1.

## 156. ONTHOPHAGUS GRANULATUS Boheman

(Figs. 410, 411, 636)

*Onthophagus granulatus* Boheman, 1858, p. 48; Harold, 1869, p. 86; Blackburn, 1903, p. 270; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212; Roberts, 1931, p. 171; Hudson, 1934, p. 170.

Head green, with edges of genae and clypeus often pale brown, disc of pronotum green with pale brown mottling, green area breaking up around the edges into a pale brown or fulvous border, broadest along sides. Elytra fulvous with darker mottling.

Pygidium fulvous to flavous, with 3 vertical black marks. Underside mostly dark green, femora flavous, usually with black markings, rest of legs and antennal clubs fuscous. Total length 6–8 mm.

*Male*

*Head.*—Clypeal margin medially very strongly reflexed at a right angle and forming a prominent rounded lobe in major male. Smaller male with lobe reduced, minor male with margin not reflexed, truncate as in female. Rest of head margin evenly rounded to eyes, genal margin not at all prominent. Clypeal suture with frontal section entirely effaced. Frons flat, unarmed in major male, in smaller male with a pair of very small tubercles at termination of genal suture, in minor male these tubercles becoming short transverse carinae, as in female. Eyes narrow, with about 6 facet rows across widest point, separated by about 15 widths, canthus incomplete. Edge of clypeus densely punctate and rugulose, rest of head smooth, sericeous, impunctate or with very minute punctures over all of surface, with very sparsely distributed, large setigerous punctures on sides of clypeus, frons, and vertex. Labium shallowly excised in an arc. *Pronotum.*—Sharply retuse anteriorly in major male, more evenly convex in minor one, with 4 oblique ridges on retuse portion, the 2 lateral ones converging upward, the 2 median ones diverging in a V. All 4 subparallel and indistinct in minor male. Median longitudinal sulcus impressed basally. Anterior angles quadrate, the apices subangulate. Hind edge unmargined. Fairly densely covered with conspicuous shiny granules, each one giving rise to a nearly straight, erect bristle, surface shagreened, sericeous, except for anterior ridges, which are nitid. *Elytra.*—Intervals feebly convex, odd-numbered ones a little more so, smooth, sericeous, with rows of prominent shiny granules each bearing an erect bristle. Granules in a single, irregularly spaced row on each discal interval, on 7th and 8th intervals interspersed with numerous smaller granules. Striae superficial, geminate, almost impunctate. *Legs.*—Fore tibiae greatly elongated in major male, the teeth small, inner apical angle a little explanate, without seta brush. Minor male with tibiae shorter but still slender, inner apical angle normal. Spur very short in major male. Hind spur slightly bifurcate at tip. *Abdomen.*—Pygidium shagreened, with numerous small, slightly asperate punctures bearing very long, more or less erect, undulate setae leaving black midline glabrous, sparse on lateral black lines. Aedeagus normal.

*Female*

Middle of clypeal margin broadly, very shallowly emarginate, the edges rounded on either side. Clypeal surface rugose. Frontoclypeal suture represented by a strong short transverse ridge, somewhat bent forward and not reaching clypeogenal sutures. Frons with a strong transverse carina, more or less interrupted in middle and not reaching eyes. Pronotum with 4 shiny vertical ridges anteriorly as in minor male, but less prominent. Fore tibiae unmodified. Otherwise like male.

*Type*

Holotype ♀, Sydney, 22–31.x.1852, NRM. Seen by the author.

*Distribution* (Fig. 431)

Victoria (except the north-west part), eastern New South Wales in a broad band from the coast across the tablelands and mountain ranges to about the 15-in. isohyet,

and south-eastern Queensland as far north as Mackay. Frequent in pastures and other open areas with sandy soil, under cow dung, human faeces, wallaby pellets, and at rabbit entrail bait. From September to May, with one record in August. Diurnal.

The species was introduced unintentionally into New Zealand, apparently at or before the last third of the 19th Century, as the Harold material in the Oberthür Collection in MNHN contains a specimen from New Zealand. Hudson (1934, p. 170) says of it: "Found very rarely amongst horse and cow dung. It is astonishing that this beetle has not become abundant in settled districts. I have not seen more than half a dozen specimens in 50 years!".

*O. granulatus* is claimed to have caused the death of a horse and possibly some calves by Roberts (1931), who reported large numbers of these beetles inside the stomach and paunch respectively, that of the horse being extensively perforated by the beetles. This extraordinary observation has not been repeated since, to the author's knowledge, although species of *Onthophagus* are well known to enter the human intestinal tract in India.

*Material Examined*

The type and 699 specimens. VICTORIA: Boolarra; 42 miles W. of Corryong; Eskdale; Gunyah; Morwell; 11 miles E. of Nathalia; Rutherglen; Wahgunyah; Wannon; 9 miles S. of Yanakie; 10 miles WNW. of Yea. AUSTRALIAN CAPITAL TERRITORY: Blundell's Flat; Canberra; Cotter Murrumbidgee Bridge; Tidbinbilla. NEW SOUTH WALES: Acacia Plateau; Armidale; Bateman's Bay; Bathurst; Beelbangera, 4 miles NE. of Griffith; Bolivia; Bowraville; Cabbage Tree Ck.; Clyde Mountain; Comboyne; Cowper; Dinner Ck., Nelligen; Dorrigo; Dubbo; Durras Water; 5–17 miles S. of Eden; Gallagher's Camp; Gilmore; 28 miles E. of Glen Innes; Hartley Vale, Blue Mountains; Jackadgery; 20 miles S. of Kempsey; Kindee; Lower Acacia Ck.; 13 miles N. of Marulan; Megan, Bellinger Valley; Moonbi; Mt. Wilson, Blue Mountains; Narrandera; New England National Park; Numeralla; Peddy's River; 10 miles NE. of Raymond Terrace; Richmond; Salisbury; Sawtell; Shoalhaven R., Braidwood; Somersby; Sydney; Tamworth; Tangmanjaroo; Terrigal; Tudibaring; 18–22 miles W. of Wagga; Wamberal; Woodenbong; Woy Woy; Yass. QUEENSLAND: Archerfield; Ballandean; Beechmont; Binna Burra; Brisbane; Carnarvon Gorge; Finch Hatton Ck.; Lotus Ck., Sarina; Maryborough; Mt. Glorious; Palen Ck.; St. Lucia; Tannymorel.

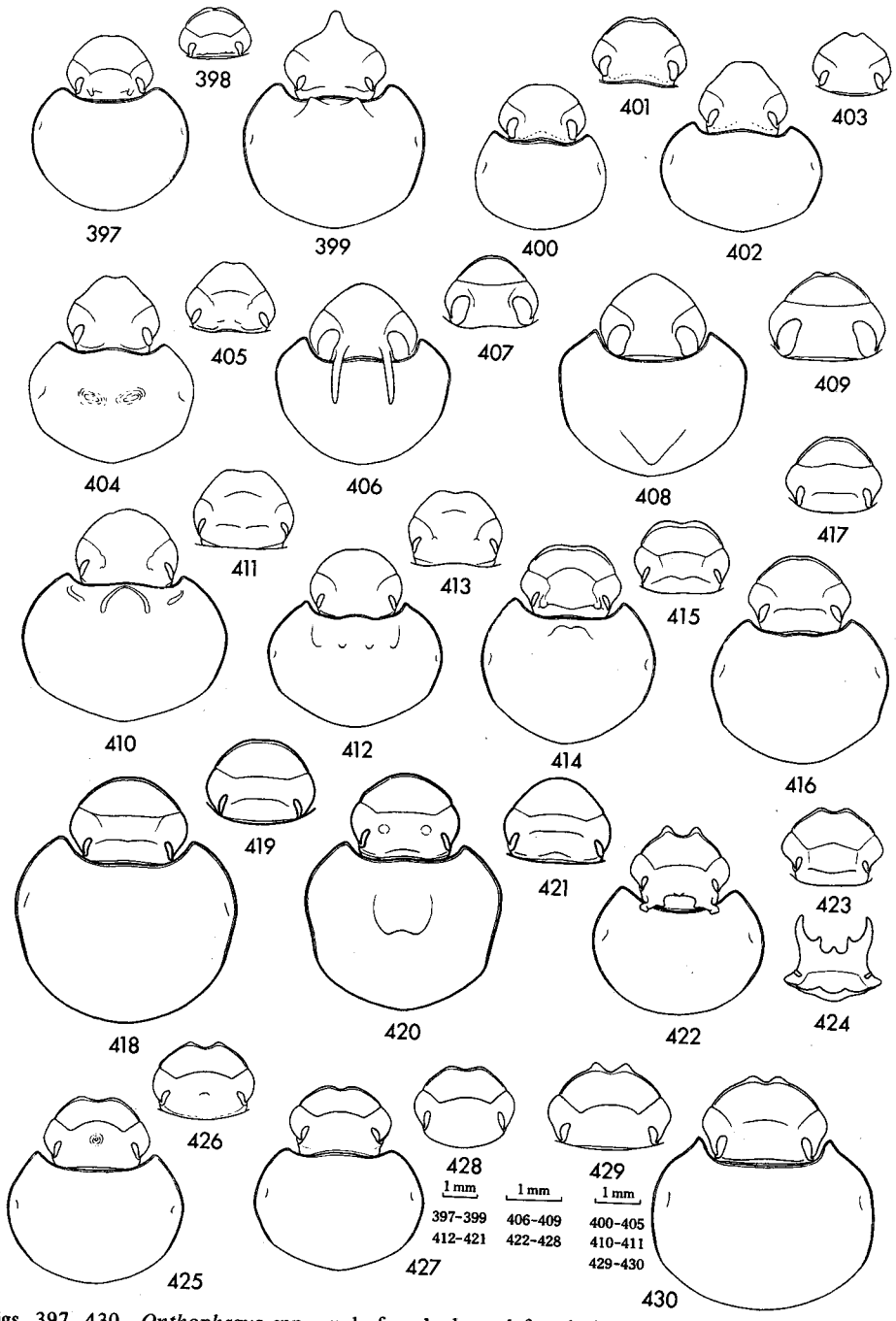
## 157. ONTHOPHAGUS BORNEMISSZAI, sp. nov.

(Figs. 412, 413, 637)

Fulvous, head with dark green irregular pattern on centre and base, pronotum with dark green transverse patch in middle of anterior declivity, sometimes broken up into 4 spots, and irregular dark mottling on disc and sides. Elytra with dark mottling, pygidium with vertical dark median patch, usually also with lateral dark spots. Underside fulvous with darker mottling. Legs fulvous to flavous, femora without dark pigment, tibiae darker. Antennal clubs fulvous. Total length 6–7 mm.

*Male*

*Head.*–Clypeal margin medially strongly reflexed and forming a prominent rounded lobe in major male, minor male with margin little or not reflexed, truncate, without lobe, rest of margin evenly rounded to eyes, genal margin not at all prominent. Clypeal suture with frontal section entirely effaced. Frons flat (slight tumescence in middle of head), unarmed. Eyes small, with about 7 facet rows across widest point, separated by about 17 widths, canthus incomplete. Edge of clypeus densely punctate,




Figs. 397–430.–*Onthophagus* spp., male fore body and female head: *397, 398, O. clypealis*; *399, O. yunkara* (male fore body only); *400, 401, O. planicollis*; *402, 403, O. macleayi*; *404, 405, O. wombalano*; *406, 407, O. pillara*; *408, 409, O. gulmarri*; *410, 411, O. granulatus*; *412, 413, O. bornemisszai*; *414, 415, O. rubrimaculatus*; *416, 417, O. bunamin*; *418, 419, O. consentaneus*; *420, 421, O. gandju*; *422–424, O. victoriensis* (*424*, male head, front view); *425, 426, O. blackwoodensis*; *427, 428, O. flavoapicalis*; *429, 430, O. depressus*: *429*, female head; *430*, male fore body.

nitid, rest of head smooth, sericeous, impunctate except for a few widely scattered punctures bearing long erect bristles. Labium excised about one-third of way to base. *Pronotum.*–Anterior declivity with a flat median section set off from sides by a pair of rounded vertical ridges and from disc by a transverse line of 4 tubercles, disc strongly flattened, concave in major male, median longitudinal sulcus not strongly impressed. Anterior angles acute, the apices rounded. Hind edge unmargined. Rather sparsely punctate with large, sharply defined setigerous punctures interspersed with

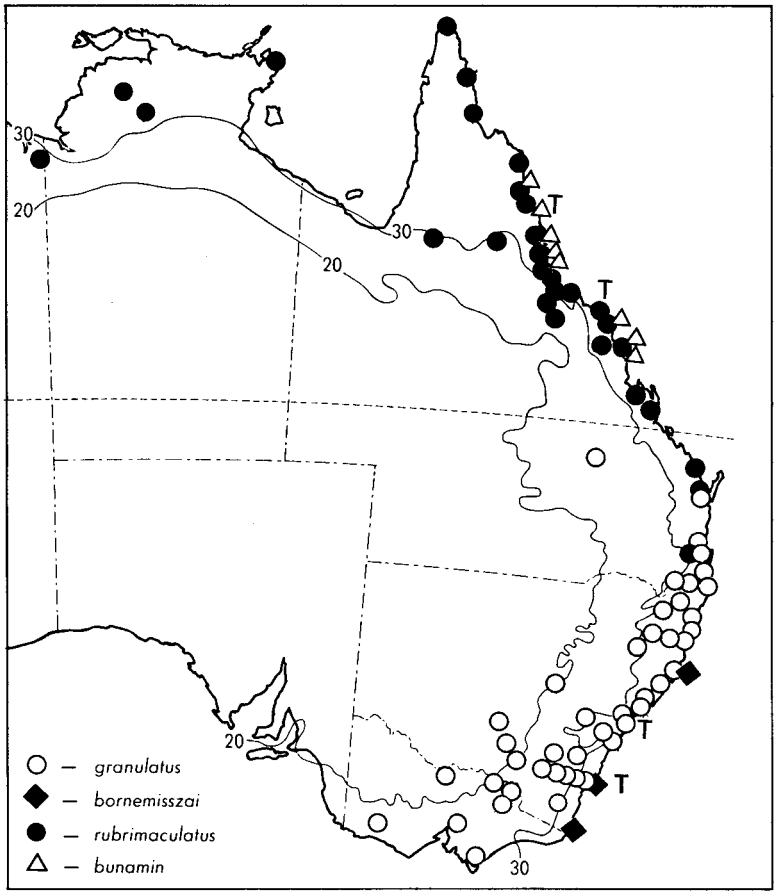



Fig. 431.–Known distribution of the ungrouped species, I, in relation to annual rainfall (in.).

small ones on sides, each puncture bearing a long erect bristle. Surface shagreened, sericeous, except on flattened anterior declivity, which is nitid. *Elytra.*–Intervals, except 5th, flat, sericeous, with a row of widely spaced, raised shiny granules down middle of each interval, each granule bearing an erect bristle, also some smaller granules on 5th, 7th, and 8th intervals. Disc of elytra quite flat or a little concave, sharply set off from flattened sides by costate 5th interval, apical edges vertical. Striae superficial, geminate, impunctate. *Legs.*–Fore tibiae greatly elongated in major male, slender, the teeth small, shorter but still slender in minor male, without seta

brush. Fore spur small in major male. Hind spur slightly bifurcate apically. *Abdomen.*—Pygidium sericeous, with small, scattered subasperate punctures bearing long erect undulate bristles but leaving black mark on midline and lateral black spots, if any, impunctate and glabrous. Aedeagus normal.

*Female*

Clypeal margin medially shallowly emarginate, rounded on either side of emargination. Clypeal surface rugose, with a short sharp transverse ridge behind rugose portion, this ridge strongly bent forward. Frons with a pair of sharp conical tubercles at ends of genal sutures, no carina. Pronotum with transverse row of 4 tubercles, as in male, but anterior median declivity and disc not sharply set off from rest of surface. Elytra as in male. Fore tibiae not modified. Otherwise like male.

*Type*

Holotype ♂, Bateman's Bay, N.S.W., 21.xii.1964, G. F. Bornemissza, ANIC.

*Remarks*

The existence of this species was first noted by Dr. G. F. Bornemissza, after whom it is named, on the basis of its ecological distribution in the Bateman's Bay area (see below). It is closely related to *granulatus*, but both sexes may invariably be distinguished by the characters given in the key.

*Distribution* (Fig. 431)

Known from three localities in coastal New South Wales: south of Eden, the Bateman's Bay area, and south of Kempsey. Occurs in coastal casuarina-eucalypt forests growing in sandy soil and, in contrast to the closely related *granulatus*, prefers shaded situations. A similar relationship exists between the sibling species-pairs *pexatus* and *nammuldi* in the same area, and *australis* and *nurubuan* a little further inland.

*Material Examined*

The type and 234 specimens. NEW SOUTH WALES: Ballengarra, 20 miles S. of Kempsey, 15.xii.1965, G. A. Yapp, ANIC, 2; Bateman's Bay, 10,19.x.1964, 21.xii.1964, G. F. Bornemissza, ANIC, 131; Durras Water, 20–26.xii.1964, G. F. Bornemissza, ANIC, 98; 5–17 miles S. of Eden, 13.i.1968, E. G. Matthews, ANIC, 3.

## 158. ONTHOPHAGUS RUBRIMACULATUS Macleay

(Figs. 414, 415, 638)

*Onthophagus rubrimaculatus* Macleay, 1864, p. 122; Harold, 1867, p. 32; Harold, 1869, p. 82; Blackburn, 1903, p. 272; Lea, 1923, p. 385; Boucomont and Gillet, 1927, p. 215.

*Onthophagus decurio* Lansberge, 1885, p. 389; Blackburn, 1903, p. 306 (syn.); Boucomont and Gillet, 1927, p. 211.

*Onthophagus emarginatus* Macleay, 1887, p. 224; Blackburn, 1903, p. 304; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 211. New synonymy.

*Onthophagus pseudoemarginatus* Goidanich, 1926, p. 76. New synonymy.

Fore body dark green, occasionally bronzed, punctures cupreous. Elytra black or rufopiceous with reddish or red humeri. Red colour usually extends back along

last interval to apices. Some specimens with red confined to indistinct area on humeri and a few with elytra entirely black. Pygidium and underside black, legs black to rufopiceous, antennal clubs fuscous. Total length 4–7 mm.

*Male*

*Head.*–Clypeal margin medially broadly, shallowly emarginate and roundly or subangularly expanded on either side. Genal angles rounded, not prominent. Clypeal suture with frontal section sharply carinate, strongly bowed forward, forming nearly right angle with genal sections, which are carinate. Vertex with a strong transverse carina laterally elevated into a pair of high transverse horns with rounded ends in major male. Minor male without horns, with only transverse carina with sloping sides. Eyes narrow, with 7–8 facet rows across widest point, separated by about 13 widths, canthus incomplete. Finely punctate, punctures densest on clypeus, glabrous, surface smooth, nitid. Labium excised about one-third of way to base. *Pronotum.*–Strongly convex, with a median anterior gibbosity which is apically double in major male, normally a little transverse, indistinct in minor male. Anterior angles quadrate to subacute, the apices rounded. Hind edge finely margined. Fairly densely, evenly punctate with small punctures separated by 2–3 diameters, glabrous except near anterior angles, which bear a group of cilia which are continued as a single or double row along sides. Surface smooth, nitid. *Elytra.*–Intervals flat, dull, each with 2 rows of very small punctures bearing microtrichia on disc, short cilia along sides, apices, and posterior parts of sutural and 3rd intervals. Striae superficial, geminate, with very small, shallow punctures. *Legs.*–Fore tibiae not slender, without brush, with inner apical angle prolonged forward. Spur short. *Abdomen.*–Pygidium sericeous, densely punctate with small to medium punctures, each puncture with a short inwardly directed seta. Parameres with points transverse, widened.

*Female*

Clypeal margin a little more strongly bilobate than that of male. Clypeal surface rugose. Vertex with a strong transverse carina joining hind edges of eyes, the middle third a little concave, the lateral thirds sloping downward. Pronotum with a trace of anterior median gibbosity in major female only. Fore tibiae unmodified. Otherwise like male.

*Types*

Holotype of *rubrimaculatus*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *decurio*: Somerset, Qld., Civic Museum of Genoa.
Holotype of *emarginatus*: ♂, Cairns, Qld., MM.
The first and last seen by the author.

*Remarks*

*O. emarginatus* is a small male of this species without red colour on the elytra. Specimens from Ingham northward along the Queensland coast tend to have dark elytra, with the red reduced to an indistinct area on the humerus or absent altogether (in very few specimens). There is no morphological or ecological evidence to suggest that a different species is involved. Goidanich (1926), without examining the situation, proposed the new name *pseudoemarginatus* for *emarginatus*, the latter being preoccupied.

The description of *decurio* can leave no doubt of its synonymy with *rubrimaculatus*, as Blackburn (1903, p. 306) states. Lea (1923) agreed with this conclusion. It is therefore surprising that Boucomont and Gillet (1927) listed *decurio* as a valid species. This was probably a lapse.

The present species was mistakenly referred to as *quadripustulatus* (Fabricius) by Harold (1867, 1869).

*Distribution* (Fig. 431)

Eastern Queensland from Brisbane north to Cape York and into south-eastern New Guinea, westward to the north of the Northern Territory, apparently in areas of 30 in. or more of annual rainfall. The westernmost record is Kununurra, W.A., just over the border from the Northern Territory. Occurs in open pastures and open woodland in various types of soil. Diurnal. Most records are from January to June, but a few have been captured in July, September, October, and December.

Collected in bovine dung and human excrement, but found more frequently by the author, particularly in the Northern Territory, in wallaby pellets, which the beetles penetrate and shred completely, without burial. This species also has marked necrophagous tendencies – 10 individuals were found under a dead dog near Darwin, and six under discarded pelts near Mackay, Qld.

*Material Examined*

The types and 1104 specimens. QUEENSLAND: Archerfield; Atherton; Ayre; 40 miles W. of Ayre; Bamaga; Belmont, 8 miles NW. of Rockhampton; Blue Water Ck., Townsville; Bowen; Brisbane; Bundaberg; Cairns; Cape R.; Carpentaria Downs; Charters Towers; Coen; Cooktown; Davies Ck., Mareeba Rd.; Eubenangee; Finch Hatton Ck.; Forrest Beach, Ingham; Gilbert R.; Howard; Ingham; Iron Range; Kuranda; Lockerbie; Mackay; 50 miles S. of Mackay; Macrossan; Mareeba; Marlborough; 10 miles W. of Marlborough; Maryborough; Millstream Falls, Ravenshoe; Mingela; Mt. Carbine; Mt. Mee; Proserpine; 2–17 miles W. of Ravenshoe; Rockhampton; Sarina; Silver Plains; Somerset; Thomson Ck., 120 miles N. of Clermont; Townsville; Tully; 5 miles NE. of Tully; Woodstock. NORTHERN TERRITORY: Berri Springs; Burnside Station; 15–27 miles S. of Darwin; Howard Springs; Humpty Doo; 12 miles N. and 2–4 miles E. of Katherine; Yirrkala, Arnhem Land. WESTERN AUSTRALIA: Kununurra; 60 miles NW. of Kununurra. NEW GUINEA: South-east, ex Mus. D. Sharp, MNHN(Ob), 4.

## 159. ONTHOPHAGUS BUNAMIN, sp. nov.

(Figs. 416, 417, 639)

Black, humeral angles and usually also bases, sides, and apices of elytra red, legs rufopiceous, antennal clubs flavous to fulvous. Total length 5.0–7.5 mm.

*Male*

*Head.*–Clypeal margin medially reflexed and forming a short truncate lobe. Genal angles rounded, not prominent. Clypeal suture with frontal section effaced, genal sections finely carinate. Frons with a strongly elevated transverse carina which is feebly bisinuate or straight and of equal height to the ends, which slope abruptly to eyes. Eyes small, with about 12 facet rows across widest point, separated by about 8 widths, canthus incomplete. Very finely punctate on centre of head, the punctures becoming larger and more crowded around edges, clypeus rugulose, rest of surface smooth, nitid, glabrous. Labium shallowly emarginate. *Pronotum.*–Strongly convex,

anterior declivity vertical and a little flattened in major male, unsculptured in minor one. Anterior angles quadrate, the apices sharply angulate. Hind edge margined. Exceedingly finely punctate, appearing impunctate, glabrous, surface smooth, nitid. *Elytra.*–Intervals flat, smooth, nitid, impunctate, glabrous. Striae shallow, finely geminate, with deeper transverse punctures only slightly wider than stria. *Legs.*–Fore tibiae unmodified. Spur long. *Abdomen.*–Pygidium finely shagreened, alutaceous, with numerous small punctures bearing short recumbent setae. Parameres with points transverse.

*Female*

Clypeal surface transversely rugose. Clypeal suture entirely carinate, forming a feebly bisinuate transverse ridge across head. Frons with a transverse carina as in male, but less strongly elevated, and very small females without any frontal carina. Pronotum evenly convex. Otherwise like male.

*Type*

Holotype ♂, Cann River, Tully, Qld., 3.v.1964, G. F. Bornemissza, ANIC.

*Distribution* (Fig. 431)

Lowland coastal areas of north Queensland not far from the sea, from Sarina to Daintree (north of Mossman), in open woodland or savannah areas with partial shade, in all types of soil from sand to gravel, generally dry. At human excrement and mammal entrails. Diurnal, although one specimen was collected at light. January–May.

*Material Examined*

The type and 72 specimens. QUEENSLAND: Cann R., 3.v.1964, G. F. Bornemissza, ANIC, 2; Cardwell Range, 9 miles N. of Ingham, 2.v.1964, G. F. Bornemissza, ANIC, 12; Conway Range National Park, 28.iii.1968, E. G. Matthews, ANIC, 25; Greenbank, 8.i.1963, G. Monteith, UQ, 2; Hutchinson Ck. near Daintree, 8.i.1967, D. K. McAlpine and G. Holloway, AM, 1; 23 miles W. of Mackay, 27.iii.1968, E. G. Matthews, ANIC, 3; 9 miles E. of Paluma, 24.iv.1969, G. F. Bornemissza, ANIC, 1; Tully, Mission Beach Road, 12.x.1969, R. J. Huppatz, ANIC, 6; Sarina, 12.iii.1965, G. F. Bornemissza, ANIC, 1; Sunday Ck., 2.v.1964, G. F. Bornemissza, ANIC, 9; Tully, 2.v.1964, G. F. Bornemissza, ANIC, 8; Upper Mulgrave R., 2.iv.1968, E. G. Matthews, ANIC, 2.

## 160. ONTHOPHAGUS CONSENTANEUS Harold

(Figs. 418, 419, 640)

*Onthophagus granulatus* Macleay, 1864, p. 124 (non Boheman, 1858); Harold, 1868*b*, p. 1027 (syn.).

*Onthophagus consentaneus* Harold, 1867, p. 33; Harold, 1869, p. 80, Blackburn, 1903, p. 270; Boucomont, 1914, p. 279; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

Black, antennal clubs pale flavous. Total length 6–11 mm.

*Male*

*Head.*–Outline of head almost evenly semi-oval, only slightly flattened in middle of clypeus. Clypeal suture completely carinate, frontal section straight joining genal sections far from margin at very obtuse angles. Frons with a straight or feebly bisinuate

transverse carina, not strongly elevated, curved back a little near eyes. Eyes small, with 8–9 facet rows across widest point, separated by about 14 widths, canthus complete. Densely punctate, the punctures small behind frontal carina, moderate to large elsewhere, glabrous, clypeus transversely rugose, rest of head smooth, nitid, area behind frontal carina finely shagreened. Labium excised about one-third of way to base. *Pronotum.*–Large, very strongly convex in major male, the anterior declivity somewhat flattened, unarmed, minor male with surface less strongly convex, not flattened anteriorly. Anterior angles subquadrate, the apices rounded. Hind edge distinctly margined. Densely punctate with medium-small punctures separated by about 1 diameter, with microtrichia, difficult to see. Surface smooth, nitid. *Elytra.*–Intervals flat, rugulose, sericeous, raised parts of rugae shinier, densely punctate with very small punctures bearing clearly visible microtrichia becoming very short setae on last intervals. Striae superficial, finely geminate, shiny, with very small, shallow punctures. *Metasternum.*–Anterior part of median lobe with a strong gibbosity. *Legs.*–Fore tibiae unmodified. Spur large, flattened. *Abdomen.*–Pygidium strongly rugose, shagreened, with numerous small punctures bearing short recumbent setae. Parameres short, terminally expanded, the points short, broadened.

*Female*

There is no sexual dimorphism in this species, except that the pronotum of the female does not become as strongly convex in large individuals.

*Types*

Holotype of *granulatus*: ♂, Port Denison (Bowen), Qld., MM.
Holotype of *consentaneus*: ♂, Rockhampton, Qld., MNHN(Ob).
Both seen by the author.

*Distribution* (Fig. 432)

This species has the most extensive distribution of any Australian *Onthophagus*, occurring in Celebes, Timor, and New Guinea (at least), as well as Australia (Boucomont and Gillet 1927, p. 210). Within Australia it also has a wide range, occurring from the extreme north-west of New South Wales throughout Queensland and the Northern Territory to north Western Australia. Four specimens are available from south of the Kimberleys, collected at Landor in 1929, Mandora in 1953, Onslow in 1965, and Roebourne in 1967. *O. consentaneus* is the only species of the genus to have been collected in the extreme south-west corner of Queensland and adjacent parts of New South Wales, primarily by E. F. Riek, although *jubatus* and *blackburni* would also be expected to occur there. At the other extreme, *consentaneus* is able to penetrate areas of high rainfall, particularly in coastal Queensland, but it is not abundant there. It appears to drop out north of Daintree on the Cape York Peninsula, as collections made by J. H. Wassell and G. Monteith at Silver Plains and Iron Range failed to turn up *consentaneus* (a species always collected if present), but it reappears at the extreme tip among specimens collected by the Darlingtons. This distributional hiatus is also seen in *atrox*.

In the Northern Territory the author found *consentaneus* in late January occurring as far north as the vicinity of Darwin, where the annual rainfall is about 50 in., but to be greatly outnumbered there by *glabratus,* whereas further south near

Katherine (± 30 in.) *consentaneus* was very much more abundant than *glabratus*. However, it was in the Kimberleys, W.A., that *consentaneus* reached a peak of abundance. At Fitzroy Crossing (± 25 in.) all traps set would fill up to the brim with this species within a few hours, till they contained an estimated 600–700 specimens, with many additional ones simply climbing out over the edges. In this area this species made up over 98% of the collected scarabaeine fauna.

*O. consentaneus* occurs in open grassland and savannah, in generally dry soils of all types. It is diurnal and crepuscular, being active until about 0930 hr in the Kimberleys, then apparently abating above-ground activity during the heat of the day, flying again from about 1630 hr through the evening until some undetermined hour after sunset. It is occasionally collected at light.

Most collections have been made from January to May, but a few records are available for all other months of the year. However, in northern Australia it may not be active at all during the dry season, as Mr. P. Ferrar searched for dung beetles in August 1969, in the same regions where the author had found *consentaneus* so abundant in January and February 1968, but did not find a single specimen.

The known food habits of *consentaneus* are markedly different from those of other species occurring with it. In the first place, it is occasionally found under decaying mushrooms together with species which appeared to be obligatory mycetophages such as *latro*, *varianus*, *endota*, and *gidju*. In the second place, it is found abundantly under vertebrate carcasses. In the Northern Territory and the Kimberleys every dead reptile and mammal encountered had several to many "push-ups" (piles of excavated soil) around it. Whenever these were dug up, they were found to be caused by *consentaneus*. Even a very old cow carcass, reduced to skin and bones, yielded some specimens of this species as did a discarded pelt. Although other species of *Onthophagus* are found under carrion, none occur there with such consistency and regularity as *consentaneus*, which must therefore be considered one of the important components of the cadaver fauna of northern Australia. In the third place, this species was never found in or under marsupial pellets, which regularly yielded several other species. On the other hand, it was very strongly attracted to human excrement and, to a lesser extent, fresh cow dung.

The very great abundance of *consentaneus*, therefore, appears not to be supported by the indigenous marsupial fauna but, directly or indirectly, by man through his own excrement and that of his cattle and through the roadside slaughter that is a consequence of motor traffic.

*Material Examined*

The types and 934 specimens. NEW SOUTH WALES: Native Dog; Pilliga; Tibooburra. QUEENSLAND: Almaden; Atherton; Ayr; Bamaga; Belmont; Blue Water Ck.; 10 miles N. and 35 miles W. of Bowen; Brisbane; Cairns; Caloundra; Camooweal; 5 miles SSW. of Canobie H.S.; Cape R.; Cardstone; Carnarvon Gorge; Carpentaria Downs; Charters Towers; Clump Point; 10 miles S. of Cunnamulla; Daintree; Davies Ck., Mareeba Rd.; Edge Hill, Cairns; Edungalba, 50 miles SW. of Rockhampton; El Arish; Finch Hatton Ck.; 30 miles N. of Gin Gin; 48 miles N. of Goondiwindi; Greenvale H.S., W. of Ingham; Greta Ck., 20 miles N. of Proserpine; Helenslee Station, Homestead; Howard; Ingham, Forrest Beach; 30 miles N. of Injune; Inverleigh Station, Punchbowl Yard; Lawes; Maalar; Mackay; 23 miles W. and 50 miles S. of Mackay; Macrossan; 10 miles W. of Marlborough; Marmor; Mary Ck., 16°33′S., 145°12′E.; Milgela; Mornington I.; Moolayember Dip, 60 miles N. of Injune; Mt. Carbine; Napamerry (or Napper Merrie); 30 miles W. of Noccundra; 3 miles S. of Normanton; Peeramon; Port Denison; Prince of Wales I.; 2–17 miles E. of Ravenshoe; Rodds Bay; 9 miles S. of Rolleston; Sarina; Sarina, Lotus Ck.;

Selheim; Stradbroke I.; Sunday Ck.; Thomson Ck., 120 miles N. of Clermont; 5 miles N. of Ticklarra (or Tickalara); Townsville; 5 miles NE. of Tully; Weir River; Woodstock; Yungaburra. NORTHERN TERRITORY: 1–17 miles N. of Adelaide River; Alice Springs; Borroloola; Brock Ck., Burnside Station; Coniston Station, Alice Springs; 15–27 miles S. of Darwin; Emily Gap, 6 miles SE. of Alice Springs; Hermannsburg; Howard Springs; 2–4 miles E., 12 miles N., 16–20 miles W., 20–28 miles S. of Katherine; 15 miles NNE. of Narwietooma; 15 miles N. of Tennant Creek; Wigley Waterhole, 5 miles NNE. of Alice Springs. WESTERN AUSTRALIA: Broome; Camballin; Crab Ck., Broome; 6–10 and 30–35 miles S. of Derby; East Kimberley; Fitzroy Crossing; 37–59 miles W. of Fitzroy Crossing; Forrest R., Wyndham; junction Fitzroy and Margaret Rivers, Calvert Expedition 1896; Kununurra; Landor Station; Langey Crossing, 26 miles S. of Derby; Liveringa H.S.; Mandora Station; Mt. Wynne; Napier Range; Onslow; Roebourne.

### 161. ONTHOPHAGUS GANDJU, sp. nov.

(Figs. 420, 421, 641)

Reddish bronze-black with faint cupreous and green reflections, antennal clubs flavous. Total length 8.5–11.0 mm.

*Male*

*Head.*—Outline circular, clypeal margin medially evenly rounded; very slightly reflexed. Clypeal suture entirely feebly carinate, frontal section straight, meeting genal sections at sharp obtuse angles far from margins. Frons with a pair of very low, well-separated, rounded tumosities, vertex with a very low, short, median transverse tumosity, centre of frons slightly depressed before it. Eyes small, with 6–7 facet rows across widest point, separated by about 17 widths, canthus complete. Clypeal surface transversely rugose, genae very closely punctate with large shallow punctures, centre of head more sparsely punctate with shallow punctures, glabrous, surface nitid. Labium excised a little less than halfway to base. *Pronotum.*—Strongly convex, with a median anterior shallow depression followed by a short prominent transverse rounded ridge situated in middle of pronotum, in minor male this ridge reduced to a small tuberosity. Anterior angles quadrate, the apices angulate. Hind edge unmargined. Rugose with large, dense, very shallow punctures, glabrous, nitid. *Elytra.*—Intervals flat, strongly rugose, impunctate, glabrous except for lateral edges along epipleura, which bear a row of short setae. Striae shallow, geminate and crenulate, impunctate. *Legs.*—Fore tibia unmodified. Spur large. Claws small. *Abdomen.*—Pygidium strongly reticulately rugose and densely punctate with very large, shallow punctures bearing long straight semi-erect bristles. Aedeagus normal.

*Female*

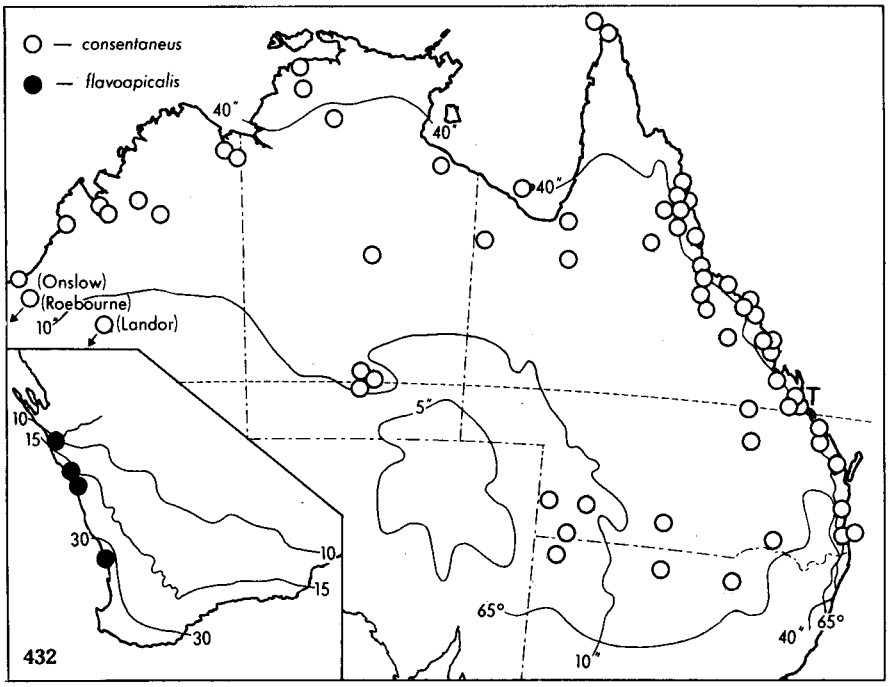
Clypeus a little prolonged, frons with an indistinct transverse carina instead of a pair of tubercles, median ridge of vertex as in male. Pronotum as in male and otherwise like male.

*Type*

Holotype ♂, Iron Range, Cape York Peninsula, Qld., 28.iv–4.v.1968, G. Monteith, QM T 6903.

*Remarks*

A highly distinctive species which could not be mistaken for any other, although sharing the strong stocky build of *consentaneus* (the two species do not seem to be



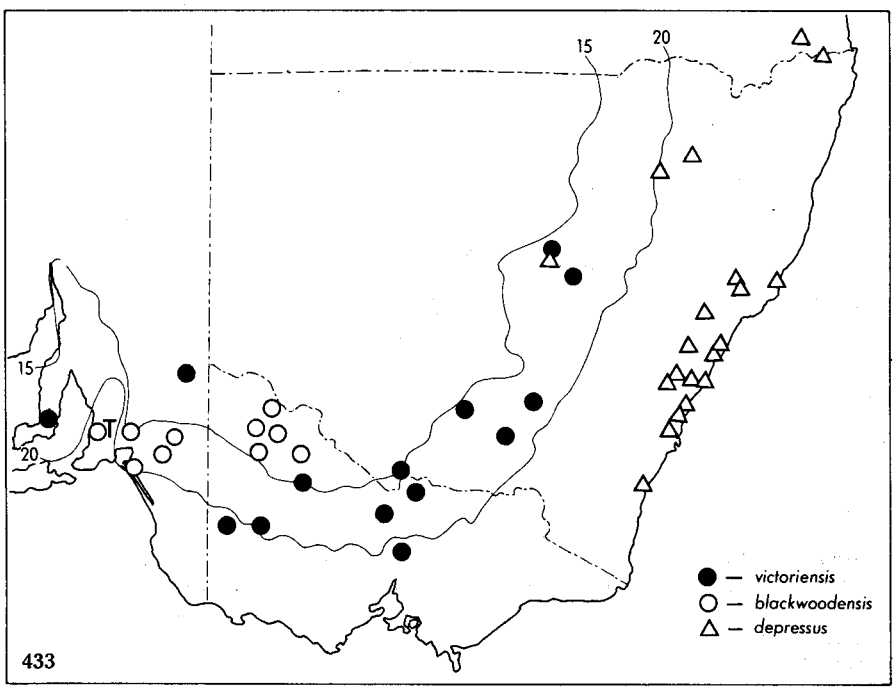
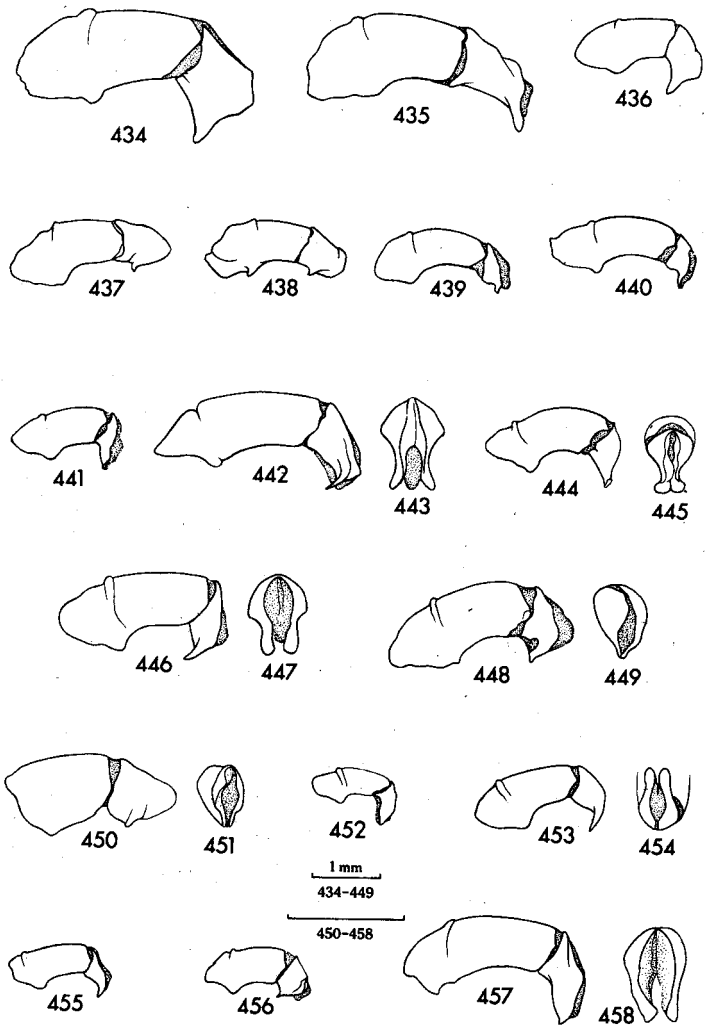




Fig. 432.—Known distribution of *O. consentaneus* and *O. flavoapicalis*, in relation to annual rainfall and mean temperature.

Fig. 433.—Known distribution of the ungrouped species, III, in relation to annual rainfall (in.).




Figs. 434–458.–*Onthophagus* spp., aedeagi: *434, O. ferox*; *435, O. pugnacior*; *436, O. kumbaingeri*; *437, O. latro*; *438, O. varianus*; *439, O. waterhousei*; *440, O. kokereka*; *441, O. blackburni*; *442, 443, O. jangga*; *444, 445, O. sydneyensis*; *446, 447, O. incornutus*; *448, 449, O. millamilla*; *450, 451, O. turrbal*; *452, O. rubescens*; *453, 454, O. manya*; *455, O. yeyeko*; *456, O. lamgalio*; *457, 458, O. flavoapicalis.*

otherwise related). Available specimens are worn and it is difficult to ascertain the exact original shape of the head, particularly the clypeal margin, and the various small prominences on the head and pronotum.

*Distribution*

Known only from the vicinity of Iron Range, Qld. Collected by Mr. Monteith in rain forest at human excrement, at which it arrived at night.

*Material Examined*

The type and 11 specimens. QUEENSLAND: Caudie R. near Iron Range airport, 7.vi.1966, D. K. McAlpine, AM, 1; Iron Range, 28.iv–17.v.1968, G. Monteith, UQ, ANIC, 10.

## 162. ONTHOPHAGUS VICTORIENSIS Blackburn

(Figs. 422–424, 642)

*Onthophagus victoriensis* Blackburn, 1903, p. 293; Lea, 1923, p. 369; Boucomont and Gillet, 1927, p. 216.

*Onthophagus jungi* Blackburn, 1904, p. 148; Lea, 1923, p. 369 (syn.).

Black, antennal clubs black. Total length 6–8 mm.

*Male*

*Head.*—Clypeal margin medially reflexed and with 2 very prominent rounded teeth, the margin between them forming a rounded angle. Margin slightly notched at clypeogenal suture, genal angles rounded, prominent. Clypeal suture completely carinate, frontal section far back on head, a little procurved, meeting genal sections far from margins. Vertex prolonged backwards into a pair of divergent horns slightly curved inward at the apices and joined together by a transverse lamina, inner bases of these horns and middle of edge of lamina produced upward into 3 shorter prongs in all but minor male. Minor male without the 3 prongs, although middle of lamina may be slightly raised, horns much shorter, erect, and straight. Eyes very small, with about 5 facet rows across widest point, separated by about 15 widths, canthus incomplete. Fairly densely punctate with large punctures bearing short to moderately long setae, surface nitid. Labium shallowly excised. *Pronotum.*—Strongly convex, flattened or a little concave anteriorly, otherwise unsculptured. Anterior angles subquadrate, the apices broadly rounded. Hind edge strongly margined. Densely punctate with large round punctures separated by about 1 diameter, those in anterior angles and some on sides with semi-erect setae, the remainder with microtrichia. Surface smooth, nitid. *Elytra.*—Intervals convex, shagreened, sericeous, with extremely small punctures bearing microtrichia except for lateral interval, which bears fairly long setae, these also present on apices and here and there on posterior part of other intervals, especially sutural. Striae shallow, geminate, with well-spaced small deep round punctures not wider than stria. *Legs.*—Fore tibiae unmodified. *Abdomen.*—Pygidium shagreened, rather sparsely punctate with small punctures bearing short setae. Aedeagus normal.

*Female*

Clypeal margin less prominently dentate. Middle of clypeal suture raised into a strong angle or tubercle. Vertex with a sharp prominent recurved transverse carina not raised into horns. Pronotum more coarsely punctate, abruptly declivous near anterior margin but not flattened or concave. Otherwise like male.

*Types*

Holotype of *victoriensis*: ♀, Victoria, SAM (fore body missing).
Holotype of *jungi*: ♂, Yorke Peninsula, S.A., Jung, BMNH.
Both seen by the author.

*Remarks*

This species shares certain aspects of form and texture with *jubatus*, to which it is probably related without fitting into the *adelaidae* group as here defined.

*Distribution* (Fig. 433)

The south-east of South Australia, northern Victoria, and the western slopes of New South Wales, between the 15- and 20-in. isohyets. Found by Dr. Bornemissza in *Callitris* association and pastures in sandy loam or loam, primarily under cow dung. In Victoria it appears to replace *blackwoodensis* south of the Mallee District.

*Material Examined*

The types and 138 specimens. SOUTH AUSTRALIA: No exact locality (cotype *jungi*), SAM, 1. VICTORIA: Birchip, J. C. Goudie, SAM, 1; 3 miles N. and 2 miles NW. of Booroopki, 14.iv.1951, P. B. Carne, ANIC, 4; 5 miles SW. of Broadford, Sept. 1949, P. B. Carne, ANIC, 1; 11 miles S. of Elmore, 10.viii.1950, P. B. Carne, ANIC, 2; Gunbower, Murray River island, NMV, 2; 12 miles SSW. of Horsham, 11.iv.1951, P. B. Carne, ANIC, 5; L. Hattah, Nov. 1954, B. Given, NMV, 1; 4 miles W. and 11 miles E. of Nathalia, 14.xii.1965, G. F. Bornemissza, ANIC, 33; Portland, Jan. 1938, C. Oke, NMV, 1; Yarrawonga, 2.viii.1953, F. E. Wilson, NMV, 3; no exact locality, SAM, 1. NEW SOUTH WALES: Cowra, 10.v.1958, B. Given, NMV, 1; 11 and 31 miles S. of Deniliquin, 14.xii.1966, G. F. Bornemissza, ANIC, 47; Grenfell, G.W.F., NMV, 1; W. of Narrandera, Sept. 1957, Darlingtons, MCZ, 6; Narromine, E. W. Ferguson, ANIC, 1; 13 miles NE. of Trangie, L. Chinnick, ANIC, 1; 18, 22, and 25 miles W. of Wagga, 12.xii.1966, G. F. Bornemissza, ANIC, 25; 5 miles SSW. of Wallendbeen, 17.x.1950, P. B. Carne, ANIC, 1.

## 163. ONTHOPHAGUS BLACKWOODENSIS Blackburn

(Figs. 425, 426, 643)

*Onthophagus blackwoodensis* Blackburn, 1891, p. 208; Blackburn, 1903, p. 292; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

*Onthophagus pontilis* Blackburn, 1903, p. 291; Lea, 1923, p. 355; Boucomont and Gillet, 1927, p. 215. New synonymy.

Fore body bronzed, sometimes greenish, hind body and underside rufopiceous, apices of elytra often with pale markings, elytra sometimes with greenish reflections, legs rufous, antennal clubs fuscous to fulvous. Total length 4.5–6.0 mm.

*Male*

*Head.*—Clypeal margin medially bidentate, margin between teeth shallowly subangulate, genal angles rounded, not prominent. Clypeal suture with frontal section carinate, procurved, meeting genal sections at strong angles remote from margins. Frons with a single, sharply conical median tubercle, otherwise unsculptured. Eyes narrow, with about 5 facet rows across widest point, separated by about 10 widths, canthus incomplete. Fairly densely punctate with medium-sized punctures, glabrous, clypeus feebly rugose, rest of head smooth, nitid. Labium shallowly excised.
*Pronotum.*—Fairly strongly convex, with a flattened or feebly concave retuse median area in front, narrowly extending to anterior angles, absent in minor male. Anterior

angles subacute, the apices angulate. Hind edge distinctly margined. Evenly punctate with medium-small punctures separated by about 2 diameters, with microtrichia, surface smooth, nitid. *Elytra.*—Intervals flat or very feebly convex, alutaceous, with slightly irregular surface, densely punctate with small punctures bearing microtrichia, last interval with short setae. Striae superficial, geminate, with close-set shallow transverse punctures interrupting edges, only very slightly wider than stria. *Legs.*—Fore tibia unmodified, with inner apical angle produced into a small point. *Abdomen.*—Pygidium shagreened, densely punctate, with small shallow punctures bearing short recumbent setae. Parameres elongate, somewhat beak-like.

*Female*

Clypeal margin strongly bidentate, clypeal surface a little more strongly rugose, clypeal carina more strongly carinate, less procurved. Frontal tubercle smaller, more transverse. Retuse part of pronotum confined to area immediately along front margin, or absent. Front tibia with inner apical angle obtuse. Otherwise like male.

*Types*

Holotype of *blackwoodensis*: ♀, Blackwood, S.A., BMNH.
Holotype of *pontilis*: ♂, Murray Bridge, S.A., BMNH.
Both seen by the author.

*Remarks*

The author cannot appreciate the differences between *blackwoodensis* and *pontilis* enumerated by Blackburn (1903) either in his key (pp. 270-1) or his discussion (p. 292). The differences mentioned that do exist are either sexual or individual, in the author's opinion.

*O. blackwoodensis* is most closely related to *flavoapicalis* of Western Australia, with which it shares the general appearance and oblong shape, shape of head and clypeal carina, microtrichia and short setae over most of body, punctuation, type of elytral striae, yellowish elytral apices (seen on about half of *blackwoodensis* specimens), and shape of male genital parameres (Figs. 457 and 458).

*Distribution* (Fig. 433)

The Mallee District in the north-west of Victoria, particularly the Lake Hattah area, westward to the coast of South Australia around the mouth of the Murray River. Evidently an exceptionally xerophilic species adapted to mallee country, but otherwise its ecology is unknown. Most specimens appear to have been collected at light from August to December and from March to May.

*Material Examined*

The types and 42 specimens. SOUTH AUSTRALIA: Lowan Station, 4 miles W. of Sherlock, 21.xii.1954, L. J. Chinnick, ANIC, 1; Murray Bridge, Sept. 1957, Darlingtons, MCZ, 2; Murray R., R. F. Kemp, NMV, 2; Murray R., A. H. Elston, AM, 3. VICTORIA: Gypsum Siding, 4.xi.1924, C. Oke, NMV, 4; Kulkwyne Forest near Hattah Lakes, 25.x.1966, G. W. Anderson, ANIC, 3; L. Hattah, J. E. Dixon, ANIC, 4; L. Hattah, 16.iii.1966, M. S. Upton and J. A. Grant, ANIC, 1; Lake Hattah National Park, 3.xi.1966, I. F. B. Common and M. S. Upton, ANIC, 1, and 25.x.1967, E. B. Britton and S. Misko, ANIC, 5; Mallee District, ANIC, AM, 3; 10 miles S. of Ouyen, 28.viii.1966, G. Anderson, ANIC, 1; 16 miles W. of Ouyen, 15.iii.1966, M. S. Upton and J. A. Grant, ANIC, 8; Sea Lake, J. C. Goudie, AM, 1; Wyperfeld National Park, 4–5.xi.1966, I. F. B. Common and M. S. Upton, ANIC, 3.

## 164. ONTHOPHAGUS FLAVOAPICALIS Lea

(Figs. 427, 428, 457, 458, 644)

*Onthophagus flavoapicalis* Lea, 1923, p. 378; Boucomont and Gillet, 1927, p. 212.

Fuscous, usually with a small paler spot on each humerus, apices of elytra yellowish, underside and legs rufous, antennal clubs flavous. Total length 4.5–6.0 mm.

*Male*

*Head.*—Clypeal margin medially excised at obtuse angle, feebly dentate on either side, notched at clypeogenal sutures, genal angles rounded, moderately prominent. Clypeal suture with frontal section carinate, moderately bent forward, meeting carinate genal sections at strong angles remote from margins. Frons and vertex unarmed. Eyes small, with about 6 facet rows across widest point, separated by about 10 widths, canthus incomplete. Frons and vertex moderately punctate with small punctures, genae and clypeus strongly punctate with large punctures, clypeus rugose, head glabrous. Labium shallowly emarginate. *Pronotum.*—Moderately convex, unsculptured. Anterior angles quadrate, the apices angulate. Hind edge unmargined. Evenly punctate with medium-sized punctures separated by about 2 diameters, with barely visible microtrichia, surface smooth, nitid. *Elytra.*—Intervals very feebly convex, shagreened, alutaceous, with slightly irregular surface, with numerous very small punctures, those on disc with microtrichia, those of 7th and 8th intervals with very short setae. Striae superficial, indistinct, geminate, with very small, shallow punctures. *Legs.*—Fore tibiae unmodified, inner apical angle quadrate or very slightly projecting. *Abdomen.*—Pygidium swollen, shagreened, with numerous medium-sized shallow punctures bearing a few very short setae, except in southern specimens, which have the pygidium glabrous. Parameres elongate, somewhat beak-like (Fig. 457).

*Female*

Clypeal surface more strongly rugose. Fore tibia with inner apical angle obtuse. Pygidium less convex. Otherwise like male.

*Type*

Holotype ♂, Geraldton, W.A., J. Clark, SAM I.15415. Seen by the author.

*Distribution* (Fig. 432)

The west coast of south Western Australia from about 75 miles north of Perth to the Murchison River, in a zone of 15–30 in. of annual rainfall. Collected by the author in dry open scrubland on sandhills near the sea, at human faeces. Collected under the same conditions near the mouth of the Murchison River by Mr. A. Douglas. Nocturnal. May, and August–October.

*Material Examined*

The type and 49 specimens. WESTERN AUSTRALIA: Carnamah, 16.iv.1968, I. F. B. Common and M. S. Upton, ANIC, 1; Dongara, 13–23.viii, 5.ix.1935, R. E. Turner, BMNH, 3; 7 miles ESE. of Dongara, 17.iv.1968, I. F. B. Common and M. S. Upton, ANIC, 5; Geraldton, Oct. 1931, P. J. Darlington, MCZ, 1; Geraldton, J. Clark, NMV, 3; Geraldton area, 24.v.1966, S. K. Skwarko, ANIC, 6; Ledge Pt., 40 miles N. of Yanchep, 13.x.1967, E. G. Matthews, ANIC, 2; Murchison R., 8.viii.1954, Sept. 1956, A. Douglas, WAM 12, Sept. 1956, BMNH, 1; Yanchep National Park, 5 miles N. of Yanchep, 12.iv.1968, I. F. B. Common and M. S. Upton, ANIC, 12; Yuna, 24.iv.1968, I. F. B. Common and M. S. Upton, ANIC, 2.

## 165. ONTHOPHAGUS DEPRESSUS Harold

(Figs. 429, 430, 645)

*Onthophagus depressus* Harold, 1871, p. 116; d'Orbigny, 1913, p. 472; Boucomont and Gillet, 1927, p. 165.

*Onthophagus carteri* Blackburn, 1904, p. 147; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210; Cartwright, 1938, p. 114 (syn.).

Black (dense stubble and adhering soil giving beetle a paler appearance), legs rufopiceous, antennal clubs flavous. Total length 7–9 mm.

*Male*

*Head.*–Clypeal margin medially strongly bidentate and reflexed, rest of margin evenly rounded to genal angles, which are rounded, margin behind angles a little concave. Clypeal suture with frontal section feebly carinate, indistinct, not reaching genal sections, the latter indistinct. Frons and vertex unarmed, base of head with a sharp margin running from eye to eye. Eyes moderate, with about 10 facet rows across widest point, separated by about 9 widths, canthus incomplete. Densely, coarsely granular, the granules on clypeus transverse, each granule giving rise to a short, very stout, blunt or clavate bristle. Labium very shallowly emarginate. *Pronotum.*–Moderately convex, with a slight longitudinal depression in middle in major male. Anterior angles very sharply drawn out, strongly acute. Hind edge margined. Extremely densely punctate and asperate, the punctures large, shallow, shaped like horseshoes around elevated edge or granule, each puncture with a very short, very stout, blunt or clavate bristle. Surface nitid between punctures. *Elytra.*–Intervals flat, nitid, very densely punctate with large shallow punctures of same type as on pronotum, and bearing stout bristles, about 4 serried rows on bases of discal intervals, reduced to 2 apically and on lateral intervals. Striae superficial, very fine, crenulated, difficult to distinguish among dense stubble and asperate punctures. *Legs.*–Fore tibiae unmodified. *Abdomen.*–Pygidium shagreened, densely punctate with large shallow ocellate punctures bearing short stout blunt bristles. Aedeagus normal.

*Female*

Clypeal teeth longer, more acute. Frontoclypeal suture more strongly carinate. Last abdominal sternite exceptionally long, equal in length along midline to all remaining sternites put together. Pygidium correspondingly shortened. Otherwise like male.

*Types*

Holotype of *depressus*: Caffraria. Not found in MNHN(Ob). A search was made among the African material in the Oberthür Collection but without success.

Holotype of *carteri*: Sydney, BMNH. Seen by the author.

*Distribution* (Fig. 433)

*O. depressus* is a South African species which was accidentally introduced, probably into the Sydney area, some time before 1900, which is the earliest date on available specimens. Soon thereafter it was described as *carteri* by Blackburn (1904). All available specimens collected up to 1941 were within a 50-mile radius of Sydney except a specimen from Eccleston (near Barrington Tops) without a date but collected by T. G. Sloane. Specimens collected after that year have been found also much

further inland in New South Wales, to Trangie and Narrabri, as far north as the Queensland border, and as far south as Bateman's Bay. This pattern may reflect the fact that early collectors concentrated their efforts in the Sydney area and later ones ranged further afield, or it may reflect an actual spread of the species during the 20th century. It is necessary now to continue collecting it and plotting its distribution to see whether it is still spreading.

*O. depressus* has a marked propensity to be transported unintentionally by man. It was discovered in the south-eastern United States in 1937 (Cartwright 1938) and in Madagascar in 1953 (Paulian 1960, p. 23). A very closely related African species, *O. bituberculatus* (Olivier), was discovered by the present author in Martinique in 1965. The only other known instances of accidental transportations of *Onthophagus* have concerned European species introduced into Canada and the Azores, and *posticus* and *granulatus* introduced into New Zealand. However, only *depressus* has a record of three successful independent establishments, as far as the author is aware. In all cases, the mechanics of introduction are quite unknown.

The ecology of *depressus* is largely unknown. Dr. Bornemissza found one individual in the sand on the sea beach near Bateman's Bay, one specimen in SAM without locality data bears the label "sea beach", and several Carter specimens "La Perouse Beach". A series of specimens has been collected on the Five Islands between Wollongong and Port Kembla. The species is therefore able to tolerate marine littoral conditions, undoubtedly an essential part of its dispersal ability. On the other hand, it has spread inland in New South Wales as far as it has along the coast. It has been collected in sand at human excrement by Dr. Bornemissza. August–May, with most records falling from December to May.

*Material Examined*

The type of *carteri* and 74 Australian specimens. NEW SOUTH WALES: Barrington House via Salisbury; Bateman's Bay; Bondi; Botany; Cabramatta; Eccleston; Five Is.; Forster; Gallagher's Camp; Georges R. valley; Gosford; Illawarra; Kangaroo Valley; La Perouse Beach; Maroubra; Naranbra; Narrabri; Nauru I.; Noonameena Station, 28 miles SE. of Bingara; Patonga; Pymble; Sydney; Trangie; Tuggerah; Upper Burragorang; Upper Colo R.; Wahroonga; Wallacia; Windsor; Woy Woy; Wyong. QUEENSLAND: Lamington, 26.i.1958, net from car at night, B. Campbell, UQ, 1.

## NOMINA INQUIRENDA

*Onthophagus crotchi* Harold, 1871, p. 115; Blackburn, 1903, p. 303; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 210.

A species 13 mm long, greenish in parts, with a single elongate horn on the head and feebly quadrituberculate pronotum. No locality in Australia is given and the species has not been recognized by subsequent workers. The author could not fine the type in MNHN(Ob), and cannot relate the description to any known Australian species.

*Onthophagus granum* Lansberge, 1885, p. 391; Blackburn, 1903, p. 304; Lea, 1923, p. 354; Boucomont and Gillet, 1927, p. 212.

A species 2.5 mm long, black with bronzed fore body, nitid and glabrous, the pronotum coarsely punctate and elytral striae deeply impressed. The head is bi-carinate with clypeal margin emarginate. The description may fit an all-black female

of *quadripustulatus* or possibly *fabricii*. Collected by d'Albertis at Somerset, Qld., and now in the Civic Museum of Genoa, where it could not be seen by the author.

ACKNOWLEDGMENTS

All the work required to prepare the present revision was carried out at the Division of Entomology, CSIRO, Canberra, and would not have been possible without use of the extensive facilities of this Division. The work is part of a project on Australian and exotic dung beetles being carried out under the direction of Dr. G. F. Bornemissza with the ultimate aim of controlling the buffalo fly, *Haematobia exigua* de Meijere, a cattle pest in northern Australia, and the bushfly, *Musca vetustissima* Walker, a pest of man throughout Australia.

Financial support for the author's activities in connexion with this project was first provided by the Australian-American Educational Foundation during 1967 and 1968 in the form of a Fulbright Fellowship. Subsequently, the Division of Entomology, CSIRO, through its Chief, Dr. D. F. Waterhouse, provided a research fellowship during 1969 and 1970. The author is most grateful for this support.

While he was at the Division, the author benefited greatly from the advice and encouragement of Dr. G. F. Bornemissza, whose extensive knowledge of the biology of dung beetles was drawn upon in the course of preparing the present work. Much of the ecological information summarized in the sections headed "Distribution" under each species is the result of Dr. Bornemissza's extensive unpublished ecological studies, carried out throughout eastern Australia. A large proportion of the specimens of *Onthophagus* which serve as a basis for this revision result from Dr. Bornemissza's collecting or that of his assistants, particularly Mr. G. A. Yapp.

Several other collectors have paid particular attention to dung beetles in recent years and helped greatly to fill some gaps in our knowledge. In particular, Mr. G. B. Monteith of the University of Queensland made valuable collections and observations in the Iron Range and Lockerbie areas of Cape York. Mr. G. Brooks provided valuable material from north Queensland, as did the late J. L. H. Wassell from Silver Plains (Coen area). Mr. J. H. Calaby of the Division of Wildlife Research, CSIRO, contributed specimens and information on the species of *Onthophagus* which cling to the fur of macropods, and on their hosts, as did Mr. B. L. Bolton of the Primary Industries Branch, Northern Territory Administration, who carried out an extensive survey on the agile wallaby and its attendant beetles near Darwin, and Mr. W. Arndt, Division of Soils, CSIRO, who communicated valuable observations on the behaviour of the beetles.

The author also wishes to acknowledge the personnel of various Commonwealth, State, and private organizations for assistance in entering and collecting in certain restricted areas, in particular: the Northern Territory Administration's Welfare Branch and the Methodist Overseas Missions, North Australia District, for permission to work and accommodation at Yirrkala, Gove Peninsula in Arnhem Land; the Northern Territory Administration's Forestry Branch for assistance and accommodation on Melville I., and its Animal Industry and Agriculture Branch, and particularly Mr. Kevin Hodder, for assistance in the Darwin area; also, the Administrator for the North West, Government of Western Australia, and the Western Australia Department of Agriculture, for providing facilities and assistance at Derby and Kununurra; the

Department of Forestry, Government of Queensland, for permission to collect in nine National Parks in Queensland; finally, Mr. Neville Fenton, Ranger at Dorrigo National Park, and the rangers at New England and Gibraltar Range National Parks, all in New South Wales, for permission to collect in their respective parks.

The assistance of Mr. J. P. Green in making the photographs, and of Mrs. G. C. Palmer in finishing the drawings and maps, is gratefully acknowledged. Both are on the staff of the Division of Entomology, CSIRO.

The author wishes to thank Dr. E. B. Britton and Dr. K. H. L. Key of the Division of Entomology, CSIRO, for reading the manuscript and making many helpful suggestions.

Finally, the author is most grateful to the 21 curators named at the beginning of this work for the opportunity to study the material in their care, and particularly to the curators named and the trustees of BMNH, DEI, ISZ, MNHN, NRM, and QM for the loan of holotypes.

## ALPHABETICAL LIST OF VALID SPECIES AND SYNONYMS OF AUSTRALIAN *ONTHOPHAGUS*, WITH NUMBERING SYSTEM ADOPTED IN THE PRESENT WORK

| Valid Species | Synonyms |
|---|---|
| *adelaidae* Hope, 92 | = *hostilis* Harold |
| *alquirta*, sp. nov., 37 | |
| *anchommatus* Lea, 61 | |
| *anisocerus* Erichson, 67 | |
| *apterus*, sp. nov., 39 | |
| *arrilla*, sp. nov., 127 | |
| *asper* Macleay, 143 | = *patruelis* Harold |
| *atrox* Harold, 20 | |
| *auritus* Erichson, 76 | = *cereus* Hope |
| | = *lucidicollis* Boheman |
| | = *micans* Sturm |
| | = *umbraculatus* Hombron & Jacquinot |
| *australis* Guérin, 68 | = *capella* Boisduval |
| | = *cupreoviridis* Blanchard |
| *bambra*, sp. nov., 85 | |
| *bicarinaticeps* Lea, 144 | = *pauperculus* Frey |
| *bicavicollis* Lea, 31 | |
| *bicornis* Macleay, 55 | |
| *blackburni* Shipp, 114 | = *hornianus* Paulian |
| | = *nitidior* Blackburn |
| | = *zietzi* Blackburn |
| *blackwoodensis* Blackburn, 163 | = *pontilis* Blackburn |
| *bornemisszai*, sp. nov., 157 | |
| *bornemisszanus*, sp. nov., 34 | |
| *brooksi*, sp. nov., 64 | |
| *bunamin*, sp. nov., 159 | |
| *capella* Kirby, 47 | = *schmeltzi* Harold |
| *capelliformis* Gillet, 46 | |
| *capellinus* Frey, 60 | |
| *capitosus* Harold, 21 | = *quadridentatus* Hope |
| *carmodensis* Blackburn, 4 | |
| *chepara*, sp. nov., 7 | |
| *clypealis* Lea, 149 | |

| Valid Species | Synonyms |
|---|---|
| *comperei* Blackburn, 44 | |
| *compositus* Lea, 120 | |
| *consentaneus* Harold, 160 | = *granulatus* Macleay |
| *conspicuus* Macleay, 30 | = *bovilli* Blackburn |
| *cruciger* Macleay, 115 | |
| *cuniculus* Macleay, 78 | |
| *dandalu*, sp. nov., 79 | |
| *darlingtoni*, sp. nov., 54 | |
| *declivis* Harold, 35 | |
| *demarzi* Frey, 23 | |
| *depressus* Harold, 165 | = *carteri* Blackburn |
| *desectus* Macleay, 36 | = *howitti* Blackburn |
| *devexus* Macleay, 38 | |
| *dicranocerus* Gillet, 41 | |
| *discolor* Hope, 74 | = *promptus* Harold |
| | = *viridiobscurus* Blanchard |
| *duboulayi* Waterhouse, 94 | = *spissicollis* Lea |
| *dummal*, sp. nov., 146 | |
| *dunningi* Harold, 63 | = *dumbrelli* Blackburn |
| | = *sydneyicus* Paulian |
| *endota*, sp. nov., 84 | |
| *erichsoni* Hope, 57 | = *quadrinodicollis* Lea |
| *evanidus* Harold, 109 | = *cupreopunctatus* Lea |
| | = *negatorius* Blackburn |
| *fabricii* Waterhouse, 110 | = *humator* Shipp |
| | = *humeralis* Macleay |
| | = *strabonis* Lea |
| *ferox* Harold, 15 | |
| *ferrari*, sp. nov., 45 | |
| *fissiceps* Macleay, 27 | = *darwini* Paulian |
| | = *integriceps* Macleay |
| | = *semirugosus* Gillet |
| *flavoapicalis* Lea, 164 | |
| *fletcheri* Blackburn, 104 | |
| *frenchi* Blackburn, 122 | |
| *fuliginosus* Erichson, 66 | |
| *furcaticeps* Masters, 77 | = *froggatti* Macleay |
| | = *furcatus* Macleay |
| | = *lobicollis* Macleay |
| *gandju*, sp. nov., 161 | |
| *gangulu*, sp. nov., 101 | |
| *geelongensis* Blackburn, 88 | = *aureoviridanus* Blackburn |
| *gidju*, sp. nov., 145 | |
| *glabratus* Hope, 5 | = *chillagoensis* Paulian |
| *granulatus* Boheman, 156 | |
| *gulmarri*, sp. nov., 155 | |
| *haagi* Harold, 97 | |
| *hoplocerus* Lea, 65 | |
| *incanus* Macleay, 98 | = *leaniensis* Paulian |
| *incornutus* Macleay, 129 | = *semihirtus* Frey |

| Valid Species | Synonyms |
|---|---|
| *jalamari*, sp. nov., 26 | |
| *jangga*, sp. nov., 123 | |
| *jubatus* Harold, 95 | = *henleyensis* Blackburn |
| *koebelei* Blackburn, 134 | |
| *kokereka*, sp. nov., 113 | |
| *kumbaingeri*, sp. nov., 62 | |
| *lamgalio*, sp. nov., 148 | |
| *laminatus* Macleay, 22 | = *cowleyi* Blackburn |
| | = *palmerstoni* Blackburn |
| *latro* Harold, 82 | |
| *leai* Blackburn, 12 | |
| *leanus* Goidanich, 33 | = *interruptus* Lea |
| *longipes* Paulian, 108 | |
| *macleayi* Blackburn, 152 | |
| *macrocephalus* Kirby, 51 | |
| *mamillatus* Lea, 52 | |
| *manya*, sp. nov., 138 | |
| *margaretensis* Blackburn, 87 | |
| *millamilla*, sp. nov., 131 | |
| *mjobergi* Gillet, 17 | |
| *mniszechi* Harold, 14 | |
| *monteithi*, sp. nov., 117 | |
| *mulgravei* Paulian, 130 | |
| *mundill*, sp. nov., 53 | |
| *murchisoni* Blackburn, 3 | |
| *mutatus* Harold, 124 | = *hirculus* Erichson |
| *muticus* Macleay, 8 | = *kingi* Harold |
| *nammuldi*, sp. nov., 105 | |
| *neboissi* Frey, 2 | |
| *neostenocerus* Goidanich, 42 | = *stenocerus* Lea |
| *nodulifer* Harold, 40 | = *divaricatus* Macleay |
| *nurubuan*, sp. nov., 69 | |
| *ocelliger* Harold, 142 | |
| *ouratita*, sp. nov., 50 | |
| *paluma*, sp. nov., 70 | |
| *parallelicornis* Macleay, 73 | |
| *parrumbal*, sp. nov., 137 | |
| *parvus* Blanchard, 9 | = *inermis* Macleay |
| | = *submuticus* Blackburn |
| *pentacanthus* Harold, 13 | |
| *peramelinus* Lea, 10 | = *postcornutus* Frey |
| *perpilosus* Macleay, 99 | |
| *pexatus* Harold, 106 | |
| *phoenicocerus* Lea, 93 | |
| *picipennis* Hope, 59 | |
| *pillara*, sp. nov., 154 | |
| *planicollis* Harold, 151 | |
| *posticus* Erichson, 128 | = *flavolineatus* Blanchard |
| | = *leechi* Frey |

| Valid Species | Synonyms |
|---|---|
| *prehensilis* Arrow, 6 | |
| *pronus* Erichson, 32 | |
| *propinquus* Macleay, 116 | = *acuticeps* Macleay |
| | = *helmsi* Blackburn |
| *pugnacior* Blackburn, 19 | |
| *pugnax* Harold, 48 | = *opacipennis* Lea |
| *purpureicollis* Macleay, 75 | |
| *quadripustulatus* Fabricius, 112 | = *albertisi* Harold |
| | = *bipustulatus* Fabricius |
| | = *minusculus* Macleay |
| *queenslandicus* Blackburn, 43 | = *fitzroyensis* Blackburn |
| *quinquetuberculatus* Macleay, 18 | |
| *rubescens* Macleay, 133 | = *imponderosus* Lea |
| *rubicundulus* Macleay, 141 | |
| *rubrimaculatus* Macleay, 158 | = *decurio* Lansberge |
| | = *emarginatus* Macleay |
| | = *pseudoemarginatus* Goidanich |
| *rufosignatus* Macleay, 81 | = *kraatzi* Harold |
| *rugosicollis* Gillet, 28 | = *cribricollis* Lea |
| *rupicapra* Waterhouse, 91 | = *granicollis* Lea |
| *salebrosus* Macleay, 24 | |
| *semimetallicus* Lea, 118 | |
| *signaticollis* Frey, 83 | |
| *sloanei* Blackburn, 16 | |
| *solidus* Gillet, 11 | |
| *squalidus* Lea, 107 | |
| *sydneyensis* Blackburn, 125 | = *monticola* Paulian |
| *symbioticus* Arrow, 135 | |
| *tabellicornis* Macleay, 56 | = *hackeri* Paulian |
| *tabellifer* Gillet, 49 | |
| *tamworthi* Blackburn, 100 | |
| *tenebrosus* Harold, 25 | = *rugosus* Kirby |
| *thoreyi* Harold, 72 | = *mastersi* Macleay |
| | = *sutilistriatus* Lea |
| *togeman*, sp. nov., 121 | |
| *tricavicollis* Lea, 29 | = *conspicuoformis* Paulian |
| *tuckonie*, sp. nov., 139 | |
| *turrbal*, sp. nov., 132 | |
| *tweedensis* Blackburn, 71 | |
| *varianus* Lea, 86 | |
| *variolicollis* Lea, 1 | |
| *vermiculatus* Frey, 96 | |
| *victoriensis* Blackburn, 162 | = *jungi* Blackburn |
| *vilis* Harold, 90 | = *microtrichius* Lea |
| *villosus* Macleay, 102 | |
| *wagamen*, sp. nov., 119 | |
| *wakelbura*, sp. nov., 103 | |
| *walteri* Macleay, 80 | |
| *waminda*, sp. nov., 136 | |

| Valid Species | Synonyms |
|---|---|
| *waterhousei* Boucomont & Gillet, 111 | = *nanus* Waterhouse<br>= *subocelliger* Blackburn |
| *wigmungan*, sp. nov., 58 | |
| *wilgi*, sp. nov., 140 | |
| *wombalano*, sp. nov., 153 | |
| *yeyeko*, sp. nov., 147 | |
| *yiryoront*, sp. nov., 89 | |
| *yungaburra*, sp. nov., 126 | |
| *yunkara*, sp. nov., 150 | |

## REFERENCES


Arrow, G. J. (1920).–A peculiar new genus of Australian beetles. *Ann. Mag. nat. Hist.* **6**, 434–7.

Berndt, R. M., and Berndt, C. H. (1964).–"The World of the First Australians." (University of Chicago Press.)

Blackburn, T. (1891).–Further notes on Australian Coleoptera, with descriptions of new genera and species. XI; XII. *Trans. R. Soc. S. Aust.* **15**, 20–74; 207–61.

Blackburn, T. (1892).–Coleoptera [from Elder Exploring Expedition, 1891, collected by R. Helms]. *Trans. R. Soc. S. Aust.* **16**, 16–61.

Blackburn, T. (1895).–Further notes on Australian Coleoptera, with descriptions of new genera and species. *Trans. R. Soc. S. Aust.* **19**, 27–60.

Blackburn, T. (1903).–Further notes on Australian Coleoptera, with descriptions of new genera and species. XXXIII. *Trans. R. Soc. S. Aust.* **27**, 262–306.

Blackburn, T. (1904).–Revision of the Australian Aphodiides, and descriptions of three new species allied to them. *Proc. R. Soc. Vict.* **17**, 145–9.

Blackburn, T. (1906).–Further notes on Australian Coleoptera, with descriptions of new species. XXXVI. *Trans. R. Soc. S. Aust.* **30**, 263–324.

Blackburn, T. (1907).–Further notes on Australian Coleoptera, with descriptions of new genera and species. XXXVII. *Trans. R. Soc. S. Aust.* **31**, 231–99.

Blanchard, C. E. (1853).–"Voyage au Pôle Sud et dans l'Océanie sur les corvettes l'Astrolabe et la Zélée; ....." Zoologie: Descriptions des insectes. Vol. IV.

Boheman, C. H. (1858).–Coleoptera, species novas descripsit. In "Kongliga Svenska Fregatten Eugenies Resa omkring Jorden .....". Vol. II, Zoologi 1, Insecta. [Not seen.]

Boisduval, J. B. A. D. de (1832).–Faune entomologique de l'Océan Pacifique, ..... Deuxième partie, Coléoptères et autres ordres. In "Voyage de Découvertes de l'Astrolabe pendant les Années 1826–1829".

Bornemissza, G. F. (1971*a*).–A new variant of the paracopric nesting type in the Australian dung beetle, *Onthophagus compositus*. *Pedobiologia* **11**, 1–10.

Bornemissza, G. F. (1971*b*).–Mycetophagous breeding in the Australian dung beetle, *Onthophagus dunningi*. *Pedobiologia* **11**, 133–42.

Boucomont, A. (1914).–Les Coprophages de l'Archipel Malais. *Annls Soc. ent. Fr.* **83**, 238–50.

Boucomont, A., and Gillet, J. J. E. (1927).–Scarabaeidae: Coprinae, Termitotroginae. *Coleoptm Cat.* **90**, 208–18.

Calaby, J. H. (1962).–Beetles associated with Australian mammals. *Bull. Aust. Mammal Soc.* **5**, 9–11.

Cartwright, O. L. (1938).–A South African *Onthophagus* found in United States (Coleoptera: Scarabaeidae). *Ent. News* **49**, 114–15.

d'Orbigny, H. (1913).–Synopsis des onthophagides d'Afrique. *Annls Soc. ent. Fr.* **82**, 1–742.

Erichson, W. F. (1842).–Beitrag zur Fauna von Vandiemensland mit besonderer Rucksicht auf die geographische Verbreitung der Insecten. *Arch. Naturgesch.* **8**, 83–287.

Erichson, W. F. (1848).–Coleoptera. 3. In "Naturgeschichte der Insecten Deutschlands". (Nicolaisches Buchhandlung: Berlin.)

Fabricius, J. C. (1775).–"Systema Entomologiae." (Flensburg and Leipzig.)
Fabricius, J. C. (1781).–"Species Insectorum." Vol. 1. (Hamburg and Cologne.)
Frey, G. (1959).–Zwei neue *Onthophagus*–Arten aus dem pazifischen Raum (Col. Copr.). *Ent. Arb. Mus. Georg Frey* **10**, 622–4.
Frey, G. (1962).–Neue *Onthophagus*–Arten (Col. Scarab.). *Ent. Arb. Mus. Georg Frey* **13**, 616–22.
Frey, G. (1963).–Neue Onthophagen (Col. Scarab.) aus Australien (Queenslandausbeute von H. Demarz) und aus Afrika. *Ent. Arb. Mus. Georg Frey* **14**, 538–49.
Frey, G. (1970).–Neue australische Coprinae (Scarab., Col.). *Ent. Arb. Mus. Georg Frey* **21**, 150–3.
Fuller, M. E. (1934).–The insect inhabitants of carrion, a study in animal ecology. Bull. Commonw. Scient. Ind. Res. No. 82.
Gillet, J. J. E. (1925).–Results of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia, 1910–1913. 40. Scarabaeidae: Geotrupinae et Coprinae. *Ark. Zool.* (*A*) **17**(7), 1–16.
Gillet, J. J. E. (1927).–Descriptions de lamellicornes coprophages nouveaux. *Bull. Annls Soc. r. ent. Belg.* **57**, 251–61.
Goidanich, A. (1926).–Osservazioni sopra il genere *Onthophagus* Latreille. VIII; IX. *Boll. Soc. ent. ital.* **58**, 54–5; 76–7.
Guérin-Ménéville, F. E. (1830–1832).–"Voyage autour du monde sur ..... La Coquille", Zool. ii, 2, Div. 1, chap. xiii, Insectes. pp. 57–302. (Pls. 1830–1832, text 1838).
Halffter, G., and Matthews, E. G. (1966).–The natural history of dung beetles of the subfamily Scarabaeinae. *Folia ent. Mex.* Nos. 12–14.
Harold, E. von (1859).–Beiträge zur Kenntniss einiger coprophagen Lamellicornien. *Berl. ent. Z.* **3**, 193–224.
Harold, E. von (1867).–Beiträge zur Kenntniss der Gattung *Onthophagus*. *Col. Hefte* **2**, 23–59.
Harold, E. von (1868*a*).–Diagnosen neuer Coprophagen. *Col. Hefte* **3**, 80–6.
Harold, E. von (1868*b*).–Scarabaeidae. In Gemminger, B., and Harold, E. von. *Coleopt. Cat.* vol. 3, pp. 753–1346 (Munich.)
Harold, E. von (1869).–Tabula synoptica specierum generis *Onthophagus* ex Australia. *Col. Hefte* **5**, 78–87.
Harold, E. von (1871).–Diagnosen neuer Coprophagen. *Col. Hefte* **8**, 114–6.
Harold, E. von (1875).–Miscellen. *Col. Hefte* **14**, 208–12.
Harold, E. von (1877).–Enumération des lamellicornes coprophages rapportés de L'Archipel Malais, de la Nouvelle Guinée, et de l'Australie boréale par MM. J. Doria, O. Beccari, et L. M. D'Albertis. *Ann. Mus. civ. Stor. nat. Giacomo Doria* **10**, 38–110.
Harold, E. von (1880).–Einige neue Onthophagen. *Dt. ent. Z.* **24**, 349–52.
Harold, E. von (1886).–Coprophage Lamellicornien beschrieben von E. v. Harold. *Berl. ent. Z.* **30**, 147–9.
Hombron, J. B., and Jacquinot, H. (Eds) (1853).–"Voyage au Pôle sud et dans l'Océanie sur les corvettes L'Astrolabe et la Zélée; ....." Zoologie, IV.
Hope, F. W. (1841, 1842).–Observations on the Coleoptera of Port Essington, in Australia, with descriptions of the following new species. *Proc. ent. Soc. Lond.* 1841, 423–30; *Trans. R. ent. Soc. Lond.* iv, *Proc.*, pp. 43–50.
Hope, F. W. (1846, 1847).–Descriptions ..... new Coleoptera, collected by Mr. Fortnum at Adelaide in South Australia. *Proc. ent. Soc. Lond.* 1846, 142–3; *Trans. R. ent. Soc. Lond.* iv, *Proc.*, pp. 280–285.
Howden, H. F., and Cartwright, O. L. (1963).–Scarab beetles of the genus *Onthophagus* Latreille north of Mexico. *Proc. U.S. natn. Mus.* **114**, 1–133.
Hudson, G. V. (1934).–"New Zealand Beetles and their Larvae." (Ferguson and Osborn, Ltd.: Wellington.)
Janssens, A. (1949).–Contribution à l'étude des Coléoptères Lamellicornes. XIV. *Bull. Inst. r. Sci. nat. Belg.* **25**(15), 1–50.
Kirby, W. (1818).–A century of insects, including several new genera described from his cabinet. *Trans. Linn. Soc. Lond.* **12**, 375–453.
Lacordaire, T. (1856).–"Genera des Coléoptères." Vol. 3. (Librairie Encyclopédique de Roret: Paris.)
Lansberge, J. W. van (1885).–Descriptions d'espèces nouvelles de Coléoptères appartenant au Musée Civique de Gênes. *Ann. Mus. civ. Stor. nat. Giacomo Doria* **22**, 375–400.

Latreille, P. A. (1802).–"Histoire naturelle, générale, et particulière des crustacées et des insectes." Vol. 3. (Paris.)

Lea, A. M. (1923).–Australian dung beetles of the subfamily Coprides. *Rec. S. Aust. Mus.* **2**, 353–96.

Lea, A. M. (1924).–On some Australian Scarabaeidae (Coleoptera). *Proc. Linn. Soc. N.S.W.* **49**, 283–213.

Macleay, W. (1864).–Descriptions of new genera and species of Coleoptera from Port Denison. *Trans. ent. Soc. N.S.W.* **1**, 106–30.

Macleay, W. (1871).–Notes on a collection of insects from Gayndah. *Trans. ent. Soc. N.S.W.* **2**, 79–205.

Macleay, W. (1887).–The insects of the Cairns District, northern Queensland. *Proc. Linn. Soc. N.S.W.* **2**, 220–5.

Macleay, W. (1888).–The insects of King's Sound and its vicinity, II. The lamellicornes. *Proc. Linn. Soc. N.S.W.* **3**, 897–904.

Masters, G. (1886).–Catalogue of the described Coleoptera of Australia. *Proc. Linn. Soc. N.S.W.* **1**, 1–126.

Olivier, G. A. (1789).–"Entomologie, ou histoire naturelle des insectes ..... Coléoptères." Vol. 1. (Paris.) [Not seen.]

Paulian, R. (1937).–Sur quelques nouveaux onthophagides africains et australiens. *Arb. morph. taxon. Ent. Berl.* **4**, 336–46.

Paulian, R. (1960).–"Faune de Madagascar. XI. Insectes Coléoptères Scarabaeides. Scarabaeina et Onthophagini." (Institut de Recherche Scientifique: Tananarive.)

Redtenbacher, L. (1868).–"Reise der österreichischen Fregatte Novara um die Erde." Zoologischer Theil Bd. II, Coleoptera. (Vienna.) [Not seen.]

Reed, A. H., and Reed, A. W. (1965).–"Aboriginal Words of Australia." (A. H. and A. W. Reed: Sydney.)

Roberts, F. H. S. (1931).–The occurrence of a beetle (*Onthophagus granulatus* Bohem.) in the stomach of domesticated animals. *Qd agric. J.* **35**, 171.

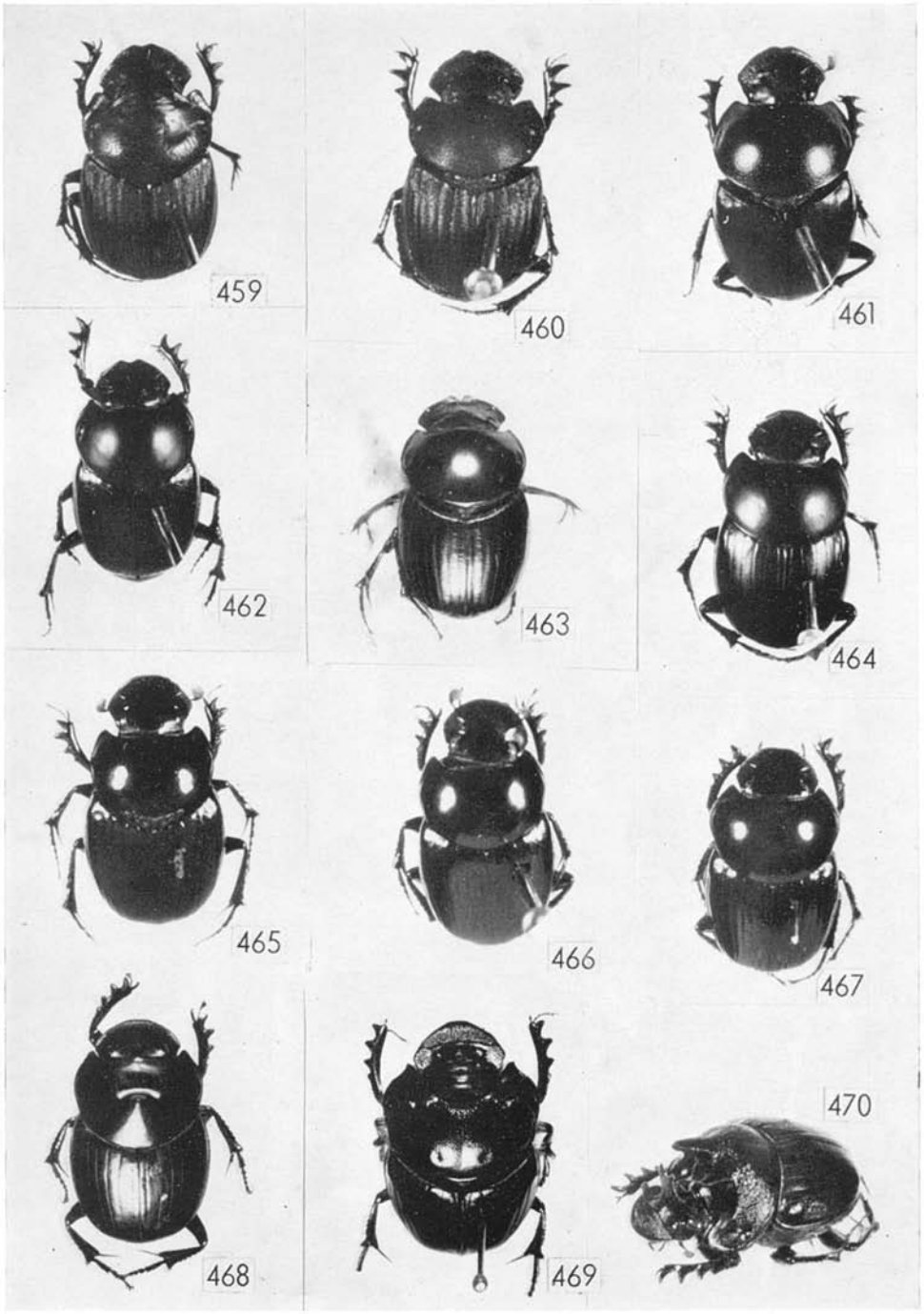
Shipp, J. W. (1895).–Notes on *Onthophagus* Latr., with corrections of nomenclature, and a description of a new genus. *Entomologist* **28**, 171–9.

Snowball, G. J. (1944).–A consideration of the insect population associated with cow dung at Crawley, W.A. *J. Proc. R. Soc. West. Aust.* **28**, 219–44.

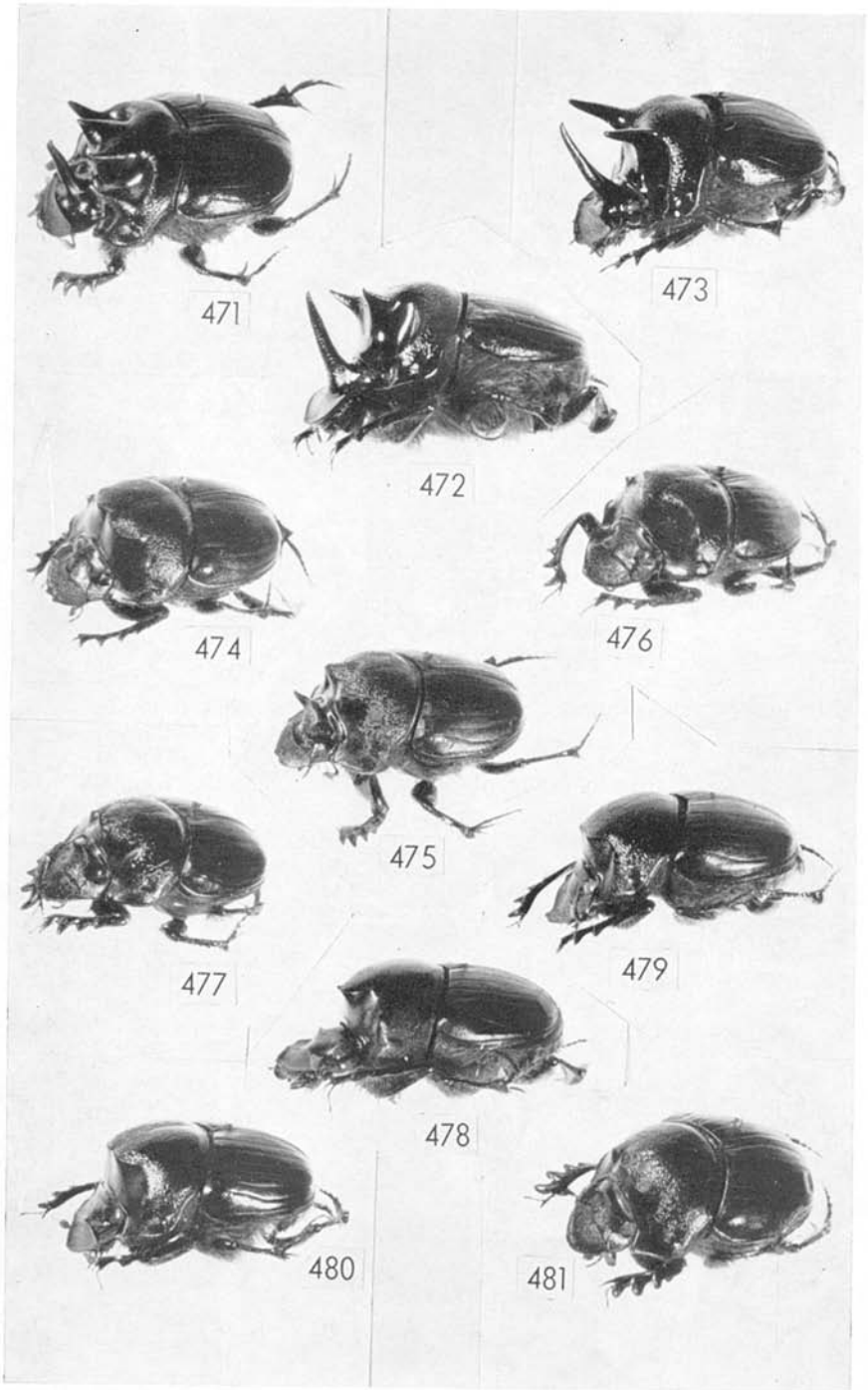
Sturm, J. (1843).–"Catalog der Käfersammlung von J. Sturm." (Author: Nürnberg.) [Not seen.]

Waterhouse, C. O. (1894).–Scarabaeidae in the British Museum – a sixth contribution. *Ann. Mag. nat. Hist.* **14**, 9–12.

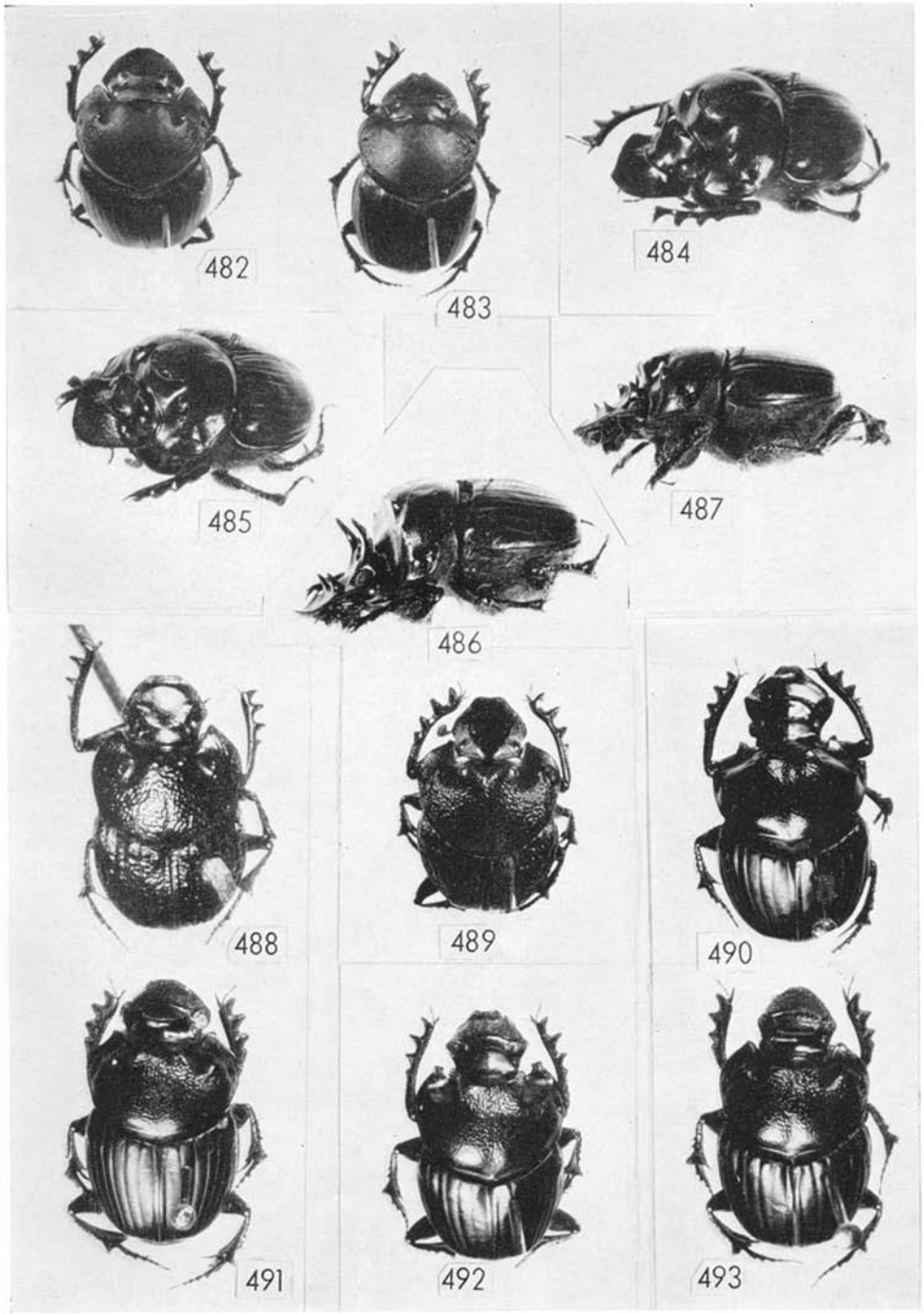
Watt, W. S. (1960).–"Climatological Atlas of Australia." (Bureau of Meteorology: Melbourne.)



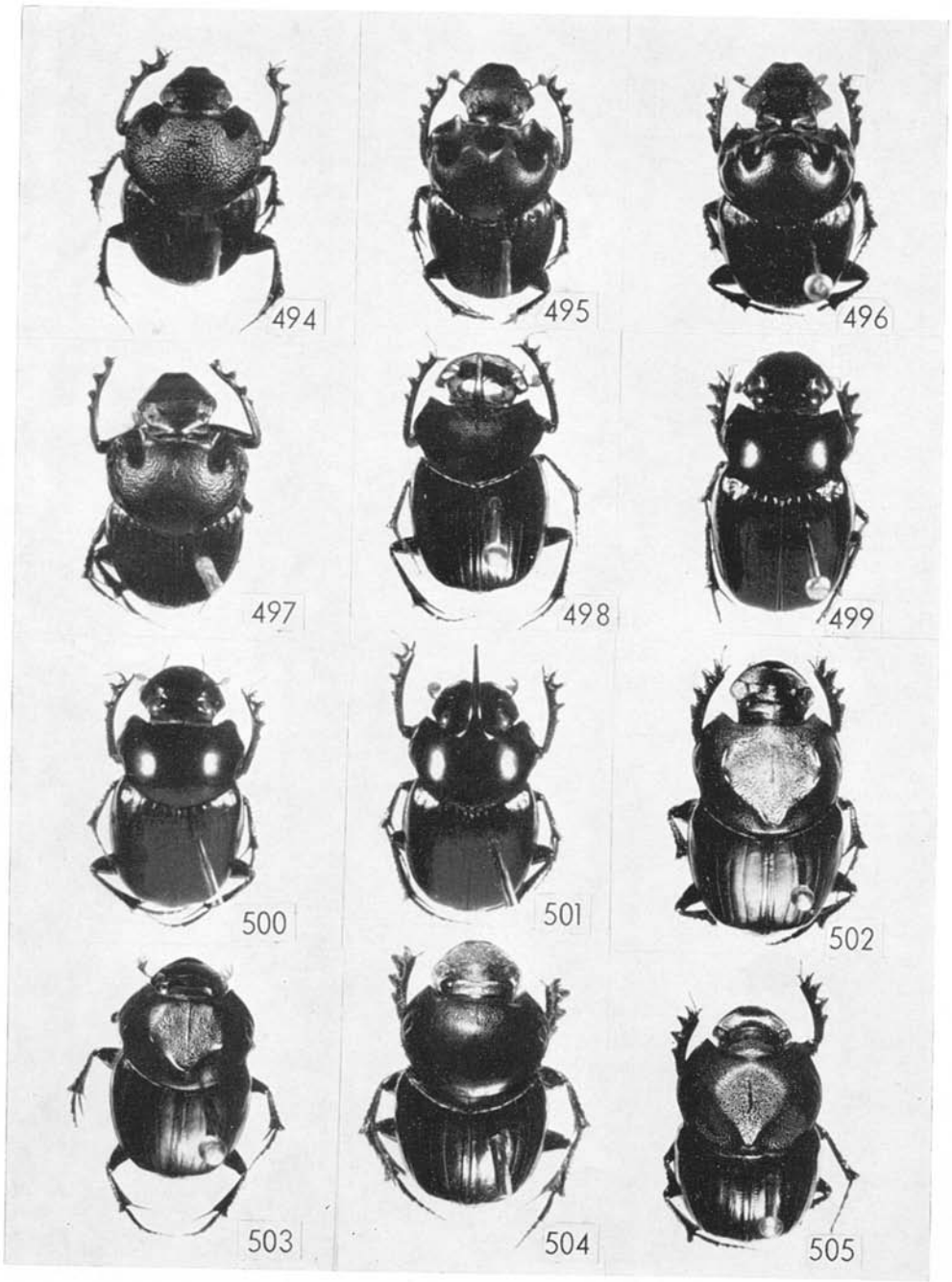

Figs. 459–470.—*Onthophagus* spp.: *459*, *460*, *O. variolicollis:* *459*, male; *460*, female; *461*, *O. neboissi* male; *462*, *O. murchisoni* male; *463*, *O. carmodensis* female; *464*, *O. glabratus* male; *465*, *O. chepara* male; *466*, *O. muticus* male; *467*, *O. parvus* male; *468*, *O. peramelinus* male; *469*, *O. solidus* male; *470*, *O. leai* male.



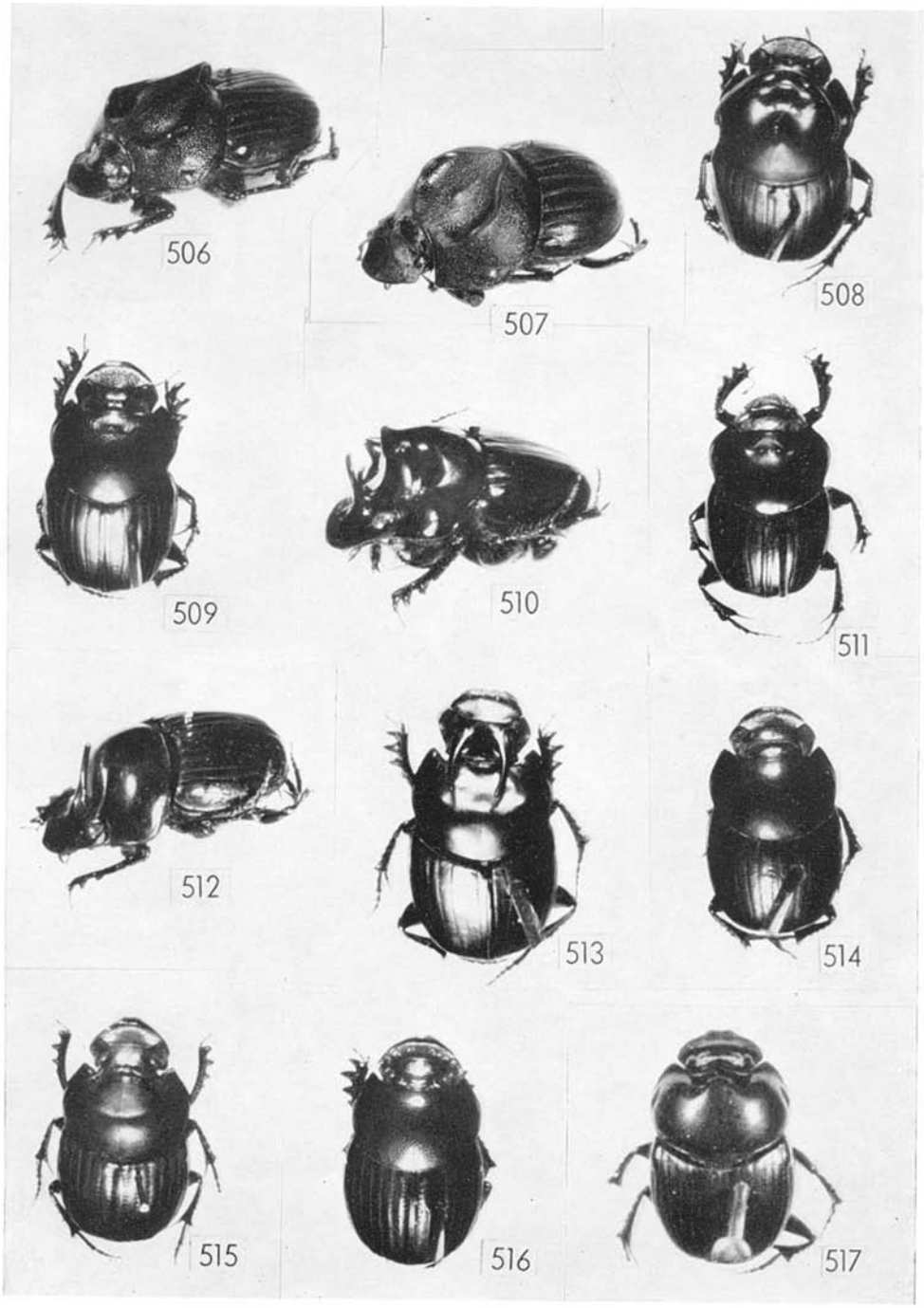

Figs. 471–481.—*Onthophagus* spp.: *471*, *O. pentacanthus* male; *472*, *O. mniszechi* male; *473*, *O. ferox* male; *474*, *475*, *O. sloanei*: *474*, male; *475*, female; *476*, *477*, *O. mjobergi*: *476*, male; *477*, female; *478*, *O. quinquetuberculatus* male; *479*, *O. pugnacior* male; *480*, *481*, *O. atrox*: *480*, male; *481*, female.



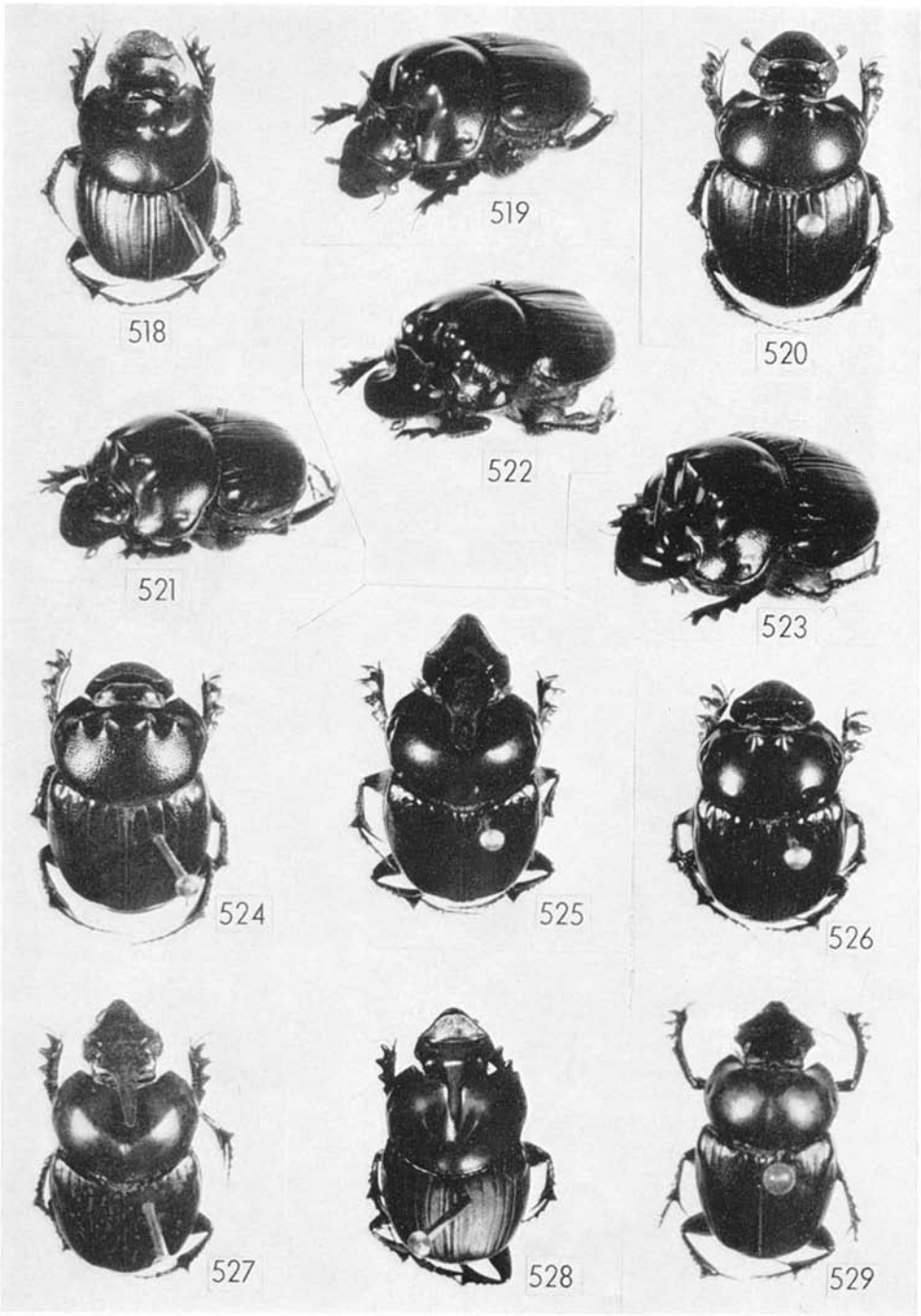

Figs. 482–493.—*Onthophagus* spp.: *482*, *483*, *O. capitosus*: *482*, male; *483*, female; *484*, *485*, *O. laminatus*: *484*, male; *485*, female; *486*, *487*, *O. demarzi*: *486*, male; *487*, female; *488*, *O. salebrosus* male; *489*, *O. tenebrosus* male; *490*, *491*, *O. jalamari*: *490*, male; *491*, female; *492*, *493*, *O. fissiceps*: *492*, male; *493*, female.



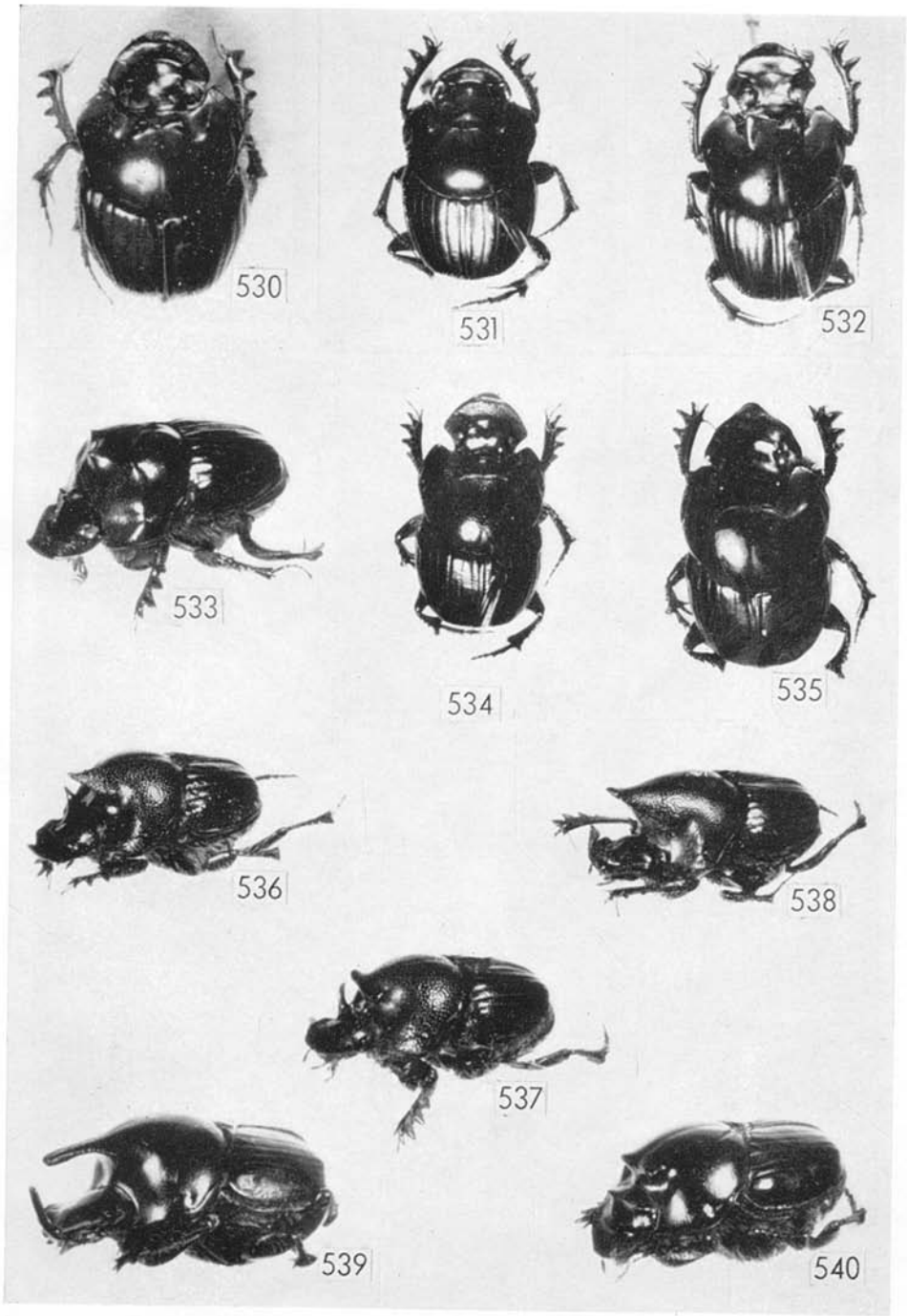

Figs. 494–505.—*Onthophagus* spp.: *494*, *O. rugosicollis* male; *495*, *O. tricavicollis*, male; *496*, *O. conspicuus* male; *497*, *O. bicavicollis* male; *498*, *499*, *O. pronus*: *498*, male; *499*, female; *500*, *O. leanus* male; *501*, *O. bornemisszanus* male; *502*, *O. declivis* male; *503*, *504*, *O. desectus*: *503*, male; *504*, female; *505*, *O. alquirta* male.



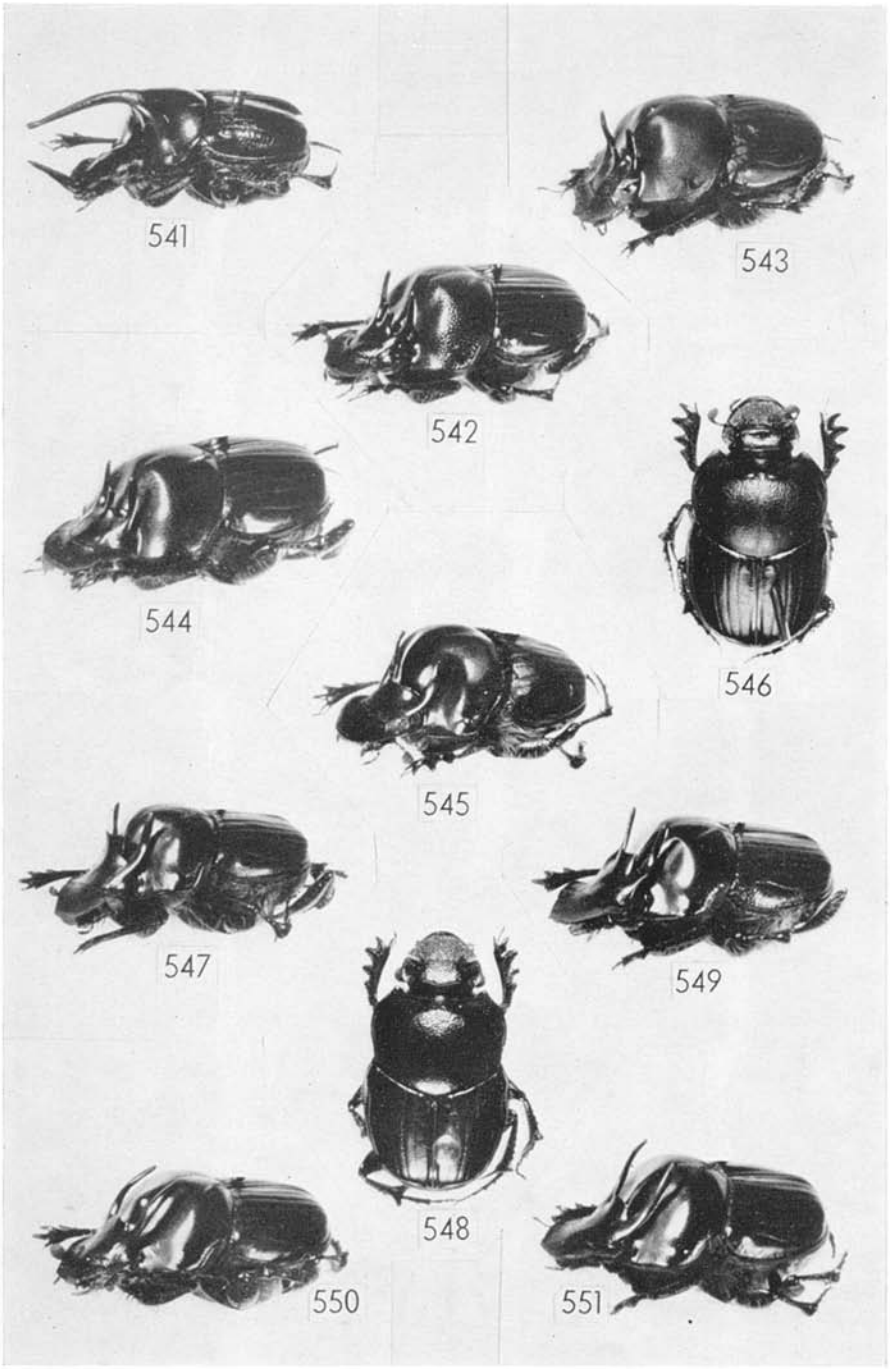

Figs. 506–517.—*Onthophagus* spp.: *506*, *O. devexus* male; *507*, *O. apterus* male holotype; *508*, *509*, *O. nodulifer*: *508*, male; *509*, female; *510*, *511*, *O. dicranocerus*: *510*, male; *511*, female; *512*, *O. neostenocerus* male; *513*, *514*, *O. queenslandicus*: *513*, male; *514*, female; *515*, *516*, *O. comperei*: *515*, male; *516*, female; *517*, *O. ferrari* male.



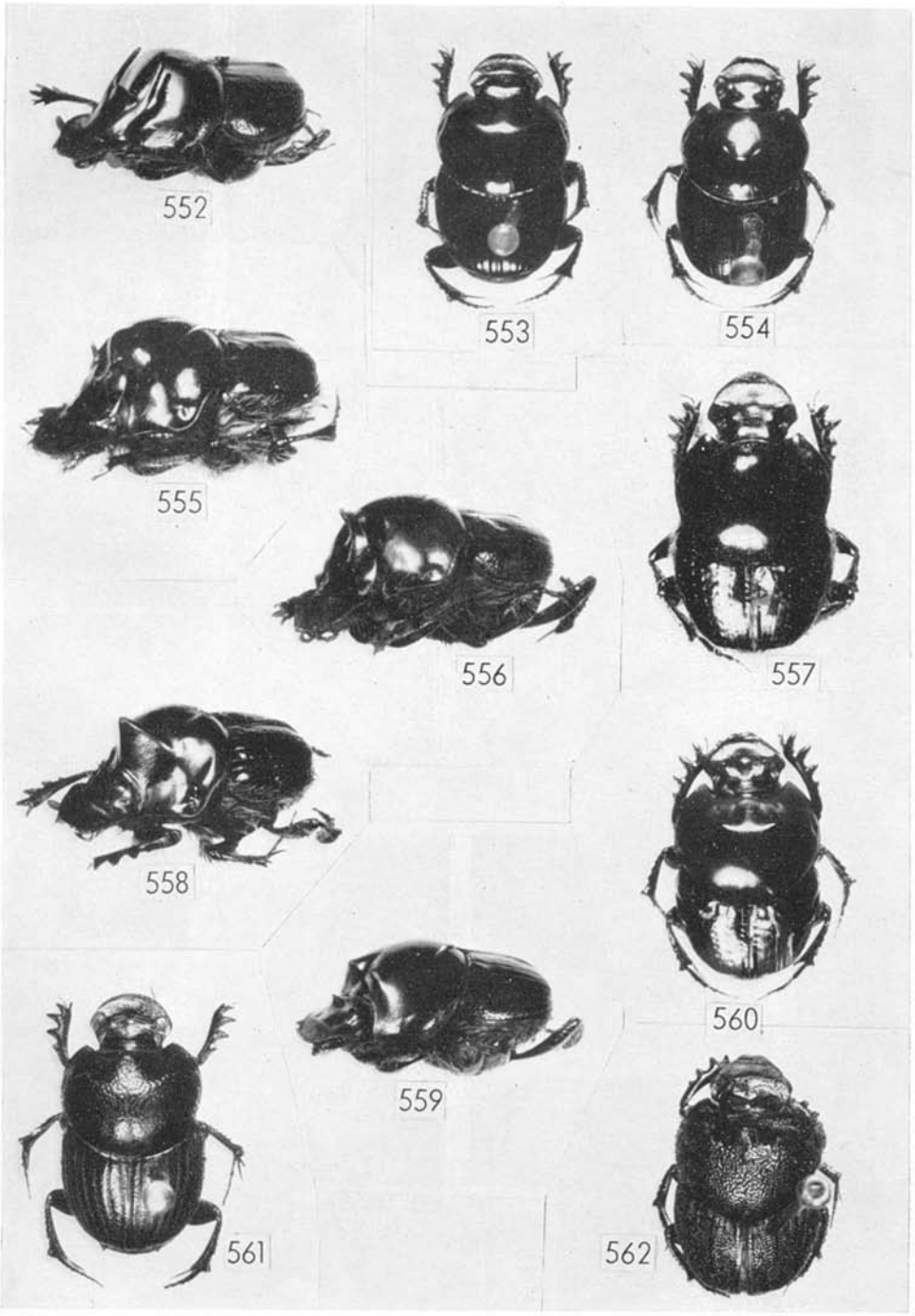

Figs. 518–529.—*Onthophagus* spp.: *518*, *O. capelliformis* male; *519*, *520*, *O. capella*: *519*, male; *520*, female; *521*, *O. pugnax* male; *522*, *O. tabellifer* male; *523*, *524*, *O. ouratita*: *523*, male; *524*, female; *525*, *526*, *O. macrocephalus*: *525*, male; *526*, female; *527*, *O. mamillatus* male; *528*, *O. mundill* male; *529*, *O. darlingtoni* male.



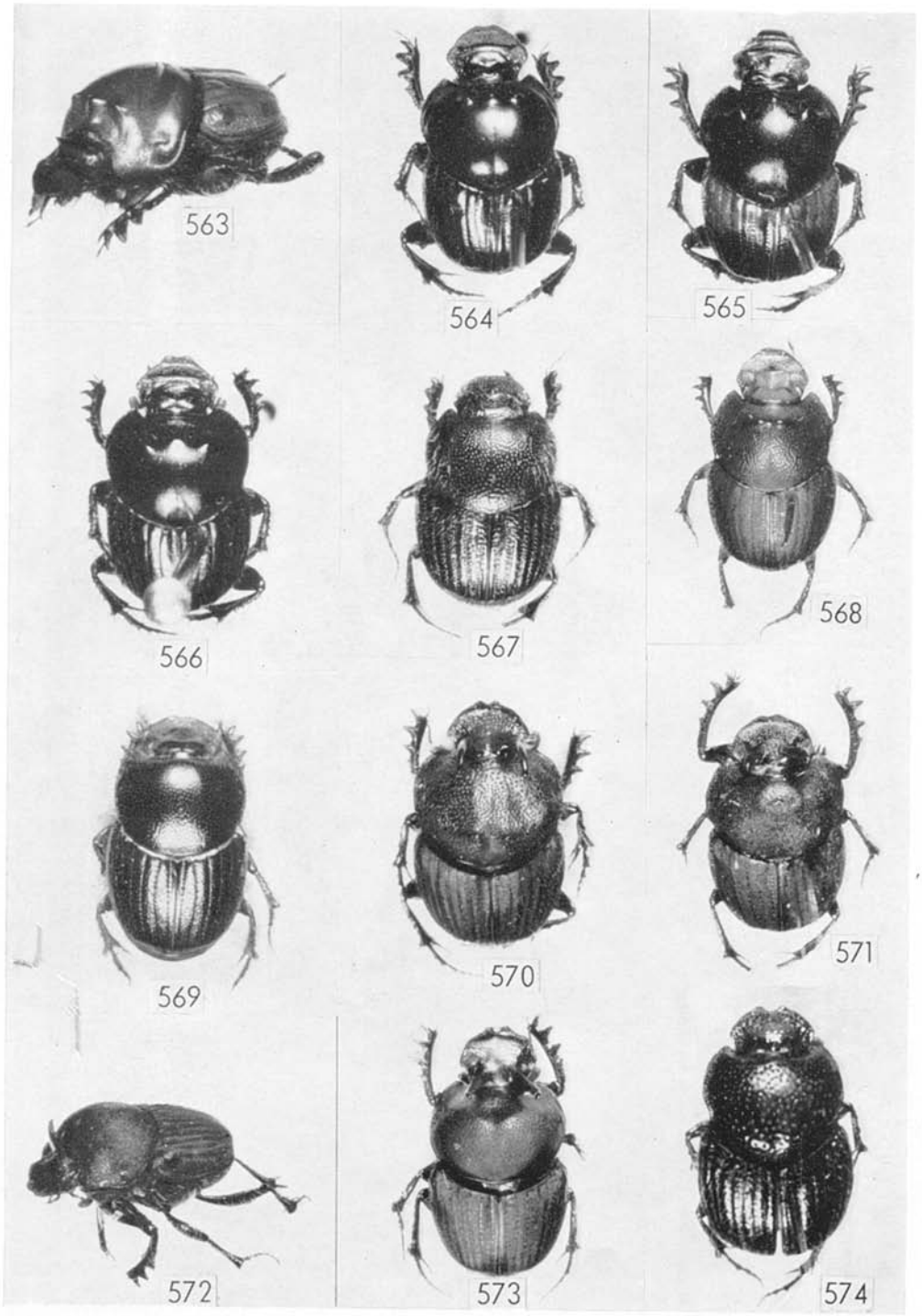

Figs. 530–540.—*Onthophagus* spp.: *530*, *O. bicornis* male; *531*, *O. tabellicornis* male; *532*, *O. erichsoni* male; *533*, *O. wigmungan* male; *534*, *O. picipennis* male; *535*, *O. capellinus* male; *536*, *537*, *O. anchommatus*: *536*, male; *537*, female; *538*, *O. kumbaingeri* male; *539*, *540*, *O. dunningi*: *539*, male; *540*, female.



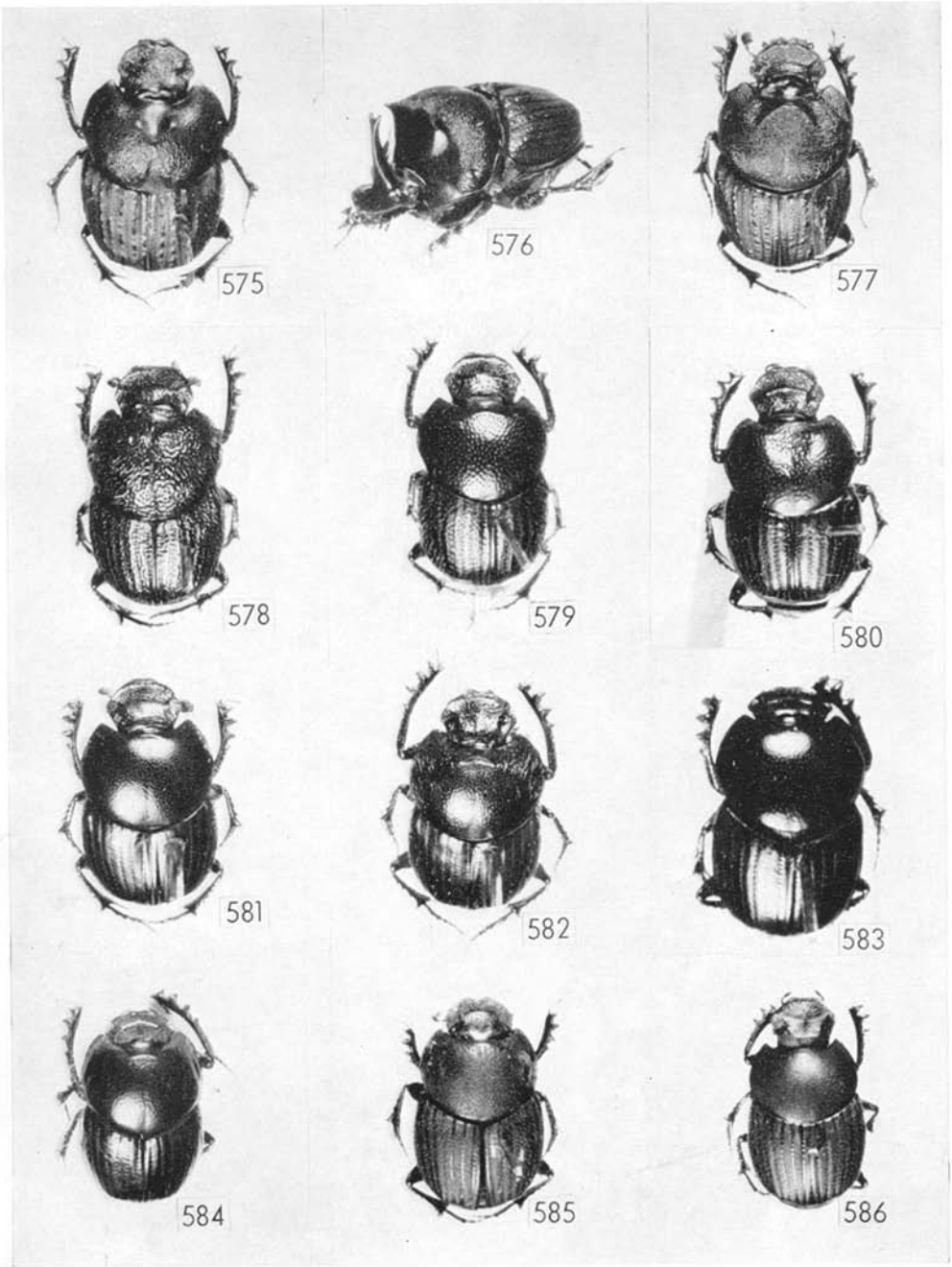

Figs. 541–551.—*Onthophagus* spp.: *541*, *O. brooksi* male; *542*, *O. hoplocerus* male; *543*, *O. fuliginosus* male; *544*, *O. anisocerus* male; *545*, *546*, *O. australis*: *545*, male; *546*, female; *547*, *548*, *O. nurubuan*: *547*, male; *548*, female; *549*, *O. paluma* male; *550*, *O. tweedensis* male; *551*, *O. thoreyi* male.



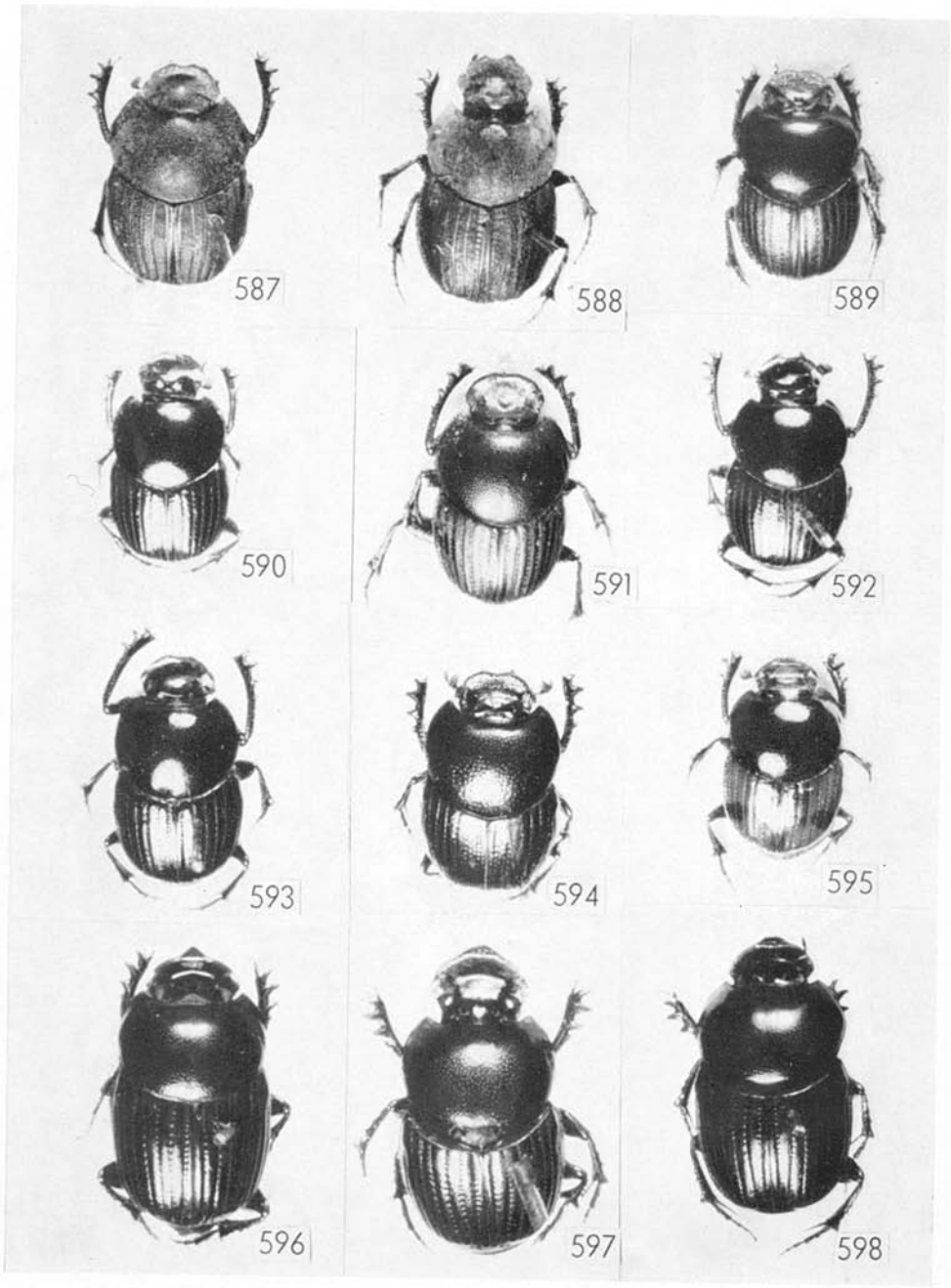

Figs. 552–562.—*Onthophagus* spp., males; *552*, *O. parallelicornis*; *553*, *O. discolor*; *554*, *O. purpureicollis*; *555*, *O. auritus*; *556*, *O. furcaticeps*; *557*, *O. cuniculus*; *558*, *O. dandalu*; *559*, *O. walteri*; *560*, *O. rufosignatus*; *561*, *O. latro*; *562*, *O. signaticollis*.



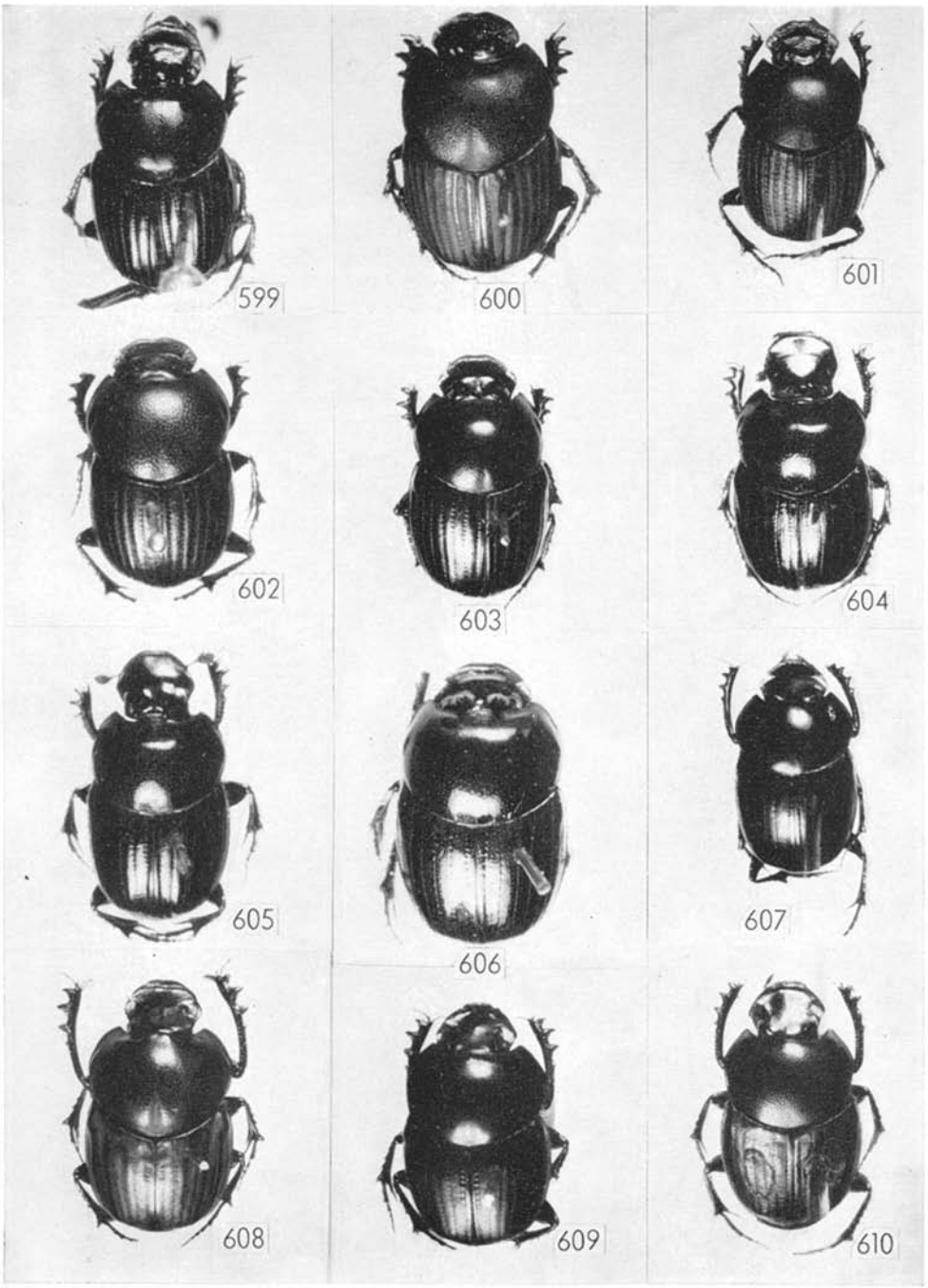

Figs. 563–574.—*Onthophagus* spp., males: *563*, *O. endota*; *564*, *O. bambra*; *565*, *O. varianus*; *566*, *O. margaretensis*; *567*, *O. geelongensis*; *568*, *O. yiryoront*; *569*, *O. vilis*; *570*, *O. rupicapra*; *571*, *O. adelaidae*; *572*, *O. phoenicocerus*; *573*, *O. duboulayi*; *574*, *O. jubatus*.



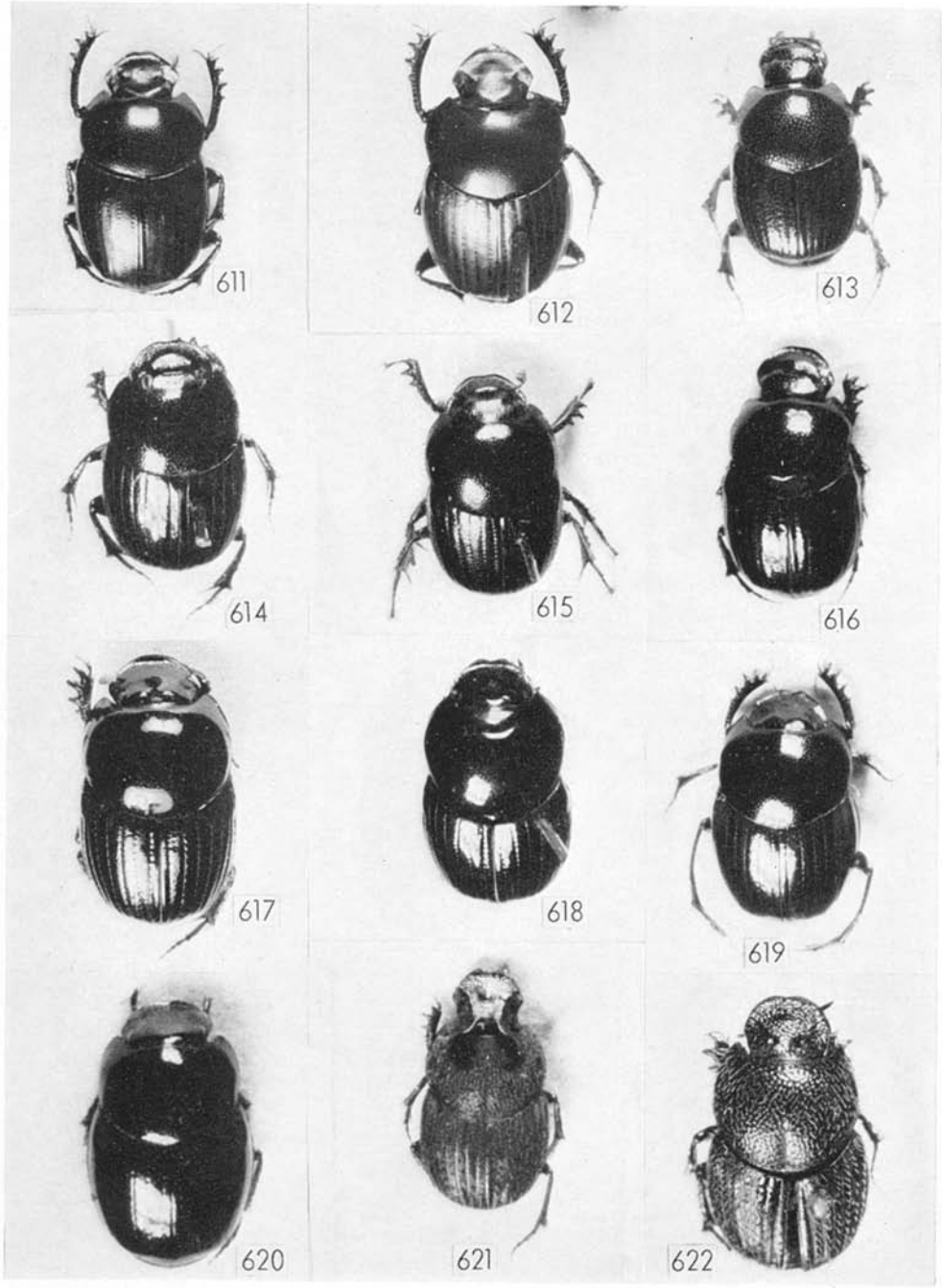

Figs. 575–586.—*Onthophagus* spp.: *575*, *O. vermiculatus* male; *576*, *577*, *O. haagi:* *576*, male; *577*, female; *578*, *O. incanus* male; *579*, *O. perpilosus* male; *580*, *O. tamworthi* male; *581*, *O. gangulu* male; *582*, *O. villosus* male; *583*, *O. wakelbura* male; *584*, *O. fletcheri* male; *585*, *O. nammuldi* male; *586*, *O. pexatus* male.



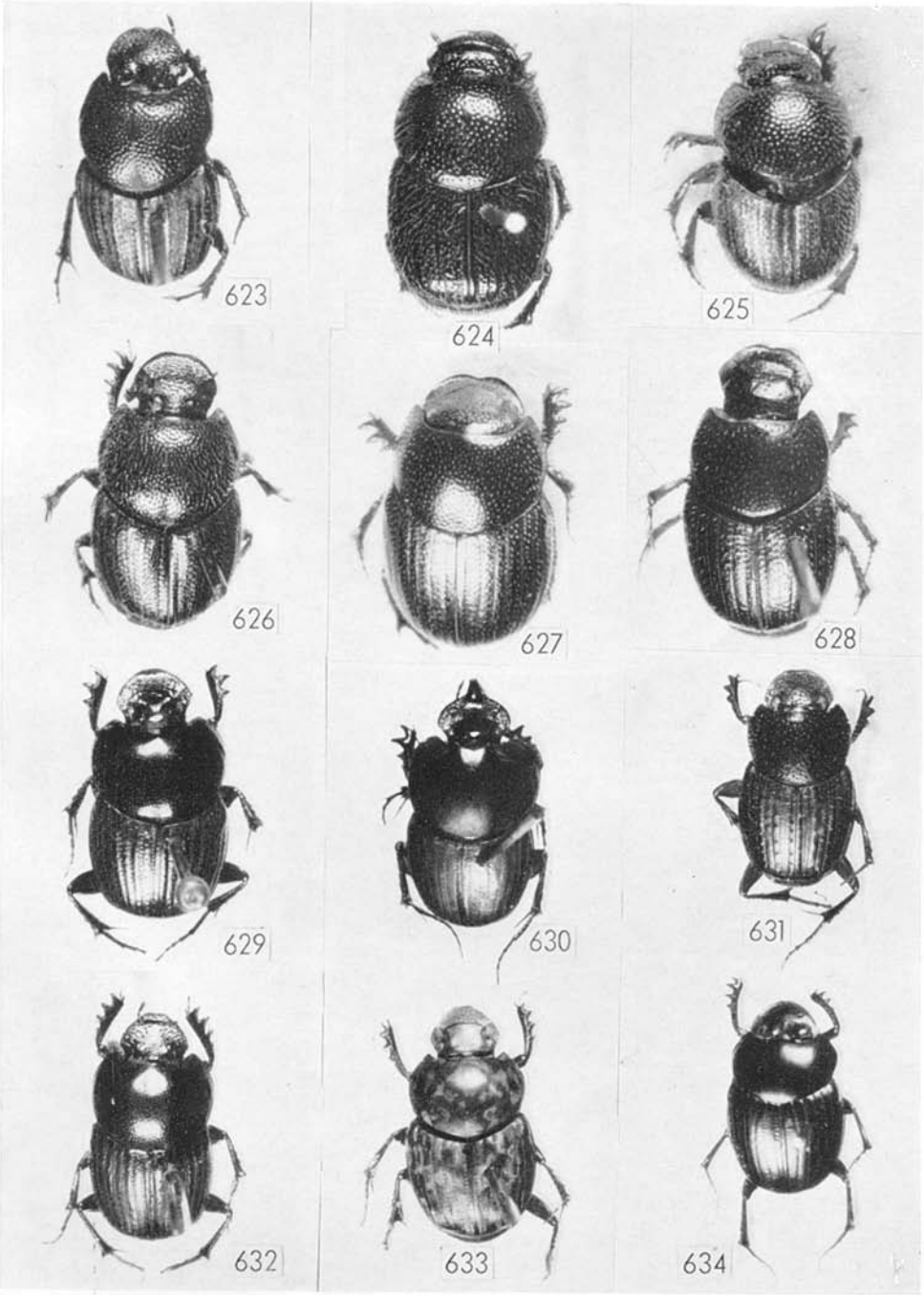

Figs. 587–598.—*Onthophagus* spp., males: *587*, *O. squalidus*; *588*, *O. longipes*; *589*, *O. evanidus*; *590*, *O. fabricii*; *591*, *O. waterhousei*; *592*, *O. quadripustulatus*; *593*, *O. kokereka*; *594*, *O. blackburni*; *595*, *O. cruciger*; *596*, *O. propinquus*; *597*, *O. monteithi*; *598*, *O. semimetallicus*.



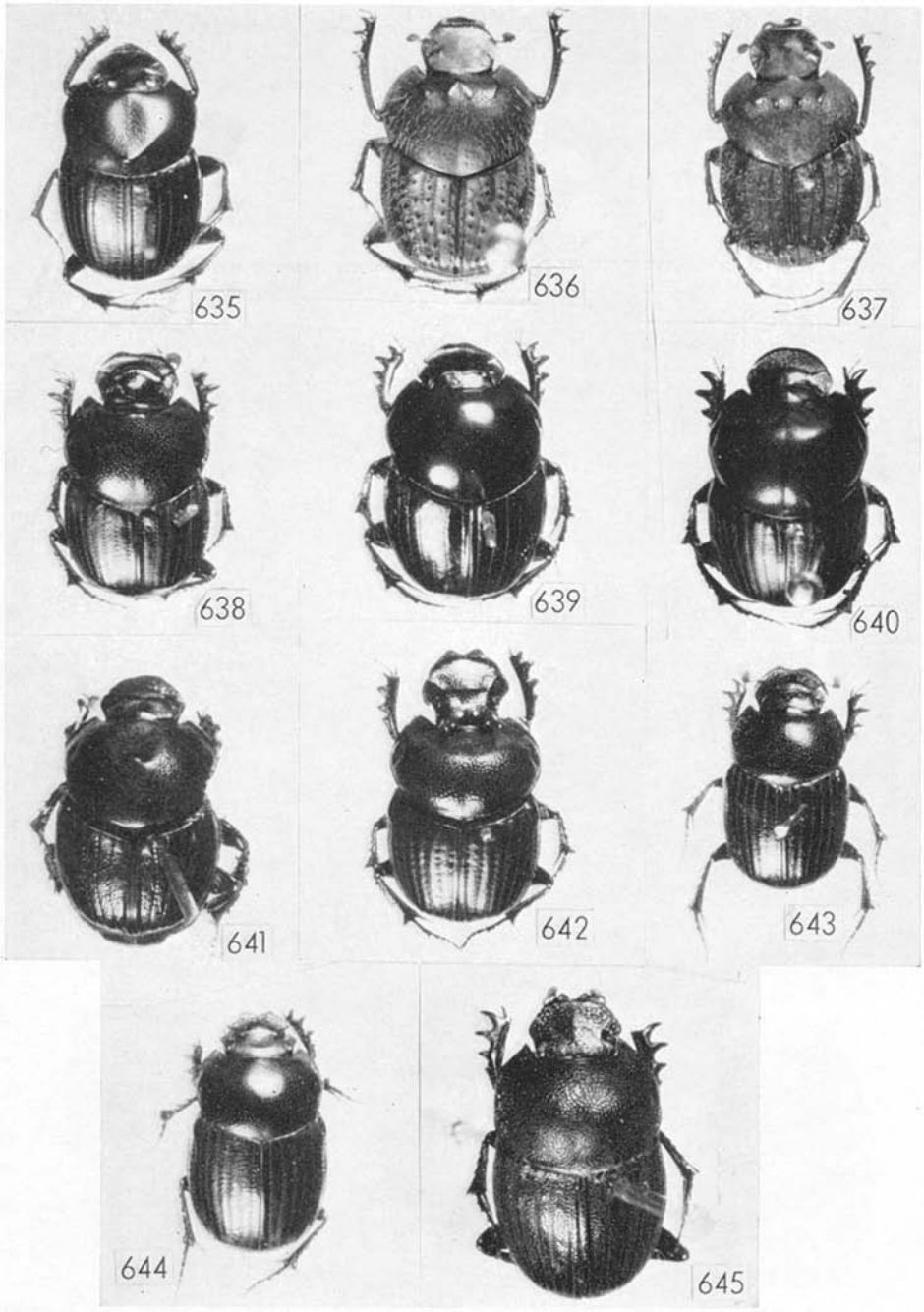

Figs. 599–610.—*Onthophagus* spp., males: *599*, *O. wagemen*; *600*, *O. compositus*; *601*, *O. togeman*; *602*, *O. frenchi*; *603*, *O. jangga*; *604*, *O. mutatus*; *605*, *O. sydneyensis*; *606*, *O. yungaburra*; *607*, *O. arrilla*; *608*, *O. posticus*; *609*, *O. incornutus*; *610*, *O. mulgravei*.




Figs. 611–622.—*Onthophagus* spp., males: *611*, *O. millamilla*; *612*, *O. turrbal*; *613*, *O. rubescens*; *614*, *O. koebelei*; *615*, *O. symbioticus*; *616*, *O. waminda*; *617*, *O. parrumbal*; *618*, *O. manya*; *619*, *O. tuckonie*; *620*, *O. wilgi*; *621*, *O. rubicundulus*; *622*, *O. ocelliger*.




Figs. 623–634.—*Onthophagus* spp.: *623*, *O. asper* male; *624*, *O. bicarinaticeps* male; *625*, *O. gidju* male; *626*, *O. dummal* male; *627*, *O. yeyeko* male; *628*, *O. lamgalio* male; *629*, *O. clypealis* male; *630*, *O. yunkara* male; *631*, *O. planicollis* female; *632*, *O. macleayi* male; *633*, *O. wombalano* male; *634*, *O. pillara* male.




Figs. 635–645.—*Onthophagus* spp., males: *635*, *O. gulmarri*; *636*, *O. granulatus*; *637*, *O. bornemisszai*; *638*, *O. rubrimaculatus*; *639*, *O. bunamin*; *640*, *O. consentaneus*; *641*, *O. gandju*; *642*, *O. victoriensis*; *643*, *O. blackwoodensis*; *644*, *O. flavoapicalis*; *645*, *O. depressus*.