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The African rhinoceros beetle *Temnorhynchus retusus* (Fabricius) established in eastern Australia (Coleoptera: Scarabaeidae: Dynastinae)

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Abstract The Afrotropical rhinoceros beetle *Temnorhynchus retusus* has been found from 1984 in New South Wales and is considered to be established in eastern Australia. Its establishment was likely supported by the exotic vegetation in the urban environment.

Key words Australia, establishment, exotic insects, rhinoceros beetle, Scarabaeidae.

INTRODUCTION

Many exotic plant and animal species have been established in Australia (New 1994), and invasions and accidental or planned introductions still continue. Among the scarab beetles (Coleoptera: Scarabaeoidea), we find impressive examples of successful introductions with many dung beetle and some rhinoceros beetle species from other continents establishing well in Australia (Carne 1957; Tyndale-Biscoe 1990).

Allsopp (1987) reported an additional introduction based on two specimens of the Afrotropical rhinoceros beetle *Temnorhynchus retusus* (Fabricius, 1781) (Scarabaeidae: Dynastinae: Pentodontini) being found at Albany, Western Australia, in 1985. This species is widely distributed in southern Africa (South Africa, Namibia, Lesotho), with a few records of single specimens from Tanzania, Ethiopia and Sudan (Krell 1993). No further records from Australia are known. Here, we give new Australian records of *T. retusus* and discuss its possible establishment in Australia.

MATERIALS AND METHODS

Specimens deposited in the following collections were studied: Australian National Insect Collection (ANIC), Canberra, Australia; collection of Dr Frank-Thorsten Krell (FTKC), Würzburg, Germany; collection of Dr George Hangay (GHIC), Narrabeen, Australia; Museo Zoologico 'La Specola' (MZUF), Firenze, Italy.

RESULTS

The following specimens of *T. retusus* from Australia were found in the collections: Australia, New South Wales: Gondola Road, Narrabeen (33.42S, 151.18E), collected by G. Hangay: 1 ♂ (destroyed), 20.i.1984 (FTKC); 2♀♀, 25.ix.1987 (ANIC, FTKC); 1♀, 16.x.1989, mercury-vapour light (MZUF, 'Mag 1091'); 1♀, 26.ii.1990 (FTKC); 1♀, 30.x.1996 (FTKC); 1♂ (destroyed), 31.x.1996 (FTKC); 1♂, 1 remnant, 4.xii.1996 (GHIC); 1♂, 30.viii.1997 (GHIC); 1♀, 31.viii.1997 (GHIC); 2♀♀, 2.ix.1997 (GHIC); 1♂, 2.i.1998 UV black-light fluorescent (GHIC); 1♂, near Batemans Bay, SW of Sydney (35.43S, 150.11E), 20.ii.1987, G. Hangay (ANIC).

All of these specimens are large (16–20.3 mm). Most of the African specimens we have seen are smaller; within South African populations the average body length appears not to usually be more than 16 mm.

The beetles in Narrabeen were always collected in the same area (in Gondola Road, Fig. 1) on or near the grassy nature strips and in the early hours of the day. Despite extensive efforts, no specimens were found outside this area, except one in Batemans Bay. Only two specimens were attracted by mercury vapour light or black-light fluorescent operated frequently at 80 Gondola Road during spring and summer nights from 1973 until present. This is in accordance with Krell's observation that specimens of South African populations are only weakly attracted to light.

The environment where the Narrabeen beetles were collected is that of a typical Sydney North-Shore suburb with cultivated gardens and watered lawns. The majority of the ornamental plants of the area are exotics, several of them of African origin. The lawns are mainly Kikuyu grass (*Pennisetum clandestinum* Hochst. ex Chiov.), couch (*Clandestinum dactylon* (L.) Pers.), buffalo grass (*Stenotaphrum secundatum* (Walter) Kuntze), and Durban grass (*Dactyloctenium australiae* Steud.). These grasses are probably of African origin, although buffalo grass inhabits most of the Southern Hemisphere

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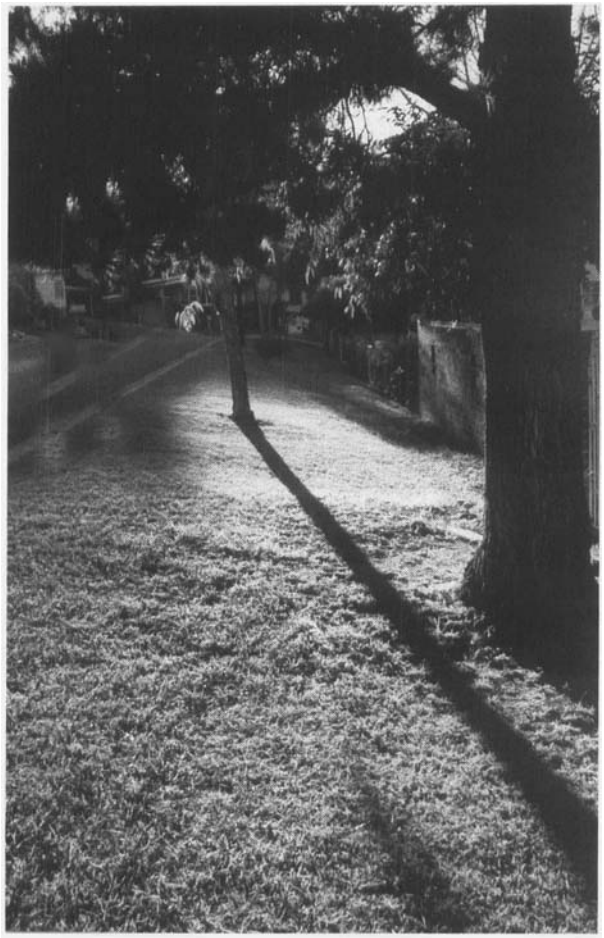

Fig. 1. Collection site of *Temnorhynchus retusus* at Gondola Road, Narrabeen, in 1997.

and the origin of couch is somewhat obscure by now, being a very widely spread cosmopolitan (S. Jacobs, pers. comm.). The Batemans Bay specimen was also collected in a suburban environment with ornamental gardens and watered lawns, not unlike the Narrabeen environment.

The insects always appeared sluggish, mostly immobile and two specimens were severely damaged by birds (Australian magpie, *Gymnorhina tibicen* Latham, and Indian myna, *Acridotheres tristis* (L.)). Numbers of these birds can be observed in the area on most mornings as they regularly feed on the common dynastine beetles *Cyclocephala signaticollis* Burmeister and *Heteronychus arator* (Fabricius), both introduced species (Carne 1957), as well as other insects.

Temnorhynchus retusus has only been previously found in Australia at Albany, Western Australia (Allsopp 1987), so the specimens we saw constitute a new record for New South Wales. Both Albany and Narrabeen/Batemans Bay are situated in the Bassian province, the southern temperate regions of Australia (New 1994).

DISCUSSION

Given the activities of insectivorous birds and that adults are not attracted to lights, we presume that *T. retusus* is more common in the Narrabeen area than is indicated by the captures. Since we know of it in the Narrabeen area from 1984, we presume that *T. retusus* is now well established in Australia and that more specimens will be taken as coleopterists become aware of its presence.

Temnorhynchus spp. feed on grasses (Krell 1993). Since exotic grasses are common in the gardens of the collecting areas, it is possible that *T. retusus* was introduced to Australia by the transport of rooted plants from Southern Africa. The presence of African grasses likely supported the establishment of *T. retusus*, even if its introduction was not with the importation of the grasses.

In the early 1920s another South African dynastine species, *Heteronychus arator* (F.), was introduced to Australia. Thirty years later, it was distributed throughout the 1500 km coastal area of New South Wales and into south-eastern Queensland, as well as in the regions of Perth and Adelaide (Carne 1957; Allsopp *et al.* 1993). We presume that during the next decades *T. retusus* may also spread, and future recordings should be published to identify its ability to disperse.

Temnorhynchus retusus is an obviously successful invader to Australia. It should, therefore, fit some of the following criteria of good invaders proposed by Ehrlich (1989) for vertebrates and which are certainly applicable to invertebrates as well:

Large native range: if the single records from eastern and north-eastern Africa are indications of autochthonous populations and not incorrect collecting labels (Krell 1993: 298), the range of *T. retusus* is large compared with the ranges of other species of this genus or of Afrotropical Dynastinae. However, as new and reliable collections are lacking from the northern part of Africa, the real range is likely to be restricted to Southern Africa.

Abundant in original range: it is abundant in western South Africa.

Vagile: yes.

Broad diet/short generation times/able to shift between r and K strategy: not known, but other invading dynastines, such as *Heteronychus arator*, have short larval times and an extended adult life (6 months) (Allsopp *et al.* 1993).

Much genetic variability: the phenotypic variability of body length and formation of head and pronotum sculptures within the African population is wide and may indicate a high genetic variability. The small phenotypic variability within the Australian population indicates that it was founded by a small number of individuals.

Gregarious: high numbers are found in some South African locations.

Female able to colonise alone: once mated.

Larger than most relatives: intraspecifically, the Australian specimens are relatively large (see above) indicating either large founder individual(s) or above-average

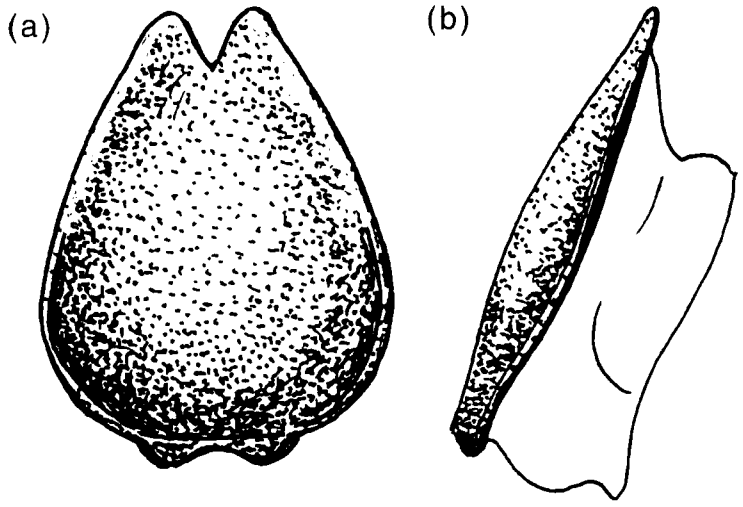

Fig. 2. Epicranial plate of *Temnorhynchus retusus*, male: (a) frontal view; (b) lateral view.

development conditions in Australia. Interspecifically, *T. retusus* is one of the smaller species of the genus.

Associated with *Homo sapiens*: yes, if *H. sapiens* cultivates the food plants of *T. retusus*.

Able to function in a wide range of physical conditions: not known.

In summary, *T. retusus* fits some of the these criteria, and these may explain why its invasion was successful. However, the important stochastic element of invasion dynamics (Lawton & Brown 1986; Simberloff 1989) allows only such an explanation *a posteriori*. It should not be used as corroboration for any predictions on the invasion success of other species which fit the same criteria.

Identification aid

Temnorhynchus Hope is constituted as a monophylum by the following autapomorphies (Krell 1993) which are also useful for recognition: epicranial area is formed as a dorsoventral, flat plate (lamina epicranialis) in both sexes: there is a tendency for divergence of the two mostly sharp dorsal points of the lamina (not in *T. retusus*, Fig. 2); number of apical bristles of hind tibiae is reduced, usually there are no such bristles; the form of the epicranial lamina is characteristic and unique within the Dynastinae (Fig. 2).

Temnorhynchus retusus can be differentiated from other *Temnorhynchus* spp. by a combination of the following characteristics (Krell 1994 gives a key): distance between clypeal denticles larger than distance between one denticle and lateral extension of cranial plate (Fig. 2); ocular canthus without bristles; outer margin of mandibles three-lobate; maxillae with two basal and two apical teeth; bristles on ventral side of parastipes of maxillae very long and dense, surpassing the galea (Krell 1993, fig. 36); anteapical rim of hind tibiae without bristles and without notches; apical spurs of hind tibiae broad, distinctly dilate to apex; apex of the slender paramera strongly diverging (Fig. 3, Allsopp 1987); dark red-brown; body 12–20.3 mm long.

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