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The larva of *Melobasis (Melobasis) vertebralis* Carter *(Coleoptera: Buprestidae)*

by

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Abstract - The larva of *Melobasis vertebralis* Carter is described from material collected during August 1985 from the Brisbane area, south-eastern Queensland, Australia. The larva is compared with the described larvae of the Australian genera *Anilara* and *Neocuris* (subfamily *Buprestinae*) and *Diadoxus* (subfamily *Chalcophorinae*). *Melobasis vertebralis* is finally compared with the described larvae of genera of the extra-Australian tribes *Kisanthobiini*, *Anthaxiini* and *Melanophilini* (subfamily *Buprestinae*).

Riassunto - È descritta la larva del buprestide australiano *Melobasis vertebralis* Carter. Essa viene confrontata con quelle dei generi anch'essi australiani *Anilara* e *Neocuris (Buprestinae)* e *Diadoxus (Chalcophorinae)*, nonché con le larve di generi non australiani appartenenti alle tribù *Kisanthobiini*, *Anthaxiini* e *Melanophilini (Buprestinae)*.

INTRODUCTION

The genus *Melobasis* Laporte & Gory, 1837, is one of the largest taxa of the Australian *Buprestidae*. According to OBENBERGER (1930), it comprises 4 subgenera and 124 species: *Melobasis* s. str. (93 spp.), *Diceropygus* Deyrolle, 1864 (18 spp.), *Paramelobasis* Théry, 1923 (1 sp.) and *Briseis* Kerremans, 1893 (12 spp.). Such generic division is accepted by modern specialists (i.e. BELLAMY, 1985, 1986), although no taxonomic revisions have been published during recent times. Based on OBENBERGER (1930), it is apparent that the majority of species occur in the Australasian region, i.e. Australia (including Tasmania and adjacent islands) (83 spp.), New Guinea and adjacent islands (Rossel, Woodlark and others) (21 spp.), some oceanic islands (Fiji, New Caledonia, Solomon Islands) (7 spp.) and the South-East Asian islands (Aru, Ambon, Misool, Timor, Java, Dili, Borneo, Sumatra and Enggano) (13 spp.). In addition, some species are known from the Oriental region: the island of Penang, Cambodia and eastern India (3 spp.), while one species was recently found in Vietnam by O. N. Kabakov (St. Petersbourg, Russia). It is obvious that *Melobasis* has an Australian origin and that during a later time, some groups have spread through New Guinea and the islands of Indonesia to continental Asia.

Originally *Melobasis* was established as a division within the genus *Buprestis* Linnaeus (LAPORTE & GORY, 1837: Neuvieme Division, *Melobasis*). The genus was later included in the generic group *Anthaxites (Buprestini)* (KERREMANS, 1903; OBENBERGER, 1930) and more recently it was placed in the tribe *Melanophilini* of the subfamily *Buprestinae* (BELLAMY, 1985, 1986). HOLYNSKI (1993) regarded *Melanophilini* as the subtribe *Melanophilina* of the tribe *Anthaxiini (Buprestinae)*. Apart from *Melobasis*, the following genera are currently included within *Melanophilini*: *Melanophila* Eschscholtz, *Phaenops* Dejean, *Xenomelanophila* Sloop, *Chalcogenia* Thomson, *Cromophila* Cobos, as well as the Australian *Torresita* Gemminger & Harold, *Montouziereta* Obenberger and *Theryaxia* Carter (BELLAMY, 1985; COBOS, 1986). The Oriental genus *Exagistus* Deyrolle, which had been included earlier in *Melanophilini*, was recently moved to the tribe *Exagistini* (TOYAMA, 1987). Among *Melanophilini*, *Melobasis* is usually placed adjacent to African

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Fig. A: *Melobasis vertebralis* Carter. Ventral view of mature larva from *Acacia leiocalyx* (Domin) Pedley *(Mimosaceae)* collected at Brisbane, Queensland. Length of larva = 24 mm. (Photo: T. J. Hawkeswood).

Chalcogenia (Obenberger, 1930; Bellamy, 1985; Holynski, 1993).

The larvae of *Melobasis* had remained previously undescribed. *Melobasis (Melobasis) vertebralis* Carter, the larva of which is described below, occurs widely in southern Queensland (Carter, 1923) but has been poorly collected and nothing previously has been recorded on its biology and host plants.

LARVAL DESCRIPTION

Melobasis (Melobasis) vertebralis Carter Figs. 1-15 and A, B

Length of the last instar larva 21.5-27.3 mm; width of the prothorax 4.7-6.4 mm; width of the abdomen 1.4-1.6 mm. The larva (figs. 9, A) is of the usual buprestid type and corresponds to the 1st morpho-ecological type, as described for the *Acmaeoderella* larva (Volkovitsh, 1979). Body of preserved larvae whitish to dirty-cream, with brownish mouthparts, spiracles, asperities of prothoracic plates and, sometimes, prothoracic grooves.

Head and mouthparts. Epistome (fig. 1) narrow, about 4.5 times wider than long; anterior margin rather deeply emarginate between the mandibular condyles which are large; posterior margin slightly bisinuate; epistome with blunt, weakly obtusely angled, nearly rectangular, latero-posterior corners, bearing two groups of 3 tightly clustered epistomal sensillae situated on the upper margin of a very shallow, poorly defined median pit divided by a sclerotized strip in the centre; each group consists of two short trichoid and one campaniform sensillae situated at about the same level (fig. 1). Clypeus (fig. 5) narrow, membranous, glabrous, with anterior margin straight. Labrum (fig. 5) subquadrate, with zones of microspinulae and microsetae on both surfaces externally. Anterior margin weakly emarginate between broadly rounded antero-lateral margins, without lateral lobes and with almost straight sides. Palantine sclerites divided into two branches - one, median internal (fig. 5, mb) and the other, lateral external (fig. 5, lb) -, which lie parallel to each other and to the median longitudinal axis of the labrum; lateral branches more strongly sclerotized than median ones; each median branch bearing dorsally 3 sensillae (median sensillae of labrum) (fig. 5, msl) comprised of one short, apical seta situated anteriorly to the middle of the labrum and not extending to the anterior margin nor the posterior margin of the zone of microsetae; 2 campaniform sensillae, almost at the same level, situated posteriorly to the midline of the labrum: the distance between apical seta and both campaniform sensillae is markedly longer than the distance between the two campaniform sensillae themselves ([1]); another group of setae and sensillae situated on both the external and internal surfaces (antero-lateral sensillae) (fig. 5, alsl) ([2]) comprising 3 sharp setae and one campaniform sensilla externally and one seta near the antero-lateral margin of each side internally; external sensillae arranged as follows on either side: two setae and one campaniform sensilla between them, fused at their bases, thereby forming a well developed additional sclerite (fig. 5, as) immediately above the apices of the palantine sclerite branches, and one sharp seta situated on the lateral branches slightly anteriorly to the centre of the branch. External surface of labrum also with zones of microspinulae (fig. 5, a) near the antero-lateral margin of each side and with a narrow transverse band of very dense microsetae (fig. 5, b) along the entire anterior margin and narrowing on the sides; labrum ventrally (epipharynx) with a region of dense microspinulae (fig. 5, c) on the sides, extending in a narrow band to base of labrum and surrounding pharynx.

Fig. B: *Melobasis vertebralis* Carter. Adult female which emerged in November 1985 from the dead wood of *Acacia leiocalyx* at Brisbane, Queensland. Length of adult = 18 mm. (Photo: T. J. Hawkeswood).

([1]) This set of three median sensillae on the labrum occurs similarly among all the taxa dealt with in this paper, although rarely are there additional campaniform sensillae and sometimes they are situated on one side only; the most lateral campaniform sensilla may have no connection with the palantine sclerite, being attached to the membrane only; the length of the apical seta and the disposition of all the median sensillae relative to one another may serve as diagnostic characters.

([2]) The composition of the antero-lateral sensillae and their location relative to one another may also be used as diagnostic characters because it appears that these parameters are rather fixed within certain genera or generic groups. To compare different taxa we can use the formula (see tables 1, 2) with external sensillae designations in the numerator and internal ones in the denominator [viz. 1, 2, 3 ..., the ordinal number of sensilla counting from the most median to lateral ones, which may not be homologous in different taxa; t = trichoid, c = campaniform sensillae; within ( ) = with fused bases; + = with bases close together; - = with bases widely separated]. For *Melobasis*, this formula is: (1t, 2c, 3t)-4t/1t.

Antennae (fig. 2) 2-segmented, situated in a deep postero-lateral incision (fig. 1, pli) between epistome and hypostome (pleurostome); articular membrane glabrous, poorly developed, not forming a covering around 1st segment, which is only slightly invaginated with membrane at the base; 1st segment broadly cylindrical, about 2.0 times longer than segment 2, about as long as wide, strongly sclerotized, with a narrow fringe of microspinulae anteriorly, completely surrounding the base of segment 2 and with a prominent campaniform sensilla medially towards the apex of the segment and often with another one laterally near the base of the segment (which is hardly visible on the slides); 2nd segment short, cylindrical, about as long as wide, with a fringe of microspinulae around the anterior margin and a very long, sharp seta (trichosensilla), which is twice and more longer than the length of the 2nd segment, also with a deep apical cavity (fig. 2, ac) containing a relatively short sensory appendage (fig. 2, sa) not extending outside the cavity, and with two small, palmate sensillae (fig. 2, ps) at the bottom of the apical cavity.

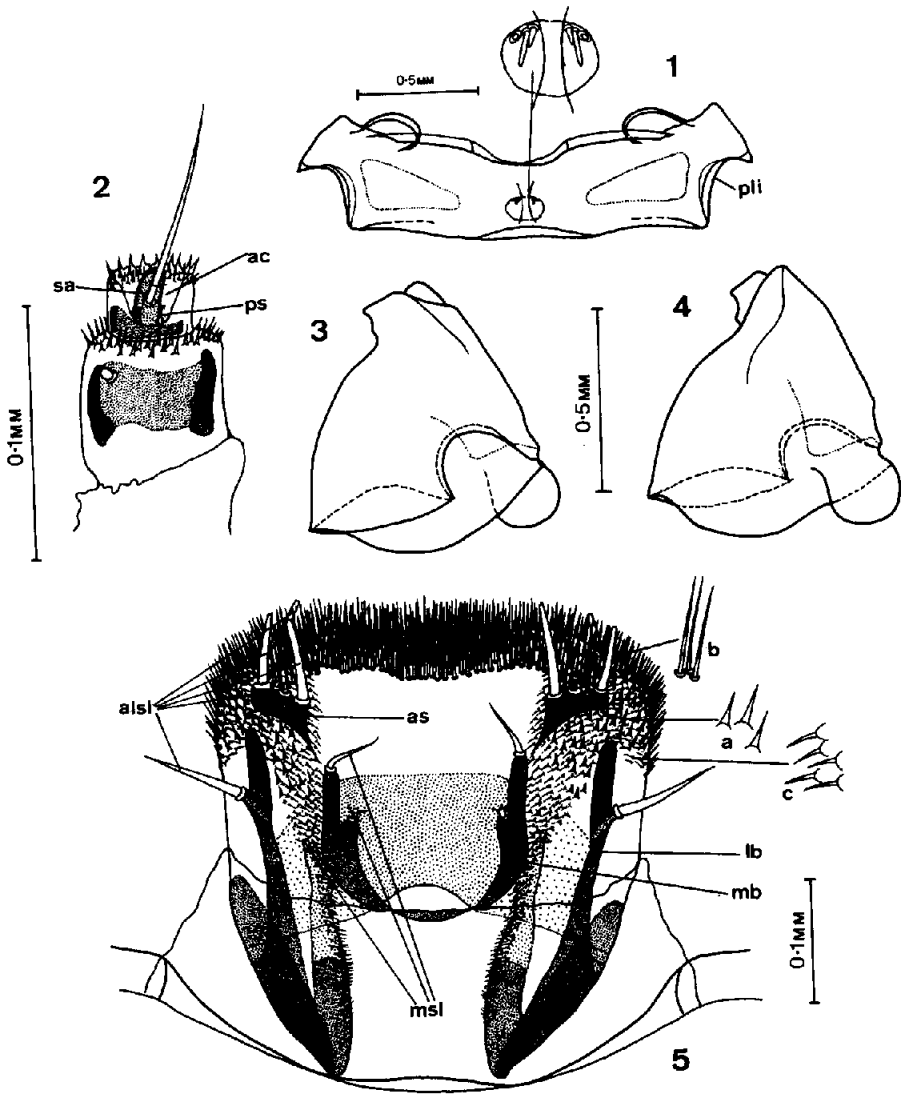
Mandibles (figs. 3, 4) black, short, robust, strongly sclerotized, broadened at the base, with a poorly developed apical tooth and two lateral ridges: ventral ridge broad, rectangular, abrupt apically.

Hypostome slightly sclerotized except for condylar recesses for the attachment of mandibles and gular sclerite; posterior margin broadly rounded; without ocelli; bearing a single trichoid and campaniform sensillae.

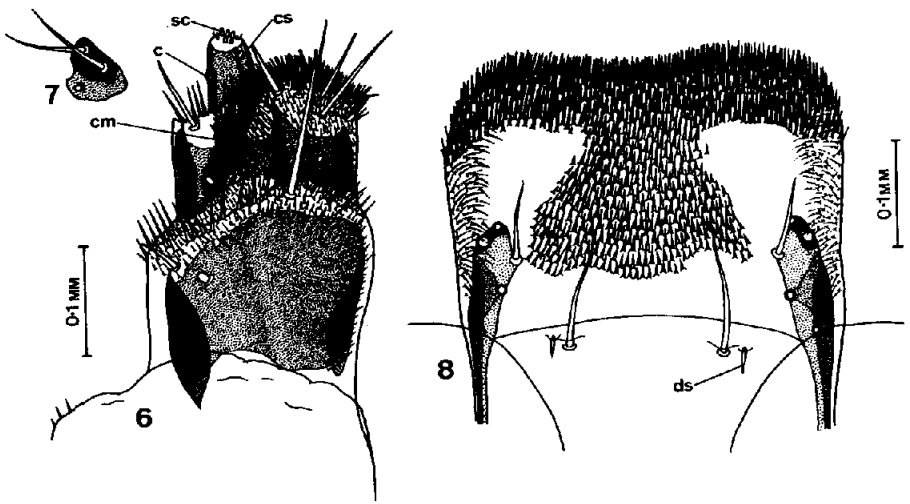
Labio-maxillary complex (figs. 6-8). Maxillary base (cardo) (fig. 6) membranous, glabrous, except for a fringe of short, barely visible microspinulae on the external antero-lateral margin, and with two long, sharp bristles and one campaniform sensilla situated on a distinct, well sclerotized sclerite (fig. 7) in the postero-lateral corner near the cardo base. Stipes (fig. 6) with a strongly sclerotized internal sclerite bearing one campaniform sensilla close to the external margin, one very short sharp seta near the lateral external margin above the sclerotized area and one long, sharp seta near the anterior margin below the mala, extending to about half the length of the 2nd segment of the maxillary palpus; a fringe of rather long, sharp microspinulae arising from membranous tubercles, denser on the external and internal corners, is situated externally along the entire anterior margin; stipes internally with short, sparse microspinulae along internal margin and external antero-lateral margin. Maxillary palpus (fig. 6) 2-segmented, basal segment strongly sclerotized, about as long as wide, nearly subquadrate, bearing a long, sharp seta situated near the antero-lateral corner, not extending to the apex of segment 2, and a campaniform sensilla situated close to base and external margin; the anterior margin with sparse, rather long, sharp microspinulae, extending to half of segment 2 and arising from membranous tubercles; 2nd segment elongate, about 1.5 times longer than wide, strongly sclerotized, with one long, modified curved sensilla (fig. 6, cs) internally near the internal margin and one campaniform sensilla (fig. 6, c) on the external margin at the middle and with about 7 small, conical sensory structures (fig. 6, sc) and a few short microspinulae at the apex. Mala (fig. 6) markedly sclerotized, with a broad internal sclerite; rather broad, tapering to apex, about 1.4 times wider than long; externally with one small campaniform sensilla close to the base and internal margin, three long, sharp setae, almost as long as the basal segment of maxillary palpus, situated close together near the apex, one long, sharp seta near the external antero-lateral corner, and one short seta between them; with sparse microspinulae along the anterior margin; internally with two long, sharp setae on the anterior margin and one long, sharp seta in the middle of internal margin, and with very dense, erect (in relation to margin) microspinulae forming a crest (fig. 6, cm) resembling the armature of "galea" of the *Acmaeoderella* larvae (Volkovitsh, 1979, fig. 28) or "lacinia" of the *Ptosima* larvae (Bily, 1972) but not homologous with them; the external margin of mala mainly glabrous. Labium (fig. 8) transverse; prementum about 1.5 times wider than long, with a slightly emarginate anterior margin and almost parallel, shallowly emarginate lateral sides; external surface of prementum with a triangular-shaped zone of short, sharp, dense microspinulae in the centre, this zone extending anteriorly to a narrow transverse strip of microspinulae along the entire anterior margin of the labium, situated in the apical 1/4, posteriorly reaching a level just behind the sharp seta on corner sclerites (3); microspinulae arising from small membranous tubercles; base of prementum with two corner sclerites each bearing one short, sharp seta and five small, campaniform sensillae at the internal apical part of sclerite; the sharp, anteriorly directed setae not reaching a position 1/3 the length of prementum from the anterior margin; internal surface of prementum with sparse microspinulae along lateral sides; postmentum (fig. 8) with two long, anteriorly directed setae, extending to the base of the zone of microspinulae on prementum and two very short, barely visible, deeply set sensillae (fig. 8, ds) laterally to the long setae.

Thorax (figs. 9, 10). Pronotal (fig. 9) and prosternal (fig. 10) plates poorly developed, mainly glabrous except for some sparse strongly and unevenly sclerotized, transverse asperities (fig. 9, c) of varying sizes, bordering the grooves on the inside, and with sparse, short bristles (fig. 9, d), which are more dense and regularly dispersed on the prosternal plate, and sparser and mainly grouped along the borders and branches of the groove on the pronotal plate;

(3) It appears that the shape of the zone of microspinulae on the labium is species specific, as can be observed in other genera. In the *Melobasis* material we have examined, some smaller larvae, apparently belonging to another species of *Melobasis* (see footnote 4), have the labium which is about as long as wide, with sparser microspinulae not extending to the anterior margin and a zone of microspinulae forming a broad, slightly converging posteriorly, projection.



Figs. 1-5: *Melobasis vertebralis* Carter. 1: Epistome showing postero-lateral incision (pli) and epistomal sensillae; 2: Right antenna showing armature, apical cavity (ac), palmate sensilla (ps) and sensory appendage (sa); 3: Right mandible, dorsal view; 4: Left mandible, ventral view; 5: Labrum, showing armature, median (mb) and lateral (lb) branches of the palantine sclerite, median sensillae of the labrum (msl), additional sclerite (as), microspinulae on the external antero-lateral region (a), microsetae along the anterior margin (b), and microspinulae on the internal surface (epipharynx) (c). (Drawings: M. G. Volkovitsh).



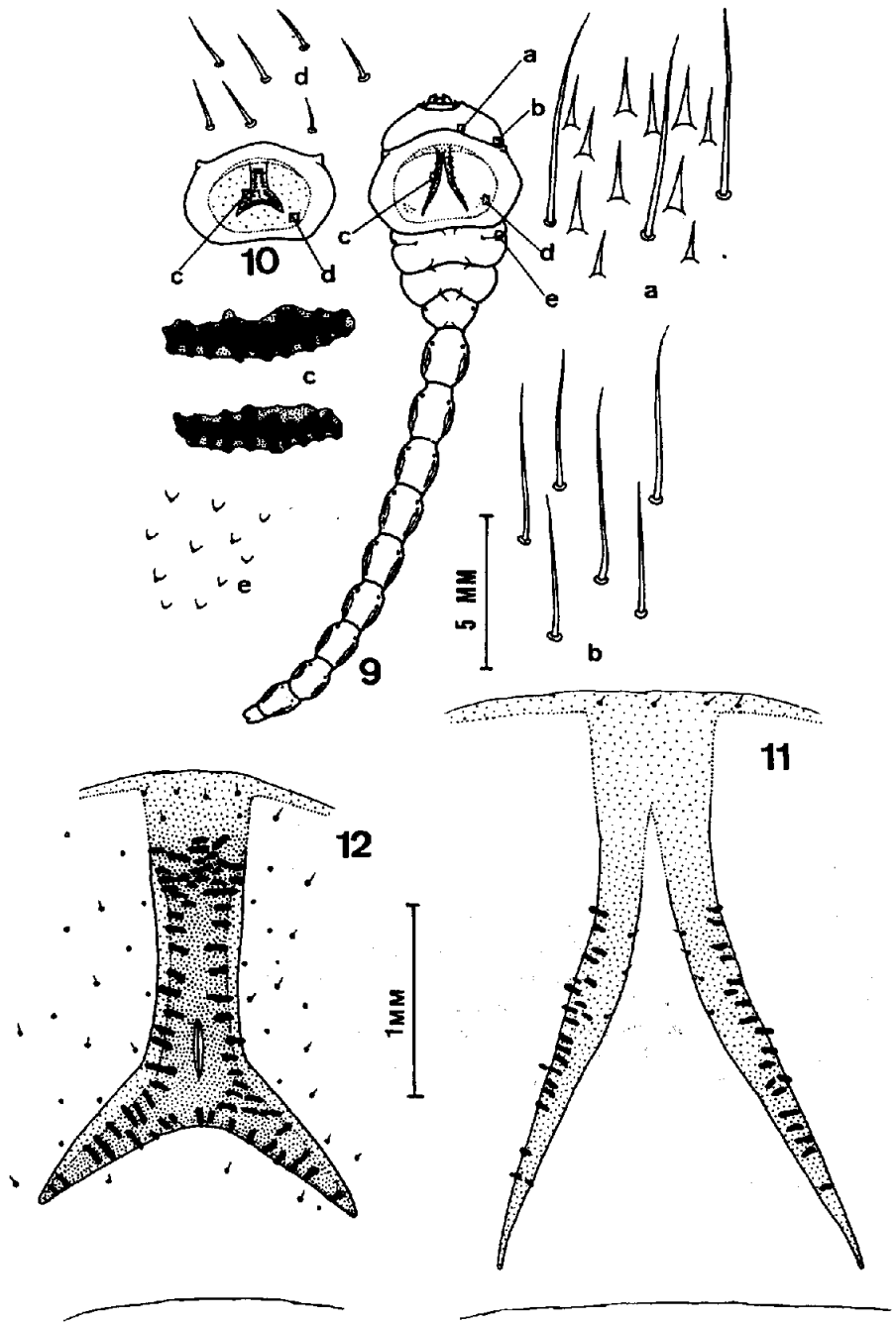
Figs. 6-8: *Melobasis vertebralis* Carter. 6: Left maxilla showing the anterior part of the cardo, stipes, maxillary palpus, mala, bristles, microspinulae, crest of microspinulae on the external margin of the mala (cm), and specialized sensory structures: sensory cones (sc), curved sensilla (cs) and campaniform sensilla (c); 7: Bristles and campaniform sensilla attached to sclerite on the maxillary cardo; 8: Labium showing prementum with its armature, corner sclerites and postmentum with setae and deeply set sensillae (ds). (Drawings: M. G. Volkovitsh).

microspinulae (fig. 9, a, e) and microampullae [as found in *Neocuris* larvae (Volkovitsh & Hawkeswood, 1987: 275, fig. 8] are absent; anterior prothoracical membrane with microspinulae and sparse bristles (fig. 9, a) at the posterior margin and dense, long bristles (fig. 9, b) at sides; zones of microspinulae mainly situated on the anterior regions of prothorax (fig. 9, a) with indistinct zones of poorly developed ones (fig. 9, e) near the thoracic spiracles; prothoracical grooves (figs. 9-12) brownish in live specimens, colorless in preserved specimens; pronotal groove (figs. 9, 11) inverted V - shaped with indistinct apical part, divided into two slightly curved branches near the apex; asperities irregularly situated along the lateral margin mostly on the central part of the branches. Prosternal groove (figs. 10, 12) inverted Y - shaped, with indistinct apical part, sharply dividing into two branches in the posterior 1/3, not extending to posterior plate margin; asperities situated along the entire external margin of groove (*).

Meso- and metathorax mostly glabrous, with sparse, short (fig. 9, d) bristles, which are denser and longer (fig. 9, b) on sides; small zones of poorly developed microspinulae and tubercles (fig. 9, e) are situated laterally to the prothoracic spiracles. Metathorax without distinct ambulatory pads. Thorax without rudiments of legs. Thoracic spiracles (fig. 13) moderately sclerotized, reniform, about 2.7 times longer than wide, with dense, strongly branched trabeculae.

Abdomen (fig. 9) with segments slightly longer than wide, flattened, with darkened, longitudinal, depressed zones laterally; 1st segment about half the width of metathorax (about 1.5 times wider than long and 1.3 and more times wider than the width of the other abdominal segments), without ambulatory pads; segments 2-9 of about similar size, slightly narrower than the 1st segment; segment 10 (anal segment) smallest. Dorsal surface of abdomen mostly glabrous, with sparse short bristles (fig. 9, d), lengthening and becoming denser on lateral margins (fig. 9, b); ventral surface of abdominal segments with indistinct longitudinal patches of poorly developed tubercles and microspinulae (fig. 9, e). Abdominal spiracles (fig. 14) very variable, circular, rarely oval or irregular in shape, with a few, weakly branched trabeculae and with a small zone of microspinulae (fig. 9, e) along the outer margin of the 1st segment.

(*) The smaller larvae in the material collected from *Acacia leiocalyx* (another species?) have prothoracic grooves strongly sclerotized, brownish or yellowish coloured on the slides, with a more distinct apical part; the asperities are sparser and smaller.



Figs. 9-12: *Melobasis vertebralis* Carter. 9: Dorsal view of the last instar larva, showing microspinulae and long bristles on the anterior prothoracical membrane (a), long bristles at the sides of the prothorax (b), asperities bordering the groove on the pronotal plate (c), shorter bristles on the postero-lateral part of the pronotal plate (d), and reduced microspinulae and tubercles forming a particular zone near the thoracic spiracle; 10: Prosternum; 11: Pronotal groove showing asperities on the inside; 12: Prosternal groove showing asperities on the inside (Drawings: M. G. Volkovitsh).

Proventriculus (fig. 15). The morphology of the fields and their armature are rather complicated, which is typical of species feeding on hard woody materials; the armature includes microspinulae, hairs and well developed, sclerotized microteeth of varying shape, situated singly (near the margins of the fields) or in groups (in the centre of the fields) on the apices of finger-like or simple, scale-shaped tubercles, often also strongly sclerotized; the groups of microspinulae and microteeth forming a complex pattern.

Material examined - 8 last instar larvae and 4 earlier instar larvae, from stem and branch billets (2.5-5 cm in diameter) of *Acacia leiocalyx* (Domin) Pedley *(Mimosaceae)*, collected by T. J. Hawkeswood at Brisbane, Queensland, August 1985 (specimens lodged in the collections of the Zoological Institute, St. Petersbourg, Russia). [It is possible that the younger larvae (smaller) belong to another *Melobasis* species, as they display some differences in the shape of the zone of microspinulae on the labium, presence of fewer asperities around the prothoracic grooves and colour of the asperities themselves].

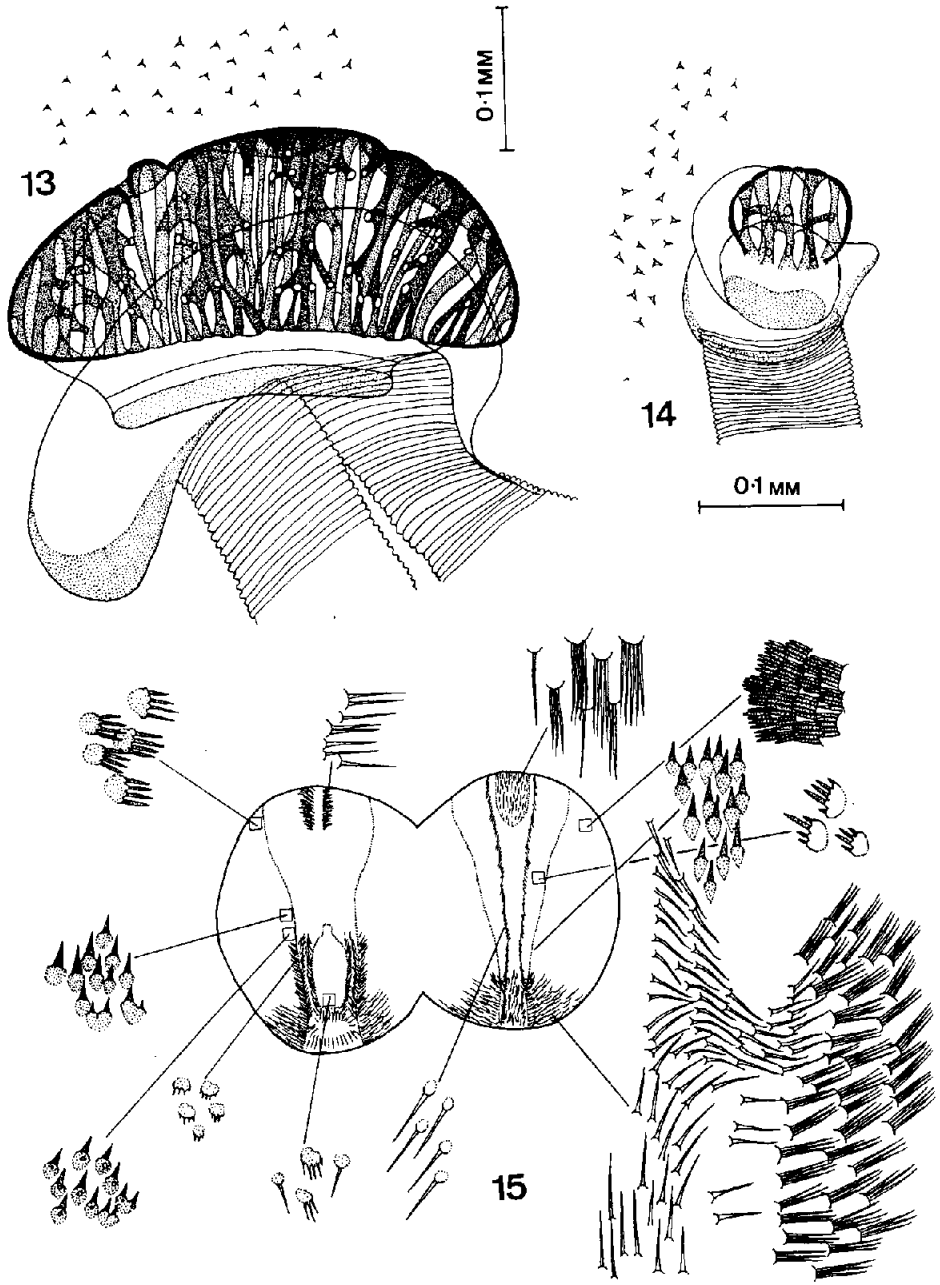
DISCUSSION

In order to compare the larva of *Melobasis vertebralis* with those of other described Australian and non-Australian buprestids, the larvae of the following genera were examined: Australian taxa. *"Anthaxiini": Neocuris* Fairmaire (*N. gracilis* Macleay; larval description: Volkovitsh & Hawkeswood, 1987), *Anilara* Thomson (*A. antiqua* Thèry, *A. nigrita* Kerremans; larval descriptions: Volkovitsh & Hawkeswood, 1993); *Epistomentini: Diadoxus* [*D. erythrurus* (White); larval description: Hawkeswood, 1985]. Palaearctic and Afrotropical taxa. *Kisanthobiini: Kisanthobia* (*K. ariasi* Robert); *Anthaxiini: Chalcogenia* (*C.* sp.), *Anthaxia* (*A. lucidipes* Gory), *Cratomerus* (*C. medvedevorum* Alexeev); *Melanophilini: Melanophila* [*M. (Trachypteris) picta picta* (Pall.)], *Phaenops* [*P. cyanea* (Fabr.)]. The descriptions and diagnoses of the larvae of *Kisanthobiini*, *Anthaxiini* and *Melanophilini* contained in the papers of Schaefer (1949), Alexeev (1964), Alexeev & Soldatova (1968), Soldatova (1969, 1970, 1973) and Bílý (1975) were also used for diagnostic purposes. The results of our morphological analyses and comparison of the larvae of some Australian taxa are shown in table 1, while the comparison of *Melobasis* larvae with those of non-Australian taxa is provided in table 2.

The main diagnostic characters of *Melobasis* larvae which allow them to be clearly distinguished from all other known buprestid larvae are (a) the shape of the prosternal groove (figs. 10,12), and (b) the armature of the prothoracic plates, including the transverse, irregular, unevenly sclerotized asperities (fig. 9, c) situated inside the grooves (figs 11, 12). Additional diagnostic characters also not found in all the other described Australian and non-Australian buprestid larvae are (a) the presence of an additional sclerite formed by the fusion of the strongly sclerotized bases of three sensillae (2 trichoid and 1 campaniform) (fig. 5, as) near the antero-lateral margin of labrum, (b) the presence of a crest of long microspinulae on the external margin of mala (fig. 6, cm), and (c) the presence of two additional, tiny, deeply set sensillae on the postmentum (fig. 8, ds).

Apart from these main diagnostic characters, the larva of *Melobasis* differs from other described Australian buprestid larvae in some other characters (see table 1). *Melobasis* differs from *Anilara* in (a) the somewhat different arrangement of the antero-lateral sensillae of the labrum (but having the same sensillar composition), (b) the maxillary cardo which has longer bristles arising from a distinct sclerite at the base, (c) the maxillary stipes which lack a corolla of hairs internally, (d) the broad maxillary mala, (e) the transverse prementum, (f) the postmentum with two long bristles, and (g) the armature of the proventriculus which is more complex.

The *Melobasis* larva differs from that of *Neocuris* in the following characters: (a) the shape of the postero-lateral corners of the epistome; (b) the antennae which have the sensory appendage not projecting outside the apical cavity, (c) the labrum which has only one trichoid antero-lateral sensilla internally and the external ones arranged in a different order, (d) the base of the maxillary cardo which has a distinct sclerite bearing one campaniform sensilla beyond two bristles, (e) the maxillary mala which lacks very large sclerotized bristles on the inner surface, (f) the transverse prementum, (g) the corner sclerites of the prementum with short bristles, and (h) the body surface



Figs. 13-15: *Melobasis vertebralis* Carter. 13: Thoracic spiracle; 14: Abdominal spiracle; 15: Armature of proventriculus. (Drawings: M. G. Volkovitsh).

lacking microampullae.

The *Melobasis* larva differs from that of *Diadoxus* in the following characters: (a) antennae structure and armature, (b) the shape of the anterior margin of the labrum, (c) the labrum which has only one trichoid antero-lateral sensilla internally and the external ones arranged in a different order, (d) the base of the maxillary cardo which has much longer bristles, (e) the maxillary stipes and mala which possess a different type of armature, (f) the prementum which has microspinulae instead of microsetae, (g) the postmentum which has much longer bristles, (h) the body surface which is not entirely covered with microteeth, and (i) the asperities on the prothoracic plates which have different shape, disposition and origin (see below).

The above listed character differences demonstrate that there is a great deal of similarity between *Melobasis* and *Anilara* larvae, particularly in regard to the structure and armature of mouthparts, less similarity between *Melobasis* and *Neocuris* larvae, while the least similarity occurs between *Melobasis* and *Diadoxus* larvae.

The results of the comparison between *Melobasis* larvae and those of *Kisanthobiini, Anthaxiini* and *Melanophilini* are shown in table 2. Apart from the above mentioned main diagnostic characters, the *Melobasis* larva differs from those of *Kisanthobiini* in the following characters: (a) the armatures of the antennae and external surfaces of the labrum and prementum which consist mainly of microspinulae and microsetae (only microsetae in *Kisanthobiini*), (b) the labrum with a different arrangement and composition of the internal antero-lateral sensillae, (c) the structure of mandibles, (d) the maxillary base (cardo) with a distinct sclerite, (e) the shape of the maxillary mala, (f) the postmentum with long bristles, and (g) some differences in the armature of proventriculus.

The *Melobasis* larva differs from those of *Anthaxiini* in the following characters: (a) the antennae of different disposition, structure and armature (fig. 18), (b) the labrum and prementum with zones of microspinulae externally, (c) the labrum with a different composition of the antero-lateral sensillae, (d) the shape of the mala, (e) the postmentum with long bristles, and (f) the metathorax without ambulatory pads connected by inner structures on both surfaces.

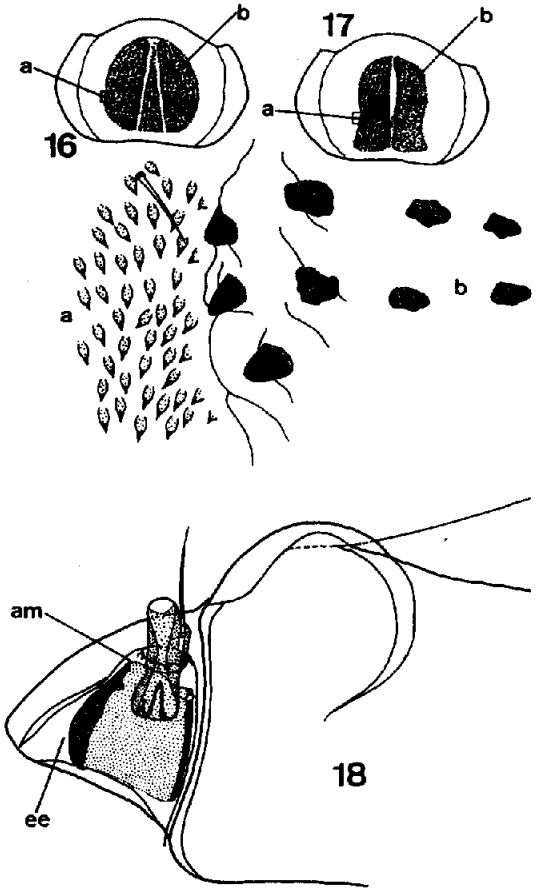
The *Melobasis* larva differs from those of *Melanophilini* in the following characters: (a) the antennal articular membrane glabrous and with antennal armature consisting of microspinulae instead of microsetae, (b) the labrum with the zones of microspinulae positioned externally and with only narrow strips of microspinulae internally, (c) the labrum with a different disposition of the antero-lateral sensillae externally and only one trichoid sensilla internally, (d) the structure of mandibles, (e) the prementum with the armature consisting of only microspinulae and not covering most of the inner surface, (f) the postmentum with long bristles, (g) the prothoracic plates without fields of asperities in the centre surrounded by microteeth (figs. 16, 17) and asperities with different shape, disposition and origin (see below), (h) the body surface without the almost total covering of microteeth, and (i) the complex armature of proventriculus.

The character shared by the larvae of both *Melobasis* and *Melanophilini* is the presence of asperities on the prothoracic plates. However, this character, consisting of enlarged, strongly sclerotized asperities surrounding the grooves and forming more or less regular zones or well differentiated fields on the prothoracic plates, occurs in very different buprestid taxa, e.g. in *Prospheres (Prospherini)* among *Polycestinae* (5); *Diadoxus (Epistomentini)* (5), *Cyphogastra, Chrysodema, Chalcophora (Chalcophorini), Capnodis (Psilopterini)* among *Chalcophorinae; Dicerca (Dicercini), Eurythyrea (Buprestini), Melanophila, Phaenops (Melanophilini)* among *Buprestinae; Chrysobothris (Chrysobothrini)* among *Chrysobothrinae*, and many others.

Apparently, the asperities and their fields have developed in a number of ways in different taxa. In a first case, the asperities developed as a result of the modification of the microteeth covering the plates, which was then followed by a moderate enlargement of their tubercles concurrent with teeth reduction; this can be clearly observed at the border of the microteeth zones adjacent to the grooves; it has resulted in the formation of irregular zones of unevenly dispersed, unevenly but uniformly sclerotized, grain-like, unequal asperities around the grooves, not separated from the surrounding zones of microteeth and showing all the conditions intermediate between typical microteeth and typical asperities (viz. *Prospheres, Diadoxus, Capnodis, Dicerca, Eurythyrea*).

In a second case, the asperities developed by way of enormous enlargement and sclerotization of the microteeth (this is obvious when observing along the border between the fields of microteeth and asperities in the larva of *Chrysobothris affinis*), in this case asperities are almost equal in size, evenly sclerotized, scale-shaped and almost regularly dispersed on the surface, forming the fields of relatively regular shape which cover almost the whole plate surface remaining distinctly separate from the microteeth surrounding them (figs. 16,17) (viz. *Melanophila, Phaenops, Chrysobothris*).

In a third case, the asperities apparently developed as cuticular newgrowths having no connection with microteeth; the asperities of this type are characterized by being irregular and transverse (e.g. *Melobasis*, fig. 9, c) or star-shaped in appearance (e.g. *Chrysodema*), and are unevenly sclerotized and of unequal size; they are evenly dispersed on the plate surfaces amidst the microteeth forming the fields (viz. *Cyphogastra, Chrysodema, Chalcophora*), or arranged inside the grooves while the remaining surface of the plates is glabrous (i.e. *Melobasis*, figs. 9-12).



Figs. 16, 17: *Melanophila (Trachypteris) picta picta* (Pall.). 16: Pronotum showing the pronotal groove and the shape of the pronotal asperities field, asperities and microteeth on the boundary of this field (a), asperities in the centre of the field (b); 17: Prosternum showing the prosternal groove and the shape of the prosternal asperities field (a and b as above). Fig. 18: *Anthaxia lucidipes* Gory. Left antenna attached to the epistome, with the excision of the epistome (ee) and the cover formed by the articular membrane (am). (Drawings: M. G. Volkovitsh).

Consequently the presence of asperities in the larvae of *Melobasis* and *Melanophilini* is ra-

(5) In our opinion, *Diadoxus* and *Prospheres* should be attributed to different subfamilies, contrary to what is presently and commonly accepted; our reasons for this will be presented in forthcoming papers.

Table 1. Comparison of the main taxonomic characters among the larvae of *Melobasis* (*M. vertebralis* Carter), *Anilara* (*A. antiqua* Thèry and *A. nigrita* Kerremans), *Neocuris* (*N. gracilis* Macleay) and *Diadoxus* [*D. erythrurus* (White)].

Character	*Melobasis*	*Anilara*	*Neocuris*	*Diadoxus*
Epistome	With weakly obtusely angled, almost rectangular latero-posterior corners (fig. 1)	With weakly obtusely angled, almost rectangular latero-posterior corners	With strongly obtusely angled latero-posterior corners	With weakly obtusely angled, almost rectangular latero-posterior corners
Antenna	Cylindrical; 1st segment about twice longer than 2nd; bottom of sensory cavity situated at base of segment 2; sensory appendage not projecting outside the cavity; with dense microspinulae on the anterior margins of segments 1 and 2; articular membrane bare (fig. 2)	Cylindrical; 1st segment about twice longer than 2nd; bottom of sensory cavity situated at base of segment 2; sensory appendage not projecting outside the cavity; with dense microspinulae on the anterior margins of segments 1 and 2; articular membrane bare	Cylindrical; 1st segment almost as long as 2nd; bottom of sensory cavity situated at the anterior 1/3 of segment 2; sensory appendage about half-projecting outside the cavity; with sparse microspinulae on the anterior margins of segments 1 and 2; articular membrane bare	Irregular; 1st segment with broad lateral lobe, markedly longer than 2nd; bottom of sensory cavity situated at base of segment 2; sensory appendage non projecting outside the cavity; with very dense microspinulae on the anterior half of each segment; articular membrane with dense microsetae
Labrum: anterior margin	Weakly arcuate (fig. 5)	Weakly arcuate	Weakly arcuate	3-lobed
Labrum: antero-lateral sensillae	(1t, 2c, 3t)-4t/1t	(1t, 2c)-3t-4t/1t	(1t, 2c)-3t-4t/(1t, 2t)	(1t, 2c)+3t-4t/1t+2t+3t
Maxillary cardo	With 2 long bristles and one campaniform sensilla arising from distinct sclerite (fig. 7)	With 2 short bristles and one campaniform sensilla arising from indistinct sclerite	With 2 long bristles arising from membrane	With 2 short bristles and one campaniform sensilla arising from distinct sclerite
Maxillary stipes	Subquadrate; corolla of hairs on the internal surface absent (fig. 6)	Transverse with rounded apex; corolla of very thin hairs present on the internal surface	Slightly transverse with rounded apex; corolla of hairs on the internal surface absent	Slightly elongate; with broad transverse strip of microsetae internally; corolla of hairs on the internal surface absent
Maxillary mala	Broad, wider than long; with very dense microspinulae on inner surface, forming a crest on external margin; with 3 normal bristles on inner surface (fig. 6)	Narrow, longer than wide; with dense microspinulae along internal margin and 4 long bristles on inner surface; without crest of microspinulae on external margin	Subquadrate, hardly wider than long; with sparse microspinulae and 3 very large sclerotized bristles on inner surface; without crest of microspinulae on external margin	Almost as long as wide; with dense microsetae and 5 large, long bristles on inner surface; without crest of microspinulae on external margin
Labium: prementum	Slightly transverse; with microspinulae arising from tubercles externally; with sparse microspinulae along lateral margin internally (fig. 8)	Rounded; with microspinulae arising from tubercles externally; with sparse microspinulae along lateral margin internally	Rounded; with microspinulae arising from tubercles externally; with sparse microspinulae along lateral margin internally	Slightly transverse; with microsetae externally; with very dense microsetae covering most of surface internally
Labium: corner sclerites of prementum	With a short bristle not exceeding the anterior third of prementum length (fig. 8)	With a short bristle exceeding the anterior third of prementum length	With a long bristle exceeding the anterior margin	With a short bristle exceeding the anterior quarter of prementum length

Character	*Melobasis*	*Anilara*	*Neocuris*	*Diadoxus*
Labium: postmentum	With 2 long bristles and 2 deeply set sensillae (fig. 8)	Without bristles or sensillae	With 2 very long bristles	With 2 very short bristles
Prothoracic plates	Mainly glabrous, with strongly, unevenly sclerotized, transverse asperities bordering the grooves on the inside, and with short bristles (figs. 9, 12)	Mainly glabrous, without asperities; with sparse, short bristles, sometimes arising from tubercles	Mainly glabrous, without asperities; with sparse, short bristles and microampullae	Whole surface covered with microteeth changing to asperities around grooves and with short bristles
Prosternal groove	Inverted Y - shaped (figs. 10, 12)	Uniramous, strip-like	Uniramous, strip-like	Uniramous, strip-like
Body surface	Mainly glabrous with small, indistinct zones of microspinulae (fig. 9c)	Mainly glabrous with small, indistinct zones of microspinulae	Mainly glabrous with small, indistinct zones of microspinulae	Whole surface covered with microteeth
Armature of proventriculus	Main zones with well-developed, dense microteeth arising singly (along the margins) or in groups (in the centre) from sclerotized tubercles (fig. 15)	Main zones with poorly developed, sparse microteeth arising in groups from unsclerotized tubercles	Main zones with well-developed, very dense microteeth arising in groups from sclerotized tubercles	Main zones with well-developed, dense microteeth arising singly from small, poorly sclerotized tubercles

ther the result of convergence than a close phylogenetic relationship, the asperities having been formed independently in different ways and having a different origin. This testifies, together with other above mentioned characters, that the *Melanophilini*, being considered in the composition accepted by modern authors (viz. Bellamy, 1985; Cobos, 1986; Holynski, 1993), is a polyphyletic group.

It can be concluded that *Melobasis*, by its larval characters, differs greatly from both true *Anthaxiini* and *Melanophilini* and has little resemblance to *Kisanthobiini* [as it has already been mentioned by us for Australian "*Anthaxiini*" in the analyses of larval characters of *Neocuris* and *Anilara* (Volkovitsh & Hawkeswood, 1987, 1993)]. The level of similarity between *Melobasis* and *Kisanthobia* is much lower than between *Kisanthobia* and *Anilara* or *Neocuris*. The level of dissimilarity among *Kisanthobiini*, *Anthaxiini* and *Melanophilini* is much more significant than among *Melobasis*, *Anilara* and *Neocuris*. In regard to *Diadoxus*, this genus is much more related to Holarctic *Buprestini* than to the three above mentioned genera. At the same time, the level of dissimilarity among the larvae of *Melobasis*, *Anilara* and *Neocuris* is much higher than among the larvae of the genera within *Anthaxiini* or *Melanophilini*.

CONCLUDING REMARKS

In our previous papers we have emphasized that the systematic position and real relationships of many Australian buprestid taxa are not clearly understood (Volkovitsh & Hawkeswood, 1987, 1990, 1993); in particular, this is true in regard to the attribution of some Australian genera to *Anthaxiini*, *Melanophilini* and some other non-Australian tribes. From our point of view, these genera have arisen independently in the Australian region and their similarity with non-Australian genera of *Anthaxiini* or *Melanophilini* has occurred through parallel evolution from ancestors, which may have been similar to Palaearctic *Kisanthobia*, Afrotropical *Aristosoma* or Australian *Torresita*. The problem of attributing Australian "*Anthaxiini*" and "*Melanophilini*" genera to some higher taxon such as the rank of tribe or subfamily, as well as their possible close relationship to *Stigmo-*

Table 2. Comparison of the main taxonomic characters among the larvae of *Melobasis* (*M. vertebralis* Carter), *Kisanthobiini* (*Kisanthobia*), *Anthaxiini* (*Anthaxia, Cratomerus, Chalcogenia*) and *Melanophilini* (*Melanophila, Phaenops*).

Character	*Melobasis*	*Kisanthobiini*	*Anthaxiini*	*Melanophilini*
Antenna	Situated in lateral incision between epistome and hypostome (pleurostome); articular membrane glabrous, not forming a cover around 1st segment; with dense microspinulae on the anterior margins of segments 1 and 2; bottom of apical cavity extending to about the base of segment 2 (figs. 1, 2)	Situated in lateral incision between epistome and hypostome (pleurostome); articular membrane glabrous, not forming a cover around 1st segment; with dense microsetae on the anterior margins of segments 1 and 2; bottom of apical cavity extending to about the base of segment 2	Situated in lateral incision of epistome; articular membrane glabrous, forming a cover, in which all of 1st and base of 2nd segments are drawn in; without microspinulae or microsetae on the anterior margins of segment 1 or both 1 and 2; bottom of apical cavity may extend to the middle of segment 1 (fig. 18) (6)	Situated in lateral incision between epistome and hypostome (pleurostome); articular membrane covered with microspinulae, not forming a cover around 1st segment; with very dense microsetae on the anterior margins of segments 1 and 2; bottom of apical cavity extending to about the base of segment 2
Labrum	Externally with dense microsetae along the entire anterior margin and zones of microspinulae laterally; epipharynx with narrow strips of microspinulae (fig. 5)	Externally with dense microsetae along the anterior margin; epipharynx with narrow strips of microspinulae	Externally glabrous; epipharynx with sparse, indistinct microspinulae or glabrous	Externally with very dense microsetae along the entire margin; most of epipharynx with the same microsetae
Labrum: antero-lateral sensillae	(1t, 2c, 3t)-4t/1t	(1t, 2c)-3t-4t/(1t, 2t, 3t)	(1c, 2c, 3t)+4t/1t+2t	(1t, 2c)+3t-4t/(1t, 2t)
Mandibles	With poorly developed apical tooth and 2 lateral ridges (figs. 3, 4)	With 2 ridges of blunt teeth arising in pairs on common bases	With 2 ridges without teeth or with poorly developed teeth	With 2 sharp teeth at apex
Maxillary cardo	With 2 long bristles and one campaniform sensilla arising from distinct sclerite (fig. 7)	With 2 long bristles and one campaniform sensilla arising from a weakly sclerotized membranous zone	With 2 long bristles and one campaniform sensilla arising from a small, isolated, weakly sclerotized sclerite	With 2 long bristles and one campaniform sensilla arising from distinct sclerite
Maxillary mala	Broad, wider than long; internally with a crest of very dense, long microspinulae along the external margin (fig. 6)	Relatively narrow, slightly longer than wide; internally without a crest of microspinulae along the external margin	Narrow, longer than wide; internally without a crest of microspinulae along the external margin	Almost as long as wide; internally without a crest of microspinulae along the external margin
Labium: prementum	With microspinulae arising from tubercles externally; with sparse microspinulae along lateral margin internally (fig. 8)	With microsetae externally; with hardly visible microspinulae along lateral margin internally	Externally and internally glabrous	With microsetae externally; with dense microsetae covering most of the surface internally
Labium: postmentum	With 2 long bristles and 2 deeply set sensillae (fig. 8, ds)	With 2 short but distinct bristles	With 2 very short, indistinct bristles or bristles absent	With 2 short, indistinct bristles
Prothoracic plates	Mainly glabrous, with strongly, unevenly sclerotized, transverse asperities bordering internally the lateral margins of the grooves (figs. 9-12)	Glabrous, except for small zones of microspinulae on the anterior and posterior margins	Mainly glabrous	Centrally densely, regularly covered with strongly, evenly sclerotized, scale-like asperities surrounded by microteeth (figs. 16, 17)
Prosternal groove	Inverted Y - shaped, divided into 2 short branches near the posterior end (figs. 10, 12)	Simple, strip-shaped	Simple, strip-shaped	Simple, strip-shaped (fig. 17)
Metathorax	Without distinct ambulatory pads	Without distinct ambulatory pads	With well-defined ambulatory pads on both dorsal and ventral surfaces and connected by inner structures (Volkovitsh & Hawkeswood, 1987, fig. 18)	Without distinct ambulatory pads
Body surface	Mainly glabrous, with sparse setae and narrow zones of poorly developed microspinulae and tubercles (figs. 9, b, d, e)	Mainly glabrous, with sparse setae and narrow zones of poorly developed microspinulae and tubercles	Mainly glabrous, with very sparse setae and indistinct zones of microspinulae	Almost totally covered with microteeth, with setae laterally
Proventricular fields of microteeth (7)	With markedly developed, very dense microteeth situated singly or in groups on the tops of sclerotized tubercles (fig. 15)	With developed, dense microteeth situated in groups or singly on the tops of poorly sclerotized tubercles	With developed, dense microteeth situated in groups or singly on the tops of sclerotized tubercles (Soldatova, 1973, figs. 1-3)	With poorly sclerotized, sparse microteeth, situated singly or rarely in groups on the tops of unsclerotized tubercles (Soldatova, 1969, fig. 1)

(6) The evolutionary trends of the antennae attributed to this type may be observed in the generic series *Chalcogenia-Cratomerus-Anthaxia*. In *Chalcogenia* sp., the inner sclerites of segment 2 are distinct and elongated, the bottom of the apical cavity has sensory organs arising from a sclerotized base and situated on the anterior half of segment 2, and the anterior margin of segment 2 is with very fine, dense microspinulae. In *Cratomerus medvedevorum*, the inner sclerites of segment 2 are markedly reduced, the bottom of the apical cavity has sensory organs situated on the anterior part of segment 1, and the anterior margins of segments 1 and 2 are glabrous. In *Anthaxia lucidipes* (fig. 18), the inner sclerites of segment 2 are absent, the bottom of the apical cavity with sensory organs is situated in the middle of segment 1, and the anterior margins of segments 1 and 2 are glabrous. It remains unresolved whether the disposition of the cavity bottom is fixed in the different taxa, or if it depends on the physiological condition of the larvae. We believe that the evolution of the antennae in *Anthaxiini* has resulted in the formation of telescopic ones, which may be able to lengthen significantly not only as a result of the cavity bottom drawing in and out (this seems characteristic for all of the taxa provided with an apical cavity), but also as a result of the movement outwards of the antennal segments from the cover formed by the articular membrane. The same evolutionary trend, although not reaching such a high level of specialization, can be seen in *Ptosimini-Acmaeoderini*. In the larvae of *Julodinae, Agrilinae* and *Trachyinae*, the apical cavity is absent and the sensory organs are situated at the apex of segment 2; this condition apparently corresponds to the most primitive type. The larval antennae of the majority of *Polycestinae, Chalcophorinae, Sphenopterinae, Buprestinae* and *Chrysobothrinae* have the same structure as *Melobasis*, thereby showing a condition which is intermediate between both the above mentioned types. Finally, some representatives of *Trachyinae* (e.g. *Aphanisticus*) as well as *Cylindromorphinae*, exhibit the partial or complete reduction of antennal segments (Volkovitsh & Hawkeswood, 1990, table 1), which is another advanced evolutionary characteristic of the antennae of buprestid larvae.

(7) The character of the proventriculus armature, including its level of development and sclerotization, and

derini, still remains unsolved. Based on the logic of HOLYNSKI (1988, 1993), who has separated the subtribes *Neocuridina (Neocuris)*, *Curidina (Curis, Cylindrophora)* and some others within *Anthaxiini*, the subtribes *Anilarina (Anilara)*, *Melobasina* [*Melobasis*, *Montouzieretta* (the close relationship between *Melobasis* and *Montouzieretta* is confirmed by adult morphology, especially the structure of the antennae)] and some others should be established. However, we do not agree whatsoever with the taxonomic composition of *Anthaxiini* as proposed by HOLYNSKI, particularly with his inclusion of such taxa as *Nascionina*, *Trachykelina*, *Bubastini*, *Melanophilini*, *Sphenopterini* and many others, as well as *Melobasis*, *Anilara*, *Neocuris* etc., to this tribe. We strongly feel that the rank, systematic position and relationships of all these taxa will only become clear when further investigations on both larval and adult morphology have been undertaken and published.

In conclusion, we would like to provide some comments on the generic composition and relationships of *Melanophilini*. The data provided in our analysis of larval characters (table 2) as well as antennal morphology of the adults, indicate that this tribe is a polyphyletic one. As well as *Melobasis* and *Montouzieretta*, the Australian genera *Torresita* and *Theryaxia* should be removed from *Melanophilini* (see list of genera in the introduction to this paper). Although the systematic position of these two latter genera remains unclear, we propose that they should be inserted, together with other Australian "*Melanophilini*" and "*Anthaxiini*", into one or several related tribes (or subtribes). According to both its larval and adult characters (including the structure of the antennae of the adults), the Afrotropical genus *Chalcogenia* must undoubtedly be attributed to *Anthaxiini*, since it is closely related to *Anthaxia* and *Cratomerus*. However, the following genera should remain in *Melanophilini*: *Melanophila* Eschscholtz, *Phaenops* Dejean, *Xenomelanophila* Sloop, and, questionably, *Cromophila* Cobos. The previously regarded close relationship between *Melanophilini* and *Anthaxiini* is also doubtful, because the latter tribe possesses some essential differences in regard to both larval (i.e. the peculiar type of antennal structure; mouthparts, prothoracic plates and remaining body surface which are practically glabrous; the metathorax with well developed ambulatory pads connected by inner structures) and adult (the antennal structure) characters. At the same time there is an essential similarity between *Melanophilini* and *Chrysobothrini*, sharing such characters as the structure and armature of the prothoracic plates and mouthparts in the larvae, and the antennal structure in the adults. We hope that further investigations will allow us to clarify these problems.

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in particular the density and shape of microteeth and microspinulae, is dependent on the degree of hardness of the food source (SOLDATOVA, 1973; VOLKOVITSH, 1979). The species which feed mainly on hard, woody matter have well-developed, dense microteeth with the tubercles well sclerotized; as a rule, the microteeth and microspinulae form a complex pattern. The species which feed on bark, soft woody matter or other soft plant tissues have poorly developed, sparse microteeth with unsclerotized or poorly sclerotized tubercles; the microteeth and microspinulae are more or less regularly dispersed, usually not forming additional fields on both dorsal and ventral surfaces of the proventriculus. For example, the proventriculus armature of *Melobasis* (fig. 15) contrasts with that of *Anilara* (VOLKOVITSH & HAWKESWOOD, 1993, fig. 14).