



Redescription of the Hispaniolan ladybird genus *Bura* Mulsant (Coleoptera: Coccinellidae) and justification for its transfer from Coccidulinae to Sticholotidinae

NATALIA J. VANDENBERG¹ & DANIEL E. PEREZ-GELABERT²

¹Systematic Entomology Lab (SEL), Plant Sciences Institute, Agricultural Research Service, USDA, c/o National Museum of Natural History, Smithsonian Institution, P.O. Box 37012, MRC-168, Washington, DC 20013-7012.

E-mail: Natalia.Vandenberg@ars.usda.gov

²Department of Entomology, National Museum of Natural History, Smithsonian Institution, P.O. Box 37012, Washington, DC 20013-7012. USA. E-mail: perezd@si.edu

Abstract

The Hispaniolan genus *Bura* Mulsant is removed from Coccidulinae and placed in Sticholotidinae. The characteristics which justify this transfer are discussed and an historical review of the classification of the Sticholotidinae is presented. *Bura* is diagnosed and redescribed, and its affinities to other Sticholotidini are discussed. Illustrations of key generic characters are provided.

Key words: taxonomy, phylogeny, Coccinellidae, Sticholotidinae, Coccidulinae, Hispaniola

Introduction

The ladybirds of Hispaniola comprise a neglected fauna whose critical study promises to bring to light many new and interesting forms. Nonetheless, the authors were surprised to encounter in recently collected material a rather abundant and good sized (2.8–3.2 mm) metallic green to blue sticholotidine that was not listed among the documented species from the island. This puzzling omission was soon explained when a matching series from the Smithsonian National Insect Collection labeled "*Bura cuprea* Mulsant" was discovered with curated material placed in the subfamily Coccidulinae.

In the current work, we discuss the features of *Bura* Mulsant that justify its transfer from Coccidulinae to Sticholotidinae, speculate on circumstances that led to its prior misclassification, and highlight current problems in the delineation of the aforementioned ladybird subfamilies.

Historical review

Ladybird higher classification suffers from the presence of para- and polyphyletic taxa (Vandenberg 2002). These problems are especially prevalent with the so-called "primitive" subfamilies (Sticholotidinae, Coccidulinae), and with the fauna of poorly studied regions like the Neotropics. Both of these conditions have evidently factored into the current misplacement of the endemic Hispaniolan genus *Bura*.

Most contemporary concepts of Sticholotidinae derive from the work of Sasaji (1968, 1971) who recognized four tribes within this subfamily: Sticholotini (=Sticholotidini, emended by Gordon 1977), Shirozuel-

lini, Sukunahikonini, and Serangiini. Sasaji identified a number of diagnostic characteristics for Sticholotidinae, including the conical to elongate oval terminal maxillary palpomere (few exceptions noted), mentum narrowly articulated with submentum, exposed antennal insertions, broadly separated mesocoxal cavities, elongate hemisternites of the female genitalia, and the metendosternite with broadly separated anterior tendons. Sasaji believed that the constituent tribes had undoubtedly developed from a single common ancestor. However, it should be noted that in his phylogenetic analyses (Sasaji 1968), each of the defining character states listed above are postulated as primitive (plesiomorphic).

Following Sasaji's (1968, 1971) landmark contributions to ladybird higher classification, the subfamily Sticholotidinae has gradually expanded to accommodate 6 additional tribes (Microweiseini Leng (1920), Cephaloscymnini Gordon (1985), Carinodulini Gordon, Pakaluk and Ślipiński (1989), Argentipilosini Gordon and Almeida (1991), Limnichoparini Miyatake (1994), and Plotinini Miyatake (1994)), bringing the total number to 10. The steady but marked growth of the group over the last 2½ decades has led to the inclusion of numerous genera and species which no longer fit Sasaji's original diagnosis (which was heavily biased toward the fauna of the Palearctic and Oriental regions), yet no new criteria have been proposed.

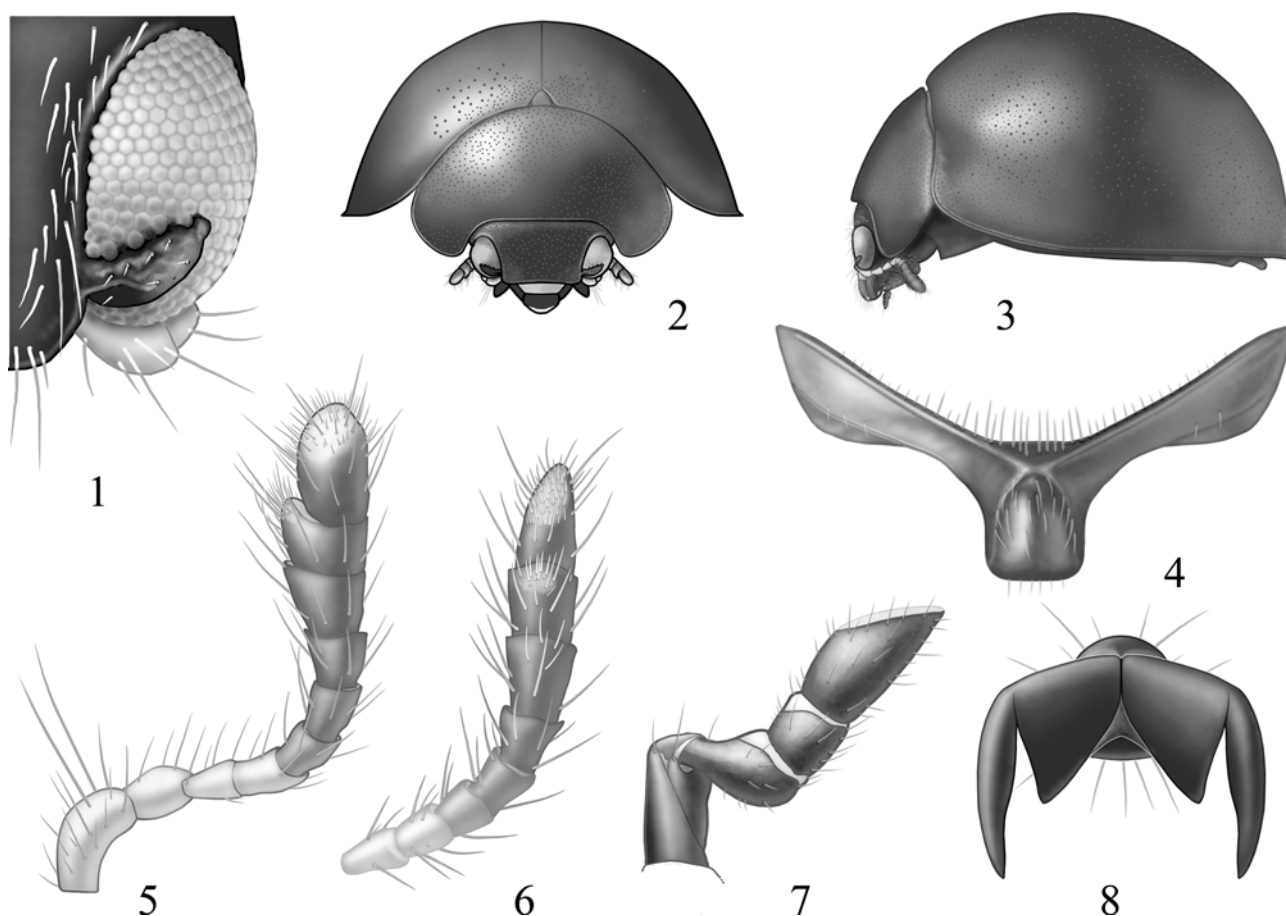
Although the shape of the terminal maxillary palpomere is considered the most distinctive and frequently cited feature of Sticholotidinae (Ślipiński 2004), it was never common to all the included taxa. Even among those that are considered to share this feature at least two distinctive architectures are represented: in *Sticholotis* and allies the terminal palpomere is often described as "elongate, conical," but the long obliquely oriented distal sensory surface forms one side of the tapered apex (Fig. 14b); while in *Sukunahikona* and allies the sensory surface is usually smaller, oval, and more distally positioned, with the taper beginning well in advance (Fig. 14a).

Thus, although the terminal palpomere of *Sticholotis* is not apically expanded or securiform, as in more conventional coccinellids (Fig. 14c), it does share with the latter the characteristic of a broad sensory surface, which is typically identified as an advanced (apomorphic) characteristic within the cerylonid series of the superfamily Cucujoidea (Pal and Lawrence 1986; Sasaji 1968, 1971).

There have been only a few attempts to deduce evolutionary trends within the Sticholotidinae and clarify relationships among the included tribes, or determine the broader relationships to other ladybird subfamilies (Sasaji 1968, 1971; Gordon 1977; Kovar 1996; Duverger 2003). In each case (Figs. 9–11), the authors have treated Sticholotidinae as a monophyletic group. However, in none of these reconstructions has monophyly been rigorously tested: Sasaji (1968) conceded that the subfamily was erected entirely on the basis of shared primitive characters; Gordon (1977) included no outside taxa in his cladistic analysis against which monophyly could be tested; and Kovar (1996) referred only to the "remarkable similarity" among the shared characteristics, and stated that the group had already been established as monophyletic by Sasaji (1968). The dendrogram in Duverger (2003) essentially reproduces the basal architecture of Kovar's tree (Fig. 11), but suggests new subfamily level names for two of the three major branches, reducing Sticholotidinae (*sensu* Duverger) to 4 tribes (Sticholotidini, Plotinini, Argentipilosini and Limnichoparini). Although the removal of the basal taxa (Carinodulini through Serangiini) may have provided a cleaner separation in some respects, the Sticholotidinae are still polyphyletic due to the inclusion of Argentipilosini which belongs in Cryptognathini (Cryptognathinae) (Vandenberg, in prep.). The placement of the highly aberrant Indo-Malaysian tribe Limnichoparini could not be evaluated due to lack of specimens.

Ślipiński provided two recent studies of Australian Sticholotidini (Ślipiński 2004) and Sukanohikonini (in collaboration with Tomaszewska; Ślipiński and Tomaszewska 2005) in which he comments on the polyphyletic nature of Sticholotidinae (*sensu lato*), but neither implements nor mentions the recent taxonomic changes suggested by Duverger (2003). Instead, he promises (Ślipiński 2004) to address these issues in a comprehensive revision of the world taxa of Sticholotidinae (Ślipiński, in prep.). One of the authors' motivations for the present paper is to draw attention to relevant neglected members of the Hispaniolan fauna, so that these will not be overlooked in Ślipiński's much anticipated World revision.

The Coccidulinae constitute another polyphyletic group which suffers from a paucity of serious global study (Pope 1988, Vandenberg 2002). Gordon (1994b) supported *Bura*'s contemporary placement in Coccidulini (Coccidulinae) because the seemingly aberrant characteristics of the genus (antenna with 10 antennomeres and fusiform club (Figs. 5–6), protuberant prosternal process (Fig. 4), absence of tibial spurs, abdomen with 6 ventrites) were shared with all the other West Indian genera of coccidulines. However, none of these West Indian genera fit the diagnosis of the Coccidulini presented in a concurrent revision of the South American representatives of the tribe (Gordon 1994a). At present there is no world treatment of Coccidulinae, but the South American taxa placed in the tribe Coccidulini (with the exception of the genera *Mimoscymnus* Gordon and *Planorbata* Gordon that belong in Hyperaspidae (Vandenberg, in prep.)) present a number of consistent diagnostic features. We contrast these with what we perceive as key characteristics of Sticholotidini (*sensu* Gordon 1977 and Miyatake 1994) (Sticholotidae), a subgroup of the notoriously paraphyletic subfamily that preliminary investigations by Ślipiński (2004) have supported as monophyletic.

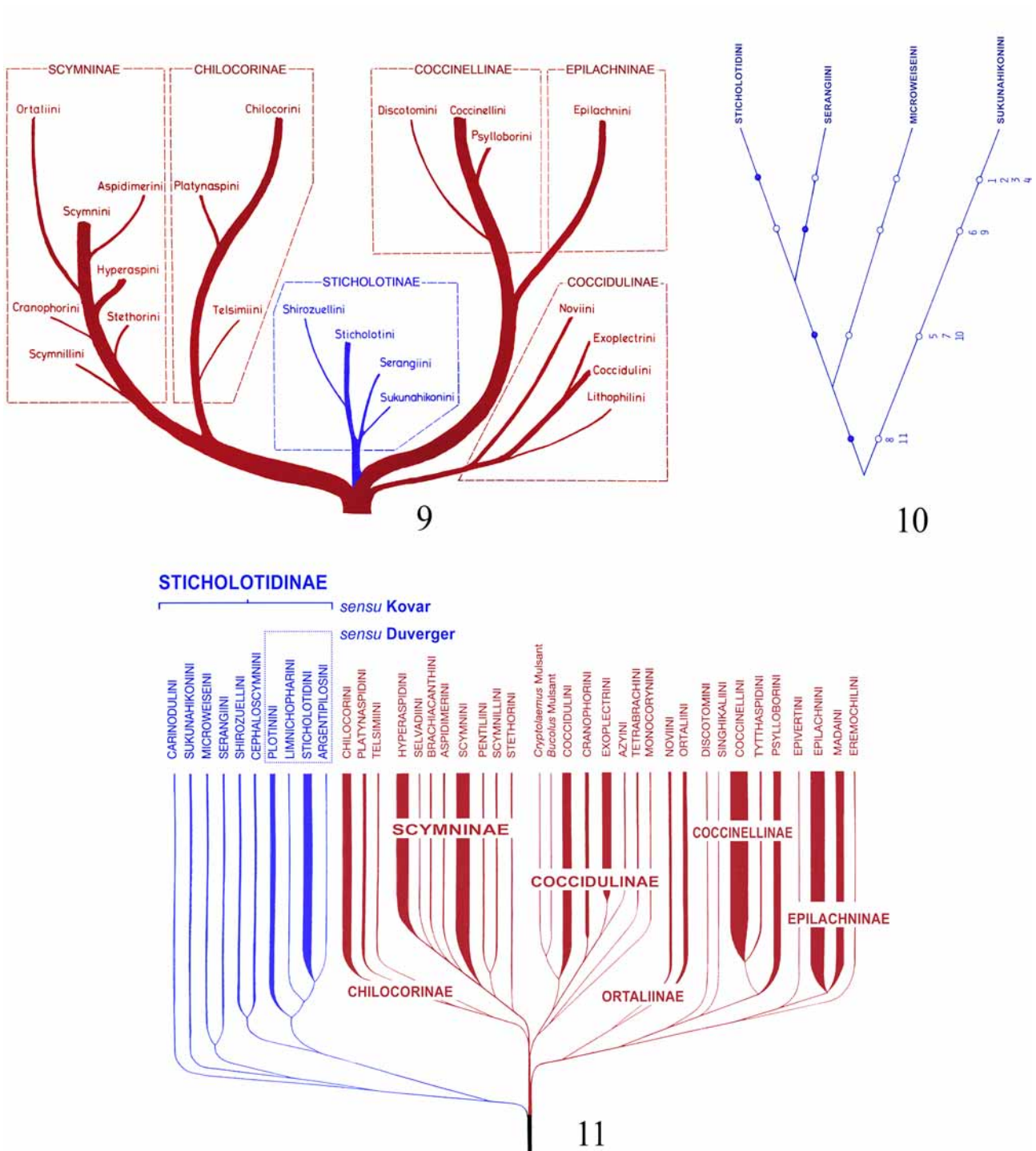


FIGURES 1–8. *Bura cuprea* Mulsant, adult specimen: 1. Head capsule, frontal view of left half showing compound eye and eye canthus; 2. Whole beetle, frontal view; 3. Same, left lateral view; 4. Prosternum, ventral surface; 5. Right antenna, lateral view; 6. Right antenna, distal portion, rotated to show patches of short sensory setae on mesal surfaces of last two antennomeres; 7. Left maxillary palp, ventral view; 8. Tarsal claw showing triangular tooth at base.

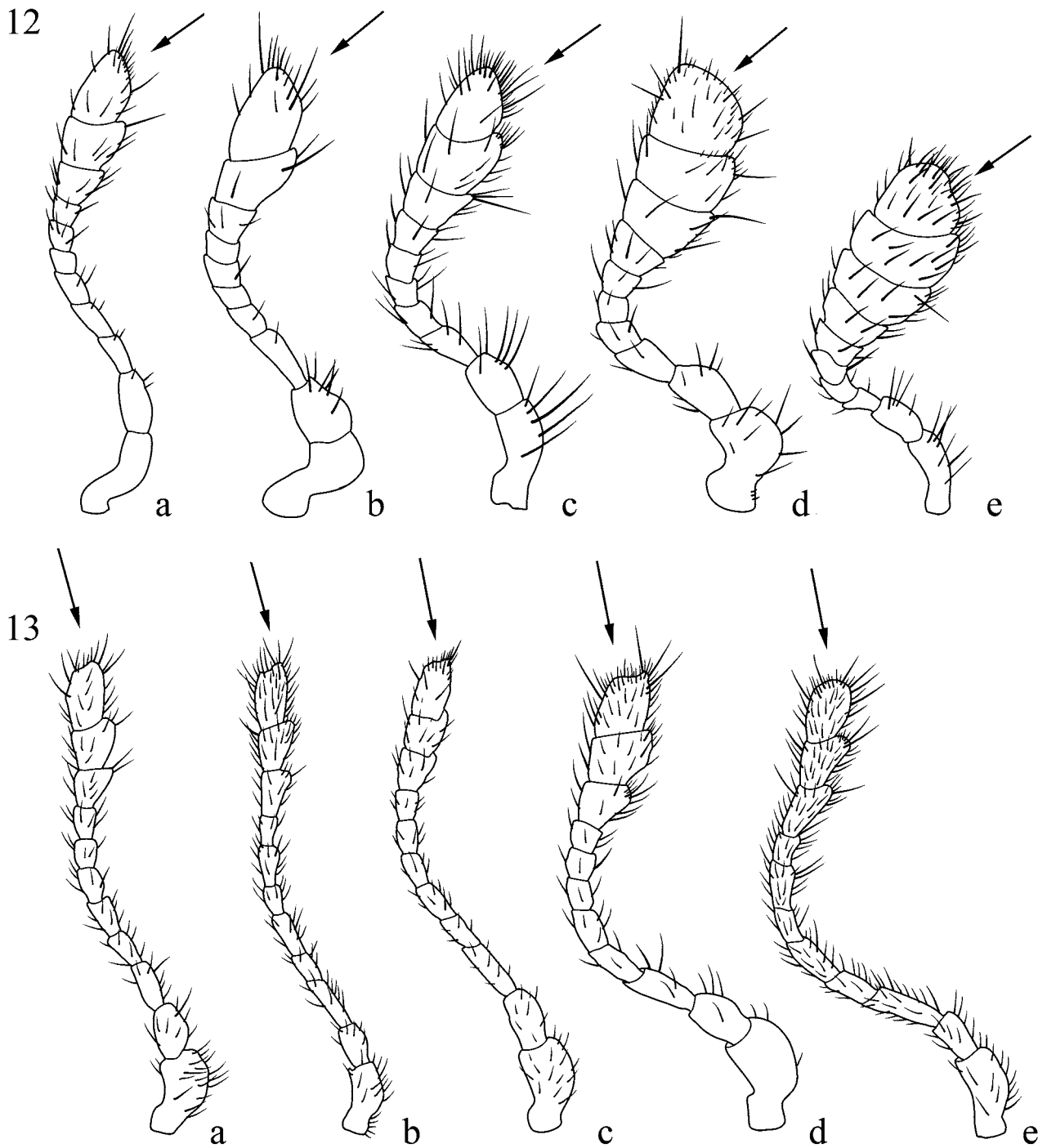
Systematics

Although many traditional character sets no longer serve to separate Sticholotidini (Sticholotidae) from Coccidulini (Coccidulinae), we believe the following diagnosis can distinguish these two tribes at least in the New World and perhaps globally. In particular, detailed differences in the antennae of these ladybirds (Figs. 12, 13) appear to be important both in separating them from superficially similar taxa and in determining actual affinities to more distantly related groups.

Ultimately, a more complete understanding of the Sticholotidini will require a careful comparison with taxa which are currently placed in other subfamilies, such as members of the tribes Scymnillini (Scymninae of authors, or Cryptognathinae *sensu* Duverger) and Chilocorini (Chilocorinae) which exhibit further similarities to certain sticholotidines, particularly in the structure of the eye, head capsule and mouthparts (Gordon 1994c; Kovar 1996; Vandenberg 2002).



FIGURES 9–11. Phylogenetic relationships among higher categories of Coccinellidae as proposed by different authors, Sticholotidinae (*sensu lato*) in blue: 9. Dendrogram proposed by Sasaji (1971); 10. Cladogram proposed by Gordon (1977); 11. Dendrogram proposed by Kovar (1996) (dotted line added to show restricted concept of Sticholotidinae *sensu* Duverger).



FIGURES 12–13. Comparison of antennal morphology between members of Sticholotidini (Sticholotidinae) and Coccidulini (Coccidulinae), arrow indicates area with concentration of short sensory setae (images have been redrawn to present a consistent orientation). 12. Sticholotidini: a, *Sticholotis* sp. (after Sasaji 1968); b, *Sticholotis* sp. (formerly *Nesolotis*) (after Miyatake 1966); c, *Lenasa* sp. (after Gordon 1994c); d, *Plotina* sp. (after Miyatake 1969); e, *Semiviride* sp. (after Gordon 1991). 13. Coccidulini (after Gordon 1994a): a, *Orbipressus* sp.; b, *Stenadalia* sp.; c, *Nothocolus* sp.; d, *Eupaleoides* sp.; e, *Eupalea* sp.

Tribe Sticholotidini

Diagnosis: Distinguished from Coccidulini by the compactly articulated antenna with well developed spin-

dle-shaped club bearing concentration of short sensory setae on mesal surface of last antennomere (Figs. 5, 6, 12 a–e) (vs. antenna loosely articulated with gradual or weakly developed saw-toothed club, concentration of short sensory setae at extreme apex or on obliquely (externally) oriented truncation (Figs. 13 a–e)). Eye canthus with narrow base, projected laterally onto compound eye and often extended well across it (Fig. 1) (vs. eye canthus obsolete to weakly developed or lobe-like with broad base). Eye facets moderate, somewhat flattened in direction of surface normal (vs. facets coarse, bead-like). Pronotum with anterior margin deeply subtrapezoidally emarginate, anterolateral angles well defined (Figs. 2, 3) (vs. pronotum with anterior margin truncate to shallowly, arcuately emarginate, anterolateral angles obsolete to broadly rounded). Meso-, metatibial spurs absent (vs. present). Male genitalia with parameres narrow, even (vs. broad, inflated). Prosternum often highly modified, abruptly raised medially or defined by sharp lateral carinae (Fig. 4) (vs. prosternum T-shaped, flattened to weakly raised).

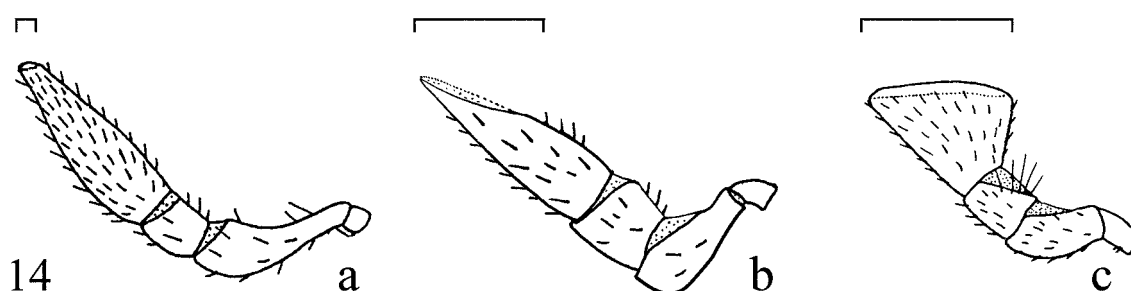


FIGURE 14. Diagrammatic comparison of the structure of the terminal maxillary palpomere, bracket indicates extent of membranous sensory surface: a, *Sukunahikona* sp.; b, *Sticholotis* sp.; c, typical securiform palp found in various taxa.

***Bura* Mulsant**

Bura Mulsant, 1850:374, 419. Type species: *Bura cuprea* Mulsant, by monotypy.

Diagnosis: Distinguished from most other Sticholotidini by the combination of circular, hemispherical to superhemispherical body form (Figs. 2–3), by the shape and development of the eye canthus (Fig. 1), clypeus not emarginate around antennal insertion, distal maxillary palpomere nearly parallel-sided (Fig. 7), and tarsal claw with a large subtriangular basal tooth (Fig. 8).

Redescription: Form (Figs. 2–3) compact, hemispherical to superhemispherical, shiny with metallic sheen; dorsum apparently glabrous except for sparse marginal setae. Punctuation on dorsal surfaces distinct, with intermixed large/small punctures on elytron, single-sized punctures on head and pronotum; minute seta associated with each puncture, scarcely visible using standard light microscopy. Head (Figs. 1–3) vertical, widest at middle of eye, tapered toward clypeus with scattered setae at inner margin of eye and anterior margin of clypeus; labrum distinctly narrower than clypeal margin, moderately setose, joined to clypeus by conspicuous trapezoidal membrane. Head capsule with slightly raised bead along inner margin of eye. Eyes (Fig. 1) well-developed, dorsally divergent; facets somewhat flattened, eye canthus long and narrow, with distal end slightly up-curved, partially dividing eye, subcarinate proximally, with several rows of facets visible below its ventral margin. Anterior, lateral margins of clypeus reflexed, not emarginate at antennal insertion. Antenna (Figs. 1, 5–6) inserted laterally beneath clypeal margin, moderately short and compact, composed of ten antennomeres; club gradual, well-developed, spindle shaped; mesal surface of penultimate antennomere projecting anterolaterally, with brush of short setae in small semi-membranous patch near apex; last antennomere with scattered short setae in distal half and dense concentration of short setae in large semi-membranous patch on mesal surface; both setal patches with indistinct boundaries. Mandible with bifid apex of which inner tooth shorter and thicker than outer tooth. Mentum moderately broadly joined to submentum. Distal maxillary

palpomere (Fig. 7) elongate, nearly parallel-sided, apically pointed, with long oblique sensory surface. Distal labial palpomere elongate, tapered to very small round sensory surface. Pronotum with marginal bead continuous along base and lateral margin to inner anterior angle directly behind inner margin of eye, very narrowly, faintly indicated beyond; anterior angle and lateral margin narrowly reflexed, with short widely spaced setae along reflexed edge. Elytron with lateral margin narrowly, sharply reflexed with distinct lateral bead bearing sparse short setae. Scutellum small, triangular. Pronotal hypomeron with depression to receive retracted antennal club. Prosternum forming a modified T or Y-shape (Fig. 4); short stem strongly raised above level of lateral arms with carinae distinct at least in anterior half and joined to form an inverted U. Coxae broadly separated; meso- and metasternites compactly joined with dividing sutures partially obliterated. Femur robust; tibia simple, slender, not externally dentate, apical spurs lacking; tarsi cryptotetramerous; claw with well developed triangular tooth at base (Fig. 8). Elytral epipleuron broad in anterior half, may be subfoveolate to receive femoral apices in repose, complete, inner margin narrowed by arcuate expansion of abdomen, tapered toward apex. Abdomen with five ventrites, extreme tip of sixth may be visible in males; postcoxal line of first ventrite curved posterolaterally, not quite attaining junction of posterior and lateral margins. Male genitalia with slender curved siphon; basal lobe and parameres elongate, bilaterally symmetrical or nearly so; basal piece symmetrical, lacking eccentric dorsal strut.

Remarks: In general facies, *Bura* looks very similar to many of the photographs of Australian *Sticholotis* species in a recent publication by Ślipiński (2004), but the latter have the clypeus emarginate around antennal insertions, distal maxillary palpomere spindle-shaped (apically convergent), median part of prosternum anteriorly produced, tarsal claw simple or merely broadened at base (lacking triangular tooth), and basal piece of male genitalia asymmetrical, with an eccentric dorsal strut.

Bura appears to be closely allied to many of the Neotropical sticholotidine genera described by Gordon (1969, 1977, 1991, 1994c), but these are generally small to minute beetles (1.8 to 1.25 mm in length) while *Bura cuprea* exceeds 2.5 mm and can reach up to 3.2 mm in length. In addition to the greater size, *Bura* can be distinguished primarily by the well-developed triangular tooth of the tarsal claw (Fig. 8). It is perhaps most similar to the genus *Lenasa* Gordon (1994c), but the latter is much smaller, more oval and less convex in body form, and with only a small acute tooth at the base of the tarsal claw. *Bura* also shares some features with the “cocciduline” taxa of the West Indies (Chapin 1930, Gordon 1994b), but in this case the overall similarity is not sufficient to cause any confusion in identification.

In his recent study of *Sticholotis*, Ślipiński (2004) chose to recognize a single broadly defined genus rather than continuing to segregate specialized species based on loss of flight wings or reduction in number of antennomeres. Presently, the Neotropical Sticholotidini consists of a number of small genera which share many features with *Bura* and with each other. If the trend begun with *Sticholotis* is continued in the world revision of Sticholotidinae (Ślipiński in prep.), we might expect a number of Neotropical sticholotidine genera to fall into synonymy with *Bura*. In particular the genus *Lenasa* does not differ from *Bura* except in the overall size and proportions of various body parts, not normally considered significant differences at the generic level.

Acknowledgments

For access to specimens examined during the study we thank Michael Ivie, West Indian Beetle Fauna Project; John Rawlins, Carnegie Museum of Natural History; and Robert Woodruff, Florida State Collection of Arthropods. For the review of the manuscript and many helpful comments, we thank Adriano Giorgi, University of Georgia, and Norman Woodley and Ronald Ochoa (SEL). Elisabeth Roberts (SEL) assisted with the final layout of plates for publication and produced the shaded illustrations (Figs. 1–8) and the antennal line drawings (Figs. 12–13). Marie Metz (SEL) colored and enhanced the phylogenetic diagrams (Figs. 9–11).

Literature cited

- Chapin, E.A. (1930) New Coccinellidae from the West Indies. *Journal of the Washington Academy of Sciences*, 20(20), 488–495.
- Duverger, C. (2003) Phylogénie des Coccinellidae. *Bulletin de la Société linnéenne de Bordeaux*, 31(2), 57–76.
- Gordon, R.D. (1969) A new genus and two new species of Sticholotini (Coleoptera: Coccinellidae) from South America. *Coleopterists Bulletin*, 23, 93–99.
- Gordon, R.D. (1977) Classification and phylogeny of the New World Sticholotidinae (Coccinellidae). *Coleopterists Bulletin*, 31, 185–228.
- Gordon, R.D. (1985) The Coccinellidae (Coleoptera) of America north of Mexico. *Journal of the New York Entomological Society*, 93(1), 1–912.
- Gordon, R.D. (1991) West Indian Coccinellidae IV (Coleoptera): new genera and species of Sticholotidini. *Proceedings of the Entomological Society of Washington*, 93, 298–316.
- Gordon, R.D. (1994a) South American Coccinellidae (Coleoptera). Part IV: definition of Exoplectrinae Crotch, Azyinae Mulsant, and Coccidulinae Crotch; a taxonomic revision of Coccidulini. *Revista Brasileira de Entomologia*, 38, 681–775.
- Gordon, R.D. (1994b) West Indian Coccinellidae V (Coleoptera): A review of Coccidulini and additions to *Psorolyma* Sicard. *Journal of the New York Entomological Society*, 102(2), 222–231.
- Gordon R.D. (1994c) West Indian Coccinellidae VI (Coleoptera): New genera and species of Sticholotidini and a cladistic analysis of included genera. *Journal of the New York Entomological Society*, 102(2), 232–241.
- Gordon, R.D. & de Almeida L.M. (1991) Sticholotidinae (Coleoptera, Coccinellidae) update: descriptions of new South American taxa. *Revista Brasileira de Entomologia*, 35, 147–154.
- Gordon, R.D., Pakaluk, J. & Ślipiński, S.A. (1989) Carinodulini, a new tribe of Sticholotidinae based upon a new genus and species from Mexico (Coleoptera: Coccinellidae). *Coleopterists Bulletin*, 43, 359–364.
- Kovar, I. (1996) Phylogeny. In: Hodek I., Honek A (Eds), *Ecology of Coccinellidae*. Dordrecht, The Netherlands: Kluwer Academic Publishers pp. 19–31 .
- Leng, C.W.(1920) *Catalogue of the Coleoptera of America, north of Mexico*. Mount Vernon, New York, 78 pp.
- Miyatake, M. (1966) A new genus belonging to the tribe Pharini from the northern part of the Ryukyu Islands (Coleoptera: Coccinellidae). *Transactions of the Shikoku Entomological Society*, 9, 47–50.
- Miyatake, M. (1969) The genus *Plotina* and related genera (Coleoptera: Coccinellidae). *Pacific Insects*, 11(2), 197–216.
- Miyatake, M. (1994) Revisional studies on Asian genera of the subfamily Sticholotidinae (Coleoptera: Coccinellidae). *Memoirs of the College of Agriculture, Ehime University*, 38, 223–292.
- Pal, T.K. & Lawrence, J.L. (1986) A new genus and subfamily of mycophagus Bothrideridae (Coleoptera: Cucujoidae) from the Indo-Australian region with notes on related families. *Journal of the Australian entomological Society, Canberra*, 25, 185–210.
- Pope, R.D. (1988) A revision of the Australian Coccinellidae (Coleoptera) Part 1. Subfamily Coccinellinae. *Invertebrate Taxonomy*, 2, 633–735.
- Sasaji, H. (1968) Phylogeny of the family Coccinellidae (Coleoptera). *Etizenia, Occasional Publications of the Biological Laboratory, Fukui University*, 35, 1–37.
- Sasaji, H. (1971) *Fauna Japonica Coccinellidae (Insecta: Coleoptera)*. Academic Press Japan, Tokyo, ix + 340 pp, xv plates.
- Ślipiński, S. A. (2004) Revision of the Australian Coccinellidae (Coleoptera). Part 2. Tribe Sticholotidini. *Annales Zoologici (Warszawa)*, 54, 389–402.
- Ślipiński, S.A. & Tomaszewska, W. (2005) Revision of the Australian Coccinellidae (Coleoptera). Part 3. Tribe Suku-nahikonini. *Australian journal of Entomology*, 44, 369–384.
- Vandenberg, N.J. (2002) Family 93. Coccinellidae Latreille 1807. In: R.H. Arnett, M. C. Thomas Jr, P.E. Skelley & J. H. Frank (Eds) *American Beetles. Volume 2. Polyphaga: Scarabaeoidea through Curculionoidea*. CRC Press LLC, Boca Raton, USA, pp. 371–389.