

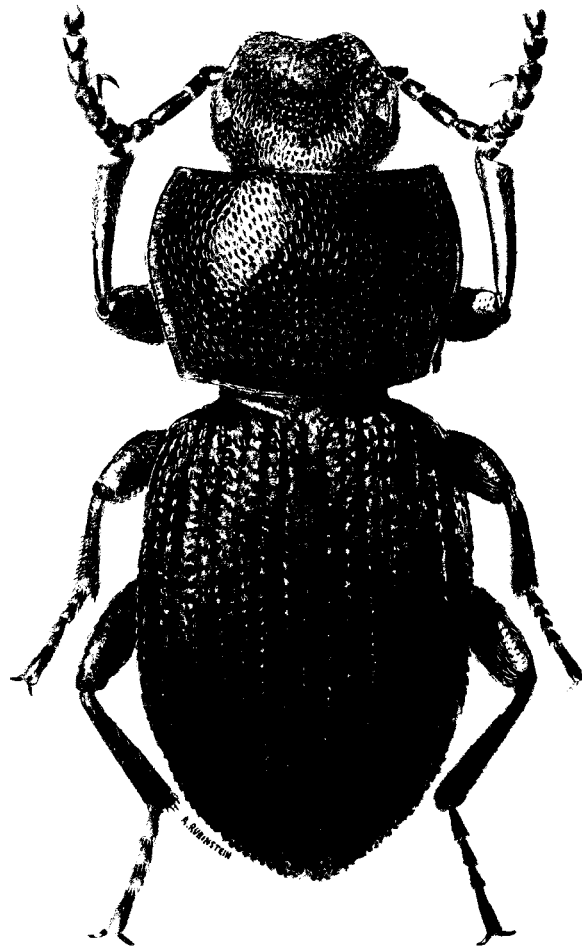
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Volume 39 (1985) is dedicated to the memory of Mrs. Patricia Vaurie, who was for many years associated with the American Museum of Natural History, New York. A biographical sketch and bibliography will be in the December issue.

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*MORYCHUS* ERICHSON,  
A SENIOR SYNONYM OF *BYRRHOBOLUS* FIORI  
(COLEOPTERA: BYRRHIDAE)

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ABSTRACT

The nomenclatural history and taxonomy of *Morychus rutilans* (Motschulsky), resurrected status, is briefly discussed. The Palearctic genus *Byrrhobolus* Fiori is newly synonymized with the Holarctic *Morychus* Erichson. *Byrrhobolus nepalensis* Paulus is transferred to *Morychus* as a new combination.

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In recent years, J. V. Matthews, Geological Survey of Canada, and other paleoentomologists/ecologists working with insect macrofossils from Quaternary peat deposits have recovered beetle specimen samples in tundra regions of Canada and Siberia which have been referred to the byrrhid species "*Chrysobyrrhulus rutilans* (Motschulsky)." Due to the growing activity in the use of insect macrofossils for interpreting past environmental conditions, and the need for nomenclatural and taxonomic clarity, the following brief notes were believed necessary.

The eastern Palearctic *Byrrhobolus rutilans* (Motschulsky, 1845) was originally described in the genus *Pedilophorus* Steffhany. Reitter (1911) placed *P. rutilans* into his new genus *Chrysobyrrhulus*, along with *P. metallicus* Chevrolat. Both species remained in the latter genus until Fiori (1965) proposed his new monotypic genus *Byrrhobolus* for *rutilans* in a general review of pedilophorine genera (Pedilophorinae, sensu Crowson 1955). *Chrysobyrrhulus metallicus* (Chev.) is the type species for its genus and has retained its generic placement. Mulsant and Rey (1869) had previously placed *rutilans* in *Morychus* Erichson, but Reitter (loc. cit.) did not include *Morychus* with the other pedilophorine genera when proposing *Chrysobyrrhulus*. Ganglbauer (1902) made no mention of *rutilans* nor of the genus *Morychus* in his earlier review of the Palearctic pedilophorine byrrhids. Consequently, *Morychus* has been traditionally associated with the byrrhine group (*Byrrhus* L., *Cytilus* Er., *Porcinolus* Muls.-Rey), although this action has never been justified. *Morychus* should be associated with the pedilophorine group. The present separation of Pedilophorinae from Byrrhinae is vague (Crowson, loc. cit., in conversation) based on the defining characters. I prefer to consider them as infrafamily groups within the Byrrhinae at this time, as a thorough phylogenetic test of the naturalness of the byrrhine-pedilophorine group is necessary before decisions can be made regarding their suprageneric classification.

Recently, Dr. Z. Kaszab, Hungarian Natural History Museum, Budapest, loaned me the same specimens of *rutilans* which Fiori used for the description

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of *Byrrhobolus*. Additionally, I examined two females loaned by J. V. Matthews, which had been collected in Siberia by S. A. Kiselyov, Moscow State University, U.S.S.R. I have not been able to examine the type; it is presumed to be in the Motschulsky collection in Moscow.

My examination of the above specimens, including a comparison with examples of the Palearctic *Morychus aeneus* (Fabricius) (the type species of *Morychus*), several Nearctic *Morychus* spp., and the Palearctic pedilophorine genera *Lamprobyrrhulus* Ganglbauer, *Pedilophorus* Steffhany, and *Carpathobyrrhulus* Ganglbauer, convinces me that *rutilans* was improperly placed by both Reitter and by Fiori, and should be returned to *Morychus*. Generic characters of *Morychus* which are found in *Byrrhobolus* (these in combination separate *Morychus* from the other genera) involve the following features: body form elongate, subparallel, highly convex dorsally, broadly rounded anteriorly and posteriorly; head incompletely retractile, mouthparts visible in repose; apical palpal segments flattened—pyriform to subsecuriform; antennae clavate, not fitting into prosternal grooves; prosternal disc T-shaped; legs highly modified for complete retraction, femora, tibiae, and tarsi closely matching and fitting into sternal excavations; tibia spinose dorsally; 3rd tarsomere with membranous ventral lobe; punctation and microsculpture moderately dense, random throughout; pubescence moderately long, slender and decumbent; dorsal integument usually aeneous or viridescens; aedeagus trilobed, apices of lateral lobes abruptly narrowing, sinuate, often hooked; apex of median lobe dorsally, subangularly explanate; basal piece not tubular, disc lightly sclerotized; female genital coxites short, broad, lightly sclerotized, moderately pubescent. *Morychus* is the valid name with *Byrrhobolus* as a new synonym and *Morychus rutilans* (Motschulsky) as a resurrected status.

Paulus (1982) described his new species *Byrrhobolus nepalensis* from the Himalayas, and repeated his earlier suggestion (Paulus 1972) that *Byrrhobolus* may be better treated as a subgenus of *Morychus*; however, a formal synonymy or recombination was not provided. I have not seen specimens of this species; however, I feel that Paulus's description and illustration leave little doubt that *nepalensis*, too, should be placed as *Morychus nepalensis* (Paulus), **new combination**.

#### ACKNOWLEDGMENTS

My thanks are extended to Dr. Z. Kaszab and Dr. J. V. Matthews, for the loan of specimens, and to Dr. A. F. Newton, M. K. Thayer and Dr. J. B. Johnson for reviewing the manuscript.

#### LITERATURE CITED

- CROWSON, R. A. 1955. The natural classification of the families of Coleoptera. Nathaniel Lloyd & Co., Ltd., London, 214 pp. (reprinted 1967).
- FIORI, G. 1965. *Byrrhobolus* nuovo genere asiatico di Pedilophorinae. VIII Contributo alla conoscenza della famiglia Byrrhidae (Coleoptera). Ist. Ent. Agr. Univ. Sassari 12:1-12.
- GANGLBAUER, L. 1902. Die generische Zerlegung der Byrrhiden-Gattung *Pedilophorus*. Verh. Zool.-Bot. Ges. Wien 3:92-94.
- MOTSCHULSKY, V. 1845. Remarques sur la collection de Coléoptères Russes. Bull. Soc. Imp. Natur. Moscou 18:51.
- MULSANT, E. AND C. REY. 1869. Tribu des Piluliformes, Histoire Naturelles Coléoptères de France. Ann. Soc. Linn. Lyon (n.s.) 17:201-378.

- PAULUS, H. F. 1972. Der Stand unserer Kenntnis über die Familie Byrrhidae (Col.). *Folia Ent. Hung.* (n.s.) 25:335-348.
- . 1982. Zwei neue Byrrhidae (Coleoptera) aus Nepal und Sikkim: *Chrysosimplocaria nepalensis* n.gen., n.sp., und *Byrrhobolus nepalensis* n.sp. *Ent. Zeit.* 92: 319-326.
- REITTER, E. 1911. *Fauna Germanica. Die Käfer des Deutschen Reiches. Vol. 3.* Stuttgart, 436 pp.

(Received 13 September 1984; accepted 5 November 1984)

### SCIENTIFIC NOTE

#### *PELIDNOTA PUNCTULATA* IN COSTA RICA—A CORRECTION (COLEOPTERA: SCARABAEIDAE)

Through an unfortunate series of events, there has recently appeared in print under my name, an article which contains numerous statements which are not supported by published information. The article in question (Janzen and Hardy 1983:753-754) includes the following inaccuracies:

1) *Pelidnota punctata* (Linnaeus) is mentioned, and references are made to observations made in Costa Rica which deal with the biology of this species. As previously published by me (Hardy 1975), this species occurs naturally in the eastern portion of the United States and in southern Ontario (Canada). Thus the species observed is not *Pelidnota punctata*, but some other taxon, which I have not examined. All statements in reference to *P. punctata* in this article should thus be disregarded.

2) There is a statement in the article which indicates that *Pelidnota punctulata* Bates is probably exceptional among closely related genera by being specific to one closely related group of plants for adult food. The biologies of most species of *Pelidnota* are unknown, and it is thus not unlikely that host specificity is quite common in the genus. *Plusiotis*, a very closely related group of species, are, to my knowledge, mainly restricted to species of *Quercus* (a few species in the genus are known to feed on other genera; however, the evidence is that these species are also host restricted).

3) In the introductory sentence, the statement that "adults of *Pelidnota punctulata* are the most conspicuous and easily located ruteline scarabs," is a remark to which I take exception, since in my experience species of *Anomala* are most readily encountered.

These are examples of specific instances of inaccuracies in the cited note. I would recommend that other data published there be used only with caution.

#### LITERATURE CITED

- HARDY, A. R. 1975. A revision of the genus *Pelidnota* of America north of Panama (Coleoptera: Scarabaeidae: Rutelinae). *Univ. California Publ. Entomol.* 78:1-43.
- JANZEN, D. H., AND A. R. HARDY. 1982. *Pelidnota punctulata* (Comecornizuelo, Ant-Acacia Beetle), pp. 753-754. *In: Costa Rican Natural History.* Edited by D. H. Janzen. University of Chicago Press, Chicago and London. 816 pp.
- Alan R. Hardy, *Insect Taxonomy Laboratory, California Department of Food and Agriculture, 1220 "N" Street, Sacramento, CA 95814.*

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## SCIENTIFIC NOTE

HOST PLANT RECORD FOR *FIGULUS REGULARIS* WESTWOOD  
(COLEOPTERA: LUCANIDAE)

On August 15, 1982 the author was collecting beetles on the Griffith University campus, Brisbane, Queensland. The standing base of a dead, partially burnt trunk (about 40 cm high) of *Xanthorrhoea johnsonii* A. Lee (Xanthorrhoeaceae) was accidentally knocked over, exposing a beetle larva (scarabaeoid). Examination of the central core region of the stump from ground level to about 10 cm below the surface, yielded two adults of *Figulus regularis* Westwood (Lucanidae) and another larva. They were found resting amongst very soft, moist, soil-like organic matter interspersed with large aggregations of faecal pellets. When disturbed or handled, the adults became rigid, with head and thorax slightly tilted upwards, mandibles spread apart and legs retracted or partially so. This behaviour appears to act as a defence mechanism. Further specimens of *F. regularis* were not collected from the area despite numerous searches, until September 30, 1984. A similar-sized, dead *X. johnsonii* stump was examined in an adjacent area on the Griffith University campus, after a moderate bush-fire had passed through the previous day. Two adults (one male and female) and two live larvae were collected from moist, decaying cortical tissue of the stump, as well as the rotting remains of another larva, apparently attacked by fungus. The outside layers of the stump, composed of tightly compacted leaf bases, were severely scorched, yet the beetles survived the fire without any apparent effects. In this woodland community where fires are frequent during summer, there may be selective advantage for *F. regularis* to colonize *Xanthorrhoea* stumps for protection against these fires and also predators.

*Figulus regularis* is a glossy-black lucanid, 15–20 mm long, with short, pointed mandibles measuring about 1.5 mm long (no sexual dimorphism in mandible size apparent). It is one of the most widespread of Australian Lucanidae, occurring from the Northern Territory to northern and eastern Queensland, but appears to be uncommon throughout this range (Hawkeswood, pers. obs.). The species is occasionally attracted to lights during summer nights and whole exoskeletons, or parts thereof, are sometimes found under fallen bark or small, rotting branches of *Eucalyptus* (Myrtaceae) on the ground. There are no other published host records for *F. regularis*, with most museum labels merely recording unidentified dead tree stumps or rotting timber as host sites. In concluding, it should be noted that the only other scarabaeoid beetle recorded from *Xanthorrhoea* is *Micropoecila breweri* Janson (Scarabaeidae) (Froggatt 1896). However, this record needs verification since almost nothing is known of the biology of this beetle. The above notes are provided since little data exist on the host plant relationships of Australian Lucanidae and beetles associated with *Xanthorrhoea* (Hawkeswood 1985).

## LITERATURE CITED

- FROGGATT, W. W. 1896. The entomology of the grass-trees (*Xanthorrhoea*). Proc. Linn. Soc. N.S.W. 21:74–87.
- HAWKESWOOD, T. J. 1985. Notes on some beetles (Coleoptera) associated with *Xanthorrhoea johnsonii* Lee (Xanthorrhoeaceae) in the Brisbane area, south-east Queensland. Vict. Nat. 102 (In press).

T. J. Hawkeswood, 49 Venner Road, Annerley, Brisbane, Queensland 4103, Australia.

(Received 24 October 1984; accepted 2 November 1984)

DESCRIPTION OF THE LARVA OF  
*ISCHALIA VANCOUVERENSIS* HARRINGTON  
(COLEOPTERA: ANTHICIDAE: ISCHALIINAE),  
WITH OBSERVATIONS ON THE SYSTEMATIC  
POSITION OF THE GENUS

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ABSTRACT

Larvae of *Ischalia vancouverensis* Harrington have been collected from fungal mycelia associated with decaying logs in Oregon and northern California. Identity of the larvae was suspected from associations with adults on the fungi and confirmed by rearing. The mature larva is described and illustrated. The presence of a single pair of stemmata, a mandibular penicillus and lack of urogomphi and urogomphal pits preclude the placement of *Ischalia* within the Pyrochroidae and indicate a close relationship with the Anthicidae.

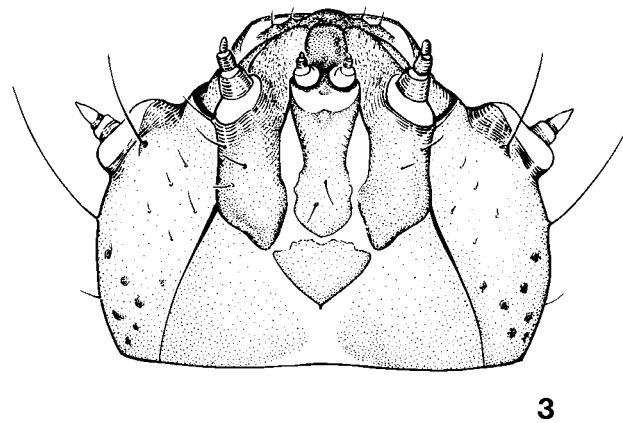
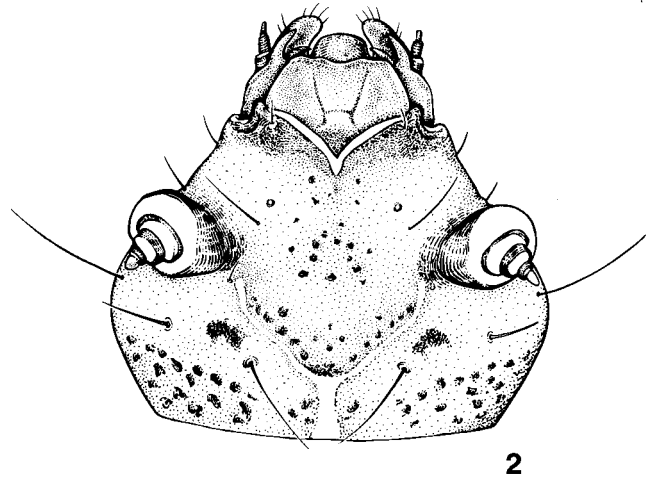
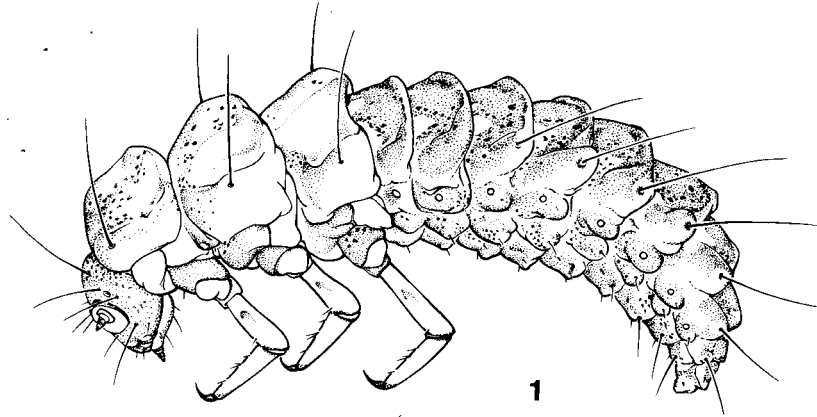
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Following his description of *Ischalia californica*, Van Dyke (1938) noted that he had always found *I. californica* and *I. vancouverensis* Harrington associated with fungal growth on decaying logs. He reported once finding a hollow log of tanbark oak, *Lithocarpus densiflora* (Hook. and Arn.), with numerous adults and larvae of *I. californica* feeding on a white fungal mycelium. Unfortunately, no larvae were adequately preserved for examination and an important character set went unstudied while *Ischalia* remained an enigma (Young 1983:1). However, two independent associations have now been confirmed for larvae of *I. vancouverensis*. In California, adults and larvae were taken as they crawled over fungal mycelium associated with the stump of a large ponderosa pine, *Pinus ponderosa* Laws. (Butte Co., 5 mi. NE Butte Meadows, 8 May 1976). Larvae have also been collected with adults in Oregon (Benton Co., 6.5 mi. SSW Philomath, 4 March 1976) and reared through to the adult stage by Mr. Gary L. Peters.

DESCRIPTION OF LARVA

Mature larvae (Fig. 1) attain lengths of 5.2-5.7 mm and widths of 1.7-2.2 mm. Body mostly orthosomatic and somewhat curved, sides subparallel. Head capsule, mandibles and coxae yellowish-brown and more heavily sclerotized than remainder of body; thoracic tergites creamy white to light yellow, flecked with brownish pigmentation, remainder of thorax creamy white, abdominal tergites yellowish-brown with cream-colored antero-lateral margins, abdominal laterotergites and sternites cream-colored with minute, raised brownish granules. Relative mesal lengths of head (from apex of labrum to occiput) to thorax to abdomen approximately 1.0:4.5:7.5. Vestiture of dorsal head capsule (Fig. 2) consisting of 10 elongate, tapering setae and several minute setae; thoracic and abdominal tergites bearing two stout, elongate tapering setae, one from each lateral margin, as well as scattered short setae and numerous slightly raised, pigmented granules.

*Head:* Cranium deflexed, nearly hypognathous, exserted from or slightly inserted within anterior portion of prothorax; moderately well sclerotized, labrum piceous, remainder



Figs. 1-3. *Ischalia vancouverensis* Harrington, larva. 1, habitus, lateral view. 2, head capsule, dorsal view. 3, head capsule, ventral view.



yellowish-brown, frequently suffused with irregular brown spots. Frontal arms of epicranial suture broadly U-shaped, extending to just behind antennal insertions; stem represented by broad, weakly sclerotized area, definitive suture lacking; endocarinae absent; frontoclypeal region slightly convex; frontoclypeal suture lacking. Each lateral aspect of head with a single, well-developed stemma located directly posteriad of antennal insertion. *Antennae* (Fig. 2) short, consisting of 3 basally sclerotized segments, capable of telescoping within the large, membranous socket; third segment longest and narrowest, lacking setae; sensory appendix lacking. *Mouthparts* retracted, supported posteroventrally by well-developed, posteriorly divergent hypostomal rods (Fig. 3); gular sutures strongly convergent distally, fusing at posterior rim of cranium, thus delimiting a subtriangular gula. *Labrum* cordate; epipharynx (Fig. 5) with 3 stout spine-like setae along each anterolateral margin and numerous mesally and posteromesally directed setae arising from either side of meson. *Mandibles* (Fig. 4) symmetrical, short, heavily sclerotized and wedge-shaped, with broadly triangular base, bidentate apex; dorsal surface of apical tooth bearing stout, blunt serrations; molar region bearing prominent, strongly curved tooth distad of dense brush of spine-like setae; dorsal mandibular armature lacking. *Maxilla* (Fig. 6) with small, undivided cardo, elongate stipes, bluntly rounded maxillary mala and 3-segmented palpus; maxillary articulating area absent. *Labium* (Fig. 3) with submentum elongate, widest anteriorly, mentum reduced, visible as small sclerite between bases of palpi, prementum heavily sclerotized I-shaped, 2-segmented palpi set in large, membranous socket; adoral surface of labium (Fig. 7) beset with dense brush of mesally and posteromesally directed setae, hypopharyngeal sclerome absent.

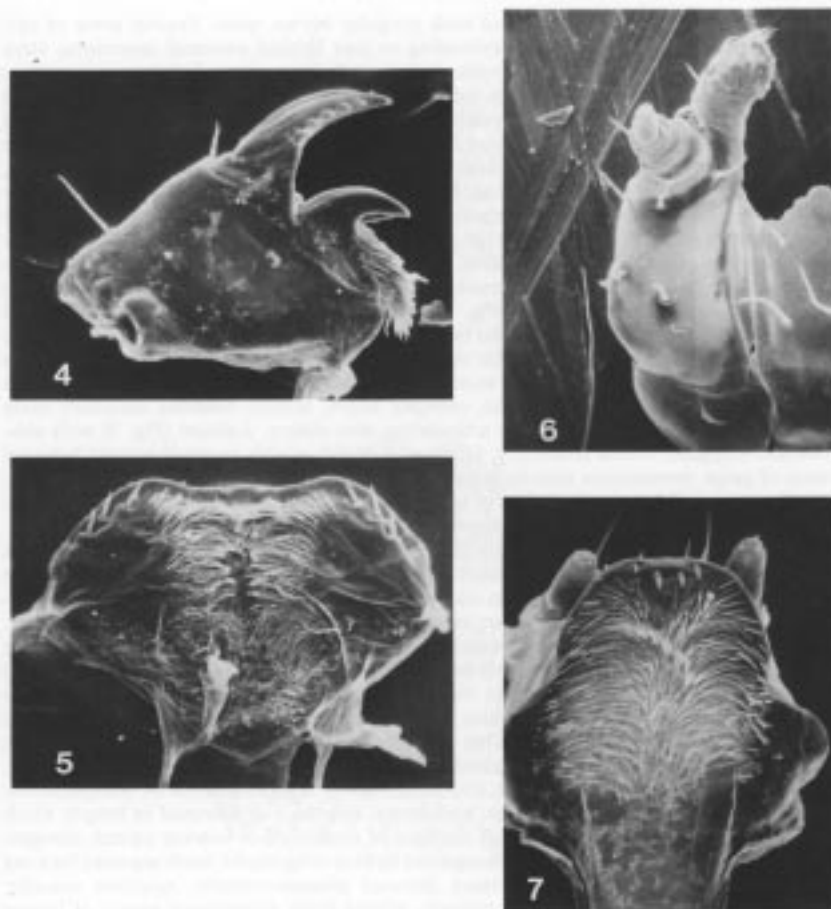
*Thorax*: Prothorax slightly longer and narrower than mesothorax and metathorax which are subequal in length and width. *Prothorax* with tergum slightly depressed on either side of meson, cervicosternum undivided; basisternum bearing 2 moderately elongate setae; coxae large, subglobular; intercoxal distance subequal to coxal diameter. *Mesothoracic* and *metathoracic* basisterna bisetose; mesothoracic laterotergite bisetose and bearing annular spiracle; legs well developed, elongate, coxa more heavily pigmented than remaining segments; trochanter with several short setae and small, ovate pigmentation spot located on ventral surface; femur bearing several short setae and a single elongate, ventrally directed seta; tibia sparsely setose, somewhat longer than femur; tarsungulus well sclerotized and pigmented.

*Abdomen*: Third segment widest, abdomen slightly tapered anteriorly, conspicuously narrower posteriad of sixth segment; abdominal tergites 1-8 subequal in length, ninth and tenth progressively shorter; hind margins of sternites 6-9 bearing paired, elongate posteroventrally directed setae; ninth segment lacking urogomphi; tenth segment forming apex of abdomen, with anal aperture directed posteroventrally; spiracles annular, slightly smaller than mesothoracic spiracle, arising from dorsolateral aspect of laterotergites 1-8.

#### SYSTEMATIC POSITION

Since its description, *Ischalia* has never enjoyed a sound systematic footing. Pascoe (1860) doubtfully referred his new genus to the Pedilidae as he expressed his dissatisfaction with the composition of the family. Unaware of Pascoe's work, LeConte (1862) described the first North American species under the generic name *Eupleurida* and placed it in the family Pyrochroidae. When he became aware of *Ischalia*, LeConte (1873) synonymized *Eupleurida*, but Blair (1920) felt that both genera were valid. In 1938, Van Dyke described *californica* and proposed that *Eupleurida* be treated as a subgenus of *Ischalia*. In recent papers (Paulus 1971; Young 1975, 1976) *Ischalia* has been treated as a pyrochroid.

Larvae of *Ischalia* may be characterized by the following diagnostic character set: head with 1 pair of stemmata; mandibles bearing a well-developed penicillus of spine-like setae basad of the mola; ninth abdominal tergum lacking urogomphi and urogomphal pits; ninth sternite without asperities. Pyrochroid



Figs. 4-7. *Ischalia vancoeverensis* Harrington, larva. 4, left mandible, dorsal view. 5, epipharynx. 6, right maxilla, ventral view. 7, hypopharynx.

larvae possess 4 stemmata on each anterolateral aspect of the head capsule, lack a mandibular penicillus, possess well-developed, fixed urogomphi and 2 urogomphal pits, and bear a series of preanal asperities along the anterior margin of the ninth abdominal sternite.

Within the Heteromera, larvae of Othniidae (*Prostominia*), Scaptiidae (Anaspidae) and Anthicidae possess a single pair of stemmata. Othniids lack a mandibular penicillus, bear well-developed urogomphi, and typically possess a series of preanal asperities along the anterior margin of the ninth abdominal sternite. Larvae of anaspidine Scaptiidae have a series of stout spines basad of the mandibular mola, but possess a pair of fixed urogomphi on the caudal margin of the ninth abdominal tergite. Most anthicid larvae also differ from the *Ischalia* diagnosis with respect to the presence of urogomphi. In fact, Böving and Craighead (1931) and Lawrence (1977) presented the view that anthicids

may be the closest relatives of the Scaptiidae. However, Lawrence (*in litt.*) has collected probable anthicid larvae from Australia which lack urogomphi, and *Ischalia* is certainly more anthicid-like with respect to anatomical features of the adult.

It should be pointed out that the scope of Anthicidae followed here is more restrictive than that proposed by Crowson (1955) and further expanded by Abdullah (1969). As presently understood, the anthicids conform to Lawrence's (1977) outline, with the addition of the Lemodinae (Young 1978) and exclusion of Pedilinae (*sensu* Young 1984). While the Eurygeniinae share numerous characters with the Anthicidae (Doyen 1979; Young, in preparation), the systematic position of this assemblage remains to be clarified. The discovery of additional eurygeniine larvae should contribute greatly to the resolution of how broadly the Anthicidae should be defined. By the same token, discovery of larvae for such aberrant "anthicid" taxa as *Steropes*, *Lagrioida*, *Mitraelabrus*, and the Ictistygynini will undoubtedly shed additional light on the higher classification of the Anthicidae.

On the basis of the above observations, it is clear that placement of *Ischalia* in the Pyrochroidae is in error. While a close relationship to Anthicidae is suggested, larvae and adults of *Ischalia* have a number of apparent autapomorphies, and it may yet require familial recognition to resolve the systematic position of the group. For the present, I recommend that *Ischalia* be transferred to the Anthicidae, where it would form a distinct subfamily, Ischaliinae, perhaps related to the Lemodinae.

#### ACKNOWLEDGMENTS

I thank Fred Andrews and Gary Peters for providing me with *Ischalia* larvae from California and Oregon, respectively. The time and effort spent by Mr. Peters to successfully rear larvae through to the adult stage and thus confirm the identification is also gratefully acknowledged. Figures 1-3 were prepared by Ms. Lana Tackett.

#### LITERATURE CITED

- ABDULLAH, M. 1969. The natural classification of the family Anthicidae with some ecological and ethological observations (Coleoptera). Dtsch. Ent. Ztsch. (N.F.) 16: 323-366.
- BLAIR, K. G. 1920. Notes on the coleopterous genus *Ischalia* Pascoe (Fam. Pyrochroidae), with descriptions of two new species from the Philippine Islands. Entomol. Mo. Mag. 56:133-135.
- BÖVING, A. G., AND F. C. CRAIGHEAD. 1931. An illustrated synopsis of the principal larval forms of the order Coleoptera. Entomologica Americana 11(N.S.):1-351.
- CROWSON, R. A. 1955. The natural classification of the families of Coleoptera. N. Lloyd, London. 187 pp.
- DOYEN, J. T. 1979. The larva and relationships of *Cononotus* LeConte (Coleoptera: Heteromera). Coleopt. Bull. 33:33-39.
- LAWRENCE, J. F. 1977. The family Pterogeniidae, with notes on the phylogeny of the Heteromera. Coleopt. Bull. 31:25-56.
- LECONTE, J. L. 1862. Classification of the Coleoptera of North America. Smithsonian Misc. Coll. 3:209-286.
- . 1873. Synonymical remarks upon the North American Coleoptera. Proc. Acad. Nat. Sci. Philadelphia 25:321-336.
- PASCOE, F. P. 1860. Notices of new or little known genera and species of Coleoptera. J. Entomol. 1:36-64, 98-132.

- PAULUS, H. F. 1971. Neue Pyrochroidae aus Nepal (Coleoptera, Heteromera), mit einer Diskussion der verwandtschaftlichen Verhältnisse der Familie. Ztschr. Arbeitsgemeinschaft Österreichischer Entomol. 23:75-85.
- VAN DYKE, E. C. 1938. New species of Pacific Coast Coleoptera (Cleridae, Pyrochroidae, Chrysomelidae). Entomol. News 49:189-195.
- YOUNG, D. K. 1975. A revision of the family Pyrochroidae (Coleoptera: Heteromera) for North America based on the larvae, pupae, and adults. Contrib. Amer. Entomol. Inst. 11:1-39.
- . 1976. A new species of *Ischalia* from southeastern China (Coleoptera: Pyrochroidae). Pan-Pacific Entomol. 52:213-215.
- . 1978. A new species of *Lagriomorpha*, with observations on the systematic position of the genus (Coleoptera: Anthicidae). Pacific Insects 18:105-109.
- . 1983. A catalog of the Coleoptera of America north of Mexico. Family Pyrochroidae. USDA Agric. Handbook 529-120, 9 pp.
- . 1984. *Anisotria shooki*, a new genus and species of Pedilinae (Coleoptera: Pyrochroidae), with a note on the systematic position of *Lithomacratia* Wickham and a key to the genera. Coleopt. Bull. 38:201-208.
- . Bionomics, phylogeny and systematics of the North American species of *Pedilus* Fischer (Coleoptera: Pyrochroidae). (In preparation.)

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### BOOKS ON COLEOPTERA

LOPATIN, I. K. 1984. (Originally printed in Russian in 1977.) **Leaf beetles (Chrysomelidae) of Central Asia and Kazakhstan.** Amerind Publishing Co., New Delhi. xxxiv + 416 pp., 721 figs. Price \$35.50 including handling and postage; available from the U.S. Department of Commerce, National Technical Information Service, Springfield, VA 22161 U.S.A. Quote order number PB85192904/LA. Also available on microfiche for \$4.50.

Contains keys to subfamilies, tribes, genera, and species, as well as descriptions of each for the 630 species and 70 subspecies from Central Asia and Kazakhstan.

MILTON, J. B., AND K. B. STURGEON (EDS.). 1982. **Bark beetles in North American conifers. A system for the study of evolutionary biology.** University of Texas Press, Box 7819, Austin, TX 78712 U.S.A. 527 pp. Price about \$20.00.

There are 10 chapters: 1) Biotic interactions and evolutionary changes, 2) Generalized ecology and life cycle of bark beetles, 3) Taxonomy and geographic variation, 4) Aggregation pheromones, 5) Relationships between bark beetles and their natural enemies, 6) Relationships between bark beetles and symbiotic organisms, 7) Host resistance and susceptibility, 8) Population dynamics of bark beetles, 9) Integrated management of bark beetles, and 10) Evolution of bark beetle communities.

REVIEW OF THE NEW WORLD GENUS  
*AENIGMATICUM* MATTHEWS  
(COLEOPTERA: CORYLOPHIDAE)<sup>1</sup>

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ABSTRACT

The species of the genus *Aenigmaticum* Matthews are reviewed. Five species are recognized; two of them, *A. mexicanum* and *A. prolatum*, are new. Lectotypes are designated for *A. californicum* Casey, *A. elongatum* (LeConte), and *A. ptilioides* Matthews. The known distribution of each species is mapped, and the median lobe for each species, except *A. prolatum*, is figured. The taxonomic history of *Aenigmaticum* is outlined, and a key to the species is included. A phylogeny of this genus is presented, and the phylogenetic position of *Aenigmaticum* in the Corylophidae is briefly discussed.

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In this paper, which is the first in a series on the taxonomy and phylogeny of the clavicorn family Corylophidae, I review the species of the New World genus *Aenigmaticum* Matthews. This genus is known only from scattered localities throughout North and Central America. These small to minute beetles are rarely collected, and our understanding of their biology and immatures is essentially nil. The limits of *Aenigmaticum* and its placement in the corylophids has been in doubt since this genus was first described nearly 100 years ago. This paper is the first attempt to place *Aenigmaticum* based on genealogy, but its sister-group and relationship to other corylophids is obfuscated since it is part of a primitive complex of genera which may be paraphyletic.

The pronotum was measured along its midline from the front to hind margin and at its widest point. Elytral length was measured from its base adjacent to the scutellum to its apical margin. A paucity of material prevented me from studying each species in the same detail. Therefore, the species descriptions vary in their content, and the only characters used in my phylogenetic analysis are those visible on whole specimens at 100× magnification.

TAXONOMIC HISTORY

Matthews (1888) described the genus *Aenigmaticum* based upon a single species, *A. ptilioides* Matthews. Casey (1889) described *A. californicum* and contrasted the two species. In a monograph of the Corylophidae of the world (Matthews 1899), *Aenigmaticum* was transferred from the Saciina, which included *Ectinocephalus*, *Conodes*, *Sacium*, and *Arthrolips*, to a new tribe, the Phanerocephalina, which consisted of the Saciina minus *Sacium* and *Arthrolips*. The Phanerocephalina were grouped together since they shared an elongate body and exposed head. Casey (1900) erected a new tribe, Aenigmaticini, for *Aenigmaticum*, and later Csiki (1910) added *Conodes* and *Ectinocephalus* to this tribe. Paulian (1950), in a reclassification of corylophids, added the Aenig-

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<sup>1</sup> Contribution number 1904 from the Department of Entomology, University of Kansas.

maticini to the Orthoperini which included the nominate genus. Orthoperines were grouped on the similarity of their mouthparts, although specimens of *Conodes* and *Ectinocephalus* were not examined.

*Aenigmaticum* Matthews

*Aenigmaticum* Matthews, 1888:104. Type species, by monotypy, *A. ptilioides* Matthews.

Members of this genus are distinguished from other corylophids by their exposed head, nine-segmented antennae, prothorax narrowed posteriorly, and elytra with finely impressed striae which extend along the elytral suture to the humeral angles. Specimens of this genus are poorly represented in museum collections. There is little information on their habitat, and immature stages are unknown.

KEY TO SPECIES OF *AENIGMATICUM*

1. Prosternum with longitudinal median carina preceding intercoxal process ..... 2
- Prosternum without longitudinal median carina preceding intercoxal process ..... 4
2. Antenna with segment IX twice as long as VIII; elytral vestiture consisting of long recurved hairs distinctly visible at 10× magnification; size small, about 1.3 mm ..... *prolatum*, new species
- Antenna with segment IX never more than 1.7× length of VIII; elytral vestiture consisting of sparse, short hairs barely visible at 10× magnification; size minute, less than 1.0 mm ..... 3
3. Funicle reduced, ½ total length of club; pronotum with very fine punctation, with a distinct median basal impression effaced laterally ..... *elongatum* (LeConte)
- Funicle normal, at least ⅔ total length of club; pronotum with moderately coarse punctation, with basal impression complete ..... *ptilioides* Matthews
4. Pygidium partially exposed; ventrite I subequal in length to ventrites II-V; size less than 1.2 mm ..... *californicum* Casey
- Pygidium entirely exposed, including part of propygidium; ventrite I subequal in length to ventrites II-IV; size 1.9 mm or larger ..... *mexicanum*, new species

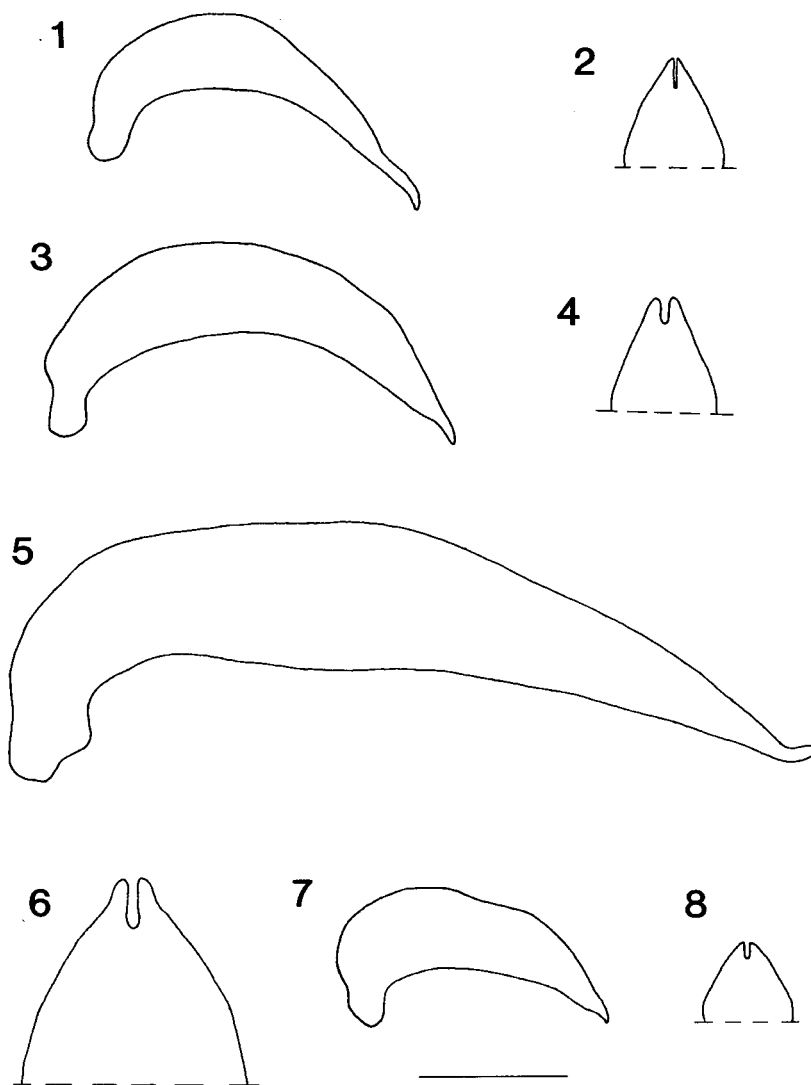
*Aenigmaticum californicum* Casey  
(Figs. 3, 4, 9)

*Aenigmaticum californicum* Casey, 1889:144. Type locality: Alameda Co., California.

This is the most common species and may be distinguished from *A. mexicanum* by its smaller size and by its pronotum being widest at the middle. The elytral vestiture consists of short, distinct hairs.

TYPE MATERIAL. Lectotype, here designated, California: Alameda Co. (USNM); paralectotypes, same data as lectotype (6 USNM); San Mateo Co. (8 USNM).

MATERIAL EXAMINED. Sixty-eight specimens from **California**: (MCZC) San Francisco (CASC, MCZC); San Francisco Bay Area (CASC); Hills back of Oakland (CASC); Monterrey Co., Pt. Lobos, Carmel (AMNH, MCZC); Santa Barbara (CASC, MCZC); Redondo (MCZC); Ventura (MCZC).



Figs. 1-8. *Aenigmaticum* spp., median lobe, 1, 3, 5, 7, lateral view; and 2, 4, 6, 8, apex, ventral view. 1, 2, *A. ptilioides*. 3, 4, *A. californicum*. 5, 6, *A. mexicanum*. 7, 8, *A. elongatum*. Scale line equals 0.1 mm.

**DISTRIBUTION.** This species is known only from California. It has been taken most often in the San Francisco Bay region, but extends along the coast to Los Angeles (Fig. 9).

**BIOLOGY.** Collected from inflorescences of an unidentified plant. This species has been taken in February-April, June-August, and December.

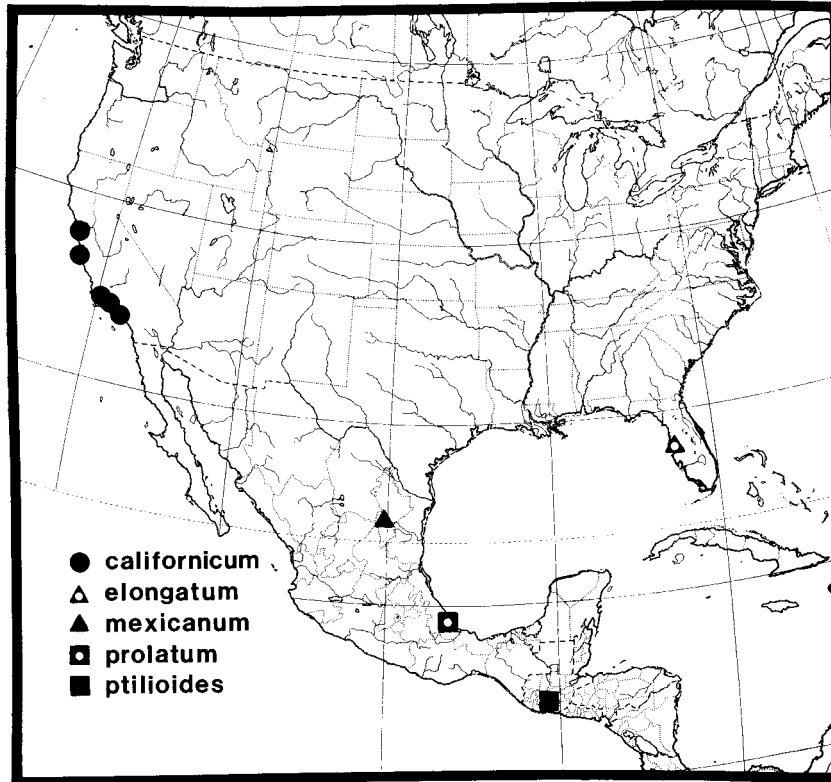


Fig. 9. Known distribution of the species of *Aenigmaticum*.

*Aenigmaticum elongatum* (LeConte)

(Figs. 7, 8, 9)

*Orthoperus elongatus* LeConte, 1878:599. Type locality: Tampa, Florida.

This is the smallest species. It is the sister-group to *A. prolatum*, although it superficially resembles *A. ptilioides*. It can be separated from *A. ptilioides* by the key characters, its smaller size, and more compact body.

TYPE MATERIAL. Lectotype, here designated, Florida: Tampa, 4.4, J. LeConte Collection (MCZC); paralectotype—same data as lectotype (MCZC).

MATERIAL EXAMINED. Five specimens. **Florida:** Tampa (USNM).

DISTRIBUTION. This species is known only from the type locality (Fig. 9).

BIOLOGY. Habitat unknown. Adults have been collected only in April.

*Aenigmaticum mexicanum* Pakaluk, new species

(Figs. 5, 6, 9)

This species is the most distinctive *Aenigmaticum*. It can be separated from the other species by its larger size, exposed propygidium, and distinct elytral vestiture.



**DESCRIPTION.** Length 1.9–2.1 mm. Color reddish-brown; vestiture of fine, short, white hairs. Antennal segment II equal in length to III + IV, segment III longer than IV, segment V longer than VI, segments III and V, IV and VI subequal. Front finely pubescent, with minute punctures barely visible at 100× magnification. Pronotum about 1.25× as wide as long, widest at apical third; punctation distinct; disc slightly convex; lateral margins visible from above for entire length, front angles gradually sloping; basal impression weak, entire. Hind tarsus with segment IV longer than I–III combined, segment III smallest. Scutellum large, about twice as wide as long. Elytra about 1.35× as long as wide, about 2.60× longer than pronotum; moderately punctate, with fine pubescence. Pygidium and most of propygidium exposed. Ventrite I large, subequal in length to ventrites II–IV; ventrites II, III, IV subequal; ventrite V longer than IV. Median lobe (Figs. 5, 6) about 0.7× as long as abdomen.

**TYPE MATERIAL.** Holotype: **Mexico:** N.L., Cerro Potosi, 10,700', VII.15.1970, A.F. Newton, between leaves at base of dead *Agave* (MCZC); 12 paratypes, same data as holotype (2 BMNH, 8 MCZC, 2 USNM).

**DISTRIBUTION.** Known only from the type locality in Nuevo León, Mexico (Fig. 9).

**BIOLOGY.** This species has been collected between the leaves at the base of dead *Agave*. The type series was collected in July.

**ETYMOLOGY.** The name *mexicanum* is derived from the country where the type series was collected.

*Aenigmaticum prolatum* Pakaluk, new species  
(Fig. 9)

This species is easily distinguished from its sister-species, *A. elongatum*, by the enlarged ninth antennal segment, larger size, and elytral vestiture of distinct, recurved hairs. Males of this species are unknown.

**DESCRIPTION.** Length 1.3 mm. Color dark reddish-brown; vestiture of relatively dense, recurved light-brown hairs. Antennal segments VII and VIII subequal, segment IX enlarged, wider and twice as long as penultimate segment. Front finely pubescent, with punctures distinct at 100× magnification. Pronotum about 1.25× as wide as long, widest at apical quarter; punctation dense; disc moderately convex; lateral margins not visible from above for entire length, obscured apically by strongly sloping front angles; basal impression weak, reduced laterally. Scutellum large, about twice as wide as long. Elytra about 1.30× as long as wide, about 2.40× longer than pronotum; punctation light but distinct, denser toward lateral edges; pubescence relatively dense, hairs recurved. Part of pygidium exposed, propygidium concealed by elytra. Ventrite I equal in length to ventrites II–V; ventrites II, III, IV subequal; ventrite V twice as long as IV.

**TYPE MATERIAL.** Holotype **Mexico:** Vera Cruz, Koebele, Koebele Collection (CASC); 1 paratype, same data as holotype (CASC).

**DISTRIBUTION.** Known only from the type locality in Vera Cruz, Mexico (Fig. 9).

**BIOLOGY.** Habitat unknown.

**ETYMOLOGY.** The name *prolatum* is derived from the Latin *prolatus*, meaning extended, referring to the elongate ninth antennal segment.

*Aenigmaticum ptilioides* Matthews  
(Figs. 1, 2, 9)

*Aenigmaticum ptilioides* Matthews, 1888:105. Type locality: Capetillo, Guatemala.

The carinate prosternum and complete basal pronotal impression easily

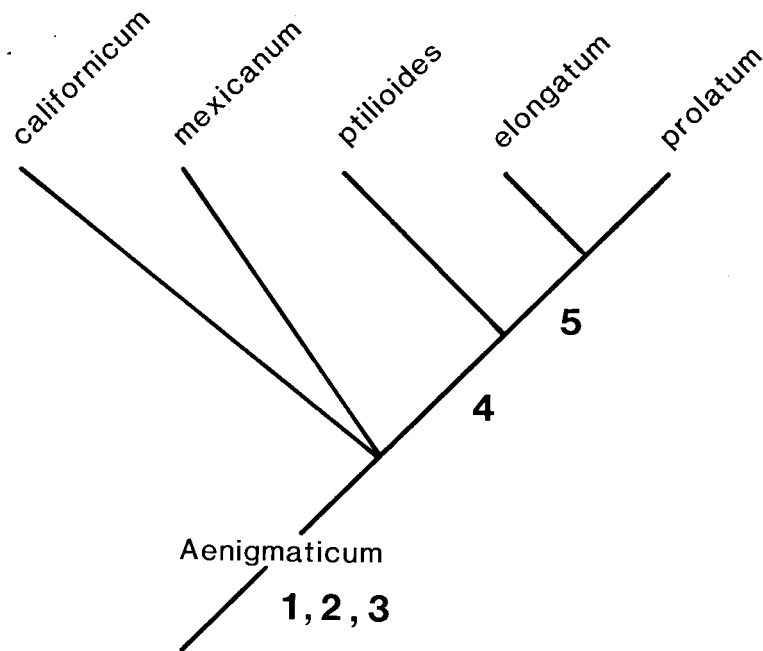


Fig. 10. Proposed phylogeny of *Aenigmaticum*.

distinguish this species. It is the sister-group to *A. elongatum* + *A. prolatum*. Matthews (1899) apparently misinterpreted a letter from Casey and synonymized this species with *A. elongatum*. The two species are, however, distinct.

**TYPE MATERIAL.** Lectotype, here designated, Guatemala: Capetillo, C. Champion (BMNH); paralectotype, Guatemala: Guatemala City, Champion (BMNH).

**MATERIAL EXAMINED.** Only the type material (2 specimens) seen.

**DISTRIBUTION.** This species is known only from Guatemala (Fig. 9).

**BIOLOGY.** Habitat unknown.

#### DISCUSSION

The sister-group of *Aenigmaticum* and the position of that lineage within the Corylophidae are unresolved. A brief discussion, however, of the phylogeny of *Aenigmaticum* and its possible relationship to other corylophids is warranted. The polarity of characters was determined by out-group comparisons, which were complicated since the relationship of *Aenigmaticum* to other corylophids is unknown. I examined taxa from each subfamily or tribe within the family, as well as primitive taxa of the two likely sister-groups to corylophids, the Cerylonidae and Lathridiidae.

Two groups can be delimited within the family. The "higher" corylophids include the Sericoderinae, Saciinae, Peltinodinae, and most Corylophinae. Apomorphic characters uniting this lineage may include a reduced prosternum and absence of a basal pronotal impression in adults, and larvae with abdominal

Table 1. Characters used in phylogenetic analysis of *Aenigmaticum*.

Character	Plesiomorphic	Apomorphic
1.	Elytra with sutural striae incomplete, not extending beyond scutellum	Elytra with sutural striae complete, extending to humerus
2.	Pronotum with strong basal impression	Pronotum with weak basal impression
3.	Antennae 10-segmented	Antennae 9-segmented
4.	Prosternum without median carina	Prosternum with median carina
5.	Pronotum with basal impression complete	Pronotum with basal impression effaced laterally

defensive glands and clavate tarsungular setae. *Orthoperus* belongs in the higher Corylophidae, so the Orthoperini is paraphyletic. The "primitive" corylophids include *Conodes*, *Aenigmaticum*, the Australian *Pria rubicunda* MacLeay (previously in the Nitidulidae), the South American genus *Hyplathrinus* (previously in the Lathridiidae), and several undescribed genera. These primitive genera may form a monophyletic group which is the sister-group to the higher corylophids, or they may represent several basal lineages within the family. It is beyond the scope of this paper to elucidate their relationships. Few characters in too few taxa have been critically studied, to be sure; so the conclusions of this paper are speculative. Until a worldwide study of corylophids is undertaken, it is premature to attempt to reclassify the family with these data.

The species of *Aenigmaticum* form a distinctive group which share several apomorphies (Table 1; Fig. 10). Complete elytral striae, extending to the humeral angles, are not found in related groups. The plesiomorphic condition is with the striae present, but never extending beyond the scutellum. This is found in all other corylophids with an exposed head. A condition similar to that of *Aenigmaticum* is found in *Holoparamacus*, but since the merophysids have recently been placed in an expanded Endomychidae (Lawrence 1982, in press), this condition has certainly evolved independently.

Most of the primitive corylophids have a strong basal impression on the pronotum. This impression is weak in *Aenigmaticum*. *Orthoperus* lacks this impression, as do most other corylophids, but this condition has been secondarily derived in some higher corylophids, e.g., *Corylophodes*. The nine-segmented antennae of *Aenigmaticum* are interpreted as apomorphic since its closest relatives possess ten- or eleven-segmented antennae. Therefore, the nine-segmented antennae of *Orthoperus* and *Sicardianus* represent two independently derived conditions. A prosternal carina is absent in all primitive corylophids except in the *A. ptilioides* group. Most of the higher corylophids have a distinct prosternal keel, but this is an accommodation to a reduced prosternum and it is not homologous.

#### ACKNOWLEDGMENTS

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## LITERATURE CITED

- CASEY, T. L. 1889. Coleopterological notices. I. Annals of the New York Academy of Sciences 5:39-198.
- . 1900. A review of the American Corylophidae, Cryptophagidae, Tritomidae and Dermestidae, with other studies. Journal of the New York Entomological Society 8:51-172.
- CSIKI, E. 1910. Pars 18. Orthoperidae, 28 pp. *In*: W. Junk and S. Schenkling (editors), Coleopterorum Catalogus, vol. 8. W. Junk, Berlin.
- LAWRENCE, J. F. 1982. Coleoptera, vol. 2:482-553. *In*: S. P. Parker (editor), Synopsis and classification of living organisms. McGraw-Hill, New York.
- . *In press*. Coleoptera. Family Corylophidae (Cucujoidea). *In*: F. W. Stehr (editor), An introduction to immature insects of North America. Vol. 2. Kendall-Hunt, Dubuque.
- MATTHEWS, A. 1888. Fam. Corylophidae, pp. 102-125. *In*: Biologia Centrali-Americana. Insecta. Coleoptera. vol. II, pt. 1.
- . 1899. A monograph of the coleopterous families Corylophidae and Sphaeriidae. Janson & Son, London. 220 pp.
- PAULIAN, R. 1950. Les Corylophidae d'Afrique. Mémoires de l'Institut français d'Afrique noire. Number 12. 126 pp.

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INTERNATIONAL COMMISSION ON  
ZOOLOGICAL NOMENCLATURE

The following Opinion has been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 42, on 2 April 1985:

Opinion No. 1290 (p. 21)—*Leptinotarsa* Chevrolat, 1837 (Insecta, Coleoptera): conserved.

R. V. Melville, Secretary  
International Comm. Zool. Nomen.  
% British Museum (Natural History)  
Cromwell Road  
London, SW7 5BD, UK

GROWTH AND DEVELOPMENT OF *APHODIUS* BEETLES  
(SCARABAEIDAE) IN LABORATORY MICROCOSMS  
OF COW DUNG

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ABSTRACT

Laboratory microcosms were designed to analyse the growth and development of *Aphodius* spp. beetles. Life cycles of these experimental beetles were similar to those of beetles under natural field conditions. Higher experimental temperatures and densities of beetles may have influenced the size of beetle progeny.

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Recently, ecologists have made increasing use of laboratory microcosms to simplify and simulate processes occurring in natural ecosystems (e.g., Giesy 1980). Microcosms are especially useful for the study of decomposition processes since organic matter decomposes under the influence of numerous biotic and abiotic factors; selected factors can be controlled in microcosms. Microcosms also have been used to measure the effects of species interactions. The work of Gause (1934, 1935) was one of the important early efforts in this area. Entomologists have used laboratory microcosms to measure the effects of scarabaeid beetles on dung-inhabiting nematode and dipteran pests of cattle (Bergstrom *et al.* 1976; Moon *et al.* 1980).

This study measured the rate of development of *Aphodius* beetles in laboratory microcosms of decomposing cattle dung. The objectives of the research were: (1) to simulate the conditions of natural dung pats in the laboratory and (2) to determine if beetle development occurs normally in microcosms.

METHODS

Two experiments were conducted. In the first experiment, 50 microcosms were used to determine the pattern of development of two species of *Aphodius*: *A. fimetarius* (L.) and *A. fossor* (L.). The focus of the second experiment was an analysis of density effects on beetle development; this experiment involved 60 microcosms.

**MICROCOSM DESIGN.** Microcosms were constructed of cylindrical, plastic-lined cardboard cartons (17 cm high, 17 cm inside diameter). Sifted soil (60% sterilized sand, 40% potting soil) was adjusted to ca. 15% moisture and firmly tamped to a depth of 10 cm. A hole (10 cm diameter) was cut in the lid of each carton and plastic screen (1 mm opening) was glued to cover the hole. This hole permitted gas exchange, light penetration and visual analysis of dung degradation.

In each carton, an artificial dung pat was constructed by placing fresh dung in a hardware cloth cylinder (12 cm diameter, 3.5 cm high). Hardware cloth

Table 1. Ranges of density (number of adults per gram of fresh dung) of aphodiine beetles in sheep and cow dung.

Type of dung	Experimental conditions	Beetle density (number/g fresh mass)	Reference
Cow	Laboratory microcosms ( <i>Aphodius fimetarius</i> and <i>A. fossor</i> )		Present study
	Experiment 1	0.004 to 0.009	
	Experiment 2	0.011 to 0.033	
Cow	Field microcosms	0.030 to 0.045	Lussenhop <i>et al.</i> 1980
Cow	Field microcosms ( <i>Aphodius rufipes</i> )	0.007 to 0.043	Holter 1979
Cow	Field microcosms ( <i>Aphodius</i> spp.)	0.001 to 0.003	Kessler and Balsbaugh 1972
Cow	Field microcosms ( <i>Aphodius haemorrhoidalis</i> )	0.021	Wingo <i>et al.</i> 1974
Sheep	Laboratory microcosms ( <i>Aphodius</i> spp.)	0.200 to 0.800	Breymeyer <i>et al.</i> 1975
Sheep and cow	Laboratory microcosms ( <i>Aphodius</i> spp.)	0.400 to 4.50	Bergstrom <i>et al.</i> 1976

cylinders were removed after dung had formed a pat. Dung was collected from lactating Holstein cows fed corn and barley silage and hay.

Microcosms were placed in a glasshouse of the Soil Invertebrate Ecology Laboratory of the Lafayette Experimental Station of the SUNY College of Environmental Science and Forestry. A shading fabric (reducing light penetration 95%) placed over the glass roof, reduced daytime temperatures during the experimental periods [June through August 1981 (experiment 1) and 1982 (experiment 2)].

**INSECT TREATMENTS.** In the first experiment, two to four unsexed adults of a single species (*A. fimetarius* and *A. fossor*) were added to each pat at the start of the experiment. In the second part of the study, microcosms had two beetle treatments: (1) low density (5 *A. fimetarius* or *A. fossor*) and (2) high density (15 beetles of a single species). These ranges of density are less than some laboratory populations of aphodiine beetles but are comparable to field populations (Table 1).

**SAMPLE SCHEDULE AND BEETLE EXTRACTION.** Five microcosms were randomly sampled on the following days: 4, 6, 8, 11, 14, 20, 32, 39, 53, and 62. In the second experiment, six microcosms of each insect treatment were randomly selected on the following days: 10, 20, 30, 40, and 48.

Adults and larvae were extracted from the soil underlying each dung pat by flotation in water. This method is highly efficient (Holter 1979). Each dung pat was hand-sorted for adults and larvae. Thus, densities of adults were known for each sample at the start of the experiment and at the sampling date. Density of larvae and pupae in each pat also were known at the sampling date. Finally,

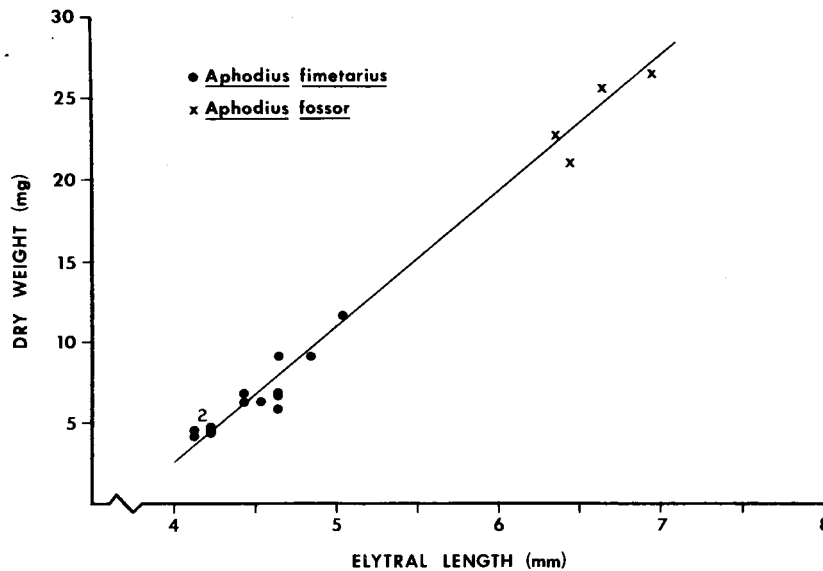


Fig. 1. Relationship between elytral lengths of *Aphodius* beetles and their dry masses. See text for statistics of the regression equation.

dry mass of adults following extraction was estimated from a regression equation of dry mass on elytral length as determined from freshly-killed *Aphodius* beetles (see Fig. 1):

$$Y = 8.357X - 30.903 \quad (r = 0.995, n = 18, P < 0.01)$$

in which Y = dry mass and X = elytral length.

#### RESULTS AND DISCUSSION

**DURATION OF LIFE CYCLE.** Both *A. fimetarius* and *A. fossor* reproduced within the experimental microcosms. Larvae developed within the dung pats, often causing considerable degradation of dung. New adults [hereafter referred to as second generation adults (those initially added to microcosms are first generation adults)] emerged from pupae that had developed in the soil underneath the pat. Thus, all stages of the beetle life cycle were completed within the microcosms.

The developmental cycle of experimental *A. fimetarius* beetles is presented in Figure 2. (Insufficient data prevented a similar analysis for *A. fossor*.) These data agree with the general life cycle of aphodiine beetles in the field. In summer, *Aphodius* beetles hatch from eggs in three to five days, and the instars last two to four days (first instar), three to eight days (second) and three to five weeks (third) (Landin 1961; Holter 1975). Pupae eclose after eight to 30 days. Thus, the environment within the experimental microcosms was suitable for normal beetle development.

**FACTORS AFFECTING ADULT BIOMASS.** Biomass of adults was determined for both first and second generation adults in the second experiment. To assess

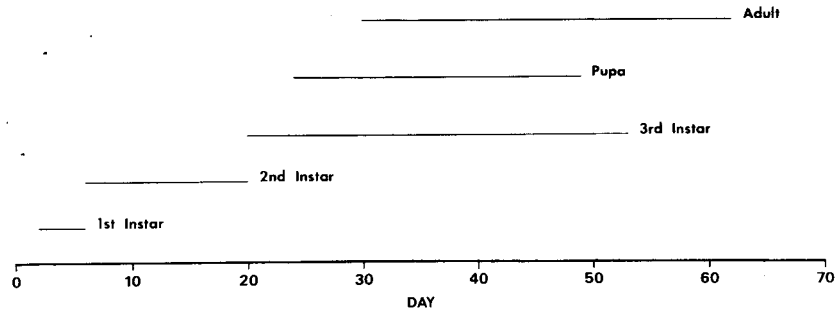


Fig. 2. Development cycle of *Aphodius fimetarius* (L.) within the experimental microcosms.

effects of the microcosm environment on beetle biomass, beetles extracted on days 10 and 20 were treated as first generation adults, since second generation adults did not appear until day 30 (see Fig. 2). Beetles from samples extracted on days 30, 40, and 48 were treated as a mixture of first and second generation adults since these two groups could not be distinguished. The excessive length of the third instar is an experimental artifact.

Combined adults of *A. fimetarius* were larger than first generation adults in low density microcosms (one-tailed *t*-test,  $t = 2.16$ ,  $df = 24$ ,  $P < 0.05$ ; Table 2) and high density units ( $t = 2.96$ ,  $df = 25$ ,  $P < 0.01$ ). Combined adults of *A. fossor* were not greater in biomass than first generation adults in low density microcosms (one-tailed *t*-test,  $t = 0.09$ ,  $df = 5$ ,  $P < 0.05$ ; Table 3) and differences in high density units could not be tested since no microcosms containing *A. fossor* beetles were collected before day 30.

These data demonstrated that second generation adults of *A. fimetarius* were larger than first generation ones and suggested that second generation *A. fossor* adults were not larger than first generation ones. Thus, some mechanism(s) must account for these differences.

The diurnal temperature of the glasshouse was greater than the external environment (Stevenson, pers. obs.). Growth rates of *Aphodius* beetles are proportional to temperature (Lumaret 1975; Stevenson 1983). Thus, *A. fimetarius* first generation adults were larger due to rapid growth under higher than normal temperatures.

Table 2. Effects of beetle density on biomass ( $\bar{x} \pm SE$ ) of *Aphodius fimetarius* (L.). First generation adults were beetles added to microcosms at the beginning of the experiment and second generation adults were beetles which developed from eggs laid by first generation adults.

Insect treatment	First generation adults (mg/beetle)	First and second generation adults (mg/beetle)
Low density	6.20 $\pm$ 0.29	6.92 $\pm$ 0.21
High density	5.85 $\pm$ 0.22	6.57 $\pm$ 0.14



Table 3. Effects of beetle density on biomass ( $\bar{x} \pm SE$ ) of *Aphodius fossor* (L.).

Insect treatment	First generation adults (mg/beetle)	First and second generation adults (mg/beetle)
Low density	25.12 $\pm$ 1.27	24.84 $\pm$ 2.07
High density	—	23.91 $\pm$ 0.15

*Aphodius fossor* adults did not appear to undergo rapid growth in the experiment (Table 3); they are considerably larger than *A. fimetarius* beetles (see Fig. 1). Both high and low density microcosms exhibited crowded conditions for larvae, particularly the larger *A. fossor* (Stevenson, pers. obs.). Crowding in larvae that develop in dung often leads to stunting in larvae and adults (e.g., Moon 1980). Lee and Peng (1982) found that progeny of *Onthophagus gazella* (F.) were significantly smaller in size in crowded microcosms than in uncrowded ones. Thus, crowding and subsequent intraspecific competition among *A. fossor* larvae possibly counteracted effects of higher temperatures on beetle growth.

#### CONCLUSIONS

Laboratory microcosms of the type used in this study are suitable environments for growth and development of aphodiine beetles. Temperature and density of adults may influence the size of beetle progeny.

#### ACKNOWLEDGMENTS

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#### LITERATURE CITED

- BERGSTROM, R. C., L. R. MAKI, AND B. A. WERNER. 1976. Small dung beetles as biological control agents: laboratory studies of beetle action on trichostrongylid eggs in sheep and cattle feces. *Proc. Helminth. Soc. Wash.* 43:171-174.
- BREYMEYER, A., H. JAKUBCZYK, AND E. OLECHOWICZ. 1975. Influence of coprophagous arthropods on microorganisms in sheep feces—laboratory investigations. *Bull. Acad. Pol. Sci.* 23:257-262.
- GAUSE, G. F. 1934. *The struggle for existence*. Hafner, New York. 163 pp.
- . 1935. Experimental demonstration of Volterra's periodic oscillations in the numbers of animals. *J. Exp. Biol.* 12:44-48.
- GIESY, J. P. (ed.). 1980. *Microcosms in ecological research*. DOE Symp. Ser. 52 (CONF-781101) NTIS, Springfield, Va. 1110 pp.
- HOLTER, P. 1975. Energy budgets of a natural population of *Aphodius rufipes* larvae (Scarabaeidae). *Oikos* 26:177-186.
- . 1979. Abundance and reproductive strategy of the dung beetle, *Aphodius rufipes* (L.) (Scarabaeidae). *Ecol. Entomol.* 4:317-326.
- KESSLER, H., AND E. U. BALSBAUGH, JR. 1972. Succession of adult Coleoptera in bovine manure in east central South Dakota. *Ann. Entomol. Soc. Amer.* 65:1333-1336.

- LANDIN, B. O. 1961. Ecological studies on dung beetles (Coleoptera: Scarabaeidae). *Opusc. Entomol.*, Suppl. 19:1-227.
- LEÉ, J. M., AND Y. S. PENG. 1982. Influence of manure availability and nesting density on progeny size of *Onthophagus gazella*. *Environ. Entomol.* 11:38-41.
- LUMARET, J. P. 1975. Étude des conditions de ponte et de développement larvaire d'*Aphodius (Agrilinus) constans* Duft. (Coléoptère Scarabaeidae) dans la nature et au laboratoire. *Vie Milieu* 25:267-282.
- LUSSENHOP, J., R. KUMAR, D. T. WICKLOW, AND J. E. LLOYD. 1980. Insect effects on bacteria and fungi in cattle dung. *Oikos* 34:54-58.
- MOON, R. D. 1980. Effects of larval competition on face fly. *Environ. Entomol.* 9:325-330.
- , E. C. LOOMIS, AND J. R. ANDERSON. 1980. Influence of two species of dung beetles on larvae of face fly. *Environ. Entomol.* 9:607-612.
- STEVENSON, B. G. 1983. Functional ecology of coprophagous insects. Ph.D. Thesis, State University of New York College of Environmental Science and Forestry, Syracuse, New York. 167 pp.
- WINGO, C. W., G. D. THOMAS, G. N. CLARK, AND C. E. MORGON. 1974. Succession and abundance of insects in pasture manure: relationship to face fly survival. *Ann. Entomol. Soc. Amer.* 67:386-390.

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### BOOKS ON COLEOPTERA

GORDON, R. D. 1985. **The Coccinellidae (Coleoptera) of America north of Mexico.** *Jour. New York Ent. Soc.* 93:1-912, 706 figs. (including maps). Price \$40.00; available from Lubrecht and Cramer, RD 1, Box 244, Forestburgh, NY 12777 U.S.A.

Contains keys to subfamilies, tribes, genera, and species. Typically each species has the synonymy, diagnosis, discussion, type locality, type depository, and distribution. For those species that the author has treated in earlier publications, only the synonymy is listed. For each species, the male genitalia are illustrated and the distribution is mapped. For many species there is a habitus drawing including 16 in color. This treatise covers 57 genera and 475 species including several new ones. There is a long chapter on the use of coccinellids in biological control.

ENDRÖDI, S. 1985. **The Dynastinae of the world.** *Series Entomologica*, vol. 28:800 pp., 2,161 genitalic drawings (plus 58 more in the appendix) and 46 plates of about 400 habitatus photographs. Price: unknown; available from Kluwer Boston, Inc., 190 Old Derby St., Hingham, MA 02043 U.S.A.

This is the English translation of the author's previous 22 papers in German on the same subject, plus updating with 4 new genera and 96 new species in addition to an appendix with 5 more new genera and 61 more new species. This is not a monograph, but an identification book designed to assist specialists and amateurs. There are keys to the tribes, genera, species, and subspecies.

LIFE HISTORY AND DISTRIBUTION OF  
*PSEUDOBARIS NIGRINA* (SAY) IN IDAHO  
(COLEOPTERA: CURCULIONIDAE)<sup>1</sup>

Craig R. Baird,<sup>2</sup> Guy W. Bishop,<sup>2</sup> and Mohammed Abu-Merdas Baruni<sup>3</sup>

ABSTRACT

*Pseudobaris nigrina* (Say) infests commercially grown mint in Idaho and Oregon, but is not an economic pest except in newly planted fields or mint grown for rootstalk increase. Adult weevils are active and mate by late May. Eggs are laid in mint stems at the soil line and hatch in about three weeks. Larvae pass through five instars in two to three weeks and then pupate in the larval tunnel inside the mint rhizome. The pupal period is two weeks. Adults overwinter in larval tunnels in mint rhizomes or in plant debris in the field. There is one generation per year. The species is found in the eastern part of the United States and is herein reported from Idaho and Oregon for the first time.

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*Pseudobaris nigrina* (Say) is a weevil found boring in stems and rhizomes of mint, goldenrod and other plants (Beutenmuller 1893; Kissinger 1963). Originally described as *Baridius nigrinus*, the species was later placed within the genus *Pseudobaris* by LeConte and Horn (1876). No biological data are available and only scattered references to hosts and collections are found in the literature. Various authors (Blatchley and Leng 1916; Casey 1920) refer to the species in taxonomic works.

In the mid-1970's several commercial peppermint (*Mentha piperita* Linnaeus) and spearmint (*M. spicata* Linnaeus) fields in southwestern Idaho were found to be infested with a weevil. Specimens were sent to the U.S. National Museum and identified as *P. nigrina* by Dr. D. R. Whitehead. This is the first report of this eastern weevil in the Pacific Northwest. A study was initiated to determine the extent of damage and basic biological characteristics of this weevil in Idaho.

METHODS AND MATERIALS

Investigations on the biology of *P. nigrina* were conducted in 1977-83 in Ada, Canyon, and Payette counties where the greatest concentrations of mint production occur in Idaho. Four fields, two peppermint and two spearmint, were selected for intensive study in heavily infested areas of Ada and Payette counties. Intensive examinations (visual and with 15-inch sweep net) were made during April and May to determine the time of emergence of adult beetles. During June and July, twice weekly visits were made to each field to determine development and abundance of life stages in soil and plant samples. Fields were examined weekly between August and November to observe pupal development, adult emergence, and overwintering sites.

Damage estimates were made in each study field by examining 10 mint

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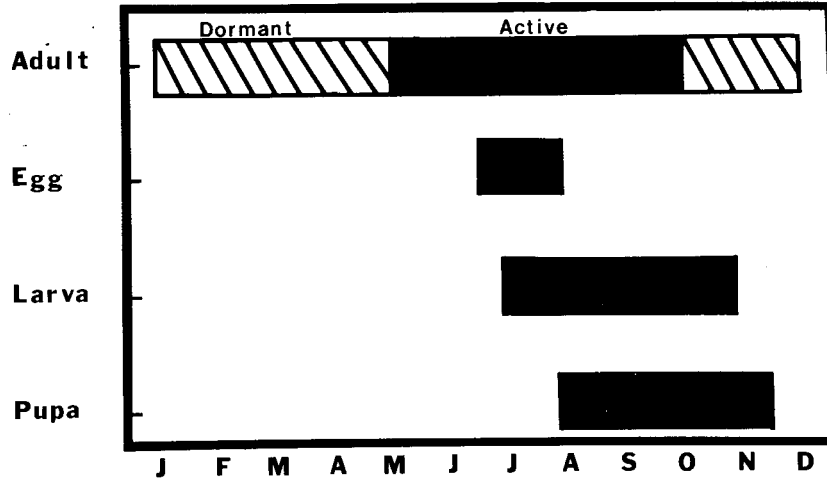


Fig. 1. Periods of activity and dormancy for life stages of *Pseudobaris nigrina*.

plants every 10 days to determine effects of weevil damage as related to stage of plant growth and to determine host preference. Twenty plants in each field were tagged for weekly observations on plant reaction to weevil infestation.

Laboratory populations of *P. nigrina* were maintained by placing potted spearmint and peppermint plants in Feeley cages. Mating pairs of weevils were placed in each cage. Observations on mating and oviposition behavior were made daily during the mint growing season. Thirty-seven beetles were observed over a 3-year period to determine duration of developmental stages.

Determination of the number of larval instars was based on Dyar's Rule (Wigglesworth 1972) and measurements of the head capsule and body length. Larvae were collected in infested mint fields from late June through August, immediately killed and preserved in 70% ethanol, and measured under a dissecting microscope.

To determine the distribution of *P. nigrina* in Pacific Northwest mint fields, a survey of mint fields in Idaho, Oregon, and Washington was conducted during July 1978. In each field 100 random sweeps were taken and ten entire plants were dissected to determine the presence or absence of the weevil. Study specimens were deposited in the William F. Barr Entomological Museum, University of Idaho.

## RESULTS

### Life History

Adult *P. nigrina* were first found in sweep net samples in early June 1977 and 1978 (Fig. 1). More intensive sampling between 1981 and 1983 revealed the first adults active on 9 June 1981, 2 June 1982, and 27 May 1983. Sampling from 1 June to 15 July never exceeded .8 beetles per sweep. Best results were obtained in mint 10 inches high or less. As the mint grew taller and more dense, it became increasingly difficult to capture beetles with a net. As the mint

canopy closed in late June and early July, the beetles were found exclusively on the lower portions of the plants.

The first adults captured were actively mating and flew readily when disturbed. Flight distance varied but did not exceed 50 to 60 feet at any one time. Most beetle activity was noted between 1100 and 1700 hrs at temperatures above 15°C. Mating continued until late June.

Eggs were deposited in the plant stems at the soil surface by mid-June. The female chewed a hole in the stem and deposited one egg; only one egg site per stem was noted. The egg capacity of 25 dissected females captured 10–13 June averaged 86 (38–106) eggs per female.

The earliest larvae were found in stems at ground level between 21 and 30 June (1981–83). These fed on the soft tissues beneath the epicuticle of the stem. In some cases, initial feeding was localized around the egg deposition site, but in others the larvae completely girdled the stem while feeding near the soil surface. Larvae then penetrated to the center of the stem and usually burrowed down into a rhizome. Occasionally, larvae were found burrowing upward into the stem. The larval feeding period extended from late June to late July, about 3 to 4 weeks. In late mint fields and in citrata (*M. citrata* Ehrhart), *P. nigrina* larvae were found in the stems and rhizomes in late October.

The data in Table 1 suggest that *P. nigrina* has five larval instars since the mean head capsule width increased whenever there was an increase in mean body length. The instars are not recognizable in the field.

Pupae were first found in the third week of July inside the rhizomes at the end of the feeding tunnel. In some cases, they were found in the tunnel near or above the soil line. The pupal period lasted almost two weeks.

There is one generation per year, but the considerable overlap in life stages and late occurring larvae suggest a partial second generation. Adults and young larvae were present in early July. By late July most spring generation adults had died and only larvae and pupae dominated. By mid-to-late August, teneral adults, pupae, and a few larvae were present in the rhizomes. In late October some adults moved into the surrounding soil; however, most adults overwintered inside the rhizome.

#### Distribution

In Idaho *P. nigrina* has been found in the following areas: Fruitland and New Plymouth (Payette County), Caldwell and Nampa (Canyon County), and Meridian, Star, and Eagle (Ada County). It was not found near Spring Valley (Latah County) or Homedale (Owyhee County) nor the Mountain Home-Hammitt areas (Elmore County). In eastern Oregon, the weevil was found at Nyssa and Ontario (Malheur County), but not in central Oregon mint producing areas near Bend or Redmond (Deschutes County). In Washington the weevil was not found in the mint producing areas near Moses Lake (Grant County) or Othello (Adams County) in the Columbia Basin. *Pseudobaris nigrina* is an eastern species that has been accidentally introduced into western Idaho and eastern Oregon. In the eastern United States, *P. nigrina* has been recorded from Alabama, Connecticut, Florida, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, and Virginia. In the midwest it is known from Illinois, Indiana, Michigan, Missouri, and Ohio (Beutenmuller 1893; Blatchley and Leng 1916; Casey 1920; Kissinger 1963; O'Brien and Wibmer 1982).

Table 1. Body length and head capsule measurements of *Pseudobaris nigrina* larvae. (The range of head capsule widths was lost.)

Body length (mm)		Head capsule width (mm)	
Range	$\bar{x}$	$\bar{x}$	n
1.5-2.4	1.95	.96	25
2.8-3.7	3.25	1.26	34
4.3-5.9	5.10	1.42	22
6.8-7.5	7.15	1.65	24
8.0-9.5	8.75	1.90	26

#### Host Plants

In Idaho and eastern Oregon *P. nigrina* larvae were found in all species of mint grown for commercial purposes including Native (Scotch) Spearmint, Black Mitchum Peppermint, and Citrata. The beetle also was found infesting wild mint (*Mentha* spp.), goldenrod (*Solidago* spp.) and *Kochia scoparia*. In the eastern U.S. several authors have recorded *P. nigrina* in commercial and wild mint (*Mentha* spp.), *Lycopus virginicus*, *Solidago* spp. and *Kochia* spp. (Beutenmuller 1893; Blatchley and Leng 1916; Kissinger 1963).

#### Damage

Early symptoms of larval infestation consisted of plant yellowing and wilting, often followed by death. Stems of infested plants were subject to lodging because of weakness in areas of ovipositional punctures and larval feeding. Young plants were usually killed back to the soil line, but often new shoots emerged from the rhizomes. In established stands, where numerous shoots emerged from a complex of rhizomes, only the stems directly associated with the infested rhizome showed symptoms. Secondary decay was consistently associated with areas of larval feeding.

Analysis of variance showed significant differences in percent of damage between spearmint and peppermint ( $PR > F = 0.139 \approx 1.40\%$ ) for 1977 and ( $PR > F = 0.021 \approx 2.1\%$ ) for 1978, with spearmint being the most heavily damaged. There were no significant differences in field damage among the several Idaho growing areas.

#### DISCUSSION

Although *P. nigrina* adults may be captured in a sweep net, this is not an efficient sampling tool because of the beetles' tendency to remain low on the plant. Beetle numbers were never greater than six to eight per ten sweeps and were usually zero or one. Nevertheless, the sweep net is useful for determining activity, mating, relative abundance and in obtaining specimens for laboratory study.

Adults of both sexes flew readily when disturbed. Although flights were short this flight capability would allow field-to-field movement. Removal of infested

plants to new fields in the spring would also initiate new infestations within or between areas.

*P. nigrina* is not considered an economic pest in established spearmint or peppermint fields. When an infested stem dies, several other stems usually arise from that rhizome. In heavily infested fields, this may cause delay in mint development and later harvest. This may in turn cause economic loss, but it would probably not justify the cost of pesticide application. Control efforts would be justified where heavy infestations in newly established mint require significant replanting of rhizomes or where mint grown for root stock or for new variety development becomes infested.

#### ACKNOWLEDGMENTS

We wish to thank Drs. W. F. Barr, J. B. Johnson, and R. L. Stoltz for reviewing the manuscript. We also acknowledge the assistance of Jackie Blackmer, Mike Anderson, and John Eaton for field and laboratory work. We wish to thank the Idaho Mint Commission for their assistance in funding this project.

#### LITERATURE CITED

- BEUTENMULLER, W. 1893. On the food habits of North American Rhynchophora. J. New York Entomol. Soc. 1:80-88.
- BLATCHLEY, W. S., AND C. W. LENG. 1916. Rhynchophora or weevils of north eastern America. Nature Publishing Company, Indianapolis. 682 pp.
- CASEY, T. L. 1920. Some descriptive studies among the American Barinae. Mem. Coleopt. 9:300-529.
- KISSINGER, D. G. 1963. Notes on the habits of some North American Curculionidae (Coleoptera). Coleopt. Bull. 17:53-57.
- LECONTE, J. L. 1859. The complete writings of Thomas Say on the entomology of North America. Vol. I. Bailliere Bros., New York. 412 pp.
- , AND G. H. HORN. 1876. The Rhynchophora of America north of Mexico. Proc. Am. Phil. Soc. 15:1-455.
- LENG, C. W. 1920. Catalog of the Coleoptera of America north of Mexico. Cosmos Press, Cambridge. 470 pp.
- O'BRIEN, C. W., AND G. J. WIBMER. 1982. Checklist of the beetles of North America, Central America and the West Indies. Fam. 135, Curculionidae. Flora and Fauna Publications, Gainesville. 240 pp.
- WIGGLEWORTH, V. B. 1972. The principles of insect physiology. Halsted Press, John Wiley and Sons, New York. 615 pp.

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#### LITERATURE NOTICES

- BLAND, R. G. 1984. Mouthpart sensilla and mandibles of the adult alfalfa weevil *Hypera postica* and the Egyptian alfalfa weevil *H. brunneipennis* (Coleoptera: Curculionidae). Ann. Ent. Soc. Amer. 77:720-724.
- CARTER, M. C., AND A. F. G. DIXON. 1984. Honeydew: an arrestant stimulus for coccinellids. Ecol. Ent. 9:383-387.
- REFSETH, D. 1984. The life cycles and growth of *Carabus glabratus* and *C. violaceus* in Budalen, central Norway. Ecol. Ent. 9:449-455.

## SCIENTIFIC NOTE

A FURTHER RECORD FOR *NOTIOKASIS* KAVANAUGH AND NÈGRE  
(COLEOPTERA: CARABIDAE)

One of the most important carabid discoveries in recent years was made by Jacques Nègre, who found a series of unusual ground beetles in the Chaudoir collection at the Muséum Nationale d'Histoire Naturelle, Paris. These were later described as *Notiokasis chaudiroidi*, the only species of a new tribe, Notiokasiini (Kavanaugh and Nègre 1982). This, they suggested, is the only representative of the supertribe, Nebriiatae, in the southern hemisphere. Current knowledge of the distribution of this species rests on the eight specimens in the Chaudoir collection, all from Montevideo, Uruguay, and one other specimen from Rio Grande do Sol: Porto Alegre, Brazil (total 3 ♂♂, 6 ♀♀).

Whilst examining the unidentified accessions of South American Carabidae in the British Museum (Natural History) with Professor George Ball (University of Alberta) we discovered a series of four specimens (all ♂♂) of *Notiokasis chaudiroidi*. The specimens are individually direct pinned and each bears a small green triangular label of no apparent significance, and a white round label with "Uruguay" written above and "75.16" written below. Reference to the appropriate Coleoptera Accessions Catalogue to which this latter number refers revealed a short list of names for some unassociated ground beetles which had been sent by E. D. Laborde from Uruguay, via S. E. M. Lettson, to the Director of the BM(NH). The "4 *Pogonus*" mentioned in this list are almost certainly the *Notiokasis*, as at first glance they resemble members of the Pogonini. A further accessions number appended to this entry leads to the Zoological Accessions Catalogue in which a letter dated 21 February 1866 from Laborde to the Director is to be found. The letter lists a number of unidentified Hymenoptera and Diptera as well as Coleoptera and their localities. Under a subheading "Coléoptères Carabiques" there are three entries as follows:

- 20 = 4 trouvés uniquement derrière le cimetière des Catholiques—fort rares
  - 21 = 4 trouvés uniquement à la punta de Carretas à 8 kilom. de la capitale. (rare)
  - 22 = 6 trouvés au même endroit que les Nos 9–10\* etc. et n'existant (du moins que l'on sâche) ailleurs que là—fort rares
- \*9— . . . côtes de la rivière Santa Lucia à 90 kilom. de la Capitale.

Almost certainly the locality for the specimens of *Notiokasis* is one of the first two above. Despite this uncertainty, the locality data at least give some idea as to where to look for further specimens.

The discovery of these specimens of *Notiokasis* so soon after the publication of the original description suggests that others may lie hidden in the unidentified accessions of other museums. Incidentally, Mr. Laborde was paid £2.5s for his collection!

## LITERATURE CITED

KAVANAUGH, D. H., AND J. NÈGRE. 1982. Notiokasiini—A new tribe of Carabidae (Coleoptera) from southeastern South America. *Coleopt. Bull.* 36:549–566.

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NOTES ON BIOLOGY AND DISTRIBUTION OF MEXICAN  
AND CENTRAL AMERICAN SCOLYTIDAE (COLEOPTERA).  
I. HYLESININAE, SCOLYTINAE EXCEPT  
CRYPHALINI AND CORTHYLINI

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ABSTRACT

New biological and/or geographical distribution data (principally in Mexico) are given for 115 species of Scolytidae in the following genera: *Hylurgops*, *Hylastes*, *Pseudohylesinus*, *Dendroctonus*, *Cnesinus*, *Pagiocerus*, *Phloeotribus*, *Phloeosinus*, *Chramesus*, *Chaetophloeus*, *Liparthrum*, *Cnemonyx*, *Scolytopsis*, *Scolytus*, *Pycnarthrum*, *Gymnochilus*, *Scolytodes*, *Pseudothysanoes*, *Thysanoes*, *Phloeocleptus*, *Micracis*, *Micracisella*, *Hylocurus*, *Cactopinus*, *Ips*, *Dendrocranulus*, *Coccotrypes*, *Premnobius*, *Dryocoetoides*, *Xylosandrus*, *Theoborus*, and *Xyleborus*.

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For the past several years we have been collecting bark and ambrosia beetles extensively from a wide variety of habitats, mostly in Central Mexico. While most of this effort has been directed towards local faunistic and ecological studies in selected areas, which will be published separately, a large number of collection records have been obtained that are of interest to students of the group due to range extensions, new host associations, or observations on the biology and ecology of these species. Due to the large number of records and species involved, the tribes Cryphilini and Corthylini (Scolytinae) will be treated in a later publication. New host plants and state or country distribution records are indicated. New host plants of polyphagous species in the tribe Xyleborini are not specifically indicated nor are species of *Pinus* for pine-inhabiting species. Observations are grouped by country, state, and locality; these data are not repeated in subsequent records; records are separated by semicolons. Abbreviations of Mexican state names are those in common use in Mexico (CHIH = Chihuahua, CHIS = Chiapas, COAH = Coahuila, DGO = Durango, GRO = Guerrero, GTO = Guanajuato, HGO = Hidalgo, JAL = Jalisco, MEX = México, MICH = Michoacán, NAY = Nayarit, NL = Nuevo León, OAX = Oaxaca, PUE = Puebla, QRO = Querétaro, QR = Quintana Roo, TAB = Tabasco, TAMPS = Tamaulipas, TLAX = Tlaxcala, VER = Veracruz). Collection numbers are listed where given with a letter prefix (S = Scolytidae, Colegio de Postgraduados; UACHB = Depto. de Bosques, Universidad Autónoma Chapingo; SM = Scolytidae of Morelos, Universidad Autónoma del Estado de Morelos; AB = Armando Burgos S.). Detailed collection data are filed on cards in the UACHB or in notebooks in the insect collection of the Colegio de Postgraduados (all other prefixes). The names of the authors (THA, AEM) are abbreviated when given as collectors. All material cited is deposited in the insect collection of the Centro de Entomología y Acarología, Colegio de Postgraduados.

## SUBFAMILY HYLESININAE

## Tribe Hylastini

*Hylurgops incomptus* (Blandford). MEXICO: **CHIH**: Area experimental INIF, Cd. Madera, 24-VIII-80, 2,360 m, *Pinus arizonica*, J. Castro C.; **MICH** (new state): Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-80, 2,340 m, S-135, **THA & AEM**; **MEX**: Carr. Toluca-Morelia, Km 49 (near Villa Victoria), 30-X-80, 2,520 m, *P. montezumae*, S-124, **THA & AEM**; **HGO**: Zacualtipan, 16-X-81, 1,800 m, *P. patula*, S-177, **AEM**. GUATEMALA: Momostenango, 11-VII-80, 2,800 m, *P. pseudostrobus*, F. Jeronimo M.; 14-VII-80, 2,900 m, *Pinus* sp., F. Jeronimo M.; Totonicapan, 26-VII-80, 2,700 m, *P. pseudostrobus*, F. Jeronimo M.; Sibilia, 4-VII-80, 2,800 m, *P. rudis*, F. Jeronimo M.; Cajolás, 5-VII-80, 2,550 m, *P. rudis*, F. Jeronimo M. Wood (1982) listed the locality, Mesa del Huracan, from the state of Chiapas because the state abbreviation on the label was given as "Chs." The locality is actually in the state of Chihuahua.

*Hylurgops planirostris* (Chapuis). MEXICO: **MICH**: Carr. Patzcuaro-Ario de Rosales, Km 32, 31-X-81, 2,360 m, *Pinus leiophylla*, S-131, **THA & AEM**; Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-81, 2,340 m, *P. montezumae*, S-135, **THA & AEM**; **MEX**: Carr. Toluca-Morelia, Km 54 (near Villa Victoria), 30-X-81, 2,520 m, *P. montezumae*, S-124, **THA & AEM**; **HGO**: Zacualtipan, VII-80, 1,900 m, *P. patula*, M. E. Guerrero & C. Pineda; **VER**: Cofre de Perote, 7-VI-83, 2,950 m, *Pinus* sp., S-890, **THA & AEM**; 5 km W of Acajete, 7-VI-83, 2,150 m, *P. patula*, S-891, **THA & AEM**; **CHIS**: San Cristobal de las Casas, 26-IX-61, H. Bravo M.; 7-VIII-65, A. Ortiz. GUATEMALA: Chiantla, 10-VII-80, 3,160 m, *P. rudis*, F. Jeronimo M.; Momostenango, 28-VIII-80, 2,450 m, *P. pseudostrobus*, F. Jeronimo M.

*Hylurgops longipennis* (Blandford). MEXICO: **HGO** (new state): Zacualtipan, 17-IX-80, 1,800 m, *Pinus patula*, S-177, **AEM**; 16-X-80, 1,800 m, *P. patula*, **THA**; **PUE** (new state): San Juan Tetla, 27-I-82, 3,390 m, J. Morales O. This species was previously known only from the Valley of Mexico; it is apparently much more widespread in its distribution.

*Hylurgops subcostulatus alternans* (Chapuis). MEXICO: **VER** (new state): Cofre de Perote, 6-VI-83, 2,950 m, *Pinus* sp., S-889, **THA & AEM**; **CHIS**: San Cristobal de las Casas, 16-IV-84, 2,740 m, *Pinus* sp., SM-257, E. Saucedo C.

*Hylastes fulgidus* Blackman. MEXICO: **CHIH**: Area semillera Madera (near Cd. Madera), 24-VII-80, 2,360 m, *Pinus arizonica*, J. Castro C.; **MICH**: No-cuaro, 9-VII-73, *Pinus* sp., UACHB-120, D. Cibrian T.; Ario de Rosales, 31-X-80, 1,640 m, *P. pseudostrobus*, S-139, **THA & AEM**.

*Hylastes flohri* (Eggers). MEXICO: **MEX**: Carr. Toluca-Morelia, Km 54, 30-X-80, 2,520 m, *Pinus montezumae*, S-124, **THA & AEM**; **HGO**: Zacualtipan, 16-X-80, 1,800 m, *P. patula*, S-177, **AEM**.

*Hylastes mexicanus* Wood. MEXICO: **MICH** (new state): Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-80, 2,340 m, *Pinus montezumae*, S-135, **THA & AEM**.

*Hylastes niger* Wood. MEXICO: **HGO**: Zacualtipan, 16-X-80, 1,800 m, *Pinus patula*, S-177, **AEM**.

*Hylastes gracilis* LeConte. MEXICO: **HGO**: Zacualtipan, 16-X-80, 1,800 m, *Pinus patula*, S-177, **AEM**; 17-IX-80, 1,800 m, *P. patula*, M. E. Guerrero & C. Pineda.

## Tribe Tomicini

*Pseudohylesinus variegatus* (Blandford). MEXICO: **MEX**: Mexicapa, 6-IV-83, *Abies religiosa*, J. Morales O.; **VER** (new state): Cofre de Perote, 8-VI-83, 3,380 m, *A. religiosa*, S-897, THA & AEM.

*Dendroctonus vitei* Wood. MEXICO (new country): **CHIS**: San Cristobal de las Casas, 12-VIII-80, *Pinus michoacana*, UACHB-577, D. Cibrian T. This identification was verified by S. L. Wood.

*Dendroctonus mexicanus* Hopkins. MEXICO: **MICH**: Zacan, 20-II-80, 2,600 m, *Pinus leiophylla*, S-32, THA; **MEX**: Carr. Toluca-Morelia, Km 54, 30-X-80, 2,520 m, *P. montezumae*, S-124, THA & AEM; Villa del Carbon, 7-I-82, 2,490 m, *P. teocote*, S-259, THA & AEM; **HGO**: Zacualtipan, 16-X-80, 1,800 m, *P. patula*, S-177, AEM; **PUE**: Puebla, 17-I-80, 2,200 m, *P. leiophylla*, S-9, THA; Atlixco, 14-VII-63, F. Pacheco M.; **VER**: El Palmar, 13-VI-63, F. Pacheco M.; **GRO**: Teloloapan, 12-VIII-57; **OAX** (new state): Teojomulco, 27-IX-75, *P. pseudostrobus*, B. Silva T.; **CHIS**: San Cristobal de las Casas, 12-VIII-80, *P. michoacana*, UACHB-577, D. Cibrian T.; Altamirano, 12-VIII-80, *P. oocarpa*, UACHB-579, D. Cibrian T.

*Dendroctonus approximatus* Dietz. MEXICO: **COAH** (new state): La Siberia (near Arteaga), III-81, *Pinus hartwegii*, D. Flores F.

*Dendroctonus adjunctus* Blandford. MEXICO: **COAH** (new state): La Siberia (near Arteaga), III-81, *Pinus hartwegii*, D. Flores F.; **VER** (new state): Cofre de Perote, 8-VI-83, 3,650 m, *P. hartwegii*, S-895, THA & AEM. GUATEMALA: Totonicapan, 13-V-77, M. Dix; 9-VI-77, *P. rudis*, M. Dix; 26-VII-80, *P. pseudostrobus*, F. Jeronimo M.; 13-VII-80, 2,850 m, *P. rudis*, F. Jeronimo M.; 19-VII-80, 2,900 m, *P. ayacahuite*, E. Franco; 24-VII-80, 2,600 m, *Pinus* sp., F. Jeronimo M.; Momostenango, 28-VII-80, 2,450 m, *P. pseudostrobus*, E. Franco; 17-VII-80, 2,445 m, *P. pseudostrobus*, F. Jeronimo; Sibilia, 4-VII-80, 2,850 m, *P. rudis*, E. Franco; 7-IV-80, 2,800 m, *P. rudis*, F. Jeronimo M.; Cajolas, 5-VII-80, 2,550 m, *P. rudis*, F. Jeronimo M.; Chiantla, 10-VII-80, 3,160 m, *P. rudis*, F. Jeronimo M.

*Dendroctonus parallellocollis* Chapuis. MEXICO: **MICH**: Carr. Patzcuaro-Ario de Rosales, Km 32, 31-X-80, 2,340 m, *Pinus montezumae*, S-135, THA & AEM; **MEX**: Carr. Toluca-Morelia, Km 54, 30-X-80, 2,520 m, *P. montezumae*, S-124, THA & AEM.

*Dendroctonus valens* LeConte. MEXICO: **CHIH**: Area Experimental INIF, Cd. Madera, 24-VII-80, 2,360 m, *Pinus arizonica*, J. Castro C.; **MICH**: Carr. Patzcuaro-Ario de Rosales, Km 32, 31-X-80, 2,340 m, *P. montezumae*, S-135, THA & AEM; Cd. Hidalgo, 1-VIII-61, *Pinus* sp.; **TLAX**: Tlaxco, 10-VII-61; **PUE**: San Nicolas Romero, 16-XII-61, W. E. Rose; Atlixco, 17-VII-63; Manzanillo, 20-VIII-64; Puebla, 17-I-80, 2,200 m, *P. leiophylla*, S-9, THA; **VER**: Cofre de Perote, 8-VI-83, 3,650 m, *P. hartwegii*, S-895, THA & AEM; Las Vigas, 9-VI-83, 2,400 m, *P. patula*, S-900, THA & AEM. GUATEMALA: Totonicapan, 26-VII-80, 2,700 m, *P. pseudostrobus*, F. Jeronimo M.; Tecpan, 27-VII-80, 2,800 m, *P. filifolia*, F. Jeronimo M.

*Dendroctonus rhizophagus* Thomas & Bright. MEXICO: **GRO** (new state): Chilapa, 23-II-82, 2,040 m, *Pinus oocarpa*, S-331, THA, AEM, M. M. Furniss, & S. L. Wood.

## Tribe Bothrosternini

*Cnesinus electinus* Wood. MEXICO: **JAL** (new state): El Tuito, 28-V-82, 640 m, Lauraceae, S-706, THA & AEM. **GRO** (new state): Santa Teresa Pilcaya,

21-II-82, 1,130 m, *Persea americana* (new host), S-324, THA & AEM; Palo Blanco (near Chilpancingo), 22-II-82, 1,200 m, *P. americana*, S-329, THA & AEM.

*Cnesinus myelitis* Wood. MEXICO: PUE: Zacapoaxtla, 6-V-81, 1,600 m, *Persea americana* (new host), S-228, THA & AEM.

*Cnesinus garrulus* Schedl. MEXICO: PUE (new state): Tepexco, 1-X-82, 1,200 m, cucurbit vine, AB-66, A. Burgos S.

*Cnesinus costulatus* Blandford. MEXICO: PUE (new state): Zacapoaxtla, 6-V-81, 1,600 m, *Persea americana* (new host), S-228, THA & AEM.

*Cnesinus prominulus* Wood. MEXICO: GRO (new state): Chilapa, 23-II-82, 1,800 m, *Senecio* sp. (new host), S-572, A. Burgos S.

*Cnesinus carinatus* Wood. MEXICO: MEX (new state): Mexicapa, 13-II-82, 2,325 m, Compositae, S-314, AEM.

*Cnesinus setulosus* Blandford. MEXICO: JAL: Puerto Vallarta, 6-III-82, 10 m, S-386 and S-387, AEM; GRO (new state): Chilapa, 23-II-82, 1,640 m, *Ardisia revoluta* (new host), S-345, THA & AEM.

*Pagiocerus frontalis* (Fabricius). MEXICO: MEX: Malinalco, 20-XII-56, H. Moreno; PUE: Atlixco, 24-X-80, seed of *Persea americana*, S-116, N. Bautista M.; Tianguismanalco, 19-I-83, 2,150 m, seed of *P. americana*, S-850, THA; GRO (new state): Chilpancingo, 12-XII-58, J. Rivera.

#### Tribe Phloeotribini

*Phloeotribus pruni* Wood. MEXICO: MEX: Villa del Carbon, 7-I-82, 2,540 m, *Prunus serotina*, S-297, THA & AEM; PUE (new state): Carr. Zacapoaxtla-Cuetzalan, 5-V-81, 1,600 m, *Prunus persica*, S-225, THA & AEM; Tianguismanalco, 19-I-83, *P. persica*, S-849, THA; VER (new state): Landero y Coss, 20-VII-83, 1,870 m, S-927, *P. serotina*, THA & AEM; GRO (new state): Chilapa, 23-II-82, 1,800 m, *P. serotina*, S-340, THA & AEM.

*Phloeotribus destructor* Wood. MEXICO: GRO (new state): Chilapa, 23-II-82, 1,800 m, *Prunus serotina*, S-297, THA & AEM; Barranca de Mayuca, 11-VI-57, Oliva A.

*Phloeotribus perniciosus* Wood. MEXICO: MICH: Carr. Patzcuaro-Ario de Rosales, 31-X-80, 2,240 m, *Prunus serotina*, S-137, THA & AEM. The type series of this species was collected from a partially broken off branch (1-3 cm diam.) of a live tree. The species is monosynous and constructs biramous horizontal galleries typical of the genus. Young adults move about freely and feed on remnants of phloem under the bark prior to emergence.

*Phloeotribus demessus* Blandford. MEXICO: JAL (new state): El Tuito, 28-V-82, 640 m, *Croton draco* (new host), S-709, THA & AEM. Collected in trunk of felled tree in diameters ranging from 10-40 cm. Galleries are typically biramous and horizontal. As in the case of the previous species, young adults move about freely and feed prior to emergence.

*Phloeotribus furvus* Wood. MEXICO (new country): VER: El Bastonal, 5-VII-80, 800 m, R. M. Murillo.

#### Tribe Phloeosinini

*Phloeosinus deleoni* Blackman. MEXICO: MICH: Cd. Hidalgo, 30-X-80, 1,900 m, *Juniperus flaccida*, S-127, THA & AEM; HGO: Cardonal, 27-III-81, 2,250 m, *J. flaccida*, S-204, THA & AEM.

*Phloeosinus serratus* (LeConte). MEXICO: CHIH: Chorro del Agua, 26-XI-77, *Cupressus* sp., UACHB-446, D. Cibrian T. This species attacks species of *Juniperus*; the host on the label is probably an error.

*Phloeosinus cristatus* (LeConte). MEXICO: **DGO** (new state): Los Altos, 7-XI-73, *Cupressus lindleyi* (new host), UACHB-168.

*Phloeosinus tacubayae* Hopkins. MEXICO: **MICH** (new state): Uruapan, 19-II-80, 1,800 m, *Cupressus lindleyi*, S-33, THA. GUATEMALA: San Miguel Dueñas, 11-IX-77, *Cupressus* sp. R. López.

*Chramesus exilis* Wood. MEXICO: **JAL**: El Tuito, 28-V-82, 640 m, *Smilax* sp., S-707, THA & AEM. This species makes biramous galleries in the fibrous outer layers of stems of its host plant, a woody vine. The 2 branches are inclined obliquely upwards and spiral around the stem in opposite directions and are similar to those of *Chramesus annectans*. The type series was collected in stems ranging in diameter from 1–2 cm.

*Chramesus annectans* (Wood). MEXICO: **PUE** (new state): San Luis Atotitlan, 27-VI-82, inflorescence of *Agave lechugilla*, S-753, AEM.

*Chramesus subopacus* Schaeffer. MEXICO: **VER** (new state): Moro de la Mancha, 19-VII-83, sea level, S-921, THA & AEM.

*Chramesus atkinsoni* Wood. MEXICO: **NL**: Cerro Chipinque, 30-I-80, 1,350 m, *Carya* sp., S-21, THA. The type series of this species was collected in small, broken branches (1–2 cm diam.) of an uncultivated hickory in oak-pine forest. The type series reported by Wood (1981) was inadvertently labeled with *Persea* sp. as host. The gallery is uniramous and longitudinal.

#### Tribe Hypoborini

*Chaetophloeus lasius* Wood. MEXICO: **GRO** (new state): Cuauhtenango (near Chilapa), 23-II-82, 1,640 m, *Rhus* sp., S-342, THA & AEM. This species was collected in broken branches of its host ranging from 1–3 cm diam. As is typical for the genus a large nuptial chamber or central "cave" is excavated with 2 or 3 very short egg galleries in which the eggs are very tightly packed. This species is apparently capable of completing more than one generation in the same host material since infested branches held in the laboratory for several months after collection showed recently established, apparently thriving attacks by beetles which had emerged.

*Chaetophloeus sulcatus* Wood. MEXICO: **HGO**: El Cardonal, 27-III-81, 2,250 m, *Flourenzia resinosa* (new host), S-209, THA & AEM. Collected from thicker stems (3 cm diam.) of a small desert composite shrub.

*Chaetophloeus minimus* Wood. MEXICO: **JAL**: El Tuito, 28-V-82, 1,050 m, *Clethra* sp. (new host), S-705, THA & AEM.

*Chaetophloeus penicillatus* (Bruck). MEXICO: **HGO** (new state): 27-III-81, 2,250 m, *Rhus* sp., S-207, THA & AEM.

*Liparthrum pruni* Wood. MEXICO: **MICH**: Aranza, 10-VII-82, *Prunus serotina*, S-756, AEM.

*Liparthrum mexicanus* Wood. MEXICO: **JAL**: El Tuito, 28-V-82, 640 m, S-720, THA & AEM. Galleries were small "cave" type excavations in the bark of the host (suspected to be a species of *Ficus*) with egg niches cut into the margins of the chamber. Judging from larval mines several eggs are placed in each niche.

### SUBFAMILY SCOLYTINAE

#### Tribe Scolytini

*Cnemonyx liratus* Wood. MEXICO: **GRO** (new state): San Juan Tetelcingo, 22-II-82, unidentified shrub of the Euphorbiaceae, S-328, THA & AEM. In small diameter branches of host plant (0.5–1.0 cm). The gallery is transverse.

*Scolytopsis puncticollis* Blandford. MEXICO: VER: Mandinga, 12-III-80, *Laguncularia racemosa*, S-47, THA.

*Scolytus mundus* Wood. MEXICO: TLAX (new state): Villarreal, 28-I-78, *Abies religiosa*, D. Cibrian T.; Terrenate, II-81, *A. religiosa*, C. Pineda; MEX: Mexicapa, 6-IV-83, *A. religiosa*, J. Morales O.

#### Tribe Ctenophorini

*Pycnarthrum hispidum* (Ferrari). MEXICO: QRO: Queretaro, IV-83, *Ficus* sp.; VER: Rancho Tepetates (30 km from Veracruz on highway to Jalapa), 12-VI-79, 15 m, *Ficus* sp., S-43, THA; CHIS: Tapachula, 3-II-81, 250 m, *Ficus* sp., THA. This species is most commonly found in thick-barked limbs and trunks of *Ficus* spp.; smaller diameter material is usually infested by *Gymnochilus* spp. or *Scolytodes* spp. Frequently the galleries are entirely in the phloem, without coming in contact with the sapwood. In very thick phloem separate gallery systems may be at different depths. The gallery is transverse and biramous. More than one generation may be completed in the same host material if decomposition is not rapid. Occasionally this species is found in injured trees near live tissues.

*Gymnochilus reitteri* Eichhoff. MEXICO: JAL: El Tuito, 27-IV-82, 600 m, *Ficus* sp., S-381, AEM; MICH: Zirimicuaro, 2-XI-80, 1,350 m, *Ficus* sp., S-155, THA & AEM. PANAMA: Los Santos, Cerro Canajagua, 4-I-81, 800 m, *Ficus* sp., THA. This species is commonly found in branches of *Ficus* spp. ranging in diameter from 3–15 cm. Material of larger diameter is normally occupied by *Pycnarthrum* spp., smaller diameter by *Scolytodes* spp. The gallery is biramous and transverse.

*Gymnochilus alni* Wood. MEXICO: MICH (new state): Carr. Toluca-Zitacuaro, Km 80, 30-X-80, 2,560 m, *Alnus acuminata*, S-126, THA & AEM. This species makes a biramous gallery in the phloem of alders. The egg galleries are transverse to oblique with respect to the wood.

*Scolytodes glabrescens* Wood. PANAMA: Los Santos, Cerro Canajagua, 4-I-82, 800 m, petiole of *Cecropia* sp., S-168, THA. This species was collected in the pith of the basal portion of fallen petioles in a very moist, shaded site.

*Scolytodes maurus* (Blandford). MEXICO: VER: Catemaco, 13-VI-79, petioles of *Cecropia* sp., THA; Coatepec, 13-III-80, 1,000 m, *Cecropia* sp., S-49, THA. PANAMA: Los Santos, Cerro Canajagua, 4-I-82, 800 m, *Cecropia* sp., S-168, THA. This species breeds only in the fallen petioles of leaves of *Cecropia*. Galleries are excavated in the pithy center of the petioles and may be found along its entire length, though most commonly in the base. It is the most commonly collected species of *Scolytodes* in this habit in Mexico and tolerates drier and more exposed conditions than *S. atratus* and *S. parvulus*, the other 2 species with which it is often associated.

*Scolytodes atratus* (Blandford). MEXICO: VER: Catemaco, 13-VI-79, *Cecropia* sp., THA. PANAMA: Los Santos, Cerro Canajagua, 4-I-82, 800 m, *Cecropia* sp., THA. As is *S. maurus*, this species is restricted to fallen petioles of *Cecropia* spp. It also bores in the pith, but is generally restricted to the thicker basal portion, probably due to its larger size. It is less commonly collected than *S. maurus*, although the 2 species are frequently collected in the same petioles; *S. maurus* appears to be restricted to very shaded, moist sites.

*Scolytodes plumeriae* Wood. MEXICO: PUE: Between Cuetzalan and Paso del Jardin, 5-V-81, 550 m, *Plumeria rubra*, S-222, THA & AEM. A small host

tree growing on the edge of a coffee farm was heavily infested. From the condition of the branches and old galleries it was apparent that several generations had been completed in the same branches, moving downwards in each subsequent generation, slowly killing the tree. At the time of collection, young adults, teneral adults, and pupae were found in the portions of the attacked area closest to living tissues. Young but fully pigmented adults seemed to have passed directly from the areas where they developed into the unattacked portions of the branches without having emerged. These made long, basically longitudinal galleries in the phloem. Galleries interconnected in many places and contained many adults of both sexes. No oviposition was apparent. This may represent maturation feeding on the part of the new adults.

*Scolytodes clusiacolens* Wood. MEXICO: JAL (new state): El Tuito, 28-V-82, 950 m, *Clusia salvinii* (new host), S-702, THA; MICH: Ario de Rosales, 31-X-80, 1,720 m, *Clusia salvinii*, THA & AEM.

*Scolytodes parvulus* Wood. MEXICO: VER: Catemaco, 13-VI-79, *Cecropia* sp., THA; OAX (new state): La Esperanza, Sierra de Juárez, 6-VII-82, 2,600 m, *Cecropia* sp., SM-15, E. Martinez F. This is the smallest of the 3 species of *Scolytodes* that are known from *Cecropia* petioles in Mexico. Unlike *S. maurus* and *S. atratus*, *S. parvulus* excavates a transverse, biramous gallery in the fibrous tissue immediately beneath the epidermis of the petioles similar to the true bark beetles.

*Scolytodes schwarzi* (Hopkins). MEXICO: JAL (new state): El Tuito, 6-III-82, 600 m, *Ficus* sp., S-381, AEM; VER: Mandinga, 6-III-80, sea level, *Ficus* sp., S-48, THA. This species is found in small shaded-out branches of live trees. It is polygynous and adults excavate radiate galleries, often grooving the wood.

*Scolytodes reticulatus* (Wood). MEXICO: MICH: La Gallina, 1-XI-80, 1,000 m, *Ficus goldmani* (new host), S-146, THA & AEM; Zirimicuaro, 2-XI-80, 1,350 m, *Ficus* sp., S-155, THA & AEM. This species is found in shaded-out branches of *Ficus* spp. and does not appear to attack cut or fallen branches.

*Scolytodes tenuis* Wood. MEXICO: JAL: Puerto Vallarta, 6-III-82, 10 m, *Ficus* sp., S-385, AEM; MICH (new state): Zirimicuaro, 2-XI-80, 1,350 m, *Ficus* sp., S-155, THA & AEM. As is the case in the preceding 2 species, *S. tenuis* is found in twigs of shaded-out branches of *Ficus* spp.

#### Tribe Micracini

*Pseudothysanoes furvatus* Wood. MEXICO: JAL: 28-V-82, 1,050 m, *Phoradendron* sp., S-703, THA & AEM. Collected in small dead mistletoe on broken oak branch.

*Pseudothysanoes fimbriatus* Wood. MEXICO: PUE: Zacapoxtla, 6-V-81, 2,150 m, *Phoradendron* sp., S-231, THA & AEM. The type series of this species was collected in a dead mistletoe on a dead oak branch. The galleries were longitudinal, biramous and in the phloem tissues.

*Pseudothysanoes tenellus* Wood. MEXICO: MICH: Carr. Patzcuaro-Ario de Rosales, Km 32, 31-X-80, 2,360 m, *Psittacanthus* sp., S-130, THA & AEM. Collected from mistletoe on dead branch of *Cratogeomys mexicanus* in branches ranging from 0.5–1 cm diam. in longitudinal biramous galleries.

*Pseudothysanoes yuccavorus* Wood. MEXICO: PUE (new state): Oriental, 4-V-81, 2,370 m, leaves of *Yucca* sp., S-214, THA & AEM.

*Pseudothysanoes perseae* Wood. MEXICO: NL: Cerro Chipinque, 30-I-80,

1,350 m, *Carya* sp., S-21, THA. The type series of this species was collected in small (1–2 cm diam.) broken branches of an uncultivated hickory in an oak-pine forest. The galleries are biramous, longitudinal, and in the phloem. Wood (1981) reported the host as *Persea* in his description of the species because of an error in labeling the type series.

*Thysanoes inornatus* Wood. MEXICO: JAL: El Tuito, 28-V-82, 1,050 m, *Struthanthus* sp. (new host), S-704, THA & AEM.

*Phloeocleptus plagiatus* Wood. MEXICO: MICH (new state): Uruapan, 19-II-80, 1,600 m, *Persea americana* (new host), S-27, THA; 1-XI-80, 1,600 m, *P. americana*, S-148, THA & AEM. Collected in phloem of broken branches and cut trunks in material ranging from 5–30 cm diam.

*Phloeocleptus atkinsoni* Wood. MEXICO: MICH: Uruapan, 17-II-80, 1,600 m, *Persea americana*, S-26, THA. The type series of this species was collected in the bark of dead twigs (0.5–1 cm diam.) on live trees.

*Phloeocleptus cristatus* Wood. MEXICO: PUE (new state): Atlixco, 19-I-83, 1,830 m, *Persea americana*, S-847, THA; Tianguismanalco, 19-I-83, 2,150 m, *P. americana*, S-848, THA.

*Phloeocleptus caudatus* Wood. MEXICO: PUE: Apulco, 6-V-81, 1,600 m, *Persea americana* (new host), S-228, THA & AEM. Attacks were found in shaded-out branches of several trees inspected. Broken branches on the ground, however, had attacks of *Cnesinus* spp., but none by *P. caudatus*.

*Phloeocleptus spicatus* Wood. MEXICO: NL: Cerro Chipinque, 30-I-80, 1,300 m, *Persea* sp., S-20, THA.

*Phloeocleptus ardis* Wood. MEXICO: NL: Cerro Chipinque, 30-I-80, 1,300 m, *Persea* sp., S-20, THA. This species was collected in the same broken branches as *P. spicatus*, but was found in the larger portions.

*Micracis lignatos* Blackman. MEXICO: NL (new state): Cerro Chipinque, 30-I-80, 1,300 m, *Quercus* sp., S-27, THA; JAL (new state): El Tuito, 6-III-82, 1,100 m, *Quercus* sp., S-384, AEM; GRO (new state): Chilapa, 23-II-82, 1,800 m, *Quercus* sp., S-339, THA & AEM.

*Micracis amplinis* Wood. MEXICO: MICH (new state): Carr. Toluca-Morelia, Km 197, 3-XI-80, 2,640 m, S-157, THA & AEM; HGO: Zacualtipan, 7-XI-80, 1,800 m, *Quercus* sp., AEM; 7 km east of Tlahuelumpa, 16-X-80, 2,050 m, *Quercus* sp., THA.

*Micracis burgosi* Wood. MEXICO: GRO (new state): Chilpancingo, 23-II-82, 1,250 m, trunk of leguminous tree, S-343, THA & AEM.

*Micracisella nitidula* Wood. MEXICO: VER (new state): Las Vigas, 9-VI-83, 2,400 m, *Arbutus xalapensis*, S-901, THA & AEM.

*Hylocurus dilutus* Wood. MEXICO: MICH: Zirimicuaro, 2-XI-80, 1,350 m, S-154, THA & AEM.

*Hylocurus femineus* Wood. MEXICO: MICH: Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-80, 2,360 m, *Quercus* sp., S-129, THA & AEM. This species was attacking a green, recently cut fence post with attacks concentrated in debarked areas.

*Hylocurus equidens* Wood, MEXICO: PUE: Coxacatlan, 27-VI-82, *Acacia farnesiana*, S-752, AEM.

*Hylocurus elegans* Eichhoff. MEXICO: VER (new state): Rancho Tepetates (near Paso de Ovejas), 12-III-80, 15 m, *Phoradendron* sp. (new host), S-40, THA.

*Hylocurus dissidens* Wood. MEXICO: GRO (new state): Chilapa, 28-II-82, 1,800 m, S-338, THA & AEM.



## Tribe Cactopinini

*Cactopinus burgosi* Wood. MEXICO: PUE: Tepenene, 1-X-82, 1,240 m, *Neobuxbaumia mejea*, AB-70, A. Burgos S. This species was collected in a blackened, decaying (but not deliquescing) portion of cactus in contact with the soil.

*Cactopinus granulatus* Wood. MEXICO: JAL: Autlan, 28-V-82, 80 m, *Pachycereus* sp., S-497, AEM. The type series was collected in a dried-out, yellowish portion of a rib of a fallen stem of cactus.

## Tribe Ipinini

*Ips mexicanus* (Hopkins). MEXICO: MICH: Zaguas, 26-VII-60; Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-80, 2,340 m, *Pinus montezumae*, S-135, THA & AEM; HGO: Zacualtipan, 16-X-80, 1,800 m, *P. patula*, S-177, AEM; 2-VII-82, 2,050 m, *P. patula*, S-74, THA; VIII-81, *P. patula*, C. Pineda; MEX: Villa del Carbon, 7-I-82, 2,490 m, *P. teocote*, S-259, THA & AEM; PUE: Puebla, 15-VII-61, *Pinus* sp., H. Bravo M.; Carr. Mexico-Zacatlan, Km 210, 7-III-62; VER: El Palmar, 13-VI-63, F. Pacheco M.; Las Vigas, 11-VI-79, *Pinus* sp.; THA; Almilanga, 1-IV-63, F. Pacheco M.; Cofre de Perote, 7-VI-83, 2,950 m, *Pinus* sp., S-890, THA & AEM. GUATEMALA: Totonicapan, 19-XI-77, M. Dix.

*Ips bonanseai* (Hopkins). MEXICO: CHIH (new state): Ejido El Largo, Mpio. Madera, 23-VIII-80, 2,300 m, *Pinus duranguensis*, O. Estrada; TAMPS (new state): Cd. Victoria, 12-III-63, *Pinus* sp., R. Balderas; HGO: Zacualtipan, 2-VII-82, 2,050 m, *P. patula*, S-74, THA; MEX: Carr. Toluca-Morelia, Km 54, 30-X-80, 2,520 m, *P. montezumae*, S-124, THA & AEM; PUE: Puebla, 15-VII-61, *Pinus* sp.; CHIS: San Cristobal de las Casas, 26-IX-61, H. Bravo M. GUATEMALA: Sibilia, 4-VIII-80, 2,810 m, *P. rudis*, E. Franco; Totonicapan, 26-VII-80, 2,700 m, *P. pseudoctobus*, F. Jeronimo M.

*Ips integer* (Eichhoff). MEXICO: CHIH: Area experimental INIF, La Laja (Mpio. Bocoyna), 24-VII-80, 2,430 m, *Pinus arizonica*, J. Castro C.; El Vergel, 14-VIII-80, 2,650 m, *P. arizonica*, J. Castro C.; Area Semillera Madera (Mpio. Madera), 19-III-81, 2,360 m, *P. arizonica*, J. Castro C.; TAMPS (new state): Cd. Victoria, 12-III-63, R. Balderas; MICH: Zaguas, 26-VII-60; Las Cocinas, 20-II-80, 2,200 m, *P. montezumae*, S-30, THA; Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-80, 2,340 m, *P. montezumae*, S-135, THA & AEM; Carr. Patzcuaro-Ario de Rosales, Km 32, 31-X-80, 2,360 m, *P. leiophylla*, S-131, THA & AEM; HGO: Zacualtipan, 16-X-80, 1,800 m, *P. patula*, S-177, AEM; PUE: Zacatlan, 15-V-74, *P. pseudoctobus*; VER: Cofre de Perote, 7-VI-83, 2,950 m, *Pinus* sp., S-888, THA & AEM; CHIS (new state): San Cristobal de las Casas, 26-IX-61, H. Bravo M.

*Ips calligraphus* (Germar). MEXICO: JAL: El Tuito, 6-III-82, 650 m, *Pinus* sp., S-380, AEM; MICH: Ario de Rosales, 31-X-80, 1,640 m, *P. pseudoctobus*, S-139, THA & AEM; MEX: Valle de Bravo, 9-III-62; Temascaltepec, 17-VIII-60, *P. oocarpa*; GRO (new state): Taxco, 22-II-82, 1,900 m, *Pinus* sp., S-325, THA & AEM; Chilapa, 23-II-82, 2,040 m, *P. oocarpa*, S-332, THA & AEM. GUATEMALA: Chichicastenango, 23-VII-80, 2,850 m.

*Ips grandicollis* (Eichhoff). MEXICO: CHIH: Ejido El Largo (near Cd. Madera), 23-VIII-80, 2,300 m, *Pinus duranguensis*, O. Estrada; MICH: Tacambaro, IX-49; Las Cocinas, 20-II-80, 2,200 m, *P. leiophylla*, S-30, THA; Carr. Patzcuaro-Ario de Rosales, Km 34, 31-X-80, 2,340 m, *P. montezumae*, S-135, THA & AEM; HGO: Zacualtipan, 2-VII-82, 2,050 m, *P. patula*, S-74, THA;

**MEX:** Villa del Carbon, 9-I-82, 2,490 m, *P. teocote*, S-259, THA & AEM; **PUE:** Puebla, 17-I-80, 2,200 m, *P. leiophylla*, S-9, THA; **VER** (new state): Cordoba, 2-IV-63, F. Pacheco M.; El Palmar, 13-VI-63, F. Pacheco M.; **GRO** (new state): Teloloapan, 12-VIII-57; Chilapa, 23-II-82, 2,040 m, *P. oocarpa*, S-332, THA & AEM; **CHIS:** Guayaquil, XI-61, *Pinus* sp.; San Cristobal de las Casas, 26-IX-61, H. Bravo M. **GUATEMALA:** Guatemala, 17-XI-77, C. MacVean; Santa Rosa, Baja Verapaz, 7-VIII-77, *P. oocarpa*, M. Dix.

*Ips lecontei* Swaine. **MEXICO:** **CHIH:** Ejido El Largo (near Cd. Madera), 23-VIII-80, 2,300 m, *Pinus duranguensis*, O. Estrada; El Vergel, 14-VIII-80, 2,650 m, *P. arizonica*, J. Castro C.

*Ips confusus* Swaine. **MEXICO:** **HGO:** El Cardonal, 27-III-81, 2,250 m, *Pinus cembroides*, S-206, THA & AEM.

#### Tribe Dryocoetini

*Dendrocranulus consimilis* Wood. **MEXICO:** **CHIS** (new state): Tapachula, 20-IV-83, 100 m, cucurbit vine, SM-141, E. Martinez F. and E. Saucedo C.

*Dendrocranulus cucurbitae* (LeConte). **MEXICO:** **MICH:** Gabriel Zamora, 1-XI-80, 650 m, *Luffa acutangula*, S-141, THA & AEM; Uruapan, 16-V-81, 1,600 m, *Sechium edulis*, AEM.

*Dendrocranulus declivis* (Schedl). **MEXICO** (new country): **VER:** Veracruz, 2-IV-82, 8 m, *Luffa acutangula*, J. F. Duran.

*Dendrocranulus sobrinus* Wood. **MEXICO:** **VER:** Veracruz, 2-IV-82, 8 m, *Luffa acutangula* (new host), J. F. Duran.

*Dendrocranulus gracilis* Wood. **MEXICO:** **MICH** (new state): Uruapan, 16-V-81, 1,600 m, *Sechium edulis* (new host), AEM.

*Coccotrypes rhizophorae* (Hopkins). **MEXICO:** **VER:** Mandinga, 12-III-80, *Rhizophora mangle*, S-46, THA. This species was found in elongating tips of aerial prop roots and hypocotyls of the host plant. When the tips of elongating roots were killed, the plant responded by branching below the point killed. Attacks were never observed in the older, lignified portions of these roots.

*Coccotrypes cyperi* (Beeson). **PANAMA** (new country): Cd. Panama, 19-XII-80, 15 m, branch of *Spondias mombin*, S-159, THA; 19-XII-80, 15 m, seed of *Mangifera indica*, S-162, THA.

*Coccotrypes carpophagus* (Hornung). **MEXICO:** **MICH** (new state): La Gallina, 1-XI-80, 880 m, seeds of *Sabal pumos* (new host), S-144, THA & AEM.

*Coccotrypes dactyliperda* (Fabricius). **MEXICO:** **MICH** (new state): Jiquilpan, 26-V-82, 1,550 m, seeds of *Phoenix canariensis*, S-466, THA & AEM.

#### Tribe Xyleborini

*Premnobius cavipennis* Eichhoff. **MEXICO:** **MICH** (new state): Patuan, 1-XI-80, 1,300 m, *Spondias mombin*, S-147, THA & AEM; **GRO** (new state): Palo Blanco (near Chilpancingo), 22-II-82, 1,200 m, S-330, THA & AEM.

*Dryocoetoides capucinus* (Eichhoff). **MEXICO:** **JAL** (new state): Puerto Vallarta, 6-III-82, 10 m, S-388, AEM; El Tuito, 28-V-82, 640 m, *Inga* sp., S-711, THA & AEM; **MICH:** Zirimicuaro, 2-XI-80, 1,350 m, *Inga* sp., S-153, THA & AEM; **GRO** (new state): Palo Blanco (near Chilpancingo), 22-II-82, 1,200 m, *Inga* sp., S-330, THA & AEM. This species is mostly encountered in branches from 5–10 cm in diameter, seldom in larger material. The gallery consists of one to several irregularly shaped brood chambers, each of which lies between adjacent growth rings. These chambers are connected by short

radial tunnels. This species requires high humidity and appears to be absent from drier tropical areas.

*Xylosandrus morigerus* (Blandford). MEXICO: **QR** (new state): Campo Experimental Forestal INIF, San Felipe Bacalar, 22-V-81; **TAB**: Camacalco, 4-II-83, *Theobroma cacao*, J. Eden de la Cruz; **CHIS**: Tapachula, 9-VII-82, *Coffea canephora* var. *robusta*, E. Aranas.

*Xylosandrus zimmermanni* (Hopkins). MEXICO: **CHIS**: Tapachula, 21-VIII-82, *Coffea canephora* var. *robusta*, E. Aranas.

*Theoborus theobromae* Hopkins. MEXICO (new country): **TAB**: Boquiapa, 25-I-82, J. A. Morales.

*Theoborus solitariceps* (Schedl). MEXICO: **VER**: Rancho Tepetates (near Paso de Ovejas), 11-III-80, 15 m, S-43, **THA**; **TAB** (new state): Cardenas, XII-79, *Erythrina* sp.; Boquiapa, 25-I-82, J. A. Morales. This species restricts its attacks to branches of small diameter (3–5 cm), either in standing trees or in cut or fallen material.

*Xyleborus horridus* Eichhoff. MEXICO: **TAMPS** (new state): Cd. Victoria, 12-III-63; **VER**: Campo Experimental El Palmar, 1-VI-68.

*Xyleborus pseudotenius* Schedl. MEXICO: **TAB** (new state): Boquiapa, 26-I-82, J. A. Morales.

*Xyleborus guatemalensis* (Hopkins). MEXICO: **PUE** (new state): Cuetzalan, 5-V-81, 960 m, *Inga* sp., S-221, **THA** & **AEM**.

*Xyleborus rugicollis* (Blandford). MEXICO (new country): **PUE**: Carr. Talcoxman-Tetela de Ocampo, 12-VII-78, *Quercus* sp.

*Xyleborus spinulosus* Blandford. MEXICO: **VER**: Rancho Tepetates (near Paso de Ovejas), 12-III-80, 50 m, *Mangifera indica*, S-45, **THA**; Morro de la Mancha, 19-VII-83, *Nectandra* sp., S-922, **THA** & **AEM**; **GRO** (new state): Palo Blanco (near Chilpancingo), 22-II-82, 1,200 m, S-330, **THA** & **AEM**. This species has only been collected from host material less than 10 cm in diameter.

*Xyleborus posticus* Eichhoff. MEXICO: **TAB** (new state): Cardenas, 24-II-82, J. A. Morales; Huimanguillo, 12-VI-81, *Erythrina* sp., J. A. Morales.

*Xyleborus ferrugineus* (Fabricius). MEXICO: **TAMPS**: Cd. Victoria, 12-III-63; **VER**: Campo Experimental El Palmar, 13-VI-63; 1-IV-68; Santiago Tuxtla, 26-VI-66, A. Ortiz; **GRO**: Chilpancingo, 23-II-82, 1,230 m, legume tree, S-343. **THA** & **AEM**; **TAB**: Cardenas, XII-79, *Erythrina* sp.; 4-III-81, *Erythrina* sp., J. A. Morales; Huimanguillo, 12-VI-81, *Erythrina* sp., J. A. Morales; Nacajuca, 4-III-81, *Erythrina* sp., J. A. Morales; **CHIS**: Cacaohoatan, 2-II-80, 640 m, **THA**; Tapachula, 3-II-80, 250 m, *Ficus* sp., **THA**. **SAN SALVADOR**: Puerto La Libertad, 1-VII-66, A. Ortiz. This species and *X. volvulus* are the most widespread species of this genus in tropical and subtropical Mexico. Both tolerate an extremely wide range of hosts and ecological conditions and are of the species most commonly found in urban and agricultural habitats. They are among the few xyleborines found in the tropical deciduous forest.

*Xyleborus affinis* (Eichhoff). MEXICO: **MICH**: Patuan, 1-XI-80, 1,300 m, *Spondias mombin*, S-147, **THA** & **AEM**; **PUE**: Apulco, 2-V-80, 1,380 m, **THA** & **AEM**; **TAB**: Cardenas, XII-79, *Erythrina* sp., R. Campos; **CHIS**: Ruinas de Palenque, 7-VIII-81, 90 m, *Persea* sp., A. Burgos S.; Tapachula, 3-II-80, 250 m, **THA**. Like *Xyleborus ferrugineus* and *X. volvulus*, this species is extremely common, polyphagous and frequently associated with man-made environments. It differs from them in that its range of environmental tolerance with respect to humidity seems to be much more limited and the species is virtually absent from drier tropical and subtropical areas within Mexico.

*Xyleborus volvulus* (Fabricius). MEXICO: TAMPS: Cd. Victoria, 17-III-63; NAY: San Blas, 22-III-62; MICH: Putuan, 1-XI-80, 1,300 m, *Spondias mombin*, S-147, THA & AEM; Zirimicuaro, 2-XI-80, 1,350 m, *Inga* sp., S-153, THA & AEM; VER: Campo Experimental El Palmar, 1-IV-63; 13-VI-60; GRO: Teloapan, 12-VIII-57; Copala, 5-VII-81, *Cocos nucifera*; TAB: Cardenas, 4-III-81, *Erythrina* sp., J. A. Morales; CHIS: Tapachula, 3-II-81, 250 m, THA; Ruinas de Palenque, 26-IV-82, 310 m, A. Burgos S.; Agua Azul, 8-VII-82, 160 m, E. Martinez F.

*Xyleborus morulus* Blandford. MEXICO: MICH: Patuan, 1-XI-80, 1,300 m, *Spondias mombin*, S-147, THA & AEM.

*Xyleborus intrusus* Blandford. MEXICO: MICH (new state): Ario de Rosales, 31-X-80, 1,640 m, *Pinus pseudostrobus*, S-139, THA & AEM; MEX: Carr. Toluca-Morelia, Km 54, 30-X-80, 2,520 m, *P. montezumae*, S-124, THA & AEM; PUE: Puebla, 17-I-80, 2,200 m, *P. leiophylla*, S-9, THA; GRO (new state): Chilapa, 23-II-82, 2,040 m, *Pinus oocarpa*, S-332, THA & AEM; CHIS: San Cristobal de las Casas, 26-IX-61. This species attacks all species of pines growing at low and intermediate altitudes. It is seldom found above 2,500 m.

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#### LITERATURE CITED

- WOOD, S. L. 1981. Nomenclatorial changes and new species in Platypodidae and Scolytidae. Great Basin Nat. 41:121-128.  
 ———. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae): a taxonomic monograph. Great Basin Nat. Mem. No. 6:1359 pp.

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#### LITERATURE NOTICES

- MONNÉ, M. A., AND S. A. FRAGOSO. 1984. Notas sobre Onciderini (Coleoptera, Cerambycidae, Lamiinae). Pesq. agropec. bras. (Brasília) 19:925-933.  
 ISRAELSON, G. 1983. An *Olisthopus* from the Azores, with a key to the Macaronesian species. Bocagiana (Funchal), No. 69:1-4.  
 AIKEN, R. B., AND F. L. LEGGETT. 1984. A unique collection of two *Rhantus wallisi* in the body cavity of a female *Dytiscus alaskanus* (Coleoptera: Dytiscidae). Ent. News 95:200-201.  
 SUMMLIN, W. D. 1984. Studies on the Australian Cicindelidae. III: observations on the Australian members of the genus *Cicindela* L. (Coleoptera). Ent. News 95:189-199.  
 BÍLÝ, S. 1984. A revision of *Anthaxia* (*Melanthaxia*) *conradti* and *corsica* species-groups (Coleoptera, Buprestidae). Acta ent. bohemoslov. 81:434-447.  
 RAKOVIĆ, M. 1984. A review of the genus *Tesarius* Rakovič (Coleoptera, Scarabaeidae, Aphodiinae). Acta ent. bohemoslov. 81:448-452.

DESCRIPTION, DIFFERENTIATION, AND  
BIOLOGY OF THE FOUR LARVAL INSTARS OF  
*ACANTHOSCELIDES OBTECTUS* (SAY)  
(COLEOPTERA: BRUCHIDAE)

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ABSTRACT

The four larval instars of *Acanthoscelides obtectus* (Say) are distinguished and described. Scanning electron micrographs and/or line drawings of the head capsule, antenna, clypeolabrum, epipharynx, maxilla, labium, leg, spiracle, and anus are provided. A sensillum placodeum and interdigitating macrotrichia, both on the maxillary palpus, are shown for the first time. Cuticular receptors are identified and their suspected functions are correlated with known larval activities both before and after they penetrate the seed.

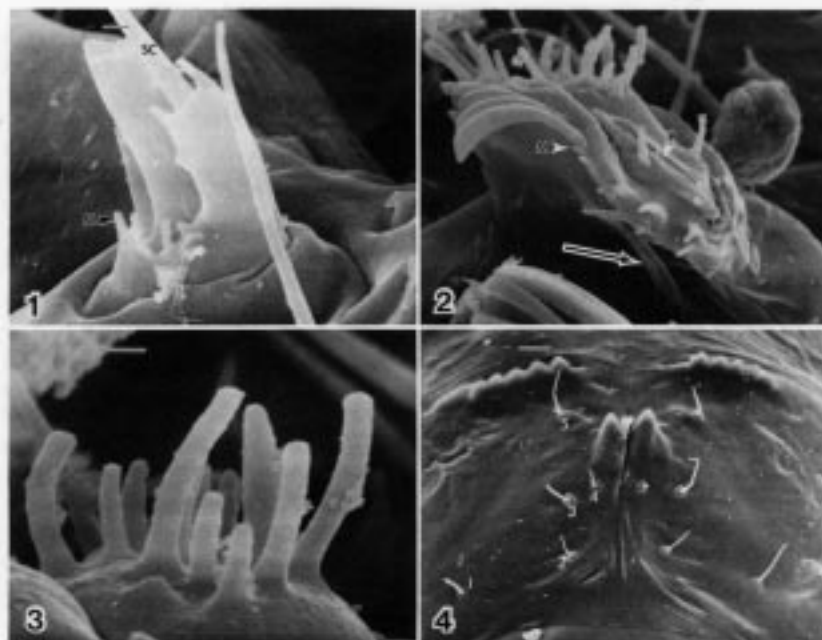
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Despite the interest shown toward the adult, little has been published about the immature stages of *Acanthoscelides obtectus* (Say). Fine structure of the egg chorion, however, is known (Fig. 2 of Biemont *et al.* 1981), and differs from that of other known forms (Pfaffenberger *et al.* 1984). The first larval descriptions of *A. obtectus* (Riley 1891, 1892; Chittenden 1898; Darboux and Mingaud 1902) were cursory and incomplete. Kunhi Kannan (1923) was first to integrate larval description with functional morphology. His work was followed shortly thereafter by more useful contributions of Böving (1927), Böving and Craighead (1930), Box (1928), Daviault (1928), Zacher (1930), and Larson and Fisher (1938). The many inaccuracies in the above works probably are the results of limitations of light microscopy. Aside from the contributions made by Pfaffenberger (in press) and Pfaffenberger and Johnson (1976), little has been published in the last 45 years on larval morphology of this species.

The purposes of this paper are to: (1) correct earlier errors in description, (2) provide, for the first time, SEM views of the larval instars, (3) show new morphological characters, (4) describe or redescribe the four larval instars and provide, for the first time, means to distinguish among them, and (5) identify various cuticular receptors and suggest probable functions.

MATERIALS AND METHODS

Larvae of *A. obtectus* were obtained from a culture at Northern Arizona University in 1973. Scanning electron micrographs of eggs are available (Biemont *et al.* 1981). Pupae were not obtained and therefore are not included in this work. During the interim larval specimens were preserved in 70% ethanol. For scanning electron microscope (SEM) studies they were subjected to a dehydration series (90%, 95%, absolute ethanol), critical point dried, coated with gold-palladium and examined using a ISI-100B SEM at an accelerated voltage of 15 KV.



Figs. 1-4. *Acanthoscelides obtectus*, first instar. 1, antenna showing microtrichia (M) and s. chaeticum (SC); bar = 1  $\mu$ m. 2, lacinia of maxilla, showing microtrichia (M), sensillum placodeum (P), and interdigitating macrotrichia (arrow); bar = 1  $\mu$ m. 3, sensilla basiconica on maxillary palpus; bar = 1  $\mu$ m. 4, prothoracic plate showing paired (pairs indicated by numbers) sensilla trichodea, paired teeth of median arms and five teeth on each posterior arm; bar = 10  $\mu$ m.

#### Larva of *Acanthoscelides obtectus* (Say)

##### FIRST INSTAR (Figs. 1-7)

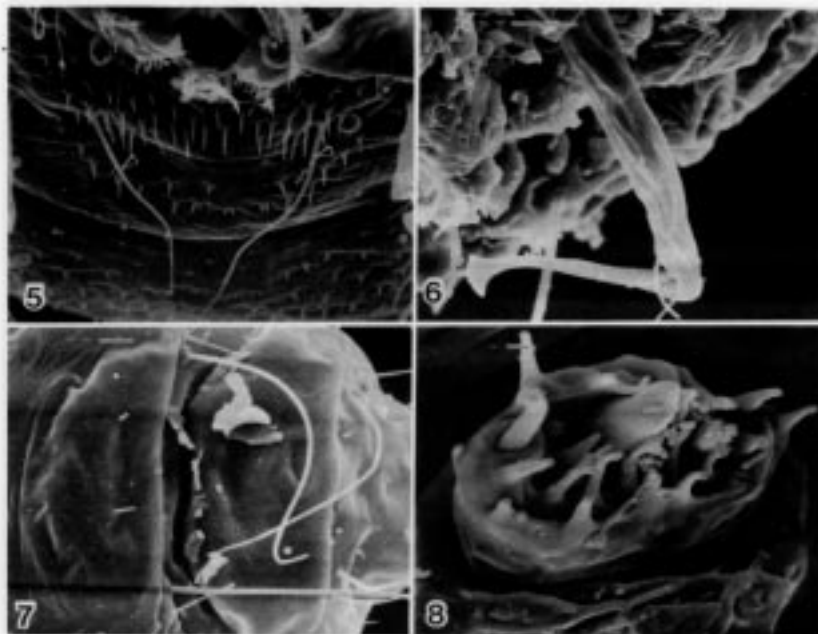
**Body:** 0.3 mm wide by 0.8 mm long, cyphosomatic, width greatest in meso- and metathoracic segments tapering to minute tenth abdominal segment. Cuticle white except for pigmented prothoracic plate. Head capsule most heavily pigmented on and near mouthparts.

**Ocelli:** Single, present at junction of frontal suture and mandibular base, between antenna and mandible (as in Figs. 9, 29).

**Antenna** (Fig. 1): One-segmented, telescopic, composed of one enlarged medial, and one smaller lateral sensilla basiconica. One elongate sensillum chaeticum (SC, Fig. 1) emerging from stalk-like base arising from distomedial antennal surface. Microtrichia (M, Fig. 1) few in number and present as single row on distoventral surface.

**Clypeolabrum:** Labral portion with 10 blunt-tipped sensilla trichodea, eight setae arranged in peripheral C-shaped arc, remaining two setae located anteromedially within arc (as in Figs. 21, 43); one sensillum ampullaceum along medial base of posterolateral pair of sensilla trichodea (as in Fig. 10, solid arrow), microtrichia absent along distal margin. Clypeal portion with convex base and concave distal margin (as in Figs. 9, 43), bearing sensillum trichodeum with subtending sensillum ampullaceum in each posterolateral corner.

**Mandible** (as in Figs. 9, 29): Monocondylic, with awl-shaped chewing surface, lateral surface with two sensilla trichodea.

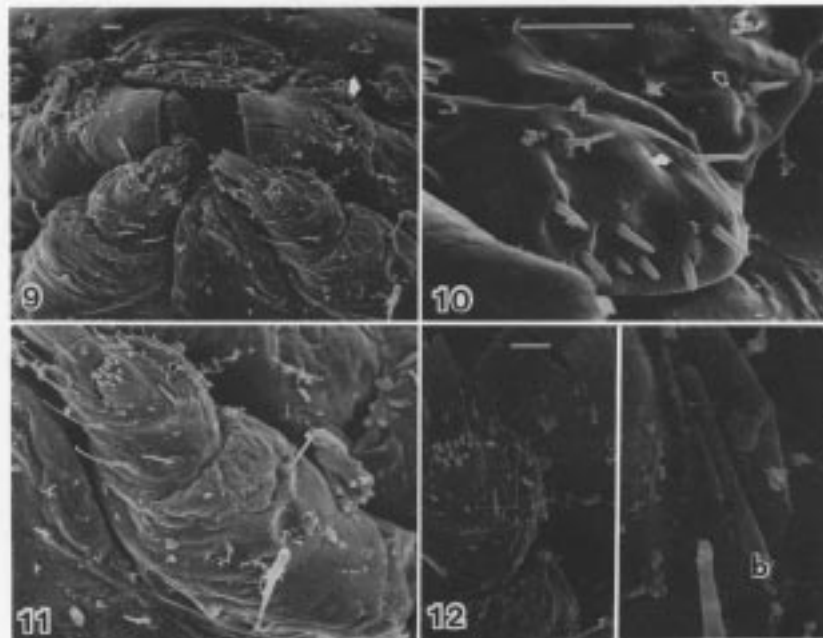


Figs. 5-7. *Acanthoscelides obtectus*, first instar. 5, metathoracic sternite showing elongate s. trichodea (darts) and sclerotized pointed projections (perhaps microtrichia); bar = 10  $\mu$ m. 6, metathoracic leg; bar = 10  $\mu$ m. 7, sclerotized eighth and ninth abdominal tergites showing short and elongate s. trichodea; bar = 10  $\mu$ m. Fig. 8, right antenna of second instar; bar = 1  $\mu$ m.

*Maxilla* (as in Figs. 2, 9, 11, 23): Cardio present, membranous stipes asetiferous with two sensilla trichodea on sclerite; palpifer with twelve sensilla trichodea, two on opposite sides of elongate sensillum placodeum (as in Fig. 11, black dart), remaining sensilla distributed along distoventromedial to ventrolateral surface. Elongate sensillum placodeum (as in Figs. 11, 12) embedded along dorsolateral surface of palpus, distal end of palpus terminating in 13 sensilla basiconica (as in Figs. 3, 13), sensillum ampullaceum present on lateral surface (as in Figs. 24, 38). Five interdigitating, elongate, macrotrichia (arrow in Fig. 2) arising from oral surface of stipes (three) and lacinia (two) (Fig. 2). Microtrichia (see M in Fig. 2) emerge beside larger, spatula-like sensilla chaetica.

*Labium* (as in Figs. 15, 16, 46): Submentum (as in Figs. 23, 46) transversely elongate, narrow and C-shaped, flanked proximally by pair of mediolateral sensilla trichodea; mentum (as in Figs. 23, 46) proximally round, with pair of narrow arms separated by tear-shaped, nonsclerotized cleft, converging toward narrow distal end, with single, unsclerotized islet bearing one sensillum trichodeum near base of each arm, distal end of each arm with sensillum trichodeum, subtended proximally by sensillum placodeum and terminating in cluster of microtrichia (as in Fig. 16), basal half of mentum bordered laterally by pair of sensilla trichodea (of which one sensillum is at least 1.5 times longer than other).

*Prothoracic plate* (Fig. 4): X- or H-shaped, with anterior, median, and posterior arms and five pairs of associated sensilla trichodea; anterior arms flanking four pairs of sensilla trichodea, one pair (#1; Fig. 4) distolateral, one pair (#2) distomedial, one pair (#3) proximolateral, one pair (#4) proximomedial; tooth formula 1 + 0 + 5; median arms



Figs. 9-12. *Acanthoscelides obtectus*, second instar. 9, facial view showing ocellus (O), clypeolabrum (top center), pair of enlarged mandibles, paired maxillae, and labium (bottom center); bar = 10  $\mu$ m. 10, clypeolabrum showing s. ampullacea of clypeus (hollow arrow) and labrum (solid arrow); note absence of microtrichia on labral margin; bar = 10  $\mu$ m. 11, maxilla showing sensillum placodeum (dart) and cardo (C); bar = 10  $\mu$ m. 12, sensillum placodeum (b) on maxillary palpus; bar = 10  $\mu$ m.

with single tooth; midway between teeth of median and posterior arms is pair of sensilla trichodea (present, but not evident in Fig. 4, is sensillum placodeum with subtending sensillum trichodeum medially; as in fig. 22G of Pfaffenberger and Johnson 1976); each posterior arm with five teeth.

*Leg* (Fig. 6): Two-segmented; length of appendage and distance between members of a pair increasing with each succeeding pair; pair of elongate, decurved sensilla trichodea located on distolateral margins of each basal segment; distal segment terminating in laterally expanded, flattened tarsus.

*Thoracic sternites* (Fig. 5): Each with pair of long sensilla trichodea and transverse rows of posteriorly directed, sclerotized projections.

*Abdominal tergites*: Eighth and ninth segments with sclerotized, transversely broad oval plates.

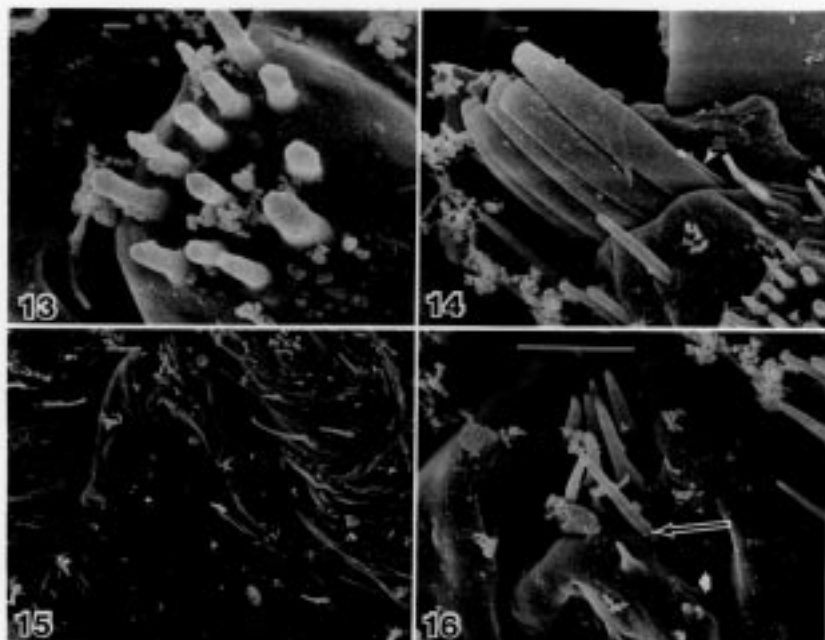
*Spiracles*: Thoracic and abdominal (as in Figs. 17, 18, respectively) with concentric opening, atrium armed with few sclerotized projections, both partially surrounded by several C-shaped, sclerotized rings, some bearing small, sclerotized projections.

**SPECIMENS EXAMINED**: 31, recovered from stock culture in 1973.

#### SECOND INSTAR (Figs. 8-19)

*Body*: 0.8-1.2 mm wide by 1.2-1.4 mm long, fleshy, C-shaped (as in Fig. 28). Cuticle white except for lightly pigmented prodorsum. Head capsule lightly pigmented with deeply pigmented mouthparts.





Figs. 13-16. *Acanthoscelides obtectus*, second instar. 13, sensilla basiconica on maxillary palpus; bar = 1  $\mu$ m. 14, maxillary lacinia showing spatula-like setae and microtrichium (M); bar = 1  $\mu$ m. 15, labium showing glossae (G); bar = 10  $\mu$ m. 16, tip of labial prementum (flanked by paired glossae) showing cluster of microtrichia nearly concealing pair of s. trichodea (hollow arrow), and sensillum ampullaceum (solid arrow); bar = 10  $\mu$ m.

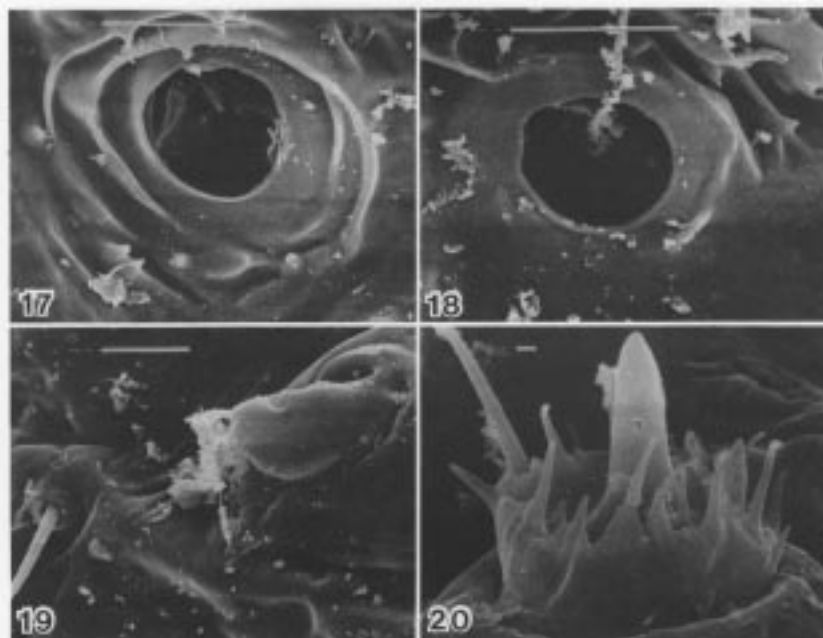
*Ocelli* (as in Figs. 9, 29): Single, at junction of frontal suture and mandible.

*Antenna* (Fig. 8): One-segmented and telescopic; with multiple rows of short microtrichia on distoventral surface and single row of short microtrichia distodorsally; one enlarged medial and one smaller lateral sensilla basiconica. Single elongate sensillum chaeticum arising from stalk-like base, latter emerges from distomedial antennal surface.

*Clypeolabrum* (Figs. 9, 10): With transversely oval sclerite and 10 blunt-tipped sensilla trichodea (an occasional mutant will bear only nine, Fig. 10), eight sensilla trichodea arranged in peripheral C-shaped arc, remaining two setae (1 seta in mutant, Fig. 10) located anteromedially within arc (as in Figs. 21, 43); one sensillum ampullaceum present (solid arrow, Fig. 10) along medial base of posterolateral pair of sensilla trichodea, microtrichia absent from distal margin. Clypeal portion with convex base and concave distal margin (as in Figs. 9, 43), bearing sensillum trichodeum with subtending sensillum ampullaceum in each proximolateral corner.

*Mandible* (as in Figs. 9, 29): Monocondylic, with awl-shaped chewing surface, lateral surface with two sensilla trichodea.

*Maxilla* (Figs. 9, 11; see also Figs. 23, 45): Cardo present (as in Figs. 11, 45); membranous stipes asetiferous with two sensilla trichodea on sclerite; palpifer with 12 sensilla trichodea, two on opposite sides of elongate sensillum placodeum (black dart, Fig. 11), remaining sensilla distributed along distoventromedial to ventrolateral surface. Elongate placoid sensillum (Figs. 11, 12) embedded on dorsolateral surface of palpus dorsal to sensillum ampullaceum (as in Fig. 24), distal end of palpus terminating in 13 sensilla basiconica (Figs. 11, 13); lacinia terminating in five spatula-like setae (Fig. 14), with mandibular surface bearing numerous, decurved microtrichia (cf. Figs. 11, 14).



Figs. 17-19. *Acanthoscelides obtectus*, second instar. 17, thoracic spiracle; bar = 10  $\mu$ m. 18, first abdominal spiracle; bar = 10  $\mu$ m. 19, metathoracic leg; note terminal s. trichodeum; bar = 10  $\mu$ m. 20, third instar antenna showing enlarged s. basiconicum (B) (with smaller s. basiconicum to the right); bar = 1  $\mu$ m.

**Labium** (as in Figs. 15, 16, 23, 46): Submentum transversely elongate, narrow and lunate-shaped, flanked proximally by pair of mediolateral sensilla trichodea, latter separated by width of mentum; mentum proximally round, with pair of narrow arms separated by tear-shaped, unsclerotized cleft, converging toward narrow distal end with single, unsclerotized islet bearing one sensillum trichodeum near base of each arm, distal end of each arm with sensillum trichodeum, subtended proximally by sensillum ampullaceum (as in Fig. 16, solid arrow) and terminating in dense cluster of microtrichia (Fig. 16), basal half of mentum bordered laterally by pair of sensilla trichodea (one 1.5 times longer than other); glossae (as in Fig. 23, G) exceed in length arms of mentum.

**Leg** (Fig. 19): Fleshy with four vague segments; terminating in single sensillum trichodeum.

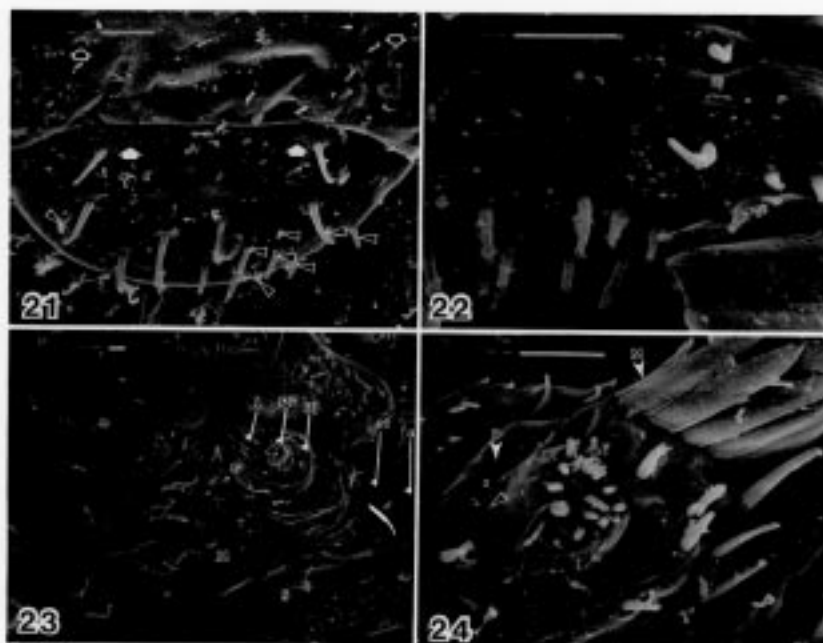
**Spiracles**: Thoracic (Fig. 17) and abdominal (Fig. 18) spiracles with concentric opening, atrium armed with few sclerotized projections; C-shaped sclerotized ridges evident in peritreme, particularly on thoracic spiracle (Fig. 17).

**SPECIMENS EXAMINED**: 20, recovered from stock culture in 1973.

#### THIRD INSTAR (Figs. 20-27)

**Body**: 1.2-1.6 mm wide by 1.4-2.4 mm long, fleshy, C-shaped (as in Fig. 28), width greatest in thoracic segments with abdominal segments tapering from broad base to minute tenth segment. Integument white to yellowish-white with slight pigmentation on prodorsum. Head capsule most heavily pigmented near mouthparts.

**Ocelli** (as in Figs. 9, 29): Single, at junction of frontal suture and mandible.



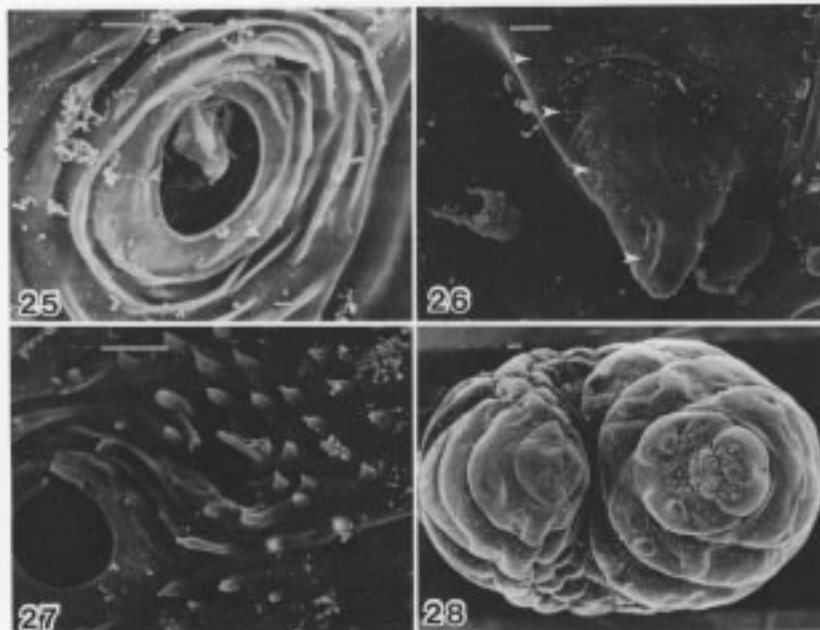
Figs. 21-24. *Acanthoscelides obtectus*, third instar. 21, clypeolabrum showing s. ampullacea on clypeus (open arrows) and labrum (solid arrows), and microtrichia (darts) on labrum; bar = 10  $\mu$ m. 22, labrum showing articulating base of s. trichodea and non-articulating base of microtrichia; bar = 10  $\mu$ m. 23, maxilla (c—cardo, st—stipes, pf—palpifer, pp—palpus, L—lacinia) and labium (S—submentum, M—mentum, G—glossa); bar = 10  $\mu$ m. 24, maxillary palpus and lacinia showing elongate s. placodeum (P), s. ampullacea (dart), and microtrichium (M); bar = 10  $\mu$ m.

**Antenna** (Fig. 20): One-segmented, telescopic, with one enlarged medial and one smaller lateral sensilla basiconica; base from which elongate sensillum chaeticum emerges subequal to base row height of microtrichia (cf. Figs. 1, 8, 20); multiple microtrichial rows evident on distodorsal surface.

**Clypeolabrum** (Figs. 21, 22): Labral portion with transversely oval sclerite and 10 blunt-tipped sensilla trichodea, eight arranged in peripheral C-shaped arc, remaining two located anteromedially within arc (as in Figs. 21, 43); one sensillum ampullaceum present (solid arrows, Fig. 21) along medial base of each posterolateral pair of sensilla trichodea; small microtrichia on distolateral margins (darts, Fig. 21; nonarticulating base, Fig. 22). Clypeal portion narrow and transversely elongate with enlarged, rounded lateral ends, proximal border convex with concave distal margin (as in Figs. 21, 43), bearing sensillum trichodeum with subtending sensillum ampullaceum in each proximolateral area.

**Mandible** (as in Figs. 23, 29): Monocondylic, with awl-shaped chewing surface, lateral surface with two sensilla trichodea.

**Maxilla** (Figs. 23, 24): Cardo present (C, Fig. 23); membranous stipes asetiferous with two sensilla trichodea on sclerite. Palpifer (pf, Fig. 23) with 12 sensilla trichodea, two on opposite sides of elongate sensillum placodeum (Fig. 24), remaining sensilla distributed along distoventromedial to ventrolateral surfaces. Palpus (pp, Fig. 23) with elongate sensillum placodeum on dorsolateral surface (P, Fig. 24), sensillum ampullaceum (as in Figs. 24 (dart), 38) located ventral to elongate sensillum placodeum, distal end terminating in 13 sensilla basiconica. Lacinia (as in Figs. 23, L; 24) terminating in five



Figs. 25–27. *Acanthoscelides obtectus*, third instar. 25, thoracic spiracle; note increasing number of folds in peritreme; bar = 10  $\mu$ m. 26, metathoracic leg (4 segments marked by darts); bar = 10  $\mu$ m. 27, first abdominal spiracle; note bordering integumental projections which surround s. trichodeum; bar = 10  $\mu$ m. 28, ventral view of fourth instar habitus (note transverse anal opening); bar = 100  $\mu$ m.

spatula-like setae, mandibular surface bearing numerous, decurved microtrichia (M, Fig. 24).

**Labium:** Submentum (S, Fig. 23) transversely elongate, narrow and lunate-shaped (as in Fig. 46), flanked proximally by pair of mediolateral sensilla trichodea, latter separated by width of mentum (M, Fig. 23); mentum proximally round, with pair of narrow arms separated by tear-shaped, membranous cleft (as in Fig. 46), converging toward narrow distal end, single unsclerotized islet with one sensillum trichodeum appearing near base of each arm, distal end of each arm with sensillum trichodeum, subtended proximally by sensillum ampullaceum (as in Fig. 16, solid arrow) and terminating in dense cluster of microtrichia, basal half of mentum bordered laterally (as in Fig. 46) by pair of sensilla trichodea (one at least 1.5 times longer than other); glossae (G, Fig. 23) exceeding in length arms of mentum.

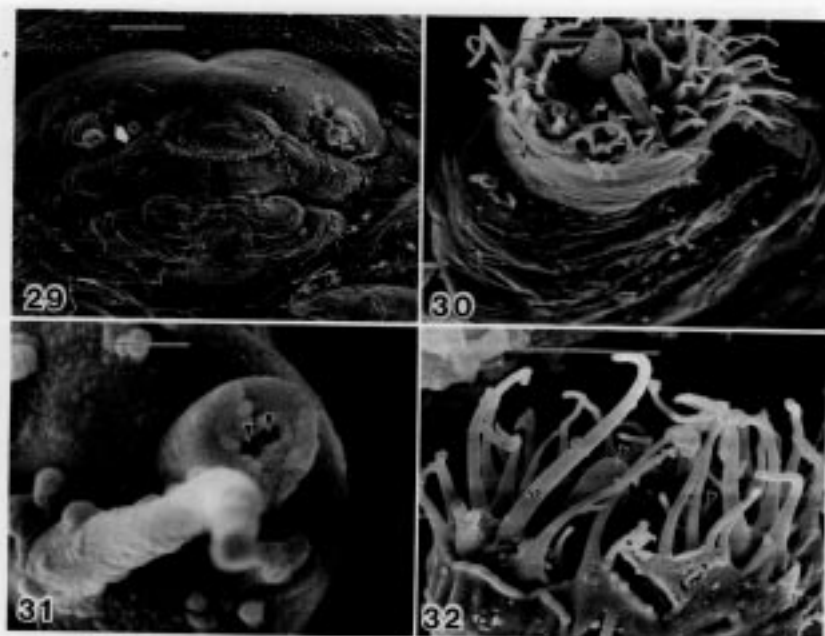
**Leg** (Fig. 26): Segmentation vaguely apparent, four-segmented with two (one lateral, one medial) sensilla trichodea at border of ultimate and penultimate segments.

**Spiracles:** Thoracic peritreme (Fig. 25) with numerous sclerotized folds, abdominal peritreme definite (Fig. 27) with fewer folds and bordered posterodorsally by cluster of pointed projections, centered in cluster of projections is single sensillum trichodeum, atrial sclerotized projections numerous.

**SPECIMENS EXAMINED:** 17, recovered from stock culture in 1973.

#### FOURTH INSTAR (Figs. 28–46)

**Body** (Fig. 28): 1.6–2.3 mm wide by 2.4–3.5 mm long, fleshy, C-shaped, width greatest at metathoracic and abdominal segments 1–4, tapering to small tenth abdominal and



Figs. 29–32. *Acanthoscelides obtectus*, fourth instar. 29, facial view showing ocellus (O) and distribution of s. trichodea on head capsule; bar = 100  $\mu$ m. 30, antenna showing s. basiconica (S); bar = 10  $\mu$ m. 31, base of broken s. chaeticum showing holes through which sensory neurons likely pass; note thickened walls; bar = 1  $\mu$ m. 32, antenna showing the protective effect microtrichia may have on the s. chaeticum (SC) and the two s. basiconica (darts); bar = 10  $\mu$ m.

prothoracic segments, distance between appendages of a segment increasing with each succeeding segment; integument white except for lightly pigmented, yellowish prodorsum, vestiture similar to that of *Caryobruchus bucki* Bridwell (as in Fig. 1, A–C; Pfaffenberger 1974).

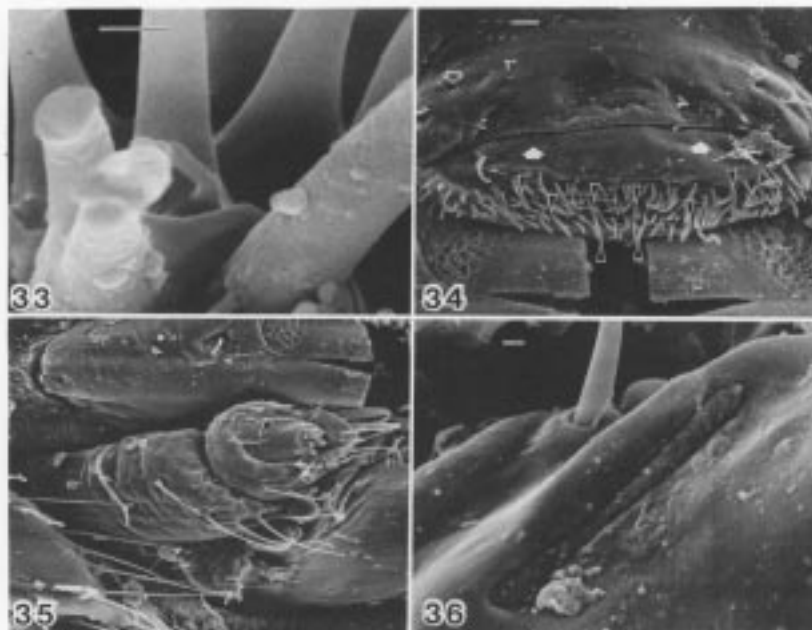
**Head** (cf. Fig. 29 with figs. 3 and 4 of Pfaffenberger 1977): Retractable, mostly asetiferous, with exception of three sensilla trichodea slightly dorsal and medial to each antenna and one sensillum trichodeum lateral to each mandibular base (Fig. 29); lightly pigmented except on and near mouthparts.

**Ocelli** (Fig. 29): Near junction of frontal suture and mandible.

**Antenna** (Figs. 30–33): Single telescopic segment, terminal sensilla include one enlarged medial and one smaller lateral sensilla basiconica and one elongate sensillum chaeticum (SC, Fig. 32), foregoing sensilla nearly concealed by multiple rows of elongate microtrichia (Fig. 32).

**Clypeolabrum** (Figs. 29, 34, 43): Labral portion with 10 blunt-tipped sensilla trichodea, eight sensilla arranged in peripheral C-shaped arc, remaining two sensilla located anteromedially within arc, all sensilla except lateral most ones (Fig. 34) nearly concealed by elongate microtrichia, single sensillum ampullaceum present (solid arrow, Fig. 34) medial to posterolateral pair of sensilla trichodea, sclerite transversely oval. Clypeal portion with convex proximal border and concave distal margin (Figs. 29, 34, 43), sclerite transversely elongate, narrow with bulbous ends, each enlarged and supporting single sensillum trichodeum and subtending sensillum ampullaceum (hollow arrows, Fig. 34).

**Epipharynx** (Fig. 44): Epipharyngeal groove bordered laterally by pair of strongly decurved sensilla trichodea and subtending triangular patch of sclerotized projections.



Figs. 33–36. *Acanthoscelides obtectus*, fourth instar. 33, articulating base of sensillum chaeticum (lower right) showing shortened, blunt microtrichia; bar = 1  $\mu$ m. 34, facial view of clypeolabrum, showing s. ampullacea (open arrows on clypeus and solid arrows on labrum), and distribution of blunt tipped s. trichodea (darts) on labrum; bar = 10  $\mu$ m. 35, lateral view of right maxilla showing s. ampullaceum (dart) near lateral base of palpus; bar = 10  $\mu$ m. 36, sensillum placodeum on maxillary palpus; bar = 1  $\mu$ m.

*Mandible* (as in Figs. 29, 35): Monocondylic, with awl-shaped chewing surface, lateral surface with two sensilla trichodea.

*Maxilla* (Figs. 35, 45): Cardo (C, Fig. 45) bowl-shaped; membranous stipes with five-seven sensilla trichodea with two each sensilla trichodea and sensilla ampullacea on sclerite of stipes (S, Fig. 45); palpifer (PF, Fig. 45) with twelve sensilla trichodea, two on opposite sides of elongate sensillum placodeum of palpus (PP, Fig. 45; see also Fig. 24) remaining sensilla distributed along distoventromedial to ventrolateral surface; palpus with dorsolateral, elongate sensillum placodeum (as in Fig. 24, P) sensillum ampullaceum (Fig. 38) located ventral to elongate sensillum placodeum, distal and terminating in 13 sensilla basiconica (Fig. 37); lacinia (L, Fig. 45) terminating in five truncate, blade-like setae (as in Figs. 14, 24), with mandibular surface bearing numerous, decurved microtrichia (as in Figs. 11, 14).

*Labium* (Figs. 39, 46): Submentum transversely elongate, narrow and lunate-shaped, flanked proximally by pair of mediolateral sensilla trichodea, latter separated by width of mentum; mentum proximally round, with pair of narrow arms separated by tear-shaped, unsclerotized cleft, converging toward narrow distal end, with single, unsclerotized islet bearing one sensillum trichodeum near base of each arm, distal end of each arm with sensillum trichodeum, subtended proximally by sensillum ampullaceum (as in Fig. 16, solid arrow) and terminating in dense cluster of microtrichia, basal half of mentum bordered laterally by pair of sensilla trichodea (one at least 1.5 times longer than other); glossae (as in Fig. 23, G) exceeding in length arms of mentum.

*Leg* (Fig. 40): Four clearly defined segments, ultimate segment nipple-like, with two

sensilla trichodea on opposite sides of distal end of penultimate segment and two elongate sensilla trichodea on anterolateral surface of basal segment.

*Spiracles*: Thoracic (Fig. 41) and abdominal (Fig. 42) peritremes with increasing numbers of integumental folds, atrial armature consisting of numerous, short rows of pointed, sclerotized projections.

*Anus* (Fig. 28): Transverse.

SPECIMENS EXAMINED: 25 larvae, recovered from stock culture in 1973.

#### INSTAR DIFFERENCES

Marcucci (1920) was the first to suggest the existence of four instars in *A. obtectus*. His morphological characters, however, were unacceptable to Zacher (1930), who painstakingly removed old exuviae from the larval gallery to determine the number of instars; he confirmed the existence of four nearly identical instars.

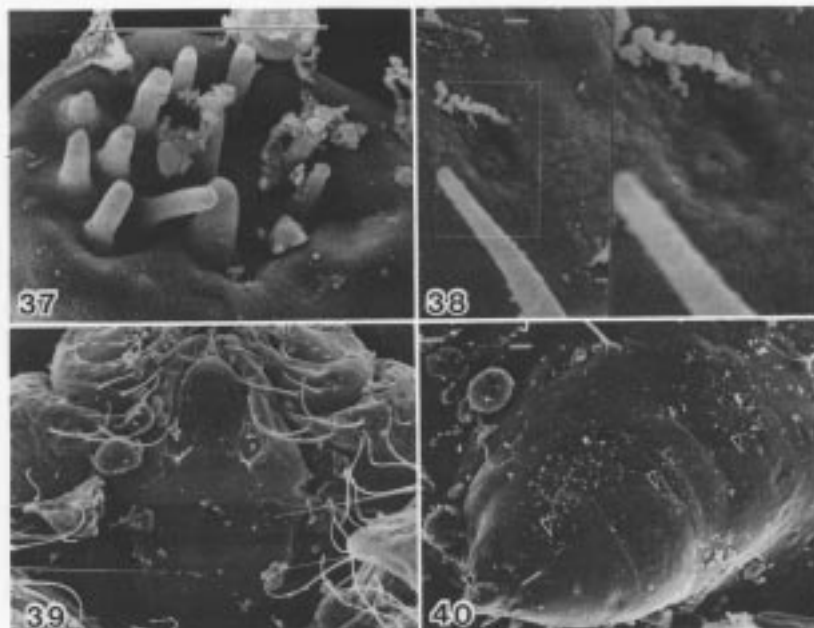
#### KEY TO INSTARS

1. Body cyphosomatic; X- or H-shaped prothoracic plate present (Fig. 4); legs stalk-like and two-segmented (Fig. 6); 8th and 9th abdominal tergites with transversely oval sclerotized plates (Fig. 7, also see illustrations in Pfaffenberger and Johnson 1976) ..... first instar
- Body robust and C-shaped (as in Fig. 28); prothoracic plate absent; legs nipple-like and four-segmented (Fig. 26); sclerotized plates absent on 8th and 9th abdominal tergites ..... 2
- 2(1). Single row of microtrichia on distodorsal antennal surface (Fig. 8); clypeolabral microtrichia absent (cf. Figs. 10, 21); leg a fleshy lobe terminating in sensillum trichodeum (Fig. 19) ..... second instar
- Combination of characters not as above ..... 3
- 3(2). Multiple rows of microtrichia evident on distodorsal antennal surface (Fig. 20), but length of microtrichia not exceeding height of large sensillum basiconicum; small microtrichia evident on distolateral margins of clypeolabrum; leg vaguely four-segmented, with two sensilla trichodea (one lateral and one medial) at border of ultimate and penultimate segments (Fig. 26) ..... third instar
- Multiple rows of elongate microtrichia nearly concealing antennal sensilla (Figs. 30, 32); clypeolabral microtrichia elongate and numerous, nearly concealing sensilla trichodea (Figs. 29, 34); leg with four clearly defined segments, with two sensilla trichodea on opposite sides of distal end of penultimate segment and two elongate sensilla trichodea on anterolateral surface of basal segment ..... fourth instar

#### SENSILLAR STRUCTURES

Knowledge of bruchid sense organs comes primarily from a limited number of electrophysiological studies on adults of *A. obtectus* (Pouzat 1981). Only one species of bruchid larva has been examined (Pfaffenberger and Janzen 1984) for cuticular sensilla and no electrophysiological information exists which provides proof of sensillar function. Therefore, the following attempt to equate function with cuticular structure is merely suggestive, realizing that sensillar functions may vary within the same insect, between insects and sexes (Zacharuk 1980).

In the following list the name of the sensory receptor is followed by its proposed function, morphological description and anatomical location.



Figs. 37-40. *Acanthoscelides obtectus*, fourth instar. 37, sensilla basiconica on maxillary palpus; bar = 10  $\mu$ m. 38, sensillum ampullaceum near lateral base of maxillary palpus; bar = 1  $\mu$ m. 39, long, pointed s. trichodea arising from maxilla and prosternum; bar = 10  $\mu$ m. 40, metathoracic leg showing four segments (marked by darts); bar = 10  $\mu$ m.

*Sensilla ampullacea*—smell (Snodgrass 1926); appear as round, shallow depressed areas on the integument (hollow arrow in Fig. 34) and possess a small hole in the center of the depressed area (Fig. 38), in line drawings they appear as round holes (Fig. 43); clypeus (hollow arrow, Fig. 34), labrum (solid arrow, Fig. 34; circles in Fig. 43), maxilla (Figs. 24, 38, 45), and labium (solid arrow, Fig. 16) (circles in Fig. 46). They also occur on or at the base of legs (Pfaffenberger 1974; Pfaffenberger and Johnson 1976).

*Sensilla basiconica*—contact chemoreception (Pouzat 1981; Slifer 1970; Snodgrass 1926); appear as a teat on an udder which may or may not be enlarged; antenna (Figs. 30, 32), maxillary palp (Figs. 3, 13, 37, 45).

*Sensilla chaetica*—mechanoreception (McIver 1975; Snodgrass 1926); appear as spines or stout hair-like structures with a socket base; antenna (Figs. 1, 31, 32).

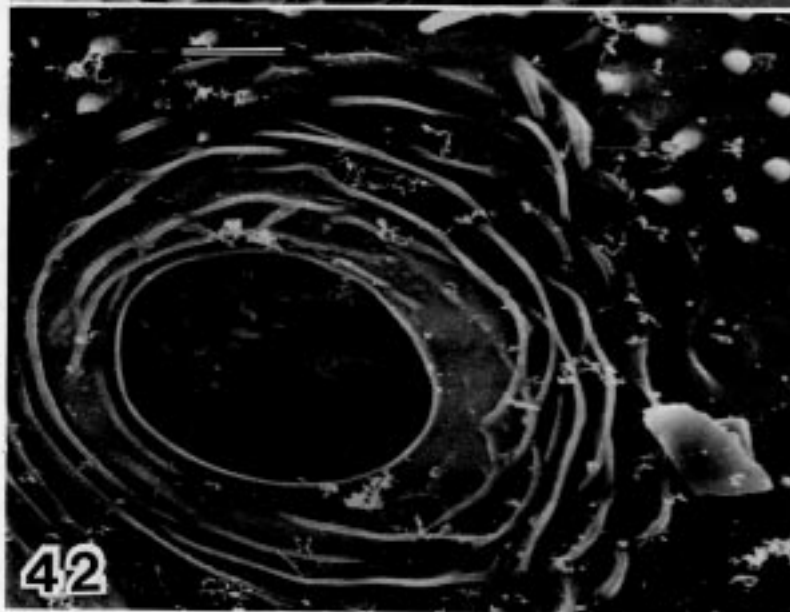
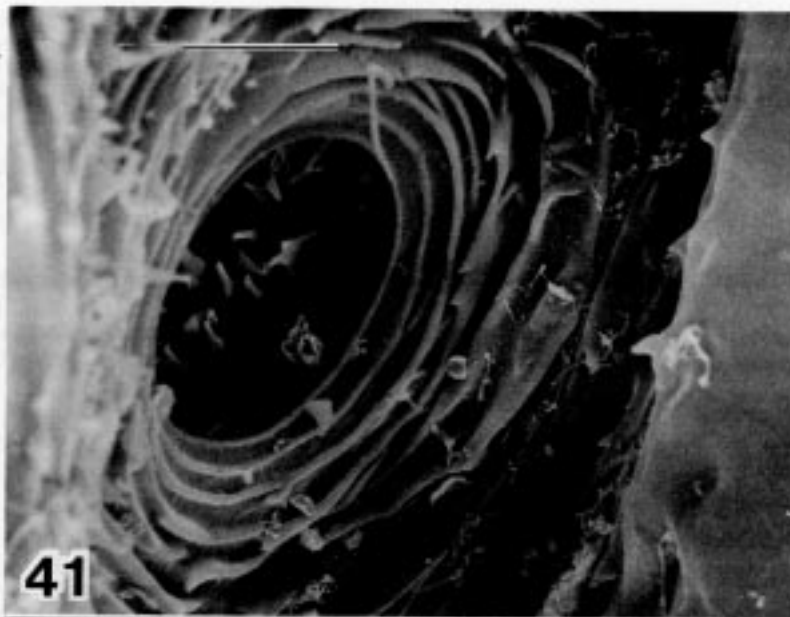
*Sensilla placodea*—infrared radiation sensitivity (Richerson *et al.* 1972); appear as a blunt stick pressed into a clay surface; maxillary palp (Figs. 12, 24, 36).

*Sensilla trichodea*—tactile hairs (Snodgrass 1926) or olfactory chemoreceptors (McIver 1982; Snodgrass 1926); all possess a socket base.

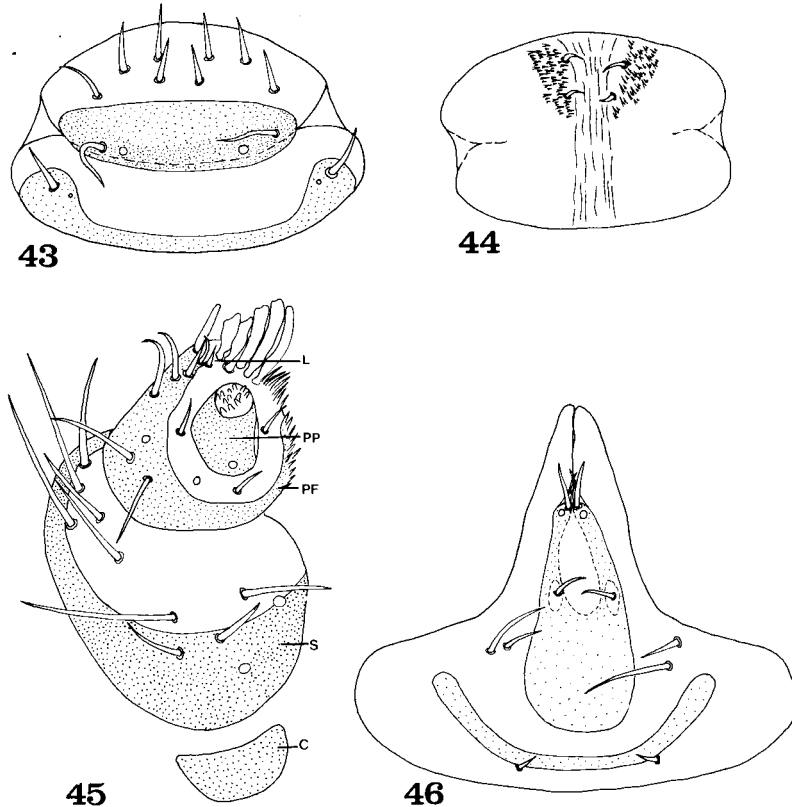
1. long or tactile hairs

- A. integument of 1st instar (Figs. 5, 7); thoracic sternites of later instars (as in Fig. 29); stipes and palpifer of later instars (Fig. 45)





Figs. 41-42. *Acanthoscelides obtectus*, fourth instar. 41, thoracic spiracle showing concentric folds in peritreme and armature of atrium; bar = 10  $\mu$ m. 42, first abdominal spiracle; note increased numbers of folds in peritreme and dense atrial armature; bar = 10  $\mu$ m.



Figs. 43–46. *Acanthoscelides obtectus*, fourth instar. 43, clypeolabrum showing distribution of s. trichodea minus the microtrichia. 44, epipharynx showing medially decurved s. trichodea bordering epipharyngeal groove. 45, maxilla showing cardo (C), stipes (S), palpifer (PF), palpus (PP), and lacinia (L). 46, labium showing broad, narrow submentum and nearly oval mentum.

- (1) excited by fatty acids
- (2) inhibited by odiferous plant oils
- 2. short or olfactory chemoreceptor hairs
  - A. pointed tip
    - (1) prothoracic plate (Fig. 4) and junction of leg segments (Fig. 6) of first instar; frons (Fig. 29) and integument (Fig. 7) of all instars
      - (a) excited by higher-chain fatty acids
      - (b) inhibited by lower-chain fatty acids
      - (c) may be specific for chemical vapors
  - B. blunt tipped type
    - (1) mouthparts (as in Figs. 2, 10, 11, 14–16, 21, 22); first abdominal spiracle (Fig. 27)
      - (a) excited by higher-chain fatty acids
      - (b) inhibited by lower-chain fatty acids
      - (c) may be specific for chemical vapors.

Other structures, which may not be innervated but are perhaps important in a discussion of functional morphology, include:

*Microtrichia*—serve in protecting and maintaining a clean surface on important sensory receptors (Figs. 30, 32), or perhaps are important food manipulating structures (Figs. 15, 16).

*Macrotrichia*—(Fig. 2) important in proprioception.

*Ocelli*—(Figs. 9, 29) light perception.

Spatula-like (perhaps *s. chaetica*) setae (Figs. 2, 14, 29) may be tactile (Richerson *et al.* 1972) or, based upon location, important in food manipulation.

#### FUNCTIONAL MORPHOLOGY

Considerable resistance is normally encountered by bruchid larvae as they attempt to penetrate and feed upon one or more host seeds (Janzen 1969). At times, such resistance is compounded when oviposition occurs on host plants to which the larva is not well suited (Johnson 1981). Regardless of host plant suitability, larvae must perform certain essential tasks. Some of these include: (1) penetration of pod wall, (2) location of host seed, (3) penetration of seed, (4) avoidance of toxic compounds, (5) avoidance of other larvae feeding within the same seed, (6) recognition of suitable food source, and (7) preparation for adult emergence. Each of the foregoing activities will subsequently be addressed and indicated by a parenthetic number which corresponds to the number in the list above.

The measure of success which *A. obtectus* experiences in wild or cultivated forms of its preferred host plant (*Phaseolus vulgaris* L.) is, of course, dependent upon activities of the first instar. Since the fruit of this host is a linear, flattened pod containing several seeds and since the female oviposits a few to many eggs in chewed holes (Pouzat 1981) and cracks or cuts in pod walls (Howe and Currie 1964), it remains for the first instar to actively search out the host seed. The first instar may exit the egg through its anterodorsal end and wander before penetration (Zacher 1930) or it may exit the egg ventrally thus penetrating the pod wall directly (Pfaffenberger, in press). In either instance it must pierce the pod wall, which requires some form of leverage which the larva obtains from either the egg chorion [which may or may not be cemented in place (Zacher 1930)], or by wedging its way into cracks or crevices. Kunhi Kannan (1923) indicated that the first instar is perfectly capable of penetrating a seed without leverage [an interesting and aggressive rebuttal is presented by Lepesme (1942), as *A. obsoletus*]. Riley (1891) also stated that as many as 28 larvae have been observed to develop within a single bean. Under these circumstances it would seem that some first instars might also utilize holes drilled by other larvae (Slingerland 1893; Zacher 1930).

Is sensory discriminating ability, such as innate recognition of a "layer effect" (Pfaffenberger and Janzen 1984), necessary to penetrate the pod wall (#1)? If so, it would entail recognition of both physical and chemical differences. Chemical recognition could arise from *s. ampullacea*, *s. basiconica* and even *s. trichodea*, while textural changes might be perceived by *s. chaetica*. While chewing its way through the pod it is doubtful that any of the pod wall would be eaten because of reduced palatability (Pouzat 1981) or even the presence of potentially toxic secondary compounds (Janzen 1969).

Once inside the pod wall the first instar must then locate the host seed (#2); such a task would be greatly enhanced by the heat sensitive *s. placodea*. Upon locating the host seed the first instar wedges itself between pod wall and bean using *s. basiconica* and the long *s. trichodea* to determine when suitable leverage

has been achieved to penetrate the seed (#3). To position its ventral surface against the bean, rather than pod wall, its heat detecting s. placodea and ocelli seemingly would become very important as would their ability to detect response promoting chemicals through their s. ampullacea, s. basiconica and perhaps even the shorter s. trichodea.

While penetrating the seed test it again would seem unlikely, for reasons alluded to above, that the first instar would feed. Once inside the testa, however, other hazards might prevail such as (#4) presence of toxic chemicals (Nelson and Johnson 1983) or, among others (#5), presence of cannibalistic larvae. Sensilla ampullacea, basiconica, and shorter s. trichodea might function as organs for perception of toxic chemicals while chamber vibrations of neighboring larvae might be perceived by s. chaetica or even the longer s. trichodea. Arrival in the endosperm likely influences the onset of molt and may also prompt the feeding response (#6) in all subsequent instars. Such changes in behavior are likely initiated by impulses from the blunt and pointed s. trichodea, as well as from organs of olfaction (s. ampullacea) and chemoreception (s. basiconica).

Increased numbers of microtrichia around the labral margin (as in Figs. 10, 21, 34) and distal end of the antennal segment (as in Figs. 1, 8, 20, 30) seem to be associated with preventing the buildup of frass and other chamber components on the essential receptors of second through fourth instars. By comparing Figures 17-18 with 41-42, similar statements are made in conjunction with increased numbers of peritreme folds and atrial spinous projections of thoracic and abdominal spiracles.

Finally, as the larva prepares to pupate (#7) the elongate s. placodea might be utilized to detect the proximity of the exterior. Sensitivity to infrared radiation, ocellar light detection and input from other sensillar types, regarding changes in the chemical and physical nature of material close to the seed testa, enable the fourth instar to weaken a part of the seed testa substantially so that the emerging adult can escape from the seed.

#### ACKNOWLEDGMENTS

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#### LITERATURE CITED

- BIEMONT, J. C., G. CHAUVIN, AND C. HAMON. 1981. Ultrastructure and resistance to water loss in eggs of *Acanthoscelides obtectus* Say (Coleoptera: Bruchidae). *J. Insect Physiol.* 27:667-679.
- BÖVING, A. G. 1927. On the classification of the Mylabridae-larvae (Coleoptera: Mylabridae). *Proc. Entomol. Soc. Wash.* 29:133-142.
- , AND F. C. CRAIGHEAD. 1930. An illustrated synopsis of the principal larval forms of the order Coleoptera. *Entomol. Amer.* 11:1-351.
- BOX, H. E. 1928. El bruquido del poroto (*Bruchus obtectus*, Say). *Rev. Industrial y Agric. de Tucuman. Circ. No.* 19(5/6):146-154.
- CHITTENDEN, F. H. 1898. Insects injurious to beans and peas. U.S.D.A. Yearbk. 1898: 233-260.
- DARBOUX, G., AND G. MINGAUD. 1902. Sur la biologie de *Laria obtecta* Say (Col.). *Bull. Soc. Entomol. Fr.* 29:72-75.

- DAVIAULT, L. 1928. Sur le developpement post embryonnaire de la bruche du haricot *Acanthoscelides obtectus* Say. Ann. Soc. Entomol. Fr. 97:105-132.
- HOWE, R. W., AND J. E. CURRIE. 1964. Some laboratory observations on the rates of development, mortality and oviposition of several species of Bruchidae breeding in stored pulses. Bull. Entomol. Res. 55:437-477.
- JANZEN, D. H. 1969. Seed-eaters versus seed size, number, toxicity and dispersal. Evolution 23:1-27.
- JOHNSON, C. D. 1981. Relations of *Acanthoscelides* with their plant hosts, pp. 73-81. In: V. Labeyrie (editor), The ecology of bruchids attacking legumes (pulses). Dr. W. Junk Publ., Boston.
- KUNHI KANNAN, K. 1923. The function of the prothoracic plate in mylabrid (bruchid) larvae (a study in adaptation). Mysore State Dept. Agric., Entomol. Ser. Bull. 7: 1-47.
- LARSON, A. O., AND C. K. FISHER. 1938. The bean weevil and the southern cowpea weevil in California (*Acanthoscelides obtectus* Say and *Callosobruchus maculatus* F.). U.S.D.A. Tech. Bull. No. 593:1-70.
- LEPESME, P. 1942. Sur l'eclosion et le comportement de la larve neonate chez *Acanthoscelides obsoletus* Say. Soc. Entomol. Fr. 47:7-9.
- MARCUCCI, E. 1920. Osservazione sulla forma esterna e sulle biologia della larva di *Acanthoscelides obtectus* Say. Arch. Zool. Italiano 9:237-261.
- MCIVER, S. B. 1975. Structure of cuticular mechanoreceptors of arthropods. Ann. Rev. Entomol. 20:381-397.
- . 1982. Sensilla of mosquitoes (Diptera: Culicidae). J. Med. Entomol. 19:489-535.
- NELSON, D. M., AND C. D. JOHNSON. 1983. Selenium in seeds of *Astragalus* (Leguminosae) and its effects on host preferences of bruchid beetles. J. Kan. Entomol. Soc. 56:267-272.
- PFaffenBERGER, G. S. 1974. Comparative morphology of the final larval instar of *Caryobruchus buscki* and *Pachymerus* sp. (Coleoptera: Bruchidae: Pachymerinae). Ann. Entomol. Soc. Amer. 67:691-694.
- . 1977. Comparative descriptions of the final larval instar of *Bruchus brachialis*, *B. rufimanus*, and *B. pisorum* (Coleoptera: Bruchidae). Coleopt. Bull. 31:133-142.
- . (In press). Family Bruchidae. In: F. Stehr (editor), An introduction to immature insects of North America. Kendall/Hunt Publ., Dubuque.
- , AND D. H. JANZEN. 1984. Life history and morphology of first and last larval instars of Costa Rican *Caryedes brasiliensis* Thunberg (Coleoptera: Bruchidae). Coleopt. Bull. 38:267-281.
- , G. S., AND C. D. JOHNSON. 1976. Biosystematics of the first-stage larvae of some North American Bruchidae (Coleoptera). U.S.D.A. Tech. Bull. No. 1525. 75 pp.
- , S. MURUAGA DE L'ARGENTIER, AND A. L. TERAN. 1984. Morphological descriptions and biological and phylogenetic discussions of the first and final instars of four species of *Megacerus* larvae (Coleoptera: Bruchidae). Coleopt. Bull. 38: 1-26.
- POUZAT, J. 1981. The role of sense organs in the relations between bruchids and their host plants, pp. 61-72. In: V. Labeyrie (editor), The ecology of bruchids attacking legumes (pulses). Dr. W. Junk Publ., Boston.
- RICHERSON, J. V., J. H. BORDEN, AND J. HOLLINGDALE. 1972. Morphology of a unique sensillum placodeum on the antennae of *Coeloides brunneri* (Hymenoptera: Braconidae). Can. J. Zool. 50:909-913.
- RILEY, C. V. 1981. The pea and bean weevils. Insect Life 4:297-302.
- . 1982. The first larval or post-embryonic stage of the pea and bean weevils. Can. Entomol. 24:185-186.
- SLIFER, E. H. 1970. The structure of arthropod chemoreceptors. Ann. Rev. Entomol. 15:121-142.

- SLINGERLAND, M. V. 1893. Notes from the Cornell insectary. III. Some observations upon two species of *Bruchus*. *Psyche* 6:445-449.
- SNODGRASS, R. E. 1926. The morphology of insect sense organs and the sensory nervous system. *Smithsonian Misc. Publ.* 77. 80 pp.
- ZACHARUK, R. Y. 1980. Ultrastructure and function of insect chemosensilla. *Ann. Rev. Entomol.* 25:27-47.
- ZACHER, F. 1930. Untersuchungen zur Morphologie und Biologie der Samenkäfer (Bruchidae-Lariidae). *Arb. Biol. Abt. (Anst. Reichsanst)* 18:233-384.

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### SCIENTIFIC NOTE

#### NEW HOST RECORD FOR *ACANTHOSCELIDES CHIRICAHUAE* (FALL) (COLEOPTERA: BRUCHIDAE)

According to Johnson (1983), *Acanthoscelides chiricahuae* has only been reared from seeds of the plant genus *Mimosa*. Recently while collecting seeds to recover larvae I reared numerous adults of *A. chiricahuae* from seeds of *Acacia greggi* Gray.

Three bruchid species have been previously reared from seeds of this host plant: *Merobruchus julianus* (Horn), *Stator limbatus* (Horn) and *Stator pruininus* (Horn) (Johnson 1981). Therefore, this report also represents a new host-genus association. Because of an ongoing effort to establish bruchid-host plant associations the following record is reported below.

*Acacia greggi* Gray: Sumner Lake State Park, Eastside Campground across lake to the east from the boat loading area, De Baca Co., New Mexico, VII-4-84. Most of the pods had already matured and dropped when collected.

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#### LITERATURE CITED

- JOHNSON, C. D. 1981. Seed beetle host specificity and the systematics of the Leguminosae, pp. 995-1027. *In: Advances in legume systematics*, Pt. 2, R. M. Polhill and P. H. Raven (editors). Royal Botanic Gardens, England.
- . 1983. Ecosystematics of *Acanthoscelides* (Coleoptera: Bruchidae) of southern Mexico and Central America. *Entomol. Soc. Amer.* 56:1-370.
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## SCIENTIFIC NOTE

NEW LARVAL HOST PLANTS FOR THREE AUSTRALIAN LONGICORNS  
(COLEOPTERA: CERAMBYCIDAE)

New larval hosts are recorded for *Aridaeus thoracicus* (Donovan), *Clytus curtisii* (Laporte & Gory) and *Pachydissus sericus* Newman.

*Aridaeus thoracicus* (Donovan)

During November 1983, larvae, pupae and teneral adults were collected from a large dead branch (14.5 cm diam.) of the introduced tree, *Delonix regia* (Boj. ex Hook.) Raf. (Caesalpinaceae), from the Ipswich area, southeast Queensland. Duffy (1963) records the introduced pear, *Pyrus malus* L. (Rosaceae) and the native *Cryptocarya glaucescens* R.Br. (Lauraceae) as larval food plants. These appear to be the only published hosts for *A. thoracicus*.

*Clytus curtisii* (Laporte & Gory)

On June 24, 1984 one dead adult was collected from a dead branch (22 mm diam.) of *Acacia leiocalyx* (Domin) Pedley subsp. *leiocalyx* (Mimosaceae), in a *Eucalyptus* woodland on the Griffith University campus, Brisbane, Queensland. The beetle was situated 4 mm below the bark at the intersection of sapwood and heartwood in a chamber measuring 38 mm long, 2.5 mm high, 3 mm wide. One end of the chamber was densely packed with chewed wood for a distance of 19 mm. The chamber led outwards at the other end to a hole blocked with loose wood fragments below the bark (1–2 mm thick). This host record appears to be the first published for *C. curtisii*. The life-stages and general biology have not been described, although it has been recorded as a pollinator of *Angophora woodsiana* F. M. Bail. (Myrtaceae) (Hawkeswood 1981).

*Pachydissus sericus* Newman (Silvery Longicorn, Silvery-brown Longicorn)

On June 28, 1984 one live adult was collected from a dead *A. leiocalyx* subsp. *leiocalyx* at Griffith University, Brisbane. The beetle was situated 8 mm below the bark in a chamber 42 mm long, 4 mm high, 8 mm wide. Both ends of the chamber were packed with chewed wood and excreta. This species is often responsible for serious damage to native *Acacia* trees and some infestations seriously affected long-leaved wattles in the Sydney district early this century (Froggatt 1923). The only other published host records are *Acacia longifolia* (Andr.) Willd. (Froggatt 1893, 1907; Duffy 1963) and *A. decurrens* (Wendl.) Willd. (French 1911; Gallard 1916; Duffy 1963).

## LITERATURE CITED

- DUFFY, E. A. J. 1963. A monograph of the immature stages of Australasian timber beetles (Cerambycidae). Brit. Mus. Nat. Hist. 235 pp.
- FRENCH, C. 1911. A handbook of the destructive insects of Victoria. Government Printer, Melbourne.
- FROGGATT, W. W. 1893. On the life-histories of Australian Coleoptera. Part I. Proc. Linn. Soc. N.S.W. 18:27–42.
- . 1907. Australian insects. W. Brooks & Co., Sydney.
- . 1923. Forest insects of Australia. Government Printer, Sydney.
- GALLARD, L. 1916. List of insects associated with *Acacia decurrens*. Aust. Nat. 3:112–114.
- HAWKESWOOD, T. J. 1981. Insect pollination of *Angophora woodsiana* F. M. Bail. (Myrtaceae) at Burbank, south-east Queensland. Vict. Nat. 98:120–129.
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## SCIENTIFIC NOTE

NEW LARVAL HOST RECORDS FOR TWO AUSTRALIAN JEWEL BEETLES  
(COLEOPTERA: BUPRESTIDAE)

***Astraeus crassus* Van de Poll.** On February 6, 1982 one larva and one pupa of an unidentified buprestid was collected from a dead main stem (4.5 cm diam.) of *Bursaria spinosa* Cav. (Pittosporaceae) growing in a woodland community on the side of a cliff in rugged gorge country at Dangars Falls, about 24 km ESE of Armidale, New South Wales (30°41'S, 151°44'E). Although the pupa resembled the adult of *Astraeus crassus* in size and general morphology, confirmation of the beetle's identity required the discovery of live or dead adults. This verification did not occur until February 20, 1984, when more extensive dissections of dead main stems and branches of about 20 *B. spinosa* (shrubs to about 2.5 m high) were undertaken. Four live larvae (later preserved in alcohol) were obtained from two dead *B. spinosa* near ground level, as well as the remains of 3 dead adults in a thick piece (6.5 cm diam.) of dead wood from the same plant examined two years earlier. The adults were severely decayed and two were covered in fungus, but the elytral pattern confirmed the identity as *A. crassus* Van de Poll, a large and distinctive species restricted to eastern New South Wales (Carter 1929). The larvae had constructed extensive chambers in the centre of the *Bursaria* wood. This is the first larval host record for *A. crassus* and the first confirmed record for an *Astraeus* species since Goudie (1920) recorded *Casuarina leuhmanniana* R. T. Baker as a larval host for *Astraeus irregularis* Van de Poll (Hawkeswood and Peterson 1982) (a record which needs confirmation due to the taxonomic confusion of *Casuarina*, Casuarinaceae). *Astraeus prothoracicus* Van de Poll from Western Australia has been recorded ovipositing on cones of *Banksia prionotes* Lindl. (Proteaceae), the only other published host data for *Astraeus* (Hawkeswood and Peterson 1982).

***Neocuris gracilis* Macleay.** On September 15, 1984 one live adult and four larvae were collected from a dead stem (1.4 cm diam.) of *Pultenaea villosa* Willd. (Fabaceae) (a multi-stemmed shrub to 1.2 m high) in a *Eucalyptus* woodland on the Griffith University campus, Brisbane, Queensland. On the following day, a further 3 adults, one pupa and 4 larvae were collected from the dead stems (0.8–1.8 cm diam.) of several *P. villosa*. The larvae had chewed out extensive smooth areas immediately below the bark before boring into the centre of the stems where they formed extensive narrow channels (0.8–1.0 mm high) parallel to the grain. Pupation occurred in randomly distributed chambers. This is the first larval host record for a *Neocuris*, a genus containing about 27 poorly known species (Carter 1928). *Neocuris gracilis* is also the first buprestid recorded from *P. villosa*.

## LITERATURE CITED

- CARTER, H. J. 1928. Revision of the Australian species of the genera *Curis*, *Neocuris*, and *Trachys*, together with notes and descriptions of new species and other Coleoptera. Proc. Linn. Soc. N.S.W. 53:270–290.
- . 1929. A check list of the Australian Buprestidae. Aust. Zool. 5:265–304.
- GOUDIE, J. C. 1920. Notes on the Coleoptera of north-western Victoria. Part VIII. Vict. Nat. 37:28–34.
- HAWKESWOOD, T. J., AND M. PETERSON. 1982. A review of larval host records for Australian jewel beetles (Coleoptera: Buprestidae). Vict. Nat. 99:240–251.
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SOME FLEA BEETLES AND THEIR FOODPLANTS FROM  
KENYA (CHRYSOMELIDAE: ALTICINAE)

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ABSTRACT

During a brief visit to Kenya, the author collected 28 species, in 15 genera, of flea beetles (Alticinae), including new foodplant records for 17 species. No foodplants are known for any species in four of these genera. Almost one-half (13) of these species were previously unknown from Kenya.

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In herbivorous insect systematics, all too often taxa are first described, included in regional faunal surveys, or monographed without regard for their foodplants. This is especially true in the tropical regions. Usually this is not the fault of the taxonomist or monographer, who often has not seen the creatures alive, but rather the collectors, whether specialists or not, who rarely make an effort to discover the foodplant hosts or to identify such hosts if they should notice them. Therefore, for many major herbivorous insect families (e.g., Chrysomelidae), where oligophagy or monophagy is quite common, virtually nothing is known about foodplant preferences or patterns in the tropics. Foodplants of a few species are known because they contain species harmful to agricultural products. In many genera of the Alticinae it would be valuable at least to know the foodplant family for a single species of a particular beetle genus, because the beetle genus may feed only on a single plant family (e.g., *Epitrix*) or several related families (e.g., *Phyllotreta*) (Furth 1979). For such cosmopolitan genera, knowledge of the foodplant from better-known regions will, thus, assist investigators to discover foodplant hosts for the tropical species in those genera. However, in many herbivorous groups the highest diversity of genera is in the tropics; e.g., Alticinae have approximately the following generic diversity: 220 (Neotropical); 100 (Oriental-Australian); and 65 (Ethiopian) (Scherer 1982).

Foodplant information is of value for biosystematic studies of the herbivores and possibly, for indicating chemical relationships among groups of plants. In addition, foodplant data are useful for finding potential biological control agents for introduced undesirable plants, i.e., noxious weeds. Unfortunately, much of the foodplant data that exist are essentially unavailable to researchers interested in ecological, biological, or biological control problems. This is because host information is often hidden in the literature in such a way as to be very difficult to retrieve, i.e., in various systematic works (especially monographs) or geographical surveys of an herbivore taxon with no accompanying foodplant index or key words. The author is especially aware of this from his attempts at surveying the arthropod herbivores of several plant groups on a worldwide basis (Balick *et al.* 1978; Furth 1985). Possibly the only way to overcome this problem would be to encourage systematists who study herbivorous arthropod groups to periodically publish foodplant surveys of their research taxa.

## METHODS AND RESULTS

The survey in the present paper is the result of a 42 day visit to Kenya, spent mainly at the International Center of Insect Physiology and Ecology (ICIPE) from early May until mid-June 1980. This period is normally in the midst of the primary rainy season. However, 1980 proved to be a drought year and relatively little rain fell; consequently, all areas of Kenya were drier than normal. Many insect groups were collected, and the non-chrysomelids were deposited in the entomological collections of the Tel Aviv University, Department of Zoology; all chrysomelids are in the author's private collection. The following areas of Kenya were visited and collections made as time permitted: 1) Nairobi (8-10 May); 2) southcentral, around Kajiado (10 May); 3) Rift Valley, Nakuru (11 May); 4) southwest, Nyanza district (12-13 May); 5) Rift Valley, Masai Mara (13 May); 6) southeast, Shimba Hills National Reserve (16-17, 19 May); 7) southeast, Mombasa North (18 May); 8) southeast, Mombasa South (20 May); 9) south, Kibwezi (23 May); 10) central, Mt. Kenya region (26-29 May); 11) southeast, Malinidi (31 May-1 June); 12) southeast, Shimba Hills National Reserve (2 June); 13) south, Amboseli area (7-8 May); 14) Nairobi, Langata Forest (9 June); 15) Nairobi, Athi River (10 June).

When alticine species were found to be feeding on a certain plant, samples of the foodplant were collected and eventually taken to the National Museum in Nairobi for identification by botanists at the herbarium. The author also made several visits to the entomological collection at the Nairobi National Museum in order to make preliminary identifications of some of the alticine specimens collected.

Table 1 lists all the species of Alticinae collected by the author while in Kenya, including the locality and foodplant/family if discovered. The known geographical distribution is also given for each species. To my knowledge there is no published foodplant information for any of these species (except as indicated in the footnotes of the Table).

## DISCUSSION

All of the foodplant records for the Alticinae listed here are new. Several of these are the first foodplant record for any member of the genus. A few host records are, in fact, in foodplant families that would be expected based on known foodplants from other regions. The two species of *Blepharida* were expected to be found on species of *Rhus* based on previous studies (Furth 1982). The records of the four species of *Chaetocnema* feeding on *Cyperus* and grasses is also no surprise, because in other regions some species are known to feed on grasses and sedges (Mohr 1966) and *Cyperus* (Furth, unpublished data).

The African genus *Gabonia* has over 130 described species and is presently in a state of taxonomic confusion and in need of revisionary study (G. Scherer, pers. comm.). During the field work for this paper (1980), the author met Dr. Michael Boppré at his field station (Shimba Hills National Reserve), where he studied the attraction and feeding of various adult Lepidoptera to plants containing pyrrolizidine alkaloids (PAs), presumably for defense and/or as precursors for male pheromones (Boppré 1981; Boppré and Scherer 1981; Boppré 1983). At that time Dr. Boppré had discovered a new species, *Gabonia gabriela* Scherer, whose males (only) were attracted in large numbers to the PA baits (see Boppré and Scherer 1981). Then, and on two subsequent occasions (localities 6 and 12), the author attempted to find females and the foodplant of *G. gabriela* but without success. In fact, even though four species of *Gabonia*

Table 1. List of flea beetles, general distribution, and foodplants from Kenya.

Species	Locality	Distribution	Foodplant
<i>Amphimela</i> sp.	12	—	—
<i>Blepharida conradi</i> Weise	14	Kenya, Tanzania	<i>Rhus natalensis</i> (Anacardiaceae)
<i>Blepharida marginalis</i> Wse.	14, 16	Kenya, Tanzania, Uganda, E. Zaire, Sudan, Ethiopia	<i>Rhus natalensis</i> , <i>R. vulgaris</i>
<i>Chaetocnema conducta suturalis</i> Bryant	16	Kenya, Tanzania, Ethiopia, E. Zaire	<i>Cyperus</i> sp. (Gramineae)
<i>Chaetocnema ljuba</i> Bechyne*	6	Sudan, Somalia	<i>Cyperus</i> sp.
<i>Chaetocnema nigripennis</i> Lab.*	12	Zaire, Tanzania, Rwanda	<i>Cyperus</i> sp.
<i>Chaetocnema wollastoni</i> Baly*	13	S. Africa, Zaire, Chad, Sudan	grasses
<i>Decaria aethiopica</i> Chapuis	3, 5	Kenya, Tanzania, Ethiopia, Sudan, Zaire, Rwanda	general sweeping (annuals)
<i>Decaria nigripennis</i> Weise*	6	Tanzania	general sweeping
<i>Gabonia</i> sp. 1	4	—	—
<i>Gabonia</i> sp. 2	7	—	forest edge tree
<i>Gabonia</i> sp. 3	10	—	sweep forest edge
<i>Gabonia</i> sp. 4	6	—	forest edge tree
<i>Hemipyxis nigripes</i> Weise	6, 7	Kenya, Ethiopia, Sudan, E. Zaire, Rwanda	forest edge tree
<i>Hespera fulvicollis</i> Weise*	14	E. Zaire, W. Aden, N. Rhodesia	<i>Rhus natalensis</i>
<i>Longitarsus gossypii</i> Bryant**	1 (lite), 15	Sudan	<i>Heliotropium steudneri</i> Vatke (Boraginaceae), <i>H.</i> sp. near <i>ci-nerescens</i>
<i>Longitarsus usambaricus</i> Wse.*	4	Tanzania	Labiatae
<i>Longitarsus zodiacus</i> Bechyne*	1 (lite), 12	Sudan, Zaire, Guinea, Nigeria	—
<i>Longitarsus</i> sp. 1	6, 4	—	—
<i>Longitarsus</i> sp. 2	6, 12	—	? <i>Asystasia laticapsula</i> (Acanthaceae) (site #6)
<i>Orthocrepis kibonotensis</i> (Wse.)*	4, 6, 7, 11	Tanzania	? <i>Asystasia laticapsula</i>
<i>Phyllotreta ruficeps</i> Weise*	11	Tanzania	<i>Tragia</i> sp. (Euphorbiaceae)
<i>Philopona usambarica</i> Csiki*	8, 12	Tanzania, S. Rhodesia	<i>Maerua triphylla</i> var. <i>pubescens</i> , <i>M. triphylla calophylla</i> (Capraceae)
<i>Physodactyla rubiginosa</i> Gerst.	8, 12	Kenya, Tanzania, S. Africa	<i>Thunbergia alata</i> (Acanthaceae)
<i>Physonychis wissmanni</i> Weise*	8, 12	Tanzania	<i>Thunbergia alata</i>
<i>Podagrica kibonotensis</i> Wese*	10, 14	Tanzania	—
<i>Podagrica weisei</i> (Jacoby)*	10	Tanzania, Mozambique, S. Africa	<i>Pavonia patens</i> (Malvaceae)
<i>Sphaeroderma</i> sp.	6	—	<i>Pavonia patens</i> general sweeping

\* = new record for Kenya.

\*\* = recorded from Kenya on *Heliotropium pectinatum* Vaupel (Boppré 1983).

were collected during this study, no definitive foodplants were established for this genus. However, individuals of *Gabonia* sp. 2 and 4 were collected at two localities (7 and 6, respectively) from the same forest edge tree species (a tree species with clusters of small green fruits). Boppré (1984) states that many more species of *Gabonia* are also attracted to sources of PAs. Another flea beetle, *Hemipyxis nigripes*, was also collected from this tree species at the same two localities (6, 7); however, this cannot be considered the foodplant of any beetle species until further investigations are made.

Based on foodplant information from other regions, species of *Longitarsus* would be expected to feed on Labiatae and Boraginaceae (Furth 1980). In fact, *L. usambaricus* and *L. gossypii* were found on these plant families. In the case of *L. gossypii*, this species was found subsequent to the present field work but recently published as feeding on *Heliotropium pectinatum* Vaupel at Shimba Hills National Reserve in Kenya (Boppré 1983). It is also interesting to note that two species, *L. gossypii* and *L. zodiacus*, are attracted to incandescent light. Two unidentified species of *Longitarsus* were thought to be feeding on *Asystasia laticapsula* (Acanthaceae). This would be the first record of any species of *Longitarsus* feeding on a member of the Acanthaceae, a family usually placed near/between Scrophulariaceae and Verbenaceae, which are known *Longitarsus* foodplant families.

The genus *Orthocrepis* is closely related (sometimes considered a subgenus) to *Hermaeophaga*, which contains some species known to feed on Euphorbiaceae (Mohr 1966; Furth, unpublished). The foodplant of *O. kibonotensis* is the euphorb *Tragia*, which is a nuisance nettle in many regions of the world, and this beetle may be a potential agent for biological control of this plant in some other regions.

It is known that some species of *Phyllotreta* feed on Capparaceae, which contain secondary/defense chemicals (thioglucosides) similar to those of the beetles' two other major foodplant families, Cruciferae and Resedaceae (Furth 1979). *Phyllotreta ruficeps* feeds on two subspecies/varieties of *Maerua*, which is the first record of a capparaceous-feeding *Phyllotreta* in Africa and the first species known to feed on *Maerua*.

Two species of two different genera, *Philopona usambarica* and *Physodactyla rubiginosa*, were found feeding on *Thunbergia alata* (Acanthaceae). This plant is commonly called the black-eyed susan and is used ornamentally in different parts of the world; these are new foodplant records for *Philopona* and *Physodactyla*.

It is well-known from the European fauna that species of *Podagriscia* feed on plants in the Malvaceae (Mohr 1966). This foodplant pattern becomes more firmly established as indicated by the fact that *P. kibonotensis* and *P. weisei* feed on the malvaceous *Pavonia patens* in Africa.

Apparently all of the 28 species of Alticinae found during this study in Kenya are endemic to the Ethiopian (tropical African) region. About half of the records from this field work proved to be new distributional records for Kenya and all foodplant records are new. The results from this relatively brief visit and limited collecting illustrate that there is a wealth of foodplant and distributional information yet to be elucidated in tropical Africa. This study demonstrates that a thorough survey (stressing foodplant associations and identification) of Alticinae of Kenya over a broader seasonal and geographical range would certainly produce valuable data about many species and genera. Expanding this to other chrysomelids and, in fact, herbivorous insects in general, would revolutionize our knowledge of insect/plant co-evolution in the tropics and produce a model for similar research in other tropical regions.

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## LITERATURE CITED

- BALICK, M. J., D. G. FURTH, AND G. COOPER-DRIVER. 1978. Biochemical and evolutionary aspects of arthropod predation on ferns. *Oecologia* 55:35-89.
- BOPPRÉ, M. 1981. Adult Lepidoptera 'feeding' at withered *Heliotropium* plants (Boraginaceae) in East Africa. *Ecol. Ent.* 6:449-452.
- . 1983. Leaf-scratching—a specialized behaviour of danaine butterflies (Lepidoptera) for gathering secondary plant substances. *Oecologia* 59:414-416.
- . 1984. Attraction of Alticinae to pyrrolizidine alkaloids (abstract only). Paper S22.8:10, First International Symposium on Chrysomelidae. Abstract Volume, 17<sup>th</sup> International Congress of Entomology, Hamburg.
- , AND G. SCHERER. 1981. A new species of flea beetle (Alticinae) showing male-biased feeding at withered *Heliotropium* plants. *Syst. Ent.* 6:347-354.
- FURTH, D. G. 1979. Zoogeography and host plant ecology of the Alticinae of Israel, especially *Phyllotreta*, with descriptions of three new species (Coleoptera: Chrysomelidae). *Israel J. Zool.* 28:1-37.
- . 1980. Wing polymorphism, host plant ecology, and biogeography of *Longitarsus* in Israel (Coleoptera: Chrysomelidae). *Israel J. Ent.* (1979) 13:125-148.
- . 1982. *Blepharida* biology, as demonstrated by the sacred sumac flea beetle (*B. sacra* (Weise)). *Spixiana*, Suppl. 7:43-52.
- . 1985. The natural history of a sumac tree: with emphasis on the entomofauna. *Trans. Conn. Acad. Arts Sci.* 46 (in press).
- MOHR, K.-H. 1966. Chrysomelidae, pp. 95-297. In: *Die Käfer Mitteleuropas. Cerambycidae and Chrysomelidae*, Band 9. H. Freude, K. W. Harde, and G. A. Lohse (editors), Goecke & Evers, Krefeld.
- SCHERER, G. 1982. Origins of the Alticinae (Coleoptera, Chrysomelidae). *Spixiana*, Suppl. 7:7-9.

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## SCIENTIFIC NOTE

AN OHIO RECORD OF *BRATHINUS NITIDUS* LeCONTE  
(COLEOPTERA: STAPHYLINIDAE)

Several specimens of the staphylinid beetle *Brathinus nitidus* LeConte have been collected from Lake Katherine State Nature Preserve in south central Ohio at the edge of the Appalachian foothills. The adult beetles were taken very early in the spring from the splash zones of intermittent stream waterfalls in deep hemlock ravines. Later in the spring and again in late autumn they were found within dark chambers formed by the rubble of large (several meters in diameter) boulders and rock slabs strewn along the floor of the ravines.

This species has a reported range from Newfoundland and Nova Scotia west to Lake Superior and south along the Appalachians to northern Alabama (Peck 1975). However, other than Steiner's recent find of the species in the mountains of western Maryland (Steiner 1981), there exists an extensive area between the northern range and the southern extreme of the range where no collections have been recorded. This note constitutes the first report of the species from Ohio.

## LITERATURE CITED

- PECK, S. B. 1975. A review of the distribution and habits of North American *Brathinus* (Coleoptera; Staphylinidae; Omaliinae). *Psyche* 82:59-66.
- STEINER, WARREN E., JR. 1981. *Brathinus nitidus* in Maryland, with notes on biology (Coleoptera: Staphylinidae). *Coleopt. Bull.* 35:233-234.

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## LITERATURE NOTICES

- ISRAELSON, G. 1984. Coleoptera from the Azores. *Bol. Mus. Mun. Funchal* 36:142-161.
- KNISLEY, C. B., AND D. L. PEARSON. 1984. Biosystematics of larval tiger beetles of the Sulphur Springs Valley, Arizona. Descriptions of species and review of larval characters for *Cicindela* (Coleoptera: Cicindelidae). *Trans. Amer. Ent. Soc.* 110:465-551.
- HOPKINS, M. J. G. 1984. The parasite complex associated with stem-boring *Apion* (Col. Curculionidae) feeding on *Rumex* species (Polygonaceae). *Ent. mon. Mag.* 120:187-192.
- WOLFE, G. W., AND J. R. ZIMMERMAN. 1984. Sensilla, punctation, reticulation, and body shape in the Hydroporinae (Coleoptera: Dytiscidae). *Int. J. Insect Morphol. & Embryol.* 13:373-387.
- PLAZA, E. 1984. Contribución al conocimiento de los Coccinellidae españoles. *Tribus Coccinellini y Psylloborini*. *Graellsia* 40:19-61.
- CHEN, S., AND S. WANG. 1984. Flea-beetles from Hengduan Mountains, Yunnan. Genera *Hespera* and *Yunohespera* (Coleoptera: Chrysomelidae). *Acta Ent. Sinica* 27:308-322.
- O'DONNELL, M. 1984. Recent occurrence of *Otiorhynchus rugosostriatus* (Coleoptera: Curculionidae) in Christchurch. *New Zeal. Ent.* 8:36-37.
- DOLIN, V. G., AND E. P. BESSOLITZINA. 1983. New species of click-beetles of the subfamily Negastrinae (Coleoptera, Elateridae) from the Tshar Hollow. (In Russian). *Zool. Zhurn.* 62:631-634.

REVIEW OF NEARCTIC SPECIES OF *ORPHILUS*  
(COLEOPTERA: DERMESTIDAE) WITH  
DESCRIPTION OF THE LARVA OF  
*O. SUBNITIDUS* LECONTE

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ABSTRACT

Comparison of phallic structures indicates that the genus *Orphilus* includes two valid, neontological, North American species, *O. ater* Erichson and *O. subnitidus* LeConte, both of which are distinct from the European *O. niger* Rossi. Horry County, South Carolina, is assigned as the restricted type locality for *O. ater*. *O. aequalis* Casey is designated a junior synonym of *O. subnitidus*. Known habitats of each species are listed. The larva of *O. subnitidus* is described and compared with the published description of the larva of *O. niger*.

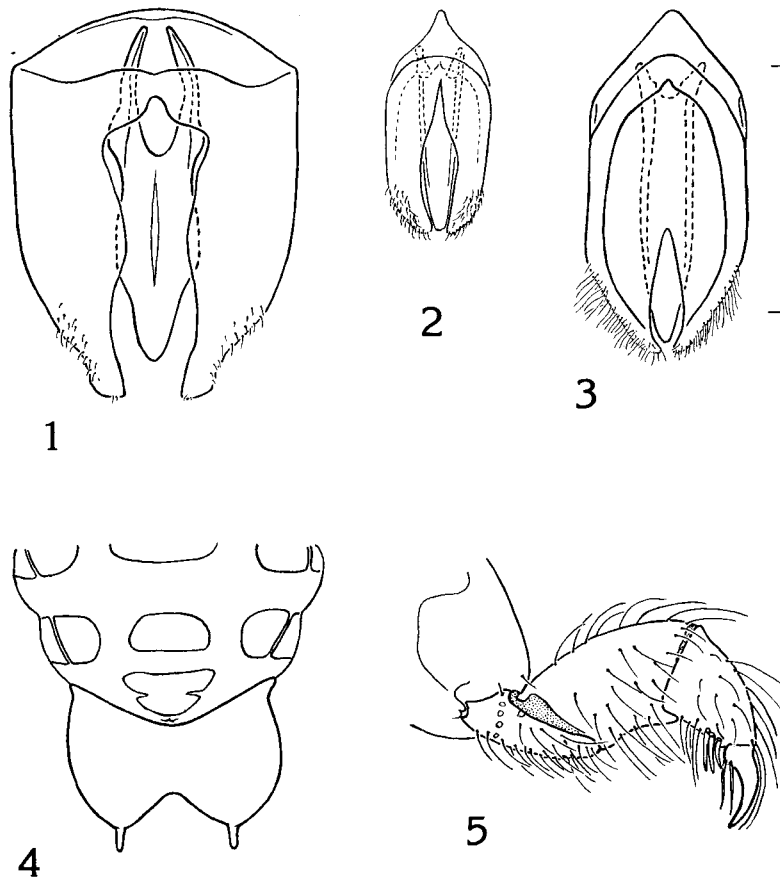
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Members of the genus *Orphilus* are small, subovate, black beetles with retractile legs and antennae. Adults are commonly taken on flowers in many parts of the United States. Being glabrous, they bear little resemblance to other Dermestidae, in some ways appearing more like a *Nosodendron*. Adults are associated with the Dermestidae by the presence of a median ocellus and excavated hind coxae. The larvae lack spicisetae (spinulate setae) and other types of specialized setae found in most other Dermestidae, but have, in addition to the usual simple setae; a peculiar type of curly setae not found in other Dermestidae. The heavily sclerotized tergum of abdominal segment 9 also sets them apart from other Dermestidae. These, however, are autapomorphic characters which do not help define relationships. On the basis of larval symplesiomorphies, *Orphilus* appears to share a more recent common ancestry with other dermestid genera than with the Nosodendridae or the Derodontidae, families generally assigned to the Dermestoidea (a subject which will be explored in detail in a paper now in preparation).

There has been little agreement on the number of species which should be recognized within the genus. One Palearctic and four Nearctic species have been described (exclusive of one fossil Colorado form). Spencer (1942) synonymized a species from British Columbia with the European *O. niger* Rossi. Subsequently Hatch (1962) examined three of the Nearctic forms and concluded all were synonyms of *O. niger*. Evidence presented here, however, argues for two distinct Nearctic species, neither of which is a synonym of *O. niger*.

SPECIES DISCRIMINATION

The phallus of the European *O. niger* (Fig. 1) differs substantially from that of Nearctic forms, so there can be little question of its specifically distinct status. The aedeagus is somewhat expanded near the middle; is provided with long, more or less straight, proximal apodemes; and, except for a narrow median slit, is well sclerotized across its ventral side. The parameres are united only



Figs. 1-3. Male phalli of species of *Orphilus*, all drawn to the same scale (line = 0.5 mm). 1, *O. niger*. 2, *O. ater*. 3, *O. subnitidus*.

Figs. 4, 5. Larva of *O. subnitidus*. 4, ventral view (denuded) of posterior segments. 5, front leg of larva of *O. subnitidus*.

at the base with their medial margins diverging just before the base. They are somewhat truncated at their apices and provided with very short setae along their lateral apical margins. In contrast, Nearctic species (Figs. 2, 3) have an aedeagus with nearly straight sides, the basal apodemes are reflexed posteriad, and the structure is well sclerotized only along the margins. The parameres are sclerotized across the entire basal  $\frac{1}{3}$  to  $\frac{1}{2}$ . The apices of the parameres are more or less acute. The setae along the margins are relatively much longer than they are in *O. niger*.

Although the Nearctic forms are externally quite similar to each other, available evidence points to two allopatric species. Specimens I have examined of the eastern form, *O. ater* Erichson, range from New Hampshire to Wisconsin south to South Carolina and Arkansas (Fig. 11). The western form, *O. subnitidus*



LeConte, occurs from British Columbia to southern Arizona and as far east as Sioux County in northwestern Nebraska. There remains a question whether these two populations are now or in the recent past have been contiguous. Kirk and Balsbaugh (1975) recorded *O. ater* from South Dakota, an identification which needs to be confirmed. Two specimens in the Nebraska State Museum have old labels reading "Sioux Co. Neb.," neither with a date nor the name of the collector. I examined the genitalia of one and found it to be *O. ater*. This locality for the species needs to be verified by further collecting. At present I am inclined to regard the specimens as mislabeled.

Externally the two species can usually be distinguished by the slightly sparser pronotal punctation of *O. subnitidus*, in which the punctures of the disc are mostly separated by a distance equal to the diameter of a single puncture. In *O. ater* most of the punctures of the disc are separated by a distance equal to about  $\frac{1}{2}$  the diameter of a single puncture. More significantly, genitalic structures of the two appear to differ consistently. The absolute length of the parameres with the basal piece in *O. subnitidus* varies from 0.58 mm to 0.68 mm; the length in *O. ater* varies from 0.46 mm to 0.49 mm. The lateral apical margins of the parameres in *O. subnitidus* (Fig. 3) are straight or slightly concave; in *O. ater* (Fig. 2) the margins are evenly rounded.

#### BIOLOGY

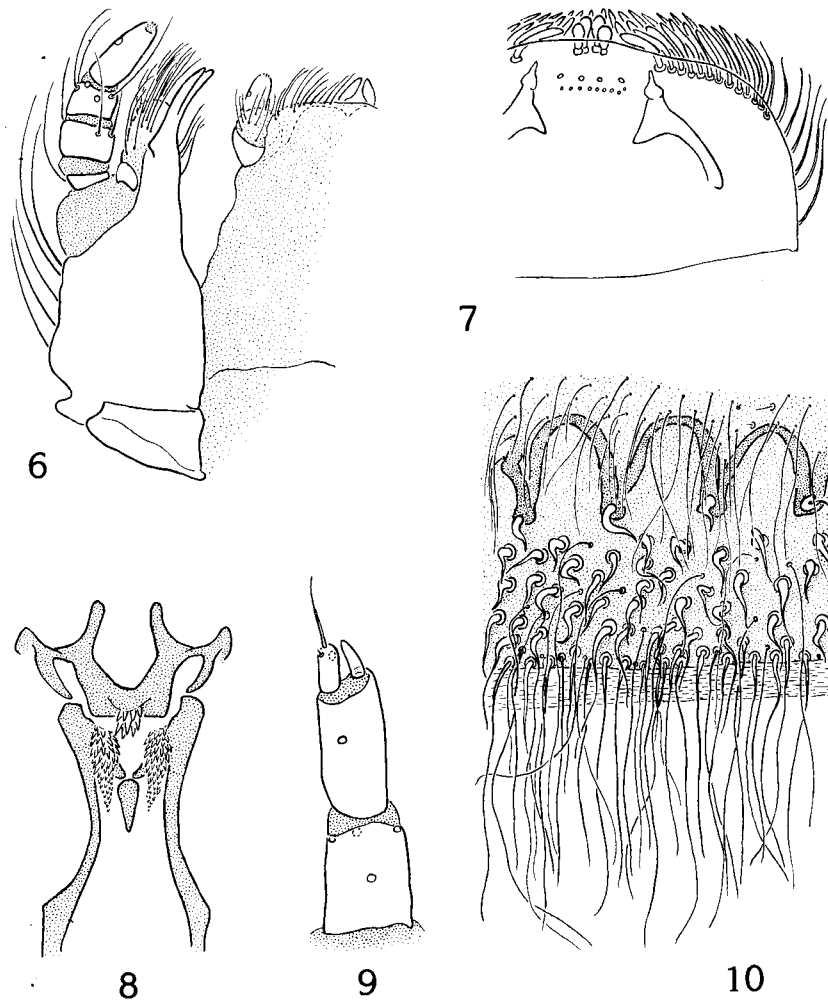
Adults are commonly taken during the summer on flowers with close inflorescences, such as *Spiraea*, *Achillea*, *Ceanothus*, *Hydrangea* and various Umbelliferae. Paulian (1942) indicated that larvae of *O. niger* were found in wood of an oak in Algiers. Spencer (1942) reared *O. subnitidus* from dead insects found in a building. Larvae of *O. subnitidus* were collected by John F. Lawrence (*in litt.*) 4 miles west of Forest Glen, Trinity County, California, April 23, 1976, in the dead wood of small branches of madrono (*Arbutus menziesii* Pursh) beneath the fruiting bodies of the polypore "Antrodia sepium" (= *Trametes sepium* Berk.). The branches were lying on the ground and the rot produced by the fungus caused the wood to be dry and somewhat crumbly.

#### LARVAE

The following is a description of the larvae collected by Dr. Lawrence.

*O. subnitidus*, mature larva. — Dorsum of head and body covered with long, fine, slightly curly, golden-white setae and shorter, thick, curled setae. Labrum with lateral setae of anterior margin rounded becoming increasingly spatulate toward middle; inner series of 4 setae at labro-epipharyngeal margin all spatulate. Epipharynx with distal row of 4 sensory papillae arranged close to proximal row of about 10 sensory cups; epipharyngeal rods Y-shaped (Fig. 7). Antenna as illustrated (Fig. 9). Maxilla as illustrated (Fig. 6). Hypopharynx as illustrated (Fig. 8); dorsal (inner) seta-like cuticular processes consisting of 2 lateral clusters of fine processes and median cluster of larger processes. Mesonotum, metanotum and each tergum with carinate and strongly crenate antecostal suture (Fig. 10). Acrotergites with simple setae about  $\frac{1}{2}$  as long as length of tergum. Tergites with simple setae and short, thick, curled setae on disc; each curled seta on small papilla; longest simple setae 1 to  $1\frac{1}{2}$  times as long as length of tergum. Tergum of segment 9 heavily sclerotized, capsular, apically emarginate, with fixed, peg-like urogomphi (Fig. 4). Prothoracic leg as illustrated (Fig. 5).

The larva of *O. subnitidus* differs in many respects from the description given by Paulian (1942) for *O. niger*. Assuming that Paulian's description is accurate, the differences further confirm the hypothesis that the Nearctic and



Figs. 6-10. Larval structures of *O. subnitidus*. 6, maxilla and labium. 7, epipharynx and labro-epipharyngeal margin. 8, hypopharynx. 9, antenna. 10, section near midline of abdominal tergum 6.

Palaearctic forms are specifically distinct. Paulian does not mention or figure deeply scalloped and raised antecostal sutures, which constitute a prominent feature of *O. subnitidus*. He stated that the maxillary palpus of *O. niger* is 3-segmented with a "very distinct" palpifer. *O. subnitidus* has a palp with a very short basal sclerite that I interpret as the first segment of a 4-segmented palp. It could, of course, be a palpifer somewhat detached from the stipes; a detailed examination of the musculature would be required to verify such an hypothesis.

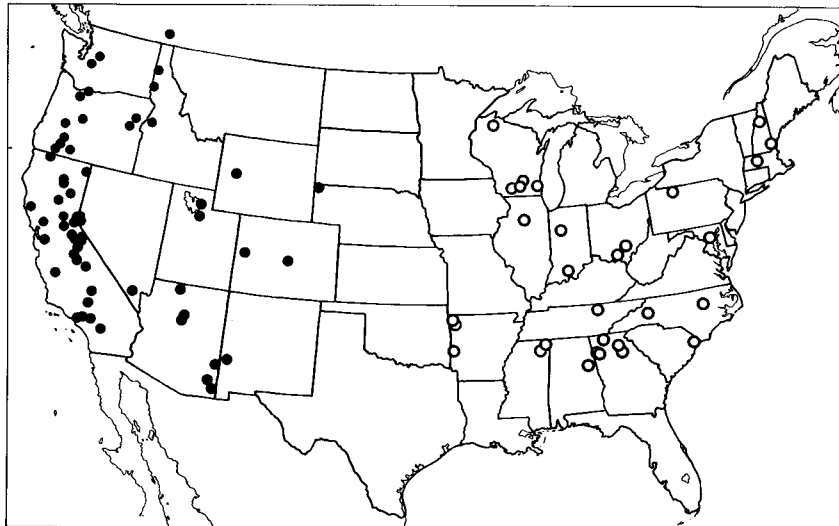


Fig. 11. Nearctic distribution of specimens of *Orphilus* examined by the author. Open circles = *O. ater*, dots = *O. subnitidus*.

The mandible of *O. subnitidus* does not seem to differ in any marked respect from that figured by Paulian for *O. niger*, except that on the meso-posterior side of the mola there is a tuft of setae-like cuticular processes. These may be present in *O. niger* as well. Their presence may be of some importance in a comparative study of the phylogeny of the genus.

#### SYSTEMATICS

The following is the known synonymy for the two Nearctic species.

##### *Orphilus ater* Erichson

*Orphilus ater* Erichson 1846:463 (Type locality: North America); LeConte 1854:113; Reitter (1880) 1881:60; Casey 1900:164; Blatchley 1910:598; Kirk 1969:56; Bayer *et al.* 1972:6; Kirk and Balsbaugh 1975:73.

*Orphilus subnitidus* Rauterberg 1885:59 (non *subnitidus* LeConte 1862).

*Orphilus glabratus* var. *ater*: Jayne 1882:373.

##### *Orphilus subnitidus* LeConte

*Orphilus subnitidus* LeConte 1862:344 (Type locality: California), 1869:370; Casey 1900:164; Stace Smith 1929:71; Leech 1947:105; Clark 1949:23.

*Orphilus glabratus* LeConte 1878:471 (non *glabratus* Fabricius 1801); Brodie 1888:213.

*Orphilus glabratus* var. *subnitidus*: Jayne 1882:373.

*Orphilus niger* Spencer 1942:27 (non *niger* Rossi 1790), 1948:8; Hatch 1962:293; Horning and Barr 1970:30.

*Orphilus aequalis* Casey 1900:164 (Type locality: Cañon of the Colorado River, Arizona); Clark 1949:23. **New synonymy.**

*Orphilus chalybeus* Casey 1900:164 (Type locality: Cour d'Alene, Idaho).

Erichson (1846) credited the name of *Orphilus ater* to *Anthrenus ater* of [August Wilhelm] Knoch. Knoch's works have been unavailable to me, so I can only accept the finding of catalogers that there was never a valid publication of the name by Knoch and that Erichson is to be credited with the authorship.

The type locality of *O. ater* Erichson is herewith restricted to Horry County, South Carolina. There possibly never will be any way of knowing the source of Knoch's specimen(s), although an Atlantic seaboard state seems most likely. A type locality needs to be fixed in the event the apparent population is found to include more than one species. There is some evidence that the species does not persist in urbanized areas. In the absence of other criteria, it would seem advisable to select as the restricted type locality an area where the species is now flourishing and available for investigation. Horry County seems to be such an area.

Although LeConte (1862) listed both California and Oregon as localities for *O. subnitidus*, there is only a single specimen present in his collection, which is labeled "Cal." and is the Museum of Comparative Zoology type No. 6883.

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#### LITERATURE CITED

- BAYER, L. J., W. E. BURKHOLDER, AND R. D. SHENEFELT. 1972. The Dermestidae of Wisconsin, primarily as represented in the University of Wisconsin insectarium.

- Research Bull. (College of Agriculture and Life Sciences, Univ. of Wisconsin, Madison), R2381. 12 pp.
- BLATCHLEY, W. S. 1910. An illustrated descriptive catalogue of the Coleoptera or beetles (exclusive of the Rhynchophora) known to occur in Indiana. Nature Publ. Co., Indianapolis. 1385 pp.
- BRODIE, W. 1888. List of Coleoptera collected by Mr. Bruce Bailey, in Kicking Horse Pass, Rocky Mountains, C. P. R., 1884. Proc. Can. Inst. Toronto 3:213-215.
- CASEY, T. L. 1900. Review of the American Corylophidae, Cryptophagidae, Tritomidae, and Dermestidae, with other studies. Jour. New York Entomol. Soc. 8:51-172.
- CLARK, M. E. 1949. An annotated list of the Coleoptera taken at or near Terrace, British Columbia. Part II. Proc. Entomol. Soc. British Columbia 45:21-24.
- ERICHSON, W. F. 1846. Dermestini Latr. (pp. 419-463). Naturgeschichte der Insecten Deutschlands. Erste Abtheilung. Coleoptera. Dritter Band, III Lieferung. Nicolaische Buchhandlung, Berlin.
- FABRICIUS, C. 1801. Systema eleutheratorum. Tomus I. Kiliae. xxiv + 506 pp.
- HATCH, M. H. 1962. The beetles of the Pacific Northwest. Part III. Pselaphidae and Diversicornia I. Univ. of Washington Publ. in Biology 16:1-503.
- HORNING, D. S., JR., AND W. F. BARR. 1970. Insects of Craters of the Moon National Monument, Idaho. Univ. of Idaho College of Agriculture Misc. Series No. 8. 118 pp.
- JAYNE, H. F. 1882. Revision of the Dermestidae of U.S. Proc. Amer. Philosophical Soc. 20:343-377.
- KIRK, V. M. 1969. A list of beetles of South Carolina. Part 1—Northern Coastal Plain. South Carolina Agric. Exp. Sta., Tech. Bull. 1033. 124 pp.
- , AND E. U. BALSBAUGH, JR. 1975. A list of the beetles of South Dakota. Agric. Exp. Sta., South Dakota State Univ., Brookings, Tech. Bull. 42. 139 pp.
- LECONTE, J. L. 1854. Synopsis of the Dermestidae of the United States. Proc. Acad. Nat. Sci. Philadelphia 7:106-113.
- . 1862. New species of Coleoptera inhabiting the Pacific district of the United States. Proc. Acad. Nat. Sci. Philadelphia 1861 (Nov.):338-359.
- . 1869. List of Coleoptera collected in Vancouver's Island by Henry and Joseph Matthews, with descriptions of some new species. Ann. Mag. Nat. Hist. (Ser. 4) 6:369-385.
- . 1878. The Coleoptera of the alpine regions of the Rocky Mountains. U. S. Geol. Geogr. Survey 4:447-480.
- LEECH, H. B. 1947. Collecting in southern British Columbia: hilltop to lakeshore for beetles. Canad. Entomol. 79:105-108.
- PAULIAN, R. 1942. The larvae of the sub-family Orphilinae and their bearing on the systematic status of the family Dermestidae (Col.). Ann. Entomol. Soc. America 35:393-396.
- RAUTERBERG, F. 1885. Coleoptera of Wisconsin. Proc. Nat. Hist. Soc. Wisconsin, pp. 58-59.
- REITTER, E. (1880) 1881. Die aussereuropäischen Dermestiden meiner Sammlung. Mit 70 Diagnosen neuer Arten. Verh. Nat. Ver. Brünn 19:27-60.
- ROSSI, P. 1790. Fauna Etrusca, sistens *Insecta*, quae in provinciis Florentina et Pisana praesertim collegit. I. Liburni. xxiii + 272 pp.
- SPENCER, G. J. 1942. Insects and other arthropods in buildings in British Columbia. Proc. Entomol. Soc. British Columbia 39:23-29.
- . (1947) 1948. Notes on some Dermestidae of British Columbia (Coleoptera). Proc. Entomol. Soc. British Columbia 44:6-9.
- STACE SMITH, G. 1929. Coleoptera. Museum and Art Notes 4:69-74.

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REDEFINITION OF THE OPATRINE TRIBES IN  
NORTH AMERICA WITH NOTES ON SOME  
APTEROUS GENERA (COLEOPTERA:  
TENEBRIONIDAE: TENEBRIONINAE)

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ABSTRACT

The opatrine lineage of the subfamily Tenebrioninae is redefined for the Nearctic region of North America. The genera *Hyocis*, *Gonocephalum* and *Cyclosattus* are not North American. The relationships of the genera *Alaudes*, *Tonibiastes*, *Nocibiotes* and *Tonibius* are discussed. *Tonibius rossi* Blaisdell is transferred to *Nocibiotes*. The species is illustrated and a modified generic diagnosis is provided for *Nocibiotes*. A revised key is presented for the Nearctic members of the opatrine tribes and genera.

Le lignage des opatrinés de la sous-famille Tenebrioninae est reconstruit pour la région Néarctique de l'Amérique du Nord. Les genres *Hyocis*, *Gonocephalum* et *Cyclosattus* ne sont pas de l'Amérique du Nord. Les rapports systématiques entre les genres *Alaudes*, *Tonibiastes*, *Nocibiotes* et *Tonibius* sont examinés. *Tonibius rossi* Blaisdell est transféré parmi les *Nocibiotes*. L'espèce est illustrée et une diagnose générique modifiée pour les *Nocibiotes* est présentée. Une clé modifiée est fournie pour les tribus et les genres d'opatrinés de la région Néarctique.

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The opatrine lineage of the subfamily Tenebrioninae is best represented in the Ethiopian and Palearctic faunal regions, only approximately 14% of the known genera being from the New World. Of these, 21 are known from the Nearctic region (including 17 endemic genera). Arnett (1962), relying mainly on Bradley's (1930) key and Gebien's (1937-48) catalog, placed many of these genera in the Pedinini, a tribe not presently known to occur in the New World, according to the classifications of Koch (1956), Español (1945, 1958), and Medvedev (1968).

The opatrine lineage presently contains 14 tribes [*sensu* Medvedev, 1968, minus the New World tribes subsequently removed to the subfamily Tentyriinae: see Doyen (1972) and Watt (1974)]. Most of these are restricted to the Ethiopian or Mediterranean regions, with only four tribes occurring in North America. These North American representatives include the Leichenini (*Leichenium* Blanchard), and the Platynotini (*Opatrinus* Latreille), the Melanimini (*Cheirodes* Gené<sup>1</sup>), and the Opatrini (with the remainder of the genera). These changes are summarized in Table 1.

DISCUSSION

A number of genera currently listed as belonging to the opatrine lineage present problems. Certain genera have been included erroneously in checklists and catalogs of North American Opatrini. Others have been incorrectly placed

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<sup>1</sup> The genus *Anemia* Laporte was synonymized under the genus *Cheirodes* by Spilman (1973:41).

Table 1. Nearctic Opatrine genera: changes in Arnett's (1962) *The beetles of the United States*.

<i>sensu</i> Arnett	Present lineage and tribe
Opatrini	
<i>Alaudes</i>	Tentyriinae (see text)
<i>Cheirodes</i> (= <i>Anemia</i> )	opatrine, Melanimini
<i>Lepidocnemeplatia</i>	Tentyriinae
<i>Ammodonus</i>	opatrine, Opatrini: Opatrina
<i>Leichenum</i>	opatrine, Leichenini
<i>Ephalus</i>	opatrine, Opatrini: Opatrina
<i>Pseudephalus</i>	opatrine, Opatrini: Opatrina
Pedinini	
<i>Idiobates</i>	Tenebrioninae, Tenebrionini
All other Pedinini	opatrine, Opatrini: Opatrina
Tenebrionini	
<i>Opatrinus</i>	opatrine, Platynotini: Platynotina

in the North American fauna. Still others have since been removed to other groups. These changes are discussed below:

1. The species *Hyocis championi* Fauvel has often been mistakenly listed from Baja California, Mexico (i.e., Blackwelder 1944). The genus *Hyocis* Pascoe, is found in Australia and Polynesia. *Hyocis championi* (Fauvel 1904:166) is from Noumea, New Hebrides.

2. The monotypic genus *Cyclosattus* Casey (1892:710), based on *Eusattus websteri* (Casey 1891:56), has been mistakenly recorded by Casey from Colorado. This insect is actually an Australian nyctozioline (Doyen, pers. comm.).

3. *Blapstinus latifrons* was described by LeConte (1874:70) from a single specimen from Vancouver Island, British Columbia, Canada. This species was correctly transferred to *Gonocephalum* by Casey (1890:393). For this reason, *Gonocephalum latifrons* (LeConte) has been listed as occurring on the North American continent. Since no other specimens of this species are known, we believe this record was based on an interception of a *Gonocephalum* from overseas. Kaszab (1952:682) listed *G. latifrons* as a synonym of *G. bilineatum* Walker, a widespread species in Southeast Asia. A specimen of the same species (*Gonocephalum bilineatum* Walker, det. Spilman 1964) was also collected in Montauk Point, New York [VIII-10-47, V. M. Kirk col., USNM], apparently on or adjacent to a sand beach, possibly on drift (Spilman, pers. comm.). Since no other specimens of this genus have been seen from the east coast of North America since that time, this isolated record no doubt also represents an accidental interception, possibly originating from a ship in the nearby heavily used shipping lanes.

4. The status of the genus *Alaudes* is problematic. Although *Alaudes* lacks abdominal defensive glands and has concealed membranes between the apical two abdominal sternites (tentyriine characters), the tegmen of the aedeagus is dorsal (a tenebrionine character). Doyen and Lawrence (1979:368) have suggested placement of the genus in the Typhlusechini (now Tentyriinae: Stenosini Aalbu and Andrews in press).

The Opatrini, consisting of 117 genera, have a worldwide distribution (Medvedev 1968). Koch (1956) proposed five subtribes, only one of which, Opatrina,

is known to occur in the New World. Among the 16 North American genera of this tribe is a distinct group of closely related genera, the species of which are apterous and are limited to the arid areas of southwestern United States and Mexico. These are easily distinguished from other Opatrini by a very broad and short scutellum and include the LeConte genera *Notibius* (1851:144) and *Conibius* (1851:145), and the Casey genera *Conibiosoma* (1890:476), *Tonibiastes* (1895:617), *Nocibiotes* (1895:618) and *Tonibius* (1895:622). They are found on a number of substrates including sand dunes and alkali scrub vegetation (*Notibius*, *Tonibius*), rocky desert areas (*Conibiosoma*, *Tonibiastes*, *Nocibiotes* and *Tonibius*), dry caves (*Conibius*), and are often associated with rodent or ant nests (*Tonibius*, *Conibius*).

As a result of better techniques for the collection of small apterous beetles, such as overnight (dry or baited) pitfall traps or longer duration ethylene glycol (antifreeze) traps, and with the greater accessibility of previously difficult to reach places, numerous specimens belonging to this group have accumulated in collections.

*Tonibius* was established in 1895 by Casey to include *Conibius sulcatus* LeConte (1851:145) [reassigned to *Notibius* by Casey (1890:472)] and *Conibius alternatus* Casey (1890:473). He characterized the genus by the presence of a feebly differentiated antennal club, convex and "simply punctate" elytral intervals, and a prothorax which is not narrowed behind. With the transfer of *rossi* to *Nocibiotes*, *Tonibius* is left with only these two species. The latter (*T. alternatus*) was reduced to synonymy by Horn (1894:352), but Casey (1895:662) supplied additional information to effectively revalidate the name. Gebien (1910:303) recognized both *T. sulcatus* and *T. alternatus*, but in 1938 (p. 444) considered *T. alternatus* a subspecies of *T. sulcatus*. Leng (1920:232) likewise gave *T. alternatus* subspecific status, but Blackwelder (1944:525) considered it a synonym of *T. sulcatus*. Whether one recognizes one or two species of *Tonibius*, the fact remains that it is a very distinctive genus in having the pronotum quadrate, not narrowed behind and not fimbriate laterally, and with sulcate elytra having strongly convex (not costiform) intervals.

The monotypic genus *Tonibiastes* Casey (1895:617) is clearly closely related to *Nocibiotes* in sharing a pronotum which is distinctly rounded laterally and narrowed behind and not laterally fimbriate. It is distinct in having the elytral intervals acutely costiform. The only species is *Tonibiastes costipennis* (Horn 1894:430), originally placed in *Notibius* and apparently confined to Baja California Sur. Another superficially similar, mostly apterous, opatrine genus, *Pedonoeces* (restricted to the Galapagos Islands), also containing a species with costate elytra, is more closely related to the genus *Blapstinus* than to this group and may indeed prove to be of subgeneric status under *Blapstinus* (Van Dyke 1953:99).

The species described as *Tonibius rossi* Blaisdell (1943:260) should be transferred to the genus *Nocibiotes* Casey as a **new combination**. We discovered this error while attempting to identify specimens using Blaisdell's 1943 paper (which contains no keys). Blaisdell (1943:260) gave a brief generic diagnosis under *Nocibiotes granulatus* (LeConte): "In this genus the elytra are sulcate, the intervals convex and asperate." Under *Tonibius sulcatus* (LeConte), he (1943:262) characterized that genus as "elytra are sulcate, the intervals convex and simply punctate." Clearly, on the basis of these statements alone, *rossi* should have been placed in *Nocibiotes*. Equally puzzling, Blaisdell (1943:262) compared *Tonibius rossi* with *Nocibiotes granulatus*, not with *Tonibius sulcatus*, an indication that the two were very similar.



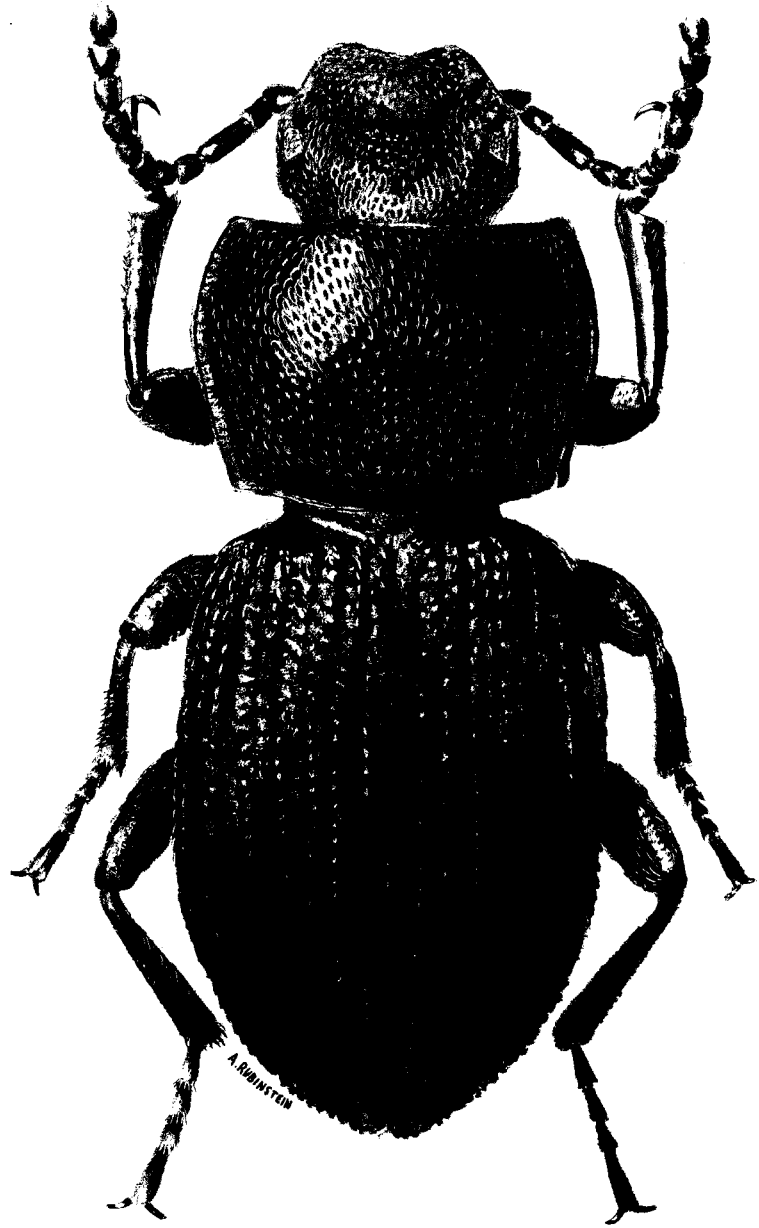


Fig. 1. *Nocibiotes rossi* (Blaisdell), adult, dorsal habitus.

The identity of *N. rossi* (Blaisdell) (Fig. 1) was verified by examination of the type (California Academy of Sciences collection type No. 5073) by the junior author. We have studied an additional 25 specimens from the following localities: Mexico, Baja California Sur, Comondu; 5 mi N El Refugio; 4.2 mi W Miraflores; 5 mi NW El Triunfo, 1900'; 8 mi S Miraflores; Rancho La Burrera, 24 km E Todos Santos; 29 km SSE Constitucion; and Playa Santispac, 21 km S Mulege. Specimens have been collected throughout the year. This species may be distinguished from all other North American Opatrini by the presence of the serially tuberculate elytral intervals (asperate in all other *Nocibiotes*), each tubercle very "shiny" and bearing a short seta posteriorly. It is also distinguished by the distinct elongate, subparallel mentum with strongly produced frontal lobes.

#### CLASSIFICATION

Casey's 1895 key to the genera of North American Blapstini (=Pedinini, Arnett) is still the best available, even though it is almost 100 years old. Arnett's 1962 key (p. 658), taken from Bradley's 1930 (p. 189) key is essentially a modification of Casey's. This key has perhaps led to some confusion for three reasons. First, Arnett included *Idiobates*, on the basis of eyes being completely divided by the epistomal canthus. This genus is clearly not an opatrine but a member of the Tenebrionini as stated by Tschinkel and Doyen (1980). Second, for perhaps the same character state of the eye, Arnett excluded the genus *Opatrinus* which lacks divided eyes (included by Bradley, but not included in Casey's keys). Third, in an apparent misspelling in his couplet 12(11), Arnett stated that *Nocibiotes* has "elytral intervals separate" as opposed to punctate in *Tonibius*. We believe that Arnett actually meant "elytral intervals asperate" (as mentioned in Casey's key) rather than "separate," which causes some specimens of *Nocibiotes* to key out to *Tonibius*.

Davis (1970:40; 1976:40) apparently was not aware of the changes made in the opatrine lineage by Old World workers. He correctly removed *Idiobates* and entirely dropped the elytral interval character from his key to North American Pedinini. However, his key leads to perhaps more confusion, favoring instead the antennal character (but misspelled): last 3 segments abruptly clubbed (*Nocibiotes*) vs last 3 segments freely (feebly in Arnett) differentiated (*Tonibius*). In both cases, we have found this character to be unreliable as it is apparently sex linked in some species.

The genera *Cenophorus*, *Platylus*, *Diastolinus*, *Ctesicles*, and *Sellio*, all known from the West Indies or Central America, are closely related to the genus *Blapstinus*. Since, at the present time, there is some controversy on the exact status and validity of these genera, some of which are currently being revised, we have decided not to include them in the following key.

This key, partly modified from those of Medvedev (1968:111), Koch (1956:20), Bradley (1930:189), Arnett (1962:653, 658) and Davis (1976:40), should serve to identify correctly to genus any known Nearctic opatrine (excluding West Indian and Central American genera).

#### KEY TO THE NORTH AMERICAN OPATRINE TRIBES AND GENERA

1. Gula with stridulating surface, consisting of symmetrically arranged, slender, transverse ridges and fossae; eyes not entirely divided by epistomal canthus ..... Platynotini (*Opatrinus*)

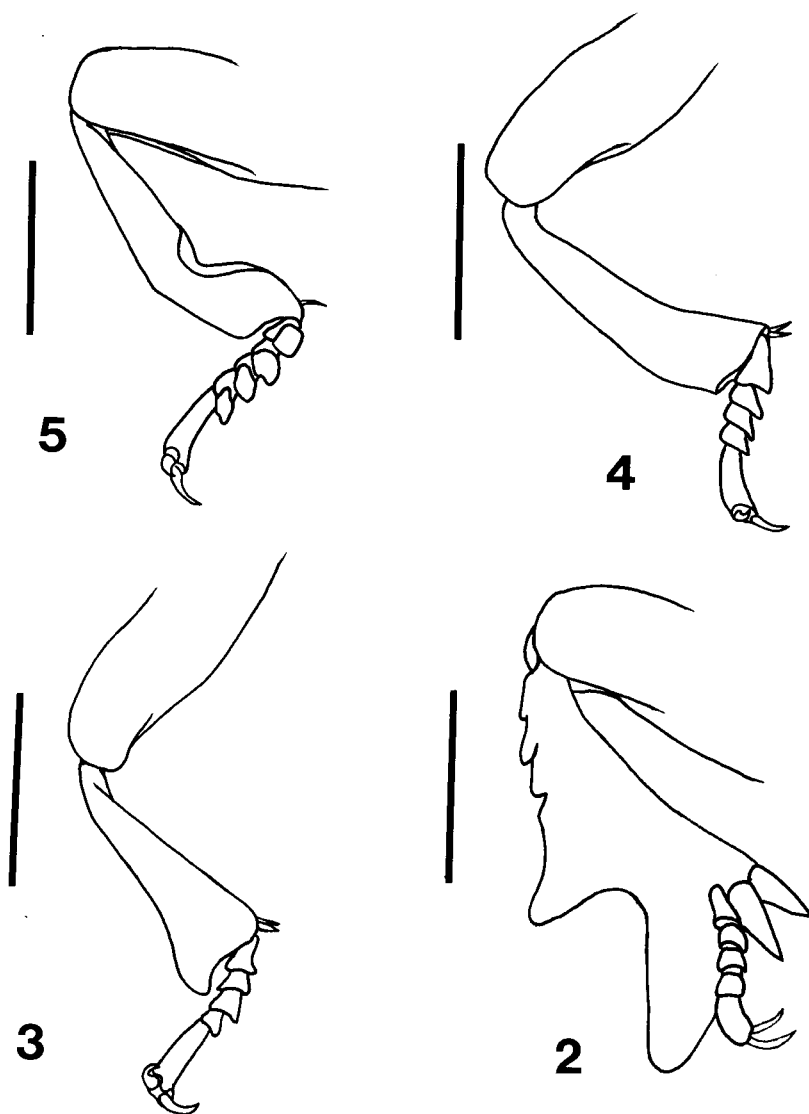


Fig. 2. *Cheirodes californica* (Horn), right protibia, anterior aspect. Fig. 3. *Ulus crassus* (LeConte), right protibia, anterior aspect. Figs. 4-5. *Trichoton sordidum* (LeConte), left protibia, posterior aspect. 4, female. 5, male. Scale lines: Fig. 2 (0.5 mm); Figs. 3-5 (1.0 mm).

-	Gula simple, irregularly sculptured or smooth without stridulating surface; eyes entirely divided or not .....	2
2(1).	Eyes with erect scales between corneal facets .....	
	..... Leichenini ( <i>Leichenum</i> )	
-	Eyes without erect scales between corneal facets .....	3
3(2).	Protibia with two greatly produced, dorsal extensions, one apical and one near midpoint of tibia (Fig. 2) .....	Melanimini ( <i>Cheirodes</i> )
-	Protibia unmodified, triangular or at most with one greatly produced, dorsal extension .....	Opatrini: <i>Opatrina</i> .....
4(3).	Eyes completely divided by epistomal canthus .....	8
-	Eyes whole or emarginate, not completely divided by epistomal canthus .....	5
5(4).	Apical segment of maxillary palp elongate-oval, finely acuminate .....	6
-	Apical segment of maxillary palp triangular or securiform .....	7
6(5).	Protibia triangular, with a single long, stout spur .....	<i>Bycrea</i>
-	Protibia gradually expanded but strongly produced laterally at apex; two short subequal spurs .....	<i>Ammodonus</i>
7(5).	Elytra without striae, but with dense confused granules .....	<i>Ephalus</i>
-	Elytra with punctate striae, fine granules on intervals only .....	<i>Pseudephalus</i>
8(4).	Scutellum triangular to subtriangular; metathoracic wings often well developed; protarsus of male usually distinctly dilated .....	9
-	Scutellum very broad and short; metathoracic wings absent; protarsus of male not dilated .....	14
9(8).	Base of pronotum bisinuate .....	10
-	Base of pronotum not bisinuate .....	12
10(9).	Protibia distinctly bent apically; vestiture of two types (Figs. 4 & 5) .....	<i>Trichoton</i>
-	Protibia straight; vestiture simple .....	11
11(10).	Protibia produced dorsally at apex; body laterally fimbriate (Fig. 3) .....	<i>Ulus</i>
-	Protibiae not produced dorsally at apex; body not laterally fimbriate .....	<i>Blapstinus</i>
12(9).	Basal pronotal margin evenly arcuate; body, in dorsal view, narrow, convex; surface and sides densely fimbriate .....	<i>Aconobius</i>
-	Basal pronotal margin straight; surface and sides not densely fimbriate .....	13
13(12).	Body, in dorsal view, broadly oval, strongly convex; pronotum widened behind; basal pronotal margin equal in width to elytral base; males with dense setal patches laterally to midline of metasternum; .....	<i>Cybotus</i>
-	Body, in dorsal view, elongate, subparallel; pronotum narrowed behind; basal pronotal margin less than width of elytral base .....	<i>Mecysmus</i>
14(8).	Pronotum densely fimbriate laterally .....	15
-	Pronotum not fimbriate laterally .....	16
15(14).	Protibia broadly triangular, compressed; body stout, oblong-oval .....	<i>Notibius</i>
-	Protibia narrow, non-fossorial; body narrow, parallel-sided .....	<i>Conibiosoma</i>

- 16(14). Elytral intervals elevated on disc ..... 17  
 - Elytral intervals not elevated on disc ..... *Conibius*  
 17(16). Elytral intervals acutely and continuously costate; pronotum narrowed behind (Baja California) ..... *Tonibiastes*  
 - Elytral intervals convex, serially tuberculate or asperate; pronotum variable behind ..... 18  
 18(17). Elytra, pronotum distinctly narrowed at base; basal width of pronotum narrower than basal width of elytra, widest anterior to middle; elytral intervals moderately convex with serial rows of asperate punctures or tubercles on crest (Fig. 1) ..... *Nocibiotes*  
 - Elytra subparallel, not narrowed at base; pronotum with lateral margins subparallel, basal width of pronotum equal to basal width of elytra; elytral intervals strongly convex, minutely punctate along crest ..... *Tonibius*

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We thank David H. Kavanaugh (CASC) for the loan of the paratypes of *Tonibius rossi*, Fred G. Andrews for the loan of CDAE material and T. J. Spilman and J. T. Doyen for their helpful suggestions concerning this manuscript. The adult habitus was prepared by A. Rubinstein.

## LITERATURE CITED

- AALBU, R. L., AND F. G. ANDREWS (in press). New species, relationships, and notes on the biology of the endogean Tentyriine genus *Typhlusechus* (Tenebrionidae: Stenosini). Occ. Papers Calif. Dept. Food & Agriculture.  
 ARNETT, R. H., JR. 1962. The beetles of the United States. Catholic University Press, Washington, D.C. 1,112 pp.  
 BLACKWELDER, R. E. 1944. Checklist of the coleopterous insects of Mexico, Central America, the West Indies, and South America. U.S. National Museum Bull. 185, parts 1-6:1-1492.  
 BLAISDELL, F. E. 1943. Contributions toward a knowledge of the insect fauna of Lower California. No. 7. Coleoptera: Tenebrionidae. Proc. Calif. Acad. Sci. (Ser. 4) 24: 171-287.  
 BRADLEY, J. C. 1930. A manual of the genera of beetles of America north of Mexico. Daw, Illston and Co., New York. 360 pp.  
 CASEY, T. L. 1890. Coleopterological notices II. Ann. New York Acad. Sci. 5:307-504.  
 ———. 1891. Coleopterological notices III. Ann. New York Acad. Sci. 6:9-214.  
 ———. 1892. Coleopterological notices IV. Ann. New York Acad. Sci. 6:359-712.  
 ———. 1895. Coleopterological notices VI. Ann. New York Acad. Sci. 8:435-838.  
 DAVIS, J. C. 1970. Revision of the genus *Blapstinus* Sturm of America north of Mexico with notes on extralimital species (Coleoptera: Tenebrionidae). Unpublished thesis, The Ohio State University.  
 ———. 1976. A review of the genus *Blapstinus* (Coleoptera: Tenebrionidae). Trans. Ky. Acad. Sci. 37:35-40.  
 DOYEN, J. T. 1972. Familial and subfamilial classification of the Tenebrionoidea (Coleoptera) and a revised generic classification of the Coniontini (Tentyriidae). Quaest. Entomol. 8:357-376.  
 ———, AND J. F. LAWRENCE. 1979. Relationships and higher classification of some Tenebrionidae and Zopheridae. Syst. Entomol. 4:333-377.  
 ESPAÑOL, F. 1945. Nuevos comentarios sistematicos sobre la subfamilia Opatrinae Reitter con la descripcion de un nuevo representante del Sahara Español (Coleoptera: Tenebrionidae). EOS 20:213-232.  
 ———. 1958. Sobre los principales divisiones propuestas por Koch para los Opatrinae pan africanos (Coleoptera: Tenebrionidae). EOS 29:99-116.

- FAUVEL, A. 1904. Faune analytique des Coléoptères de la Nouvelle Calédonie: part 2. *Revue d'Entomol.* 23:113-208.
- GEBIEN, H. 1910. *Coleopterorum Catalogus: Tenebrionidae*. W. Junk ed., Berlin. Vol. 18. 740 pp.
- . 1937-48. *Katalog Der Tenebrioniden*. Pub. del Museo Entomol. Pietro Rossi, Dvino 2:1-899.
- HORN, G. H. 1894. The Coleoptera of Baja California. *Proc. Calif. Acad. Sci. (Ser. 2)* 4:302-449.
- KASZAB, Z. 1952. Die indomalayischen und ostasiatischen Arten der Gattung *Gonocephalum* Solier (Coleoptera: Tenebrionidae). *Entomol. Arbieten Mus. G. Frey* 3:416-688.
- KOCH, C. 1956. Tenebrionidae II (Coleoptera: Polyphaga) Opatrinae part I: Platynotini, Litoborini and Loensini. Exploration du Parc National de l'Upemba, Mission G. F. De Witte. Fascicule 40. Brussels. 472 pp.
- LECONTE, J. L. 1851. Descriptions of new species of Coleoptera, from California. *Ann. Lyc. Nat. Hist. New York* 5:125-184.
- . 1874. Descriptions of new Coleoptera, chiefly from the Pacific Slope of North America. *Trans. Amer. Entomol. Soc.* 5:43-72.
- LENG, C. W. 1920. *Catalogue of the Coleoptera of America, north of Mexico*. Cosmos Press, Cambridge, Mass. 470 pp.
- MEDVEDEV, G. S. 1968. Darkling beetles (Tenebrionidae) subfamily Opatrinae. Tribes Platynotini, Dendarini, Pedinini, Dissonomini, Pachypterini, Opatrini (part) and Heterotarsini. *Fauna U.S.S.R.* 19(2):1-285. [Akad. Nauk SSSR, Zool. Inst., N.S. No. 97] (English Translation in 1977 by Indian National Documentation Centre for U.S. Dept. of Agriculture, Washington, D.C. 386 pp.)
- SPILMAN, T. J. 1973. Nomenclatural problems in six genera of Tenebrionidae (Coleoptera). *Proc. Entomol. Soc. Wash.* 75:39-44.
- TSCHINKEL, W. R., AND J. T. DOYEN. 1980. Comparative anatomy of the defensive glands, ovipositors and female genital tubes of tenebrionid beetles (Coleoptera). *Intern. J. Insect Morph. Embryol.* 9:321-368.
- VAN DYKE, E. C. 1953. The Coleoptera of the Galapagos Islands. *Occ. Papers Calif. Acad. Sci.* 22:1-181.
- WATT, J. C. 1974. A revised subfamily classification of Tenebrionidae (Coleoptera). *N. Zealand J. Zool.* 1:381-452.

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#### LITERATURE NOTICES

- NIKITSKY, N. B., AND V. V. BELOV. 1983. Palaeartic species of the genus *Salpingus* (Coleoptera, Salpingidae). (In Russian). *Zool. Zhurn.* 62:516-529.
- PUTHZ, V. 1984. Euaesthetinae aus Ghana II. (Coleoptera: Staphylinidae). 39. Beitrag zur Kenntnis der Euaesthinen. *Fol. ent. hung.* 45:195-203.
- ANGELINI, F. 1984. Reports of Agathidiini from Mongolia (Coleoptera: Leiodidae). *Fol. ent. hung.* 45:9-13.
- MARCUZZI, G. 1984. A catalogue of tenebrionid beetles (Coleoptera: Heteromera) of the West Indies. *Fol. ent. hung.* 45:69-108.
- KIRK, A., AND J. E. FEEHAN. 1984. Method for increased production of eggs of *Copris hispanus* L. and *Copris lunaris* L. (Coleoptera: Scarabaeidae). *J. Aust. ent. Soc.* 23:293-294.
- MCCAIN, ELISABETH, MARY K. SEELY, N. F. HADLEY, AND VIVIAN GRAY. 1985. Wax blooms in tenebrionid beetles of the Namib Desert: correlations with environment. *Ecology* 66:112-118.
- LEVEY, B. 1985. Afreminae: a new subfamily of Anthicidae (Coleoptera) from southern Africa. *Ent. Scand.* 15:419-422.

REVISION OF THE TYPES OF SPECIES OF OXYPODINI  
AND ATHETINI (*SENSU* SEEVERS) DESCRIBED BY  
MANNERHEIM AND MÄKLIN FROM NORTH AMERICA  
(COLEOPTERA: STAPHYLINIDAE)

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ABSTRACT

The type series of the staphylinid species in the tribes Athetini and Oxypodini described by Mannerheim (1843, 1846) and Mäklin (1852, 1853) from northwestern North America were studied. Lectotypes were designated for the following species (with the current generic names in parentheses): *Homalota maritima* Mannerheim (*Adota*), *H. picipennis* Mannerheim (*Dimetrota*), *Stonalota granulata* Mannerheim (*Atheta*), *Tachyusa fucicola* Mäklin (*Tarphiota*), *H. laevicollis* Mäklin (*Philhygra*), *H. cursor* Mäklin (*Atheta* (*Xenota*)), *H. nitens* Mäklin (*Liogluta*), *H. moesta* Mäklin (*Dimetrota*), *H. pratensis* Mäklin (*Atheta* (*Xenota*)), *H. geniculata* Mäklin (*Tarphiota*), *H. planaris* Mäklin (*Dinaraea*), *H. breviscula* Mäklin (*Atheta* (*Mocyta*)), *Myrmedonia angularis* Mäklin (*Lypoglossa*), *H. comparabilis* Mäklin (*Adota*), *H. litoralis* Mäklin (*Emplenota*), *H. vasta* Mäklin (*Liogluta*), and *Oxypoda irrasa* Mäklin (*Oxypoda*). Three new generic synonymies are proposed: *Panalota* Casey, a synonym of *Adota* Casey, *Pseudomegista* Bernhauer of *Liogluta* Thomson, and *Megacrotona* Scheerpeltz of *Lypoglossa* Fenyés. Five new specific synonymies are proposed: *Adota massetensis* Casey, a synonym of *Adota maritima* (Mannerheim), *Dimetrota carlottae* Casey of *Dimetrota picipennis* (Mannerheim), *Atheta maeklini* Fenyés of *Dimetrota moesta* (Mäklin), *Tarphiota insolita* Casey of *Tarphiota geniculata* (Mäklin), and *Acrotona prudens* Casey of *Atheta* (*Mocyta*) *breviuscula* (Mäklin). Three new combinations are given: *Liogluta nigropolita* (Bernhauer) (from *Pseudomegista*), *Boreophilia nomensis* (Casey) (from *Dinaraea*), and *Lypoglossa lateralis* (Mannerheim) (from *Megacrotona*).

To establish a reasonable base for further study of some neglected groups of North American Aleocharinae, we have undertaken revisions of the types of the species described by the authors of the 19<sup>th</sup> century. Many of these types have been ignored or misidentified by subsequent authors. In this paper we have treated only those species of Oxypodini and Athetini described from northwestern North America by Mannerheim and Mäklin. The types of these species, all from the Zoological Museum, Helsinki, Finland, were studied while the senior author was visiting the Biosystematics Research Institute in Ottawa, Canada.<sup>1</sup>

<sup>1</sup> Another paper, dealing with the types of North American Aleocharinae described by Gravenhorst, Erichson and Sachse is in preparation.

For each species treated in this paper, we quote the original description, describe and illustrate other important characters, provide the data of the type material and comment, if necessary, on the taxonomy, relationships, distribution, etc., of the species. Lectotypes are designated for all species and are deposited in the collection of the Zoological Museum, Helsinki, Finland.

The types were made available through the kindness of Mag. Phil. H. Silfverberg, Helsinki. The senior author also thanks Dr. P. S. Spangler, National Museum of Natural History, Washington, D.C., who enabled him to compare the types with specimens in the Casey collection. We also thank Dr. J. M. Campbell in the Coleoptera Section, Biosystematics Research Institute, Ottawa, for his suggestions and criticisms of the manuscript.

*Homalota maritima* Mannerheim 1843  
Figs. 1, 2

*Homalota maritima* Mannerheim 1843:224.

“*Homalota maritima* Eschscholtz: Linearis, depressa, nigra, subtiliter griseo-pubes-cens, antennis brevibus, thorace subquadrato, coleopteris vix angustiore, longi-tudinaliter impresso, abdomine supra parcius subtiliterque punctato, pedibus fus-co-testaceis.

“Longit.  $1\frac{1}{2}$  lin. Latit.  $\frac{1}{2}$  lin.

“Habitat in insula Sitka ad littora maris D. Eschscholtz.

“Statura fere *Tachysae*, sed tarsi hujus generis.”

Length 3.0–3.4 mm. Eyes rather small, the postocular region about  $1\frac{1}{2}$  times their length. Punctuation of head shallow and not dense but distinct; postocular region arcuate, head broadest at some distance behind eyes. Abdomen rather shining, its punctuation regularly distributed, not dense, 7<sup>th</sup> tergite in proximal half nearly without, in distal half with only scattered punctuation. Head 0.45 mm wide; pronotum 0.52 mm wide, 0.47 mm long; elytra combined 0.75 mm wide, suture 0.52 mm long, sides 0.6 mm long; abdomen 0.62 mm wide. Male: Apical margin of 8<sup>th</sup> tergite as in Figure 1, aedeagus as in Figure 2.

There are 3 specimens in the Mannerheim collection: 1 from Kodiak and 2 from Sitka, the *locus typicus*. As 1 of the specimens from Sitka was collected by Pippingsköld and not by Eschscholtz, as mentioned in the description, we have designated the other specimen as the lectotype. It is labelled: Sitka; Coll. Mannh.; 29c; *Homalota maritima* Eschsch.; Typus; Mus. zool. H. fors Spec. Typ. 2236 *Homalota maritima* Mannh. We added the label: *Homalota maritima* Eschscholtz Lectotypus, Lohse fix. 1983.

DISCUSSION. This species belongs to the genus *Adota* Casey (1910) which should be regarded as a *genus proprium*, not as a subgenus of *Atheta* Thoms. The type species of *Adota*, *A. massetensis* Casey, is conspecific with *H. maritima*, so that the latter becomes the type species of *Adota* with *A. massetensis* as a junior synonym (**new synonymy**). As *Panalota* Casey (1910), with its only included species *P. setositarsis* Casey, cannot be separated from *Adota*, we regard *Panalota* as a junior synonym of *Adota* (**new synonymy**).

The characters of the genus *Adota* are: Labrum deeply sinuated (nearly bilobed); anterior margin of clypeus concave, temporal carina missing but sometimes neckline reaching postocular region. Pattern of pubescence of pronotum of type I (after Hoeg 1945) with all hairs at midline directed anteriorly, others directed nearly horizontally laterad. Elytral pubescence on inner half more or less horizontal. Abdomen parallel-sided, tergites 3–6 basally im-



pressed. Tarsi with setae unusually long. The genus is distributed over the Pacific coasts of North America and northern Asia. The habitat of the species is littoral, if not intertidal.

*Adota maritima* is at present known from Alaska (there are 4 specimens in the Canadian National Collection labelled: Haines, VII.3.1968, Campbell and Smetana, sifting algae on beach), from Kodiak and Sitka (Coll. Mannerheim) and from British Columbia: Queen Charlotte Islands (Coll. Casey). Brundin's record from Iturup (Kuril Islands), based on a specimen from Bernhauer's collection, is wrong, as already suggested by Brundin after receiving a female of *A. maritima* from Sitka (Brundin 1943).

The European seashore species *Thinobaena vestita* (Gravenhorst) and *Adota maritima* are very similar in shape, proportions, pattern of pubescence, and in having long tarsal setae; however, *Thinobaena* differs from *Adota* by having the anterior margin of the labrum convex, by having only 3 abdominal tergites impressed basally and by the quite different male genitalia.

*Homalota picipennis* Mannerheim 1843

Figs. 3, 32

*Homalota picipennis* Mannerheim 1843:224.

"*Homalota picipennis*: Nigra, tenuiter pubescens, elytris piceo-castaneis, pedibus ferrugineis, thorace subquadrato, vix depresso, basi obsolete foveolato, abdomine supra anterieus parce subtiliterque punctato.

"Longit.  $1\frac{1}{2}$  lin. Latit.  $\frac{1}{2}$  lin.

"Habitat in Insula Sitkha D.D. Kuprianoff et Blaschke.

"*H. sociali*? valde affinis et forsitan ejus varietas, sed thorace anterieus angustato, basi obsolete foveolato et antennis brevioribus diversa videtur."

Length 3.2 mm. This species belongs to the species-group regarded by some authors (especially Brundin 1953, Casey 1910) as *Dimetrota* Mulsant and Rey. As there is a good description of this species by Casey (1910:32) under the name *D. carlottae* Casey, which must be regarded as a junior synonym of *H. picipennis* (new synonymy), we have supplemented this description only with the figures of the male genitalia (Figs. 3, 32). The Palaearctic species *Atheta aeneipennis* Thomson, incorrectly placed in synonymy with *H. picipennis* by Faubel (1875), is not Mannerheim's *H. picipennis*, therefore the name *A. aeneipennis* Thomson (*A. picipennis sensu* Brundin 1953, *nec* Mannerheim 1843) must be regarded as valid. An excellent description of this species is given by Brundin (1953:383-384).

There are 10 specimens in the Mannerheim collection, 6 from "Sitka," the *locus typicus*, the rest from Kenai. One male from Sitka, with the aedeagus dissected and mounted, was designated as the lectotypus. It is labelled: Sitka; Coll. Mannh.; 97a; Mus. Zool. H. fors Spec. typ. No. . . . *Homalota picipennis* Mann. We added the label: *Homalota picipennis* Mannerheim Lectotypus, Lohse fix. 1983.

*Homalota picipennis* is not the most common species, but it is the only described species from a group of many related similar species from north-western North America; it is widespread from Alaska (Prudhoe Bay) to British Columbia (*D. carlottae* in Coll. Casey). Records from California (Brundin 1953) are doubtful.

<sup>2</sup> *H. sociali* is *Atheta castanoptera* Kraatz.

DISCUSSION. Brundin (1953), in his treatment of the Palaearctic species of *Dimetrota*, argued that *D. cadaverina* Brisout differs from all other species of this group and excluded it from *Dimetrota*. Blackwelder (1952) designated *D. tristicula* Mulsant and Rey (a junior synonym of *D. cadaverina*) as type species of *Dimetrota*, using the argument that *D. marcida* Erichson, designated as the type species by Fenyes (1918), was not originally included. By this procedure the concept of *Dimetrota sensu* Blackwelder would be quite different from that of all other authors. In fact, *D. marcida* was "originally included"; it is the first species immediately following Mulsant's description of *Dimetrota*. Blackwelder argues that another paper of Mulsant and Rey (1873*b*), published in the same year, seems to have appeared first. It is not known which paper was published first, but it is evident that this paper was written later, otherwise Mulsant would not have used the name "*Dimetrota*" in his description of *D. tristicula*. The designation of *D. marcida* as the type species of *Dimetrota* by Fenyes (1918) should therefore be considered as valid.

*Stonalota granulata* Mannerheim 1846

Figs. 4, 5

*Stonalota granulata* Mannerheim 1846:508.

"*Stonalota granulata*: Linearis, depressa, aterrima, nitida, parce pubescens, antennis longioribus, extrorsum incrassatis pilosis, thorace subquadrato, coleopteris parum angustiore, posterius longitudinaliter impresso, elytris granulatis, abdomine laevigato, tibiis tarsisque fusco-testaceis.

"Longit. 1½ lin. Latit. ½ lin.

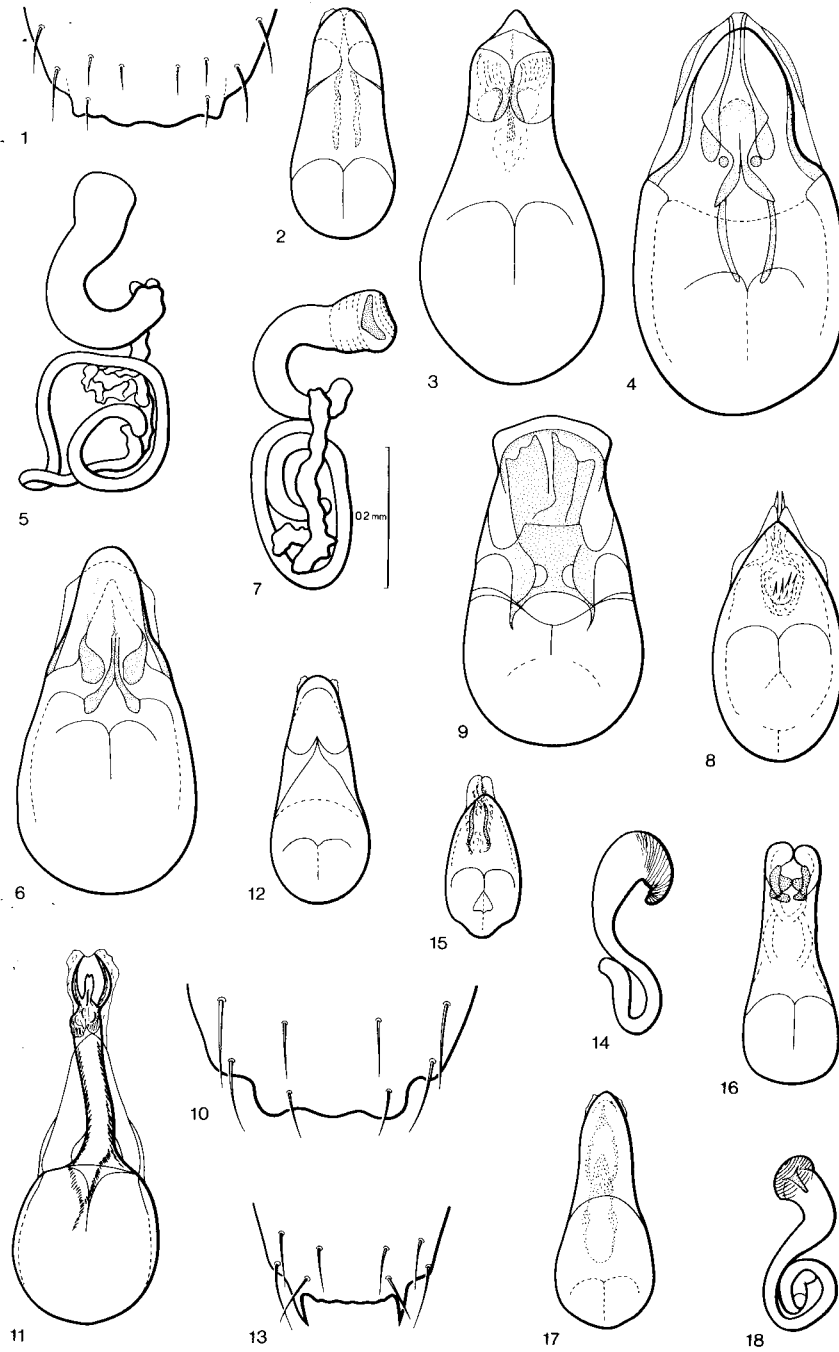
"Habitat in insula Unalaschka.

"Statura fere *H. maritima* Eschsch., sed major, nigrior, parcius et longius pubescens, antennis longioribus multo validioribus elytris granulatis diversa."

Length 4.0–4.3 mm. This species belongs to *Atheta* Thomson *s. str.* Black, strongly shining, elytra sometimes pitchy-black. Easily recognizable by asperate, granulose elytral punctation (stronger in male). Antennae long and slender, all segments elongate or at least (8–10) not wider than long. Eyes rather flat, subequal in length to length of postocular region. Tempora with incomplete carina. Head nearly circular (not transverse), with extremely fine, scattered punctation. Pronotum moderately transverse, widest somewhat before middle, weakly arcuately narrowed to obtuse hind angles; punctation very fine, but more distinct than on head, surface with or without (female) very superficial microsculpture. Pattern of pubescence of type I (after Hoeg 1945), with hairs of midline directed anteriorly. Elytra longer and wider than pronotum, strongly sculptured. Abdomen subparallel-sided, shining, its punctation sparse and fine, stronger towards apex, first 3 visible basal tergites each with transverse basal

→

Figs. 1–18. 1–2, *Adota maritima*. 1, apical margin of male 8<sup>th</sup> tergite. 2, aedoeagus. 3, *Dimetrota picipennis*, aedoeagus. 4–5, *Atheta granulata*. 4, aedoeagus. 5, spermatheca. 6–7, *Atheta graminicola*. 6, aedoeagus. 7, spermatheca. 8, *Tarphiota fucicola*, aedoeagus. 9, *Philhygra laevicollis*, aedoeagus. 10–11, *Atheta cursor*. 10, apical margin of male 8<sup>th</sup> tergite. 11, aedoeagus. 12, *Liogluta nitens*, aedoeagus. 13–14, *Dimetrota moesta*. 13, apical margin of male 8<sup>th</sup> tergite. 14, spermatheca. 15, *Tarphiota geniculata*, aedoeagus. 16, *Dinaraea planaris*, aedoeagus. 17–18, *Atheta breviscula*. 17, aedoeagus. 18, spermatheca. All aedoeagi shown in ventral view.



impression. Legs slender, tarsal joints 1–4 subequal in length. Head 0.5 mm wide; pronotum 0.75 mm wide, 0.56 mm long; elytra combined 1.0 mm wide, suture 0.7 mm, side 0.8 mm long; abdomen 0.95 mm wide. Male: 8<sup>th</sup> tergite with asperate granulation and crenulate apical margin, last sternite parabolic, narrowly sinuated at its end, sinuation delimited on each side by a blunt angle; aedoeagus as in Figure 4. Female: 8<sup>th</sup> tergite with less strong granulation, last sternite rounded; spermatheca as in Figure 5.

There are 3 specimens in the Mannerheim collection, 2 from Kenai and 1 from Unalaska, the *locus typicus*; the latter specimen was designated as the lectotype. It is labelled: Cygnoeus; Unalaska; Homalota granulata Mannerh.; Mus. Zool. H. fors Spec. Typ. No. 2252 Homalota granulata Mannerh. We added the label: Stonalota granulata Mannh. Lectotypus, Lohse fix. 1983.

DISCUSSION. The name *Atheta* Thomson (1858) could be regarded as a junior synonym of *Stonalota* Mannerheim (1846). But since Mannerheim himself changed this name in 1852 to *Homalota*, Blackwelder (1952) fortunately regarded it as an error.

Bernhauer (1906) placed *A. granulata* in synonymy with the Palaearctic species *A. graminicola* (Gravenhorst), and this synonymy was accepted and continued by Fenyés (1920) and Scheerpeltz (1934). Although *A. granulata* and *A. graminicola* can be distinguished from each other only if seen side by side (*A. graminicola* has denser pronotal and abdominal punctation), the differences in the genitalia show that they are 2 different species (Figs. 4–7). The figure of the spermatheca shown by Seevers (1978:207, fig. M) is an *A. granulata*-form and not *A. graminicola*, as cited.

*Atheta granulata* belongs to a complex of species (or subspecies) which cannot be distinguished externally, but which differ in their genitalia, especially in the shape of the spermathecae. Species of this group occur in northern North America (Alaska and Canada) as far east as Quebec: Parc Gatineau near Hull. Another species of this complex is *A. nomadica* Casey (1910). Casey compared this species with *A. subplana* J. Sahlberg, a species of another genus (*Boreophilia* Benick 1973), without any similarity to *A. nomadica*.

As there is no specimen of *A. subplana* in Casey's collection, we do not know Casey's concept of the species. It is impossible to separate *A. nomadica* from *A. granulata*, even by the shape of the spermatheca.

It should be mentioned that *Pseudomegista nigropolita* Bernhauer (1907) does not belong to this complex; this species is a *Liogluta* Thomson (**new combination**) and the name *Pseudomegista* Bernhauer should be regarded as a junior synonym of *Liogluta* Thomson (**new synonymy**).

*Tachyusa fucicola* Mäklin 1852 and  
*Homalota fucicola* Mäklin 1853

Fig. 8

*Tachyusa fucicola* Mäklin 1852:306.

“*Tachyusa fucicola* Mäklin: atra, opaca, pube tenuissima cinereo-sericea dense vestita; thorace latitudine sua tertia parte brevior, longitudinaliter late impresso: elytris thorace dimidio longioribus et tertia parte latioribus; abdomine lineari, subnitido, crebre subtiliter punctulato; pedibus piceis, geniculis tarsisque dilutius piceo-testaceis.

“Longit. 1¼–1½ lin. Latit. ½–½ lin.

“Sub fucis mari rejectis in insula Edgecombe non procul ab insula Sitkha initio m. Septembris a D. Holmberg inventa. (“Mäklin”).”

*Homalota fucicola* Mäklin 1853:182.

“*Homalota fucicola* Mäklin.

“*Tachyusa fucicola* Mäklin: Mannerh. Bullet. de la Soc. de Moscou. 1852 I p. 306. 32.

“In insula Kadjak sub lapidibus in vicinitate maris a D. Holmberg copiose lecta.”

Length 3.4 mm. This species belongs to the genus *Tarphiota* Casey, as previously noted by Casey (1910:75). Antennae with segments 5–10 not incrassate and nearly quadrate. Eyes of medium size; postocular region not convex, as long as length of eyes seen from above. Head 0.5 mm wide; pronotum 0.62 mm wide, 0.55 mm long; elytra combined 0.85 mm wide, suture 0.6 mm long, sides 0.75 mm long. Aedoeagus as in Figure 8.

There are 19 specimens in the Mannerheim collection, all from Kodiak and not from Edgecombe (near Sitka) as mentioned in the description. These are the specimens recorded by Mäklin one year later as “*Homalota*” *fucicola*. As these specimens are obviously Mäklin’s original material, we have designated 1 specimen of this series as the lectotype. It is labelled: Kadjak; Holmberg; Mus. Zool. H. fors Spec. typ. No. . . . *Homalota fuscicola* Mäkl. We added the label: *Homalota fucicola* Lectotypus, Lohse fix. 1983. We have not seen this species from any other localities.

*Homalota laevicollis* Mäklin 1852

Figs. 9, 33

*Homalota laevicollis* Mäklin 1852:306–307.

“*Homalota laevicollis* Mäklin: elongata, subdepressa, nigra, nitida, parcius pubescens, subtilissime obsoleteque punctulata: thorace omnino fere laevigato; antennis capite cum thorace paulo longioribus, articulis penultimis tribus parum transversis; antennarum basi, elytris, ano pedibusque rufo-testaceis; thorace subquadrato, deplanato, longitudine tertia parte latiore, ante scutellum obsolete foveolato et vix visibilibus longitudinaliter obsoleteque canaliculato; elytris thorace paulo longioribus, versus scutellum angulisque apicalibus nonnihil infuscatis; abdomine anterieus parce obsoleteque punctulato, segmentis ultimis laevigatis.

“Longit. 1–1½ lin. Latit. ½ lin.

“Habitat in insula Sitkha; DD. Pippingsköld et Frankenhaeuser.

“Variat antennarum basi elytrisque totis piceis aut dilutius fusco-testaceis (“Mäklin”).”

Length 3.4 mm. This species belongs to the genus *Philhygra* Mulsant and Rey (1873a). It can easily be distinguished from other North American species of *Philhygra* by the pubescence of the pronotum, which is characteristically reduced and consisting of only a few scattered hairs on each side, and by the characteristic form of the aedoeagus (Figs. 9, 33). The punctuation of the elytra is extremely fine and rather scattered. The microsculpture of the pronotum is very fine and consists of small round meshes.

We have designated 1 of the 2 specimens in the Mannerheim collection, labelled “Sitka,” as the lectotype. It is labelled: Sitka; Frankenh.; Coll. Mäklin; *Homalota laevicollis* Mäklin, Sitka, pr. Mannh.; Typus; Mus. Zool. H. fors. Spec. typ. No. 2239. We added the label: *Homalota laevicollis* Mäkl. Lectotypus, Lohse fix. 1983. The lectotype is a female; the last antennal segment of each side is missing. The species seems to be very rare; there are only 3 specimens in the Canadian National Collection labelled: Alaska, 8 mi N.W. Haines, VII 3 68, Campbell and Smetana. The aedoeagus of 1 of them is illustrated in Figure 9.

*Homalota cursor* Mäklin 1852

Figs. 10, 11

*Homalota cursor* Mäklin 1852:307.

"*Homalota cursor* Mäklin: nigra, nitidula, tenuiter pubescens; palpis, antennarum basi, elytris, summo apice ani pedibusque testaceis; antennis capite cum thorace longioribus, harum articulis penultimis transversis; thorace longitudine dimidio latiore, crebre subtilius punctulato, longitudinaliter obsolete impresso; elytris thorace tertia parte longioribus, confertim punctulatis; abdomine basin versus parce punctulato, segmentis ultimis laevigatis.

"Longit.  $1\frac{1}{2}$  lin. Latit.  $\frac{1}{2}$  lin.

"Habitat in insula Sitkha; D. Holmberg. Varietates elytris nigro-piceis aut omnino nigris ibidem legerunt DD. Pippingskold et Frankenhaeuser. ("Mäklin")."

Length 3.1 mm. This species belongs to *Atheta* subgenus *Xenota*; it resembles some fungivorous species like *Atheta pallidicornis* Thomson, *A. nigrigula* (Gravenhorst), etc. Antennae rather thick, segment 3 somewhat shorter than 2, widened apically; segments 4–10 transverse, about  $1\frac{1}{2}$  times broader than long. Head transverse, widest over the rather large eyes, these visibly longer than postocular region. Pattern of pronotal pubescence of type I (after Hoeg 1945). Pronotum 0.56 mm wide, 0.41 mm long; elytral suture 0.47 mm, sides 0.56 mm long. Abdomen slightly narrowed to apex, tergites 3–5 with scattered punctation, segments 6 and 7 nearly impunctate, the surface with transversal wavy microsculpture. Male: 8<sup>th</sup> tergite of characteristic shape (Fig. 10); aedeagus as in Figure 11.

There are 5 specimens in the Mannerheim collection: 2 from Kenai, belonging to *Dimetrota*; 1 without a locality label; the remaining 2 are labelled "Sitka," the *locus typicus*. Since 1 of them was severely damaged by someone trying to dissect the genitalia, the other Sitka specimen was designated as the lectotype. It is labelled: Sitka; Holmberg; Coll. Mäklin; *Homalota cursor* Mäklin. Sitka, pr. Hlm.berg; Typus; Mus. Zool. H. fors Spec. typ. Nr. 2253 *Homalota cursor* Mäkl. We have added the label: *Homalota cursor* Lectotypus, Lohse fix. 1983. This specimen was received dissected. We have seen no other specimen of *A. cursor*, neither in Casey's collection nor in the Canadian National Collection.

*Homalota nitens* Mäklin 1852

Fig. 12

*Homalota nitens* Mäklin 1852:307.

"*Homalota nitens* Mäklin: nigra, nitida, parcius pubescens; antennarum basi anoque piceis, elytris pedibusque testaceis; antennis crassiusculis capite cum thorace longioribus, articulis earum penultimis transversis; fronte late impresso; thorace longitudine dimidio fere latiore, parce punctulato, in medio transversim late at obsolete impresso (an semper?); elytris thorace paulo longioribus, hoc paulo densius punctulatis; abdomine toto fere omnino laevigato.

"Longit.  $1\frac{1}{4}$  lin. Latit.  $\frac{1}{2}$  lin.

"In insula Sitkha a D. Holmberg sub arborum cortice inventa. ("Mäklin")."

Length 2.8–3.3 mm. This species belongs to the genus *Liogluta* Thomson. It is remarkably smaller than all European species of this genus. Eyes flat, their length equal to the postocular region, temporal carina fine, but complete. Pattern of pronotal pubescence of type II (after Hoeg 1945) with hairs at midline directed caudad, at sides obliquely posteriad, hairs rather long, scattered; lon-

gitudinal median impression not distinct in females. Abdomen subparallel-sided, very shining with very fine scattered punctation; first 3 visible tergites weakly impressed basally. Head 0.45 mm wide; pronotum 0.56 mm wide, 0.44 mm long; elytra combined 0.75 mm wide, suture 0.45 mm, sides 0.60 mm long; abdomen 0.7 mm wide. Male: 8<sup>th</sup> tergite covered with numerous asperate granules [as in the European *L. longiuscula* (Gravenhorst)].

There are 2 specimens in the Mannerheim collection, 1 without any locality label. The other specimen (male) was designated as the lectotype. It is labelled: Sitcha; Holmberg; Coll. Mäkl.; *Homalota nitens* Mäkl., Sitka pr. Hlm.berg; Typus; Mus. Zool. H. fors. Sp. Typ. No. 2242 *Homalota nitens* Mäkl. We dissected the aedoeagus and added the label: *Homalota nitens* Mäklin Lectotypus, Lohse fix. 1983. The aedoeagus is as in Figure 12.

This species seems to be frequent in the northwest; there is a great number of specimens in the Canadian National Collection from Alaska, Yukon Territory, British Columbia and Oregon.

*Homalota moesta* Mäklin 1852

Figs. 13, 14

*Homalota moesta* Mäklin 1852:307.

"*Homalota moesta* Mäklin: nigra, nitidula, confertissime punctata, pedibus testaceis; antennis crassiusculis, capite cum thorace longitudine aequalibus, articulis earum penultimis transversis; thorace leviter transverso, latius canaliculato; elytris fuscis, thorace tertia parte longioribus; abdomine basi densius, apicem versus parce punctato, fere laevigato.

"Longit,  $\frac{4}{5}$  lin. Latit.  $\frac{1}{4}$  lin.

"Habitat in insula Sitkha D. Holmberg. ("Mäklin")."

Length 2.1 mm. This species belongs to *Dimetrota* Mulsant and Rey (*sensu* Palm 1970, *nec* Blackwelder 1952). Body somewhat fusiform. Antennae rather thick, segment 3 elongate, not visibly shorter than segment 2; segments 4–10 broader than long, width increasing distad, segment 10 about  $1\frac{1}{3}$  times as wide as long. Head transverse, eyes large, their length about twice as long as post-ocular region; tempora with carina. Pronotum  $1\frac{1}{3}$  times as wide as long, longitudinally impressed, especially in male; sides subparallel, slightly arcuate, continuing into arcuate base without forming an angle, each with 3 rather long bristles. Pronotal pubescence of type I (after Hoeg 1945). Pronotum distinctly broader than head and much narrower than elytra. Head, pronotum and elytra with dense, strongly asperate punctation. Middle tibiae and abdomen with long bristles, as usual in *Dimetrota*. Punctation of abdomen rather sparse, diminishing toward apex, nearly absent on 7<sup>th</sup> tergite. Microsculpture on tergites consisting of transverse or wavy confluent meshes. Head 0.38 mm wide; pronotum 0.48 mm wide, 0.36 mm long; elytra combined 0.64 mm wide, suture 0.40 mm long, sides 0.53 mm long; abdomen at level of 4<sup>th</sup> tergite 0.52 mm wide. Male: Apical margin of 8<sup>th</sup> tergite truncate, with a long spine at each side (Fig. 13). Spermatheca as in Figure 14 (very similar to that of *Dimetrota intermedia* Thomson).

There are 3 specimens in the Mannerheim collection: 1 from Kenai and 2 from "Sitcha," the *locus typicus*. As 1 of the Sitka specimens has no head and pronotum, we designated the other one as the lectotype. It is labelled: Sitcha; Coll. Mäklin; Holmberg; *Homalota moesta* Mäkl. Sitka, Hlm.berg.; Zool. Mus. H. fors. Spec. typ. No. 2256 *Homalota moesta* Mäkl. We added the label: *Homalota moesta* Mäkl. Lectotypus, Lohse fix. 1983.

We could not find this species in the Casey collection, but we have seen several specimens in the Bernhauer collection from Baring, Washington (Fenyès). In the Canadian National Collection there is 1 male and 1 female from Alaska: Denali St. Pk., Byers Lake Campgr., 20.VI.78, and another female from Kenai Peninsula: Kenai Mts., 2 mi south Moose Pass, 500', 30.V.78, all Smetana and Becker.

DISCUSSION. Fenyès (1918) changed the name to *Atheta maeklini* by reason of homonymy. This can only be accepted if we regard *Aleochara moesta* Zetterstedt 1828 (a junior synonym of *Atheta graminicola*) as congeneric with *Homalota moesta* Mäklin, a *Dimetrota*. This certainly is not the case, as they are generically different, based on the highly specialized spermatheca of *Atheta graminicola*. Thus *A. maeklini* Fenyès is a **new synonym** of *H. moesta* Mäklin.

*Homalota pratensis* Mäklin 1852

*Homalota pratensis* Mäklin 1852:308.

"*Homalota pratensis* Mäklin: nigra, nitida, densius subtiliusque punctulata, elytris piciscentibus, pedibus testaceis; antennis capite cum thorace longitudine aequalibus, articulis penultimis fortius transversis; thorace longitudine plus quam dimidio latiore, obsolete canaliculato; elytris thorace plus quam dimidio longioribus; abdomine basi parce punctato, segmentis duobus penultimis laevigatis.

"Longit.  $\frac{3}{4}$  lin. Latit.  $\frac{1}{2}$  lin.

"Habitat in insula Sitkha, in graminosis; D. Frankenhaeuser.

"Hom. moesta quodammodo similis, sed magnitudine minore, antennarum articulis penultimis fortius transversis, thorace brevior, punctura etc. diversa ("Mäklin")."

Length 2.1 mm. This species belongs to the group, which Casey (1910) referred to as *Atheta* and Seevers (1978) as *Xenota* (without any taxonomic base, as explained in the Discussion under *Homalota litoralis*). It is similar to most *Dimetrota* species, but the abdomen is not narrowed caudad, the bristle of the middle tibia is short (not longer than width of tibia) and pronotum deep black with weak metallic lustre. Head, pronotum and elytra rather densely, asperately punctate. Antennae rather slender, hardly longer than head and pronotum combined; segment 3 much shorter than 2, but elongate; segment 4 quadrate, segments 5–10 becoming wider, segment 10 about  $1\frac{1}{2}$  times as wide as long. Head somewhat narrower than pronotum; length of eyes visibly longer than postocular region, temporal carina complete. Postocular region slightly arcuate, head at level of tempora not wider than at level of eyes. Pubescence of pronotum of type I (after Hoeg 1945). Pronotum  $1\frac{1}{4}$  times as broad as long, its sides nearly parallel, slightly arcuate, continuing into strongly arcuate base without forming an angle. Sides of pronotum with 3 long bristles. Elytra much longer and wider than pronotum, their pubescence wavy, as in *D. atramentaria* (Gyllenhal). Abdomen narrower than elytra; first 3 visible tergites (3–5) each with basal impression and not dense asperate punctation, which diminishes only slightly, but visibly to the apex. Apical margin of both 8<sup>th</sup> and last sternite rounded, weakly sinuate in middle. Head 0.36 mm wide; pronotum 0.42 mm wide, 0.24 mm long; elytra combined 0.62 mm wide, suture 0.44 mm, sides 0.56 mm long; abdomen 0.48 mm wide.

There were 6 specimens, belonging to the same species in the Mannerheim collection; 3 from Kenai, 1 without locality label and 2 from "Sitkha," the *locus typicus*. Since 1 of them was without the abdomen, the remaining specimen was designated as the lectotype, although it is rather immature. It is labelled: Sitka; Holmberg; pratensis Mkl. Sitka; Mus. Zool. H. fors Spec. typ.



No. 2243 *Homalota pratensis* Mäkl. We added the label: *Homalota pratensis* Mäklin Lectotypus, Lohse fix. 1983.

We could find no specimens of this species, neither in the Casey collection nor in the Canadian National Collection.

*Homalota geniculata* Mäklin 1852

Fig. 15

*Homalota geniculata* Mäklin 1852:308.

"*Homalota geniculata* Mäklin: linearis, depressa, nigra, opaca, dense pubescens; antennarum basi pedibusque piceis, geniculis tarsisque testaceis; capite, thorace elytrisque subtilissime confertissimeque punctulatis; thorace longitudine dimidio fere latiore, canaliculato; elytris thorace plus quam tertia parte longioribus; abdomine sub-nitido, evidentius dense punctato.

"Longit.  $\frac{3}{4}$  lin. Latit.  $\frac{1}{6}$  lin.

"In insula Edgcombe sub fucis e mari rejectis a D. Holmberg inventa ("Mäklin")."

This intertidal species belongs to the genus *Tarphiota* Casey 1893 (p. 332); a good diagnosis of the genus was given by Seevers (1978:132–133).

Length 2.0 mm. Antennae rather short, segment 4 rounded quadrate, the following segments not appreciably longer, but gradually becoming wider, so that segment 10 is about  $1\frac{1}{3}$  times as wide as long; all segments rounded, not cylindrical. Eyes longer than postocular region. Pattern of pubescence of pronotum of type III (after Hoeg 1945), with hairs at midline in basal  $\frac{2}{3}$  directed caudad, in apical  $\frac{1}{3}$  anteriad, at the sides horizontal laterad. Head 0.35 mm wide; pronotum 0.42 mm wide, 0.35 mm long; elytra combined 0.50 mm wide, suture 0.35 mm, sides 0.50 mm long; abdomen parallel-sided, 0.45 mm wide. Aedoeagus as in Figure 15.

There are 15 specimens in the Mannerheim collection, all from Sitka; most are in poor condition. One of the best preserved specimens, mounted on a plate with another specimen, was designated as the lectotype. It is labelled: Sitka; Holmberg; Coll. Mäkl.; *Homalota geniculata* Mäklin, Sitka pr. Holmberg, Typus; Mus. Zool. H. fors Spec. typ. No. 2234 *Homalota geniculata* Mäkl. We have added the label: Left Ex. design. as Lectotypus, Lohse 1983. All specimens of this species in the Canadian National Collection are from San Francisco. Casey redescribed this species as *T. insolita* (new synonymy) from the Queen Charlotte Islands, as *T. geniculata* is not mentioned in his paper (1910:74–76).

*Homalota planaris* Mäklin 1852

Fig. 16

*Homalota planaris* Mäklin 1852:309.

"*Homalota planaris* Mäklin: subdepressa, nigra, nitida, subtiliter punctulata, tenuiter pubescens; pedibus fuscis, geniculis tarsisque dilutioribus; antennis crassiusculis capite cum thorace longitudine aequalibus, articulis penultimis fortius transversis; fronte interdum excavato; thorace transverso, longitudine duplo fere latiore, longitudinaliter obsolete impresso; elytris thorace dimidio fere longioribus; abdomine fere omnino larvigato.

"Longit.  $\frac{4}{5}$  lin. Latit.  $\frac{1}{4}$  lin.

"In insula Sitkha locis humidis a DD. Pippingsköld, Frankenhaeuser et Holmberg inventa. ("Mäklin")."

Length 2.0–2.1 mm. This species belongs to the genus *Dinaraea* Thomson.

Dorsal surface is not "*nitida*" as mentioned in the description, but only moderately shining, owing to the strong microsculpture of round meshes and asperate, not very dense punctation. Antennae strong, exceeding combined length of head and pronotum by last 2 segments, segment 2 longer than 3, segment 4 quadrate, segments 5-10 increasingly broader. Head, as in all *Dinaraea* species, with clypeus nearly on same level as frons (not bent downwards), transverse and flat; temporal carina wanting. Eyes flat, their length seen from above about as long as the weakly arcuate postocular region. Head at level of tempora not wider than at level of eyes, nearly as wide as the pronotum. Pronotum rather flat, widest at apical third, sides slightly converging basally, continuing without forming an angle into arcuate base. Pattern of pronotal pubescence of type III (after Hoeg 1945), with hairs at midline directed anteriorly in apical half and caudad in basal half. Elytra rather long with pubescence characteristically directed horizontally in caudal third. Abdomen parallel-sided, with first 3 visible tergites (3-5) impressed basally; punctation asperate, scattered but visible on all tergites among strong microsculpture of round meshes. Tarsal segments 1 and 2 equal in length. Head 0.39 mm wide; pronotum 0.44 mm wide, 0.35 mm long; elytra combined 0.66 mm wide, suture 0.50 mm, sides 0.60 mm long. Male: 8<sup>th</sup> tergite with apical margin truncate, each side of tergite with some asperate punctures; aedoeagus as in Figure 16.

There are 3 specimens in the Mannerheim collection, all from "Sitka." The specimen in the best condition was designated as the lectotype. It is labelled: Sitka; Coll. Mäklin; H. planaris; Typus; Mus. Zool. H. fors Spec. typ. No. 2247 *Homalota planaris* Mäkl. We added the label: *Homalota planaris* Mäkl. Lectotypus, Lohse fix. 1983.

**DISCUSSION.** The usual habitat of *Dinaraea* species is subcortical. *Dinaraea planaris* and *D. subdepressa* Bernhauer are at present the only described North American species, although we have seen a few additional undescribed species from North America. It should be noted that *Dinaraea nomensis* Casey is not a *Dinaraea*, but belongs to the genus *Boreophilia* (**new combination**) (according to Lohse's on-going revision of the types).

In addition to the original specimens we have only seen 1 male specimen in the Canadian National Collection labelled: Yukon Territory, Dempster Hwy. mi 42, N. Klondike R., 18.VII.1978, 3,300', Smetana and Campbell. The species is not represented in the Casey collection.

*Homalota breviscula* Mäklin 1852

Figs. 17, 18

*Homalota breviscula* Mäklin 1852:309.

"*Homalota breviscula* Mäklin: nigra, nitida, dense punctata, tenuiter pubescens; pedibus antennisque testaceis, harum apice anoque fusco-testaceis; elytris thorace longitudine aequalibus, nonnihil picescentibus; abdomine basi dense, apicem versus parce subtiliusque punctato.

"Longit.  $\frac{1}{5}$  lin. Latit. parum ultra  $\frac{1}{4}$  lin.

"Habitat in insula Sitkha; D.D. Pippingsköld, Frankenhaeuser et Holmberg.

"Ad divisionem 4, tam operis V. Cl. Erichson referenda: Hom. fungi auct. statura corporis subsimilis, sed multo minor. ("Mäklin")."

Length 2.1-2.5 mm. This species belongs to *Atheta* subgenus *Mocyta* Mulsant and Rey and is so similar to the common Holarctic species *A. fungi* (Gravenhorst) that it is here compared to that species. Smaller (*A. fungi* 2.4-2.8 mm). Eyes smaller, postocular region seen from above distinctly longer

than diameter of eyes (distinctly shorter in *A. fungi*). Antennae shorter and stronger, pronotum broad, nearly as wide as elytra (narrower in *A. fungi*); elytra at sides shorter or as long as pronotum at midline (always longer in *A. fungi*). Aedoeagus as in Figure 17. Spermatheca as in Figure 18.

There are 3 specimens in the Mannerheim collection from Sitka; 1 of them was designated as the lectotype. It is labelled: Sitka; Coll. Mäkl. *H. breviscula*; Typus; Mus. Zool. H. fors Spec. typ. No. . . . *Homalota breviscula* Mäkl. We added the label: *Homalota breviscula* Mäklin Lectotypus, Lohse fix. 1983.

This species is widespread in northwestern North America. We have seen many specimens from Alaska (several localities on Kenai Peninsula), Alberta (Waterton N.P.) and from British Columbia. This species was redescribed by Casey as *Acrotona prudens* (Casey 1910:149), **new synonymy**.

DISCUSSION. Bernhauer (1906) and Fenyés (1920) regarded *A. breviscula* as a synonym of *A. fungi*; Scheerpeltz (1934) in the Junk-Schenkling Catalogue treated it as a subspecies of *A. fungi*. Neither opinion can be accepted, as *A. fungi* seems to be parthenogenetic (the bisexual species is *A. amplicollis* Mulsant and Rey) and *A. breviscula* is bisexual. The ventral lobe of the aedoeagus of *A. breviscula* is narrower than that of *A. amplicollis* and the spermatheca is substantially smaller. Also, it is uncertain whether Bernhauer really knew *A. breviscula*, since he based his opinion on specimens from California, and *A. breviscula* probably does not occur there.

*Myrmedonia angularis* Mäklin 1853

Figs. 19–21

*Myrmedonia angularis* Mäklin 1853:181.

“*Myrmedonia angularis* Mäklin: confertim subtilissime punctata, fusca, antennarum basi, thoracis lateribus, pedibus elytrisque testaceis, his sutura, basin versus latius angulisque apicalibus oblique late infuscatis; thorace transverso, obsoletius cancellulato, basi leviter transversim foveolato.

“Longit. 1½ lin. Latit. ⅔ lin.

“Habitat in pennisula Kenai; in interiore parte et ad sinum Woskersensk a D. F. Frankenhaeuser rarissime inventa (“Mäklin”).”

Length 4.0–4.5 mm. This species belongs to the genus *Lypoglossa* Fenyés 1918 (p. 239); the species of this genus can be easily recognized by their broad fusiform shape, by the 4, 5, 5 tarsal formula, by the extent of the surface of pronotum, which is greater than that of elytra, and by the characteristic sculpture of the abdomen. Antennae elongate, scarcely incrassate toward apex, segment 3 visibly longer than 2, segments 4 and 5 elongate, segments 6–10 quadrate. Head transverse, much smaller than pronotum, broadest far behind the eyes. Diameter of eyes shorter or subequal to postocular region, tempora widened, incompletely carinated. Prothorax broad, almost as wide as elytra, broadest in middle, sides arcuate, somewhat more narrowed toward apex than toward base, hind angles very obtuse, nearly rounded. Elytra rather short, nearly parallel-sided. Abdomen broad, narrowed toward apex, with first 3 visible tergites transversely impressed basally. Legs long and slender, segments 1–4 of hind tarsus decreasing in length. Surface of head with punctation hardly visible; pronotum somewhat shining, with fine and dense asperate punctation, pattern of pubescence of type I (after Hoeg 1945), sculpture of elytra equal to that of pronotum. Abdomen with silky pubescence and very fine and dense punctation on tergites 3–5, punctation equally fine but less dense on tergite 6, scattered

on tergite 7. Tergites 6 and 7 with slight metallic shine and with very fine and dense transverse microsculpture. Head 0.65 mm wide; pronotum 0.95 mm wide, 0.75 mm long; elytra combined 1.05 mm wide, suture 0.55 mm and sides 0.75 mm long; abdomen (at level of tergite 4) 1.0 mm wide. Aedoeagus as in Figures 19, 20. Spermatheca as in Figure 21.

There is only 1 specimen in the Mannerheim collection; it is hereby designated as the lectotype. It is labelled: Coll. Mäklin; Myrmedonia angularis Mäkl.; Woskres.; *Dasyglossa prospera* Bernhauer; Mus. Zool. H. fors Spec. typ. No. 2270 Myrmedonia angularis Mäkl. We added the label: Myrmedonia angularis Mäklin Lectotypus, Lohse fix. 1983. There are more than 250 specimens in the Canadian National Collection from Alaska and British Columbia and 1 specimen from Newfoundland, so that it is probable that this species is transcontinental.

**DISCUSSION.** The determination of *M. angularis* as *Dasyglossa* (now *Devia* Casey) *prospera* Erichson was a serious mistake of Bernhauer, who should have known the real *D. prospera* from his homeland. The aedoeagi of *Devia prospera* and *D. congruens* are illustrated in Figures 22, 23. In 1907, Bernhauer described another species of "*Dasyglossa*" namely *D. fenyesi*, from British Columbia. Fenyés (1918) remarked that this species had a tarsal formula 4, 5, 5 and not 5, 5, 5 as *Devia*, and founded the monotypic genus *Lypoglossa* for this species, without regarding the "*prospera*" of Bernhauer's paper. This "*prospera*" of Bernhauer (1907) is indeed *L. angularis*, as Bernhauer writes: "Hinterleib genauso wie bei prospera am 6. Dorsalsegment viel weitläufiger, am 7. zerstreut punktiert." This sculpture is about the best character, in addition to the tarsal formula, for distinguishing *Lypoglossa* from *Devia*, in which genus the typical "*Oxypoda*-like" sculpture is equally spaced on all tergites. *Lypoglossa fenyesi* and *L. angularis* are difficult to distinguish; in *L. fenyesi* the antennae are more slender with segments 4–6 more elongate, the pronotum is usually uniformly yellowish-brown and more strongly depressed in the middle in the male. For the difference in the genitalia see Figures 19–21, 23–25. Also *L. fenyesi* is more widespread than *L. angularis*. We have seen almost 80 specimens of *L. angularis* from Alaska, British Columbia, Yukon Territory, Washington, California, and from Ontario and Quebec. The Palearctic species *Megacrotona lateralis* (Mannerheim 1831) belongs in fact to *Lypoglossa* (**new combination**). The name *Megacrotona* Scheerpeltz 1968 becomes a junior synonym of *Lypoglossa* Fenyés 1918 (**new synonymy**).

*Homalota comparabilis* Mäklin 1853

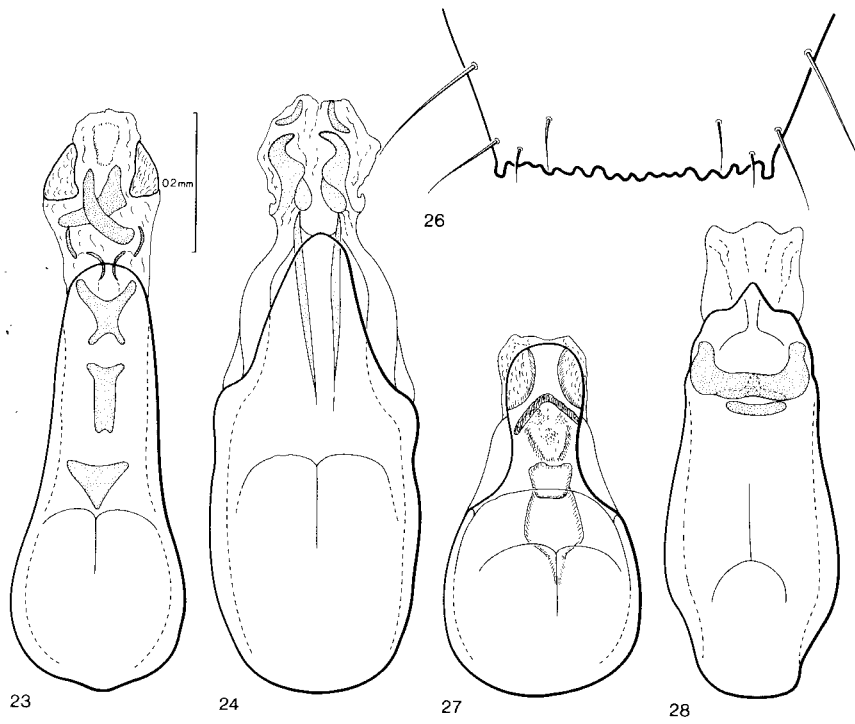
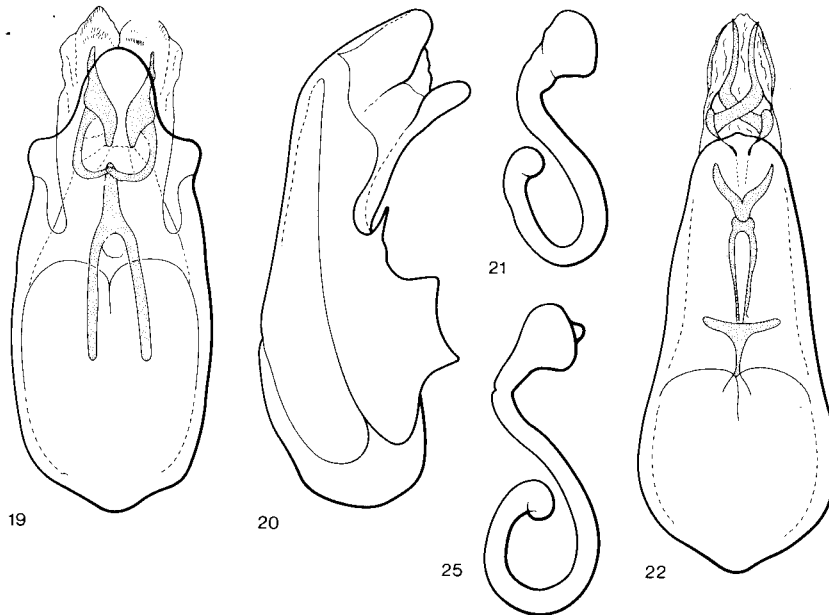
Figs. 26, 27

*Homalota comparabilis* Mäklin 1853:181–182.

"*Homalota comparabilis* Mäklin: elongata, subdepressa, nigra, geniculis tarsisque testaceis; antennis filiformibus, capite cum thorace longioribus; thorace basin

→

Figs. 19–28. 19–21, *Lypoglossa angularis*. 19, 20, aedoeagus in ventral and lateral views. 21, spermatheca. 22, *Devia prospera*, aedoeagus in ventral view. 23, *Devia congruens*, aedoeagus in ventral view. 24–25, *Lypoglossa fenyesi*. 24, aedoeagus in ventral view. 25, spermatheca. 26–27, *Adota comparabilis*. 26, apical margin of male 8<sup>th</sup> tergite. 27, aedoeagus in ventral view. 28, *Emplenota litoralis*, aedoeagus in ventral view.



versus angustato elytrisque subtiliter coriaceis, vix visibiliter confertissime punctulatis; illo longitudinaliter obsolete canaliculato; his thorace tertia parte longioribus; abdomine dense evidentius punctato.

"Longit. fere 2 lin. Latit. parum ultra  $\frac{1}{3}$  lin.

"In insula Kadjak a D. Holmberg rarissime capta.

"Statura corporis *H. maritimae* Eschsch. (Mannerh. *Bullet. de la Soc. de Moscou*. 1843. p. 224. 102) affinis et similis, sed multo major, minus depressa, thorace longiore et in aliis diversa. Ad div. I. operis Col. Erichson referenda. Variat pedibus totis fusco-testaceis. In individuo unico thorax punctis duobus impressis signatus est. ("Mäklin")."

The species belongs to the genus *Adota* Casey 1910 (*Panalota* Casey 1910). Length 4.1 mm. Eyes flat, their diameter equal to postocular region seen from above; dorsal surface, except abdomen, dull, with extremely fine and dense punctation, appreciable only at higher magnification ( $\times 50$ ). Basal impressions of tergites 3–6 very distinct, punctation of each tergite rather strong on posterior half and becoming weak to nearly missing toward base. Abdomen less shining than that of *A. maritima* Mannh., surface with microsculpture of narrow rounded meshes, similar to that of all species of this genus we have seen. Head 0.62 mm wide; pronotum 0.82 mm wide, 0.62 mm long; elytra combined 1.25 mm wide, suture 0.75 mm long, sides 1.0 mm long; abdomen 1.0 mm wide. Male: Apical margin of 8<sup>th</sup> tergite truncate, extremely finely crenulate and with a stronger lateral tooth on each side (Fig. 26); last sternite long, parabolic. Aedeagus as in Figure 27.

There are 3 specimens in the Mannerheim collection: 1 among the undetermined material from Kenai, the second without a locality label and the third from Kodiak, the *locus typicus*. The last specimen is designated as the lectotype. It is labelled: Kadjak: Holmberg; Coll. Mäkl. *Homalota comparabilis* mihi Kadjak pr. Holmberg.; Mus. Zool. H. fors Spec. typ. 2237 *Homalota comparabilis* Mäkl. We added the label: *Homalota comparabilis* Mäklin Lectotypus, Lohse fix. 1983.

We have seen no other specimens of *A. comparabilis*, neither in the Casey collection nor in the Canadian National Collection. As Brundin (1943) described 3 other species of this genus from single females from the northeastern coasts of Kamchatka and Japan, we ran *A. comparabilis* through their descriptions, but there is no match.

*Homalota litoralis* Mäklin 1853

Figs. 28, 29

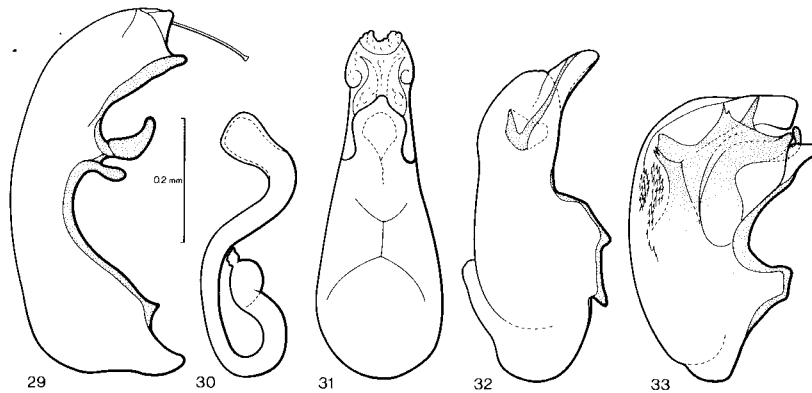
*Homalota litoralis* Mäklin 1853:182.

"*Homalota litoralis* Mäklin: depressa, nigra, opaca, pube grisea subrigida dense vestita, elytris flavis, lateribus latus, basi angustius nigro-fuscis, pedibus piceis, tarsis testaceis: antennis crassiusculis, capite cum thorace brevioribus; thorace leviter transverso, posterius ante basin latissime transversim impresso, confertim subtilissime punctulato; elytris thorace vix longioribus, dense at minus confertim et paulo evidentius quam thorax punctatis; abdomine vix nitido, parcius et parum profunde punctato, segmento ultimo subtiliter densius granulato.

"Longit. fere 2 lin. Latit. ultra  $\frac{1}{3}$  lin.

"Habitat in insula Kadjak; a D. Holmberg rarissime inventa. ("Mäklin")."

This species belongs to the genus *Emplenota* Casey 1884 [not to be considered as a subgenus of *Aleochara* Gravenhorst (1802)]; it is conspecific with *Emplenota longiceps* Casey (types compared); the names *E. longiceps* and *E.*



Figs. 29–33. 29, *Emplenota litoralis*, aedeagus in lateral view. 30, *Liogluta vasta*, spermatheca. 31, *Oxypoda irrasa*, aedeagus in ventral view. 32, *Dimetrota picipennis*, aedeagus in lateral view. 33, *Philhygra laevicollis*, aedeagus in lateral view.

*maritima* Casey are junior synonyms of *E. litoralis* (Klimaszewski 1984). Aedeagus as in Figures 28, 29.

There is only 1 specimen in the Mannerheim collection, which is hereby designated as the lectotype. It is labelled: Kadjak; Holmberg; Coll. Mäkl. Homalota litoralis mihi, Kadjak, Hlb.; Mus. Zool. H. fors Spec. typ. No. 2246 Homalota litoralis Mäkl. We added the label: Homalota litoralis Lectotypus, Lohse design. 1983.

DISCUSSION. Seevers (1978) assigned *H. litoralis* in his genus *Xenota*. He included in this genus many species of several genera, such as *Adota* (*A. maritima* Mannh., *A. subintima* Csy.), *Liogluta* (*L. kansana* Csy., *L. nevadensis* Csy.), *Dimetrota* (*D. alaskana* Csy., *D. vacunalis* Csy.), *Stethusa*, etc. The genus *Xenota sensu* Seevers is therefore merely an assemblage of heterogeneous taxa and has nothing to do with *Xenota* Mulsant and Rey (type species *Homalota myrmecobia* Kraatz 1856).

*Homalota vasta* Mäklin 1853

Fig. 30

*Homalota vasta* Mäklin 1853:183.

“*Homalota vasta* Mäklin: latiuscula, nigra, nitida, antennarum basi pedibusque testaceis, elytris piceo-testaceis, angulis apicalibus nonnihil nigricantibus; antennis capite cum thorace vix longioribus, apicem versus sensim incrassatis; thorace transverso, subtiliter obsolete punctato, ante scutellum obsolete longitudinaliter impresso; elytris thorace paulo longioribus, dense et multo evidentius quam thorax punctatis; abdomine segmentis primis parcissime subtiliter punctatis, ultimis fero omnino laevigatis.

“Longit. 1½ lin. Latit. fere ½ lin.

“A.D. Holmberg in insula Sitkha semel capta.

“Ad div. 2 operis Cel. Erichson referenda. (“Mäklin”).”

Length 4.0 mm. This species belongs to the genus *Liogluta* Thomson. Head narrower than pronotum (1:1.28), eyes flat, postocular region 1½ times as long as their length seen from above; tempora flat, arcuate, head broadest behind

eyes. Scattered punctation of head nearly invisible among microsculpture of narrowly rounded meshes. Pronotum as broad as elytra at shoulders, broadest before middle, laterally narrowed in nearly straight line to obtuse hind angles; punctation dense, surface with microsculpture of narrowly rounded meshes. Proportions of pronotum (length : width) = 1:1.33. Pattern of pubescence of type II (after Hoeg 1945), as usual in *Liogluta*. Elytra broad, their suture (without scutellum) as long as pronotum at midline. Legs as in other *Liogluta* species with segments 1-4 decreasing in length distad, basal segment longer than 5<sup>th</sup>.

There are 2 specimens in the Mannerheim collection; 1 of them belongs to the genus *Boreophilia* and does not agree with the description; the other one was designated as the lectotype. It is labelled: Sitka; Holmberg; Homalota vasta m., Sitkha; Typus; Mus. Zool. H. fors Spec. Typ. No. 2250 Homalota vasta Mäkl. This specimen is missing the 7<sup>th</sup> and 8<sup>th</sup> abdominal segments. We added the label: Homalota vasta Mäkl. Lectotypus, Lohse fix. 1983.

This unusually broad *Liogluta* seems to be very rare; it is not represented in the Casey collection. We found only 1 female in the Canadian National Collection, the spermatheca of which is shown in Figure 30. This specimen is from the Yukon Territory, Dempster Hwy., mi 45, 3,500', VII.14.1968, Campbell and Smetana.

DISCUSSION. Seevers (1978:262) assigned *L. vasta* to the genus *Athetalia* Casey 1910; this shows that he had an incorrect concept of *Athetalia*, otherwise he would have remarked that *Athetalia* has a tarsal formula of 5, 5, 5 (and not 4, 5, 5 as in Casey's description) and is related to *Isoglossa* Casey 1893. *Liogluta vasta* and the 2 other species included by Seevers in *Athetalia* (*A. metlakatana* Bernhauer and *A. oregonensis* Bernhauer), have a tarsal formula of 4, 5, 5 and belong near *Athetalia*.

*Oxygoda irrasa* Mäklin 1853

Fig. 31

*Oxygoda irrasa* Mäklin 1853:183.

"*Oxygoda irrasa* Mäklin: nigra, opaca, subtilissime et confertissime punctulata; fusco-pubescentis, elytris obscure fuscis, pedibus testaceis; thorace convexo, aequali.

"Var. b. elytris rufo-piceis.

"Longit. 1½ lin. Latit. ½ lin.

"In insula Sitkha a D. Holmberg semel, et in parte interiore peninsulae Kenai a D.F. Frankenhaeuser rarissime inventa.

"O. opacae Grav. statura corporis admodum similis, sed paullo angustior et multo minor. ("Mälkin")."

Length 3.2 mm. Fusiform, similar in habitus to *Oxygoda induta* Mulsant and Rey. Antennae strong, as long as pronotum and elytra combined, segment 3 shorter than 2, twice as long as wide, segment 4 quadrate, segments 5-10 increasing in size, but only slightly broader than long, segment 11 as long as segments 9 and 10 combined. Head rounded, somewhat broader than long, 2/3 as wide as pronotum. Eyes of medium size, their length seen from above equal to that of postocular region. Pronotum broadest near base, slightly narrower than the elytra at shoulders, 1.4 times wider than long, laterally arcuate and narrowed toward apex, pattern of pubescence of type II (after Hoeg 1945), as in nearly all Palaearctic species of *Oxygoda*, whereas most Nearctic species have the pronotal pubescence of type V (hairs directed more or less caudad). Elytra rather long, somewhat widened caudad, their suture as long as pronotum,



combined  $\frac{1}{4}$  wider than their length at shoulders. Abdomen acuminate caudad. Male: Aedoeagus of a specimen from Kenai, Anchor River, in the Canadian National Collection is illustrated here (Fig. 31).

There are 2 specimens in the Mannerheim collection belonging to 2 different species: the specimen which agrees with the description was designated as the lectotype. It is labelled: *Oxypoda irrasa* Mäklin; Kenai; Mus. Zool. H. fors Spec. typ. 2268 *Oxypoda irrasa* Mäkl. We added the label: *Oxypoda irrasa* Mäklin Lectotypus, Lohse fix. 1983.

The species seems to be rare. There are no specimens in Casey's collection. There are a few specimens from Alaska in the Canadian National Collection: Kenai Pen., Anchor Riv. at Hwy., 450', 4.VI.1978, Smetana and Becker; Kenai Pen., Clam Gulch, 6.VI.1978, Smetana and Becker; and Denali St. Pk., Byers Lake Cpgd, 26.VI.1978, Smetana and Becker.

## LITERATURE CITED

- BENICK, G. 1973. Die von Prof. Dr. Z. Kaszab in der Mongolei gesammelten Arten der Subfamilie Athetae (Col. Staphyl.). *Nouv. Rev. Ent.* 3:211-217.
- BERNHAEUER, M. 1906. Neue Aleocharinen aus Nordamerika (II. Teil). *Deutsche Ent. Ztschr.* 1906:337-348.
- . 1907. Neue Aleocharini aus Nordamerika (3. Stück). *Deutsche Ent. Ztschr.* 1907:381-405.
- BLACKWELDER, R. E. 1952. The generic names of the beetle family Staphylinidae. *Bull. U.S. Nat. Mus. No. 200.* 483 pp.
- BRUNDIN, L. 1943. Zur Kenntnis einiger in die *Atheta*-Untergattung *Metaxyia* Muls. et Rey gestellten Arten. *Acta Univ. lundensis (N.F.)* 54:19-25.
- . 1953. Die palaearktischen Arten der *Atheta*-Untergattung *Dimetrota* Muls. et Rey. *Ark. Zool.* 5:369-434.
- CASEY, T. L. 1884. Contributions to the descriptive and systematic coleopterology of North America. Part I. Philadelphia. 60 pp.
- . 1893. Coleopterological notices. V. *Ann. N.Y. Acad. Sci.* 7:281-606.
- . 1910. New species of the staphylinid tribe Myrmedoniini. *Memoirs on the Coleoptera* 1:1-183.
- FAUVEL, A. 1875. Faune Gallo-Rhénane, Caen. pp. 545-738.
- FENYES, A. 1918. Aleocharinae. *Genera Insectorum. Fasc. 173A,* pp. 1-110.
- . 1920. Aleocharinae. *Genera Insectorum. Fasc. 173B,* pp. 111-414.
- GRAVENHORST, J. L. C. 1802. *Coleoptera Microptera Brunsvicensia. Brunsvigae,* 66 + 206 pp.
- HOEG, N. 1945. Beitrag zur Systematik der Aleocharinen. *Ent. Meddel.* 24:264-286.
- KLIMASZEWSKI, J. 1984. A revision of the genus *Aleochara* Gravenhorst of America north of Mexico (Coleoptera: Staphylinidae, Aleocharinae). *Memoirs Ent. Soc. Can. No. 129.* 211 pp.
- KRAATZ, G. 1856-1858. Staphylinii. *Naturgeschichte der Insecten Deutschlands. II.* Berlin, 8 + 1,080 pp.
- MÄKLIN, F. 1852. *In: Mannerheim, C. Zweiter Nachtrag zur Kaefer-Fauna der Nord-Amerikanischen Laender des Russischen Reiches. Bull. Soc. Imp. Nat. Moscou* 25:283-387.
- . 1853. *In: Mannerheim, C. Dritter Nachtrag zur Kaefer-Fauna der Nord-Amerikanischen Laender des Russischen Reiches. Bull. Soc. Imp. Nat. Moscou* 26:95-273.
- MANNERHEIM, C. G. 1831. Précis d'un nouvel arrangement de la famille des Brachélytres de l'ordre des insectes Coléoptères. *Mem. Ac. Sci. St. Pétersb.* 1:415-501.
- . 1843. Beitrag zur Kaefer-Fauna der Aleutischen Inseln, der Insel Sitkha und Neu-Californiens. *Bull. Soc. Imp. Nat. Moscou* 16:175-314.
- . 1846. Nachtrag zur Kaefer-Fauna der Aleutischen Inseln und der Insel Sitkha. *Bull. Soc. Imp. Nat. Moscou* 19:501-516.

- MULSANT, M. E., AND C. REY. 1873a. Histoire naturelle des Coléoptères de France Brévipennes. Aléochariens. Myrmédoniaires I. Paris, 695 pp.
- , AND ———. 1873b. Description de divers coléoptères brévipennes nouveaux ou peu connus. Op. Ent. 15:147–189.
- PALM, T. 1970. Svensk Insektfauna. 9. Coleoptera. Fam. Staphylinidae. H.6. Underfam. Aleocharinae. (*Atheta*). Stockholm, pp. 113–296.
- SCHNEERPELTZ, O. 1934. Coleopterorum Catalogus, Pars 130, Staphylinidae VIII: Supplementum, pp. 1501–1881.
- . 1968. Catalogus Faunae Austriae, Teil XV. Wein, pp. 1–279.
- SEEVERS, C. H. 1978. In: A generic and tribal revision of the North American Aleocharinae. Seevers, C. H., and L. H. Herman (editors). Fieldiana Zool. 71:1–289.
- THOMSON, C. G. 1858. Försök till uppställning af Sveriges Staphyliner. Öfv. Kön. Vet. Akad. Förh. 15:27–40.
- ZETTERSTEDT, J. W. 1828. Fauna Insectorum Lapponica. Hammone, 20 + 563 pp.

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#### LITERATURE NOTICES

- BARANOWSKI, R. 1985. Two new species of *Cercyon* Leach from boreal Sweden (Coleoptera: Hydrophilidae). Ent. Scand. 15:341–347.
- KIRKENDALL, L. R. 1984. Long copulations and post-copulatory "escort" behaviour in the locust leaf miner, *Odontota dorsalis* (Coleoptera: Chrysomelidae). J. Nat. Hist. 18:905–919.
- KOEHLER, H. 1984. Zum Nahrungsspektrum und Nahrungsumsatz von *Pterostichus oblongopunctatus* und *Pterostichus metallicus* (Coleoptera, Carabidae) im Ökosystem "Buchenwald." Pedobiologia 27:171–183.
- BASILEWSKY, P. 1984. Nouvelle contribution à l'étude des genres *Hystrichopus* Boheman et *Plagiopyga* Boheman (Coleoptera Carabidae Lebiinae). Rev. Zool. Afr. 98:804–860.
- CHAMBERS, J., N. J. MCKEVITT, AND M. R. STUBBS. 1984. Nuclear magnetic resonance spectroscopy for studying the development and detection of the grain weevil, *Sitophilus granarius* (L.) (Coleoptera: Curculionidae), within wheat kernels. Bull. ent. Res. 74:707–724.
- SCHNEIDER, P. 1984. Flug und Flugmotor der Käfer. Mitt. Int. Ent. Ver. Frankfurt a.M. 9:25–43.
- EPSTEIN, M. E., AND H. M. KULMAN. 1984. Effects of aprons on pitfall trap catches of carabid beetles in forests and fields. Great Lakes Ent. 17:215–221.
- LARSON, D. J., AND A. N. NILSSON. 1985. The holarctic species of *Agabus* (*sensu lato*) Leach (Coleoptera: Dytiscidae). Can. Ent. 117:119–130.
- LEDoux, G. 1984. Nouveaux *Penetrechus* du Cachemire Indien (Coléoptères, Patrobinae). Anns Soc. ent. Fr. (N.S.) 20:399–409.
- ROUGON, D., AND CH. ROUGON. 1984. Description de la larve et de la nymphe d'*Onitis alexis* Klug (Coleoptera, Scarabaeidae). Anns Soc. ent. Fr. (N.S.) 20:411–417.
- COIFFAIT, H. 1984. Contribution à la connaissance des Staphylinides de l'Himalaya (Coleoptera, Staphylinidae). Anns Soc. ent. Fr. (N.S.) 20:373–387.
- ALLEMAND, R., AND J.-C. MALAUSA. 1984. Compatibilité génétique et distance phylétiques entre les espèces du genre *Chrysocarabus* Thomson (Col., Carabidae). Anns Soc. ent. Fr. (N.S.) 20:347–363.
- BRANCUCCI, M. 1984. Notes on some species of the genus *Antiporus* (Coleoptera: Dytiscidae). Aquatic Insects 6:149–152.
- GRESSITT, J. L. 1984. Systematics and biogeography of the longicorn beetle tribe Tmesisternini. Pacific Insects Monogr. 41:263 pp.
- YATES, M. G. 1984. The biology of the oak bark beetle, *Scolytus intricatus* (Ratzeburg) (Coleoptera: Scolytidae), in southern England. Bull. ent. Res. 74:569–579.

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