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THE NORTH AMERICAN CERYLONIDAE (COLEOPTERA: CLAVICORNIA)¹

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INTRODUCTION

The Cerylonidae are a family of small to minute beetles (usually 2 mm. or less) which occur most commonly in forest litter and under bark. At present, there are about 40 genera and over 300 described species known from all of the major zoogeographic regions. Crowson (1955) first recognized the Cerylonidae as an independent clavicorn family, including the cerylonines and murmidiines, as well as *Euxestus* and its allies; but these groups have been treated as tribes of the heteromerous family Colydiidae by both Hetschko (1930) and Arnett (1968). In their world generic revision of the family, Sen Gupta and Crowson (1973) added *Anommatus* Wesmael, *Abromus* Reitter, and *Ostomopsis* Scott, while transferring *Eidoreus* Sharp (= *Eupsilobius* Casey) to the Endomychidae. The present paper consists of a revision of the 10 genera and 18 species of Cerylonidae occurring in America north of Mexico. With respect to the composition of the family and that of its major subordinate groups, we have followed the classification presented by Sen Gupta and Crowson; the interrelationships among the subgroups, however, are still obscure, so we have treated the Euxestinae, Anommatinae, Metaceryloninae (not North American), Murmidiinae, Ostomopsinae, and Ceryloninae as independent subfamilies.

The following abbreviations have been used in keys and descriptions: PL — pronotal length, PW — pronotal width, EL — elytral length, EW — elytral width, and TL — sum of PL and EL. The word "length" refers to the total length, including the head, and is

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not equivalent to TL. The word "ventrite" has been used for each of the five visible abdominal sternites; thus the first and last ventrite refer to abdominal sternites three and seven, respectively. Descriptions of pronotal and elytral punctation should be used with caution, since the apparent diameters of punctures may vary considerably with the angle of light.

A complete family definition and comparisons with related or similar groups have been provided by Sen Gupta and Crowson (1973). A brief summary will be given here. Adult Cerylonidae may be characterized as follows: 1) antennal insertions exposed; 2) antennal club compact, rarely with more than 2 segments; 3) corporotentorium with median anterior process; 4) procoxae small and rounded, with concealed lateral extensions; 5) mesocoxal cavities broadly closed outwardly by the sterna and joined by a straight line; 6) trochanters not or only weakly heteromeroid (obliquely attached to femur); 7) tarsal formula 4-4-4 (or rarely 3-3-3), the segments simple (or rarely the first lobed), with simple claws; 8) hindwing without a closed radial cell and with one anal vein, or with the first anal running into the subcubital fleck; 9) abdominal ventrites free, the first distinctly longer than the second; 10) aedeagus of the clavicorn type, lying on its side when retracted, often with a reduced tegmen. In addition, the majority of cerylonids are glabrous, and many have reduced antennal segmentation, aciculate maxillary palps, femoral lines, and a crenulate hind margin on the last ventrite.

Several of the above characters are shared with other families of the cerylonid series (Crowson, 1955), namely, the Sphaerosomatidae, Endomychidae, Coccinellidae, Corylophidae, Discolomidae, Mero-physiidae, and Lathridiidae. The broadly closed middle coxal cavities, characteristic tentorium, more or less compact antennal club rarely more than 2-segmented, and simple tarsi will distinguish the cerylonids from most of the above groups. Corylophids have similarly closed mesocoxal cavities, but the tentorium is reduced, the antennal club is 3-segmented and relatively loose, and the second tarsal segment is often lobed. Although cerylonids were formerly included in the family Colydiidae, members of the latter group are easily distinguished by having the basal three or four ventrites connate, the aedeagus of the pseudotrilobe type, and the trochanters strongly heteromeroid or the antennal insertions concealed.

Cerylonid larvae are elongate or oval in shape, without or with weakly developed frontal sutures, and with 0, 2, or 3 ocelli on each side of head. The antennae are relatively short, with the sensory

appendix longer than the terminal segment, the tarsungulus bears a single seta, and the spiracles are annular. In the more generalized forms, such as *Anommatus*, *Murmidius*, and the Euxestinae, the head is prognathous or somewhat inclined, and the mouthparts are of the normal clavicorn type, with a chewing, mola-bearing mandible and a short, blunt mala. In the Ceryloninae, however, the head is strongly hypognathous or opisthognathous, and the mouthparts form a highly modified piercing apparatus, in which both mandible and the mala are elongate and blade-like.

The flat, onisciform larvae of *Murmidius ovalis* (see Böving and Craighead, 1931; Halstead, 1968; Sen Gupta and Crowson, 1973) resemble those of the Discolomidae and certain Corylophidae. Discolomid larvae, however, have only 2-segmented maxillary palps, those of the Corylophidae have the labrum and clypeus fused, and both lack the characteristic bundles of long, barbed setae along the sides of the body. The larvae of *Euxestus* and *Hypodacne* bear a resemblance to certain Languriidae, especially *Cryptophilus*, in the form of the tergal processes, surface granulation and setation, and in the single tarsungular claw, but the latter group may be distinguished by the presence of a mandibular prosthema, bicameral spiracles, and 5 or 6 ocelli on each side of the head. Cerylonine larvae are similar in form to some of the smaller Endomychidae, but they are easily recognized by the modified piercing mouthparts.

Because of their small size, most cerylonids are collected by mass sampling techniques, and little is known of their food habits or life histories. The most frequented habitats for the group are leaf litter and rotten wood, especially cambium. Species of *Cerylon*, *Philothermus*, and *Mychocerus* are usually collected under bark, while those of *Lapethus* appear to be equally common in leaf litter and forest debris. A number of species have been recorded from ant nests: *Hypodacne punctata* is known from *Camponotus* galleries; *Aculagnathus mirabilis* Oke has been associated with *Amblyopone* in Australia; and two species of *Lapethus* have been collected in large numbers in the refuse deposits of the leaf-cutting ant *Atta mexicana*. *Elytrotetrantus chappuisi* (Jeannel and Paulian) is known from a mole-rat nest, while *Euxestus erithacus* Chevrolat was found breeding in bat guano in a Jamaican cave. Adults and larvae of certain Neotropical *Philothermus* have been taken in polypore fungi, but there were never more than a few individuals. Finally, *Murmidius ovalis* is known to feed on stored products of man.

Almost nothing has been recorded on the actual type of food material taken in by cerylonids. Several gut dissections were made

by one of us, but the particles were often impossible to identify. The larval gut contents of the *Euxestus* from bat guano contained a variety of hyphal sections and spores, while numerous darkly-pigmented spores of a single type were found in the adult proventriculus of a *Philothermus* collected under pine bark in Mexico. The proventriculus of *Cerylon castaneum* collected on dried mushrooms from a tree was filled with sculptured basidiospores, while that of the same species taken under conifer bark contained sections of hyphae, as well as spores. Those forms with piercing-sucking mouthparts have been assumed to be predators (Besuchet, 1972), but as yet there is no direct evidence supporting this hypothesis (*see below*).

Perhaps the most interesting feature of the subfamily Ceryloninae is the occurrence of piercing-sucking mouthparts in all known larvae and in adults of over 50 species in at least six genera. This condition may have evolved twice in the larval forms and several times in the adults (*see below*). The most highly specialized type of piercing apparatus in adult cerylonids occurs in the genus *Cautomus* and has been described and illustrated by Besuchet (1972). In this group, the labrum-epipharynx and the labium together form an elongate, tubular beak, in which are contained four pairs of stylets, each set consisting of a mandible and its lacinia mandibularis (prostheca), a galea, and a lacinia. The molar area of the mandible is absent, while both the mandibular apex and the prostheca are long and blade-like. The maxillary stylets are extremely long and thin and are attached to a basal fulcrum which allows them to be protracted; the lacinia bears fine recurved teeth and the galea is provided with hairs at the apex. Finally the pharynx is enlarged, forming a pharyngeal pump. This type of condition also occurs in *Axiocerylon* and its relatives, in the New World *Cerylcautomus*, and in a few species of *Lapethus*. Although the mechanics have not been studied, it is obvious that this represents a piercing-sucking organ similar to those found in various Diptera and Hemiptera.

Besuchet (1972) also discussed the transition from normal chewing mouthparts found in *Cerylon* to those in *Cautomus* through forms such as *Ectomicrus*, which exhibit an elongation of the labrum, mandibular apex, galea, and labium. The same type of intermediate condition may be found in species of *Lapethus* (figs. 11-12) and in certain *Philothermus*. In most of these species, the labrum and labium are somewhat elongate, the galea and lacinia are both stylet-like, the mola is usually present, and the mandibular apex retains two

or three small teeth, which appear to interlock with those of the opposite mandible. This type of mandible resembles that found in Collembola, and it may function in a similar way, with the apical teeth pulling hyphae or strands of wood into the mouth, where they are acted upon by the mola (Folsom, 1899; Macnamara, 1924). The maxillary lobes, although very long and stylet-like, have numerous fine hairs which may serve to gather spores or other particles into the mouth cavity. These mouthparts are somewhat similar to those found in the rhyptobiine Corylophidae (Paulian, 1950). In *Rhypobius* and its relatives, the maxilla has a single stylet, the mandible is divided, with a basal fulcrum and a long hooked apex, and both are enclosed within the head cavity when not in use.

The larvae of cerylonines have two different types of feeding mechanism. In *Philothermus* and *Lapethus*, the labrum and labium form a tubular beak, while the mandible and the mala are both modified into long, blade-like stylets. In addition, the pharynx is enlarged and a pair of salivary glands extend back into the thorax for a distance equal to the head length. These, like the *Cautomus* adults, have a well-developed piercing-sucking apparatus. The larval head, however, is strongly hypognathous, and not prognathous like that of the adult. The second type of feeding apparatus is found in the larvae of *Cerylon*. Here the head is opisthognathous with the labium short and fused to the thorax, and the mandibular and maxillary stylets completely enclosed within the head and apparently attached to a heavily sclerotized internal framework. This condition is remarkably similar to that found in the entognathous apterygote insects, such as the Diplura, Protura, and Collembola (Tuxen, 1959).

As mentioned above, the actual food source of these small and uncommon insects is often difficult to ascertain, and this is especially true for those species ingesting fluids, if this is the case. Although it would be an obvious conclusion that those cerylonids with piercing beaks are predators on small arthropods and nematodes, it is also possible that the beaks penetrate wood or fungal hyphae or that these substances are digested extra-orally. Another possibility is that spores or other objects less than 5 or 6 microns in length are moved into the labral-labial tube by suction or by the action of the setiferous galea; the apical openings of those beaks examined were at least 8 microns wide. Another matter to consider is the normal position of the head. In most of the adults with piercing beaks, the head is somewhat prognathous, so that predation would be possible on active prey species of various sizes. Most cerylonine larvae, however, are

strongly hypognathous, while that of *Cerylon* is opisthognathous with entognathous stylets. It is less likely that either larval type would be predaceous. It is hoped that observations on living specimens will provide more information on the feeding habits of both larvae and adults.

The evolution of piercing-sucking mouthparts has occurred at least two more times in the Coleoptera. Leiodid beetles of the genus *Myrmecholeva* Lea, which occur with ants in Australia, have a relatively robust, piercing beak and prognathous head, and they may be predators on ant larvae. The maxillary stylets are well-developed and blade-like in this group, but the mandibles are much shorter than the beak and do not appear to function as piercing organs. In the family Eucinetidae, members of an undescribed genus from the New World are extremely small (less than 1 mm.) with a hypognathous head and a labral-labial beak with an opening of about 5 microns; the mandibles in these insects are even further reduced, but the maxillary stylets are very long and fine. A detailed comparison of piercing-sucking feeding mechanisms in beetles will be included in a paper now in preparation by J. F. Lawrence and T. F. Hlavac.

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Key to the Genera of North American Cerylonidae

1. Frontoclypeal suture present; terminal segment of maxillary palp at least $2 \times$ as long as and more than $0.5 \times$ as wide as segment 3, which is shorter than or subequal to segment 2; last ventrite not or very finely crenulate. 2
- Frontoclypeal suture absent; terminal segment of maxillary palp aciculate, shorter than and less than $0.5 \times$ as wide as segment 3, which is longer than segment 2; apex of last ventrite always strongly crenulate (fig. 1). 7
2. Procoxal cavities closed behind; length at least 2 mm.; body oval and highly convex, with smooth, even, lateral edges and no antennal cavities. *Hypodacne* LeConte
- Procoxal cavities open behind; length less than 1.5 mm.; without other characters in combination. 3
3. Prothorax without antennal cavities; lateral edges of pronotum crenulate or serrate; metasternum and first ventrite without femoral lines; tarsi 3-segmented; body more elongate, TL/EW more than 1.75. 4
- Prothorax with antennal cavities; lateral edges of pronotum smooth; metasternum and first ventrite with femoral lines; tarsi 4-segmented; body round or oval in outline, TL/EW less than 1.75. 5
4. Lateral margins of pronotum crenulate; eyes absent; body elongate, TL/EW about 2.5; elytra with 7 rows of punctures bearing very short, fine hairs; procoxal cavities very narrowly separated, the intercoxal process depressed and less than $0.2 \times$ a coxal width. *Anommatus* Wesmael
- Lateral margins of pronotum serrate; eyes present; body oblong, TL/EW less than 2.0; elytra with 10 rows of punctures bearing longer, suberect hairs; procoxal cavities more widely separated, the intercoxal process not depressed and at least as wide as one coxa. *Ostomopsis* Scott
5. Antennal cavities of prothorax dorsal, easily visible from above (fig. 21); antennae 10-segmented; body strongly convex and elytral punctation seriate. *Murmidius* Leach
- Antennal cavities of prothorax ventral, not visible from above; antennae with less than 10 segments; body flattened or elytral punctation confused. 6
6. Body distinctly flattened; antennae 9-segmented; elytral punctation seriate; mesosternum truncate anteriorly; metasternal suture present. *Mychocerus* Erichson

- Body strongly convex; antennae 8-segmented; elytral punctation confused; mesosternum rounded anteriorly; metasternal suture absent. *Botroodus* Casey
- 7. Prothorax with large, ventral, antennal cavities, situated laterally and formed primarily from the hypomera; metasternum and first ventrite with femoral lines; antennae 8-segmented.
..... *Lapethus* Casey
- Prothorax without antennal cavities, or with smaller, mesal cavities, formed entirely from the prosternum; metasternum and abdomen without femoral lines; antennae 10- or 11-segmented. 8
- 8. Prosternum raised mesially and excavate laterally, forming two shallow antennal cavities; labrum acute at apex, beak-like; length less than 1.3 mm.; antennae 10-segmented, with a 1-segmented club. *Cerylautomus* Sen Gupta and Crowson
- Prosternum without antennal cavities; labrum not acute; length more than 1.3 mm. 9
- 9. Procoxal cavities open behind or narrowly closed, the postcoxal bridge at apex less than 0.25 × as wide as cavity (fig. 9); intercoxal process of prosternum not widened behind; mesosternum concave; antennae 11-segmented with a 2-segmented club; lateral margins of pronotum visible for their entire lengths from above. *Philothermus* Aubé
- Procoxal cavities broadly closed behind, the postcoxal bridge more than 0.5 × as wide as cavity (fig. 10); intercoxal process of prosternum strongly widened posteriorly; mesosternum flat or slightly convex; antennae 10-segmented with 1-segmented club; lateral margins of pronotum not visible for their entire lengths from above. *Cerylon* Latreille

Euxestinae Grouvelle

As used here, this group is equivalent to the tribe Euxestini described and delimited by Sen Gupta and Crowson (1973), and including the Cycloxenini and Tachyoryctidiini of Jeannel and Paulian (1945). Sen Gupta and Crowson admitted that those characters shared by the Euxestini, the Anommatini, and the Metacerylonini of Heinze (1944) are, for the most part, primitive for the family, and that all three tribes might be given subfamily rank. Of the eight known genera, only one, *Hypodacne*, occurs in America north of Mexico. The genus *Euxestus* Wollaston, however, includes a widely distributed Neotropical species which might be expected to occur in southern Florida (see below).

Hypodacne LeConte

Hypodacne LeConte, 1875: 170. Type species, by monotypy, *H. punctata* LeConte.

Euxestus, of authors (not Wollaston).

Sen Gupta and Crowson resurrected LeConte's name for a group of species, usually included in *Euxestus*, which have simple tarsi, lacking the characteristic ventral lobe on the first tarsal segment. In addition to the North American *H. punctata*, several Australian and New Zealand species are included.

Hypodacne punctata LeConte

(Fig. 20)

Hypodacne punctata LeConte, 1875: 171. Type locality: Eastern United States. Holotype, No. 6763 M.C.Z.

This species is easily distinguished from other North American cerylonids by the highly convex and oval body, which is longer than 1.5 mm., widely separated and posteriorly closed procoxal cavities, distinct frontoclypeal suture and characteristic antennal club, and the lack of pronotal antennal cavities, femoral lines on the abdomen, and crenulations on the last visible ventrite. The related *Euxestus erithacus* Chevrolat occurs in the Greater Antilles and might be found in southern Florida, but that species is smaller in size and bears a distinct ventral lobe on the first tarsal segment, a feature absent in *Hypodacne*.

Distribution. Known from scattered localities throughout eastern North America, from southern Ontario to Florida and west to Kansas and Texas.

Biology. According to Stephan (1968), this species occurs in the galleries of carpenter ants (*Camponotus*) in southern Ontario. Specimens were observed crawling on walls of carpenter ant galleries in oak, elm, and beech. The larva of *H. punctata* is unknown, but that of the Australian species, *H. bivulneratus* (Lea), was described by Sen Gupta and Crowson (1973: 381) from specimens collected in leaf litter and decayed wood.

Anommatinae Ganglbauer

This subfamily includes the two Palaearctic genera *Abromus* Reitter and *Anommatus* Wesmael, the latter of which has been introduced into North America. Ganglbauer (1899) originally considered this tribe to be related to cerylonids, but Crowson (1955)

placed the group in his Merophysiidae. Sen Gupta and Crowson (1973) recognized its affinities to the Cerylonidae, and especially the Euxestinae, after the description of the *Anommatus* larva by Dajoz (1968).

Anommatus Wesmael

Anommatus Wesmael, 1835: 338. Type species, by monotypy, *A. terricola* Wesmael [= *A. duodecimstriatus* (Müller)].

This genus is native to Europe, where it is represented by 49 species. It has been recently revised by Dajoz (1965).

Anommatus duodecimstriatus (Müller)

(Fig. 23)

Lyctus duodecimstriatus Müller, 1821: 190. Type locality: Odenbach, Germany. (For complete synonymy, see Dajoz, 1965.)

This species may be distinguished by the elongate form, distinct frontoclypeal suture, apparently 1-segmented antennal club, 3-segmented tarsi, and the lack of eyes or wings. It superficially resembles the eyeless colydiid *Aglenus brunneus* (Gyllenhal), which differs by having a 3-segmented antennal club, 4-segmented tarsi, and hidden antennal insertions.

Distribution. Fairly widely distributed in Europe and extending at least to Turkey and Algeria. Recorded also from Madeira, St. Helena, South Africa, Chile, Tasmania and North America (Cooper, 1962). North American specimens collected at Rochester, New York (Cooper, 1962; Peck, 1972); Cincinnati, Ohio (Dury, 1928); and Lake Forest, Lake Co., Illinois (W. Suter, Nov. 7, 1959).

Biology. Adults have been collected from litter and damp soil under railroad ties, under stones, around grass roots, and from grass cuttings. The Illinois specimen was taken in a tree hole. Larvae have been found in soil at the base of a tree and in leaf mold (Dajoz, 1968; Sen Gupta and Crowson, 1973). No males have been found in North America, and Cooper (1962) and Peck (1972) have postulated that our populations may be parthenogenetic.

Murmidiinae Jacquelin DuVal

This corresponds to the Murmidiinae of Sen Gupta and Crowson, except for the exclusion of *Ostomopsis* (see Ostomopsinae below). The group may be characterized by the presence of a frontoclypeal

suture and prothoracic antennal cavities, and it includes the three genera *Murmidius*, *Mychocerus*, and *Botrodoxus*, all of which are represented in North America. Casey (1895) also included the Lapethini and the Eupsilobiini, with the single genus *Eupsilobius*. According to Sen Gupta and Crowson (1973), the lapethines should be transferred to the Ceryloninae, while *Eupsilobius* Casey, a junior synonym of *Eidoreus* Sharp, should constitute a distinct subfamily of Endomychidae.

Murmidius Leach

Murmidius Leach, 1822: 41. Type species, by monotypy, *M. ferrugineus* Leach [= *Murmidius ovalis* (Beck)].

Ceutocerus Germar, 1824: 85. Type species, by monotypy, *C. advena* Germar [= *Murmidius ovalis* (Beck)].

This genus contains five Neotropical species and five from the Old World. One of the latter, *M. ovalis*, has been introduced in stored products to many parts of the world, including North America. Hinton (1942b) provided a key to the Old World species.

Murmidius ovalis (Beck)

(Fig. 21)

Histor ovalis Beck, 1817: 7. Type locality: Bavaria.

Murmidius ferrugineus Leach, 1822: 41.

Ceutocerus advena Germar, 1824: 85.

This species may be distinguished by its small size (1.2-1.4 mm.), oval, convex body with seriate elytral punctation, dorsal antennal cavities, 10-segmented antennae with a 1-segmented club, and 4-segmented tarsi.

Distribution. Cosmopolitan. In North America, recorded from Alaska, California, Kansas, Illinois, Ontario, New York, Maryland, District of Columbia, Louisiana, and Florida.

Biology. Usually associated with stored products and often found in granaries and warehouses. Reported from fruits and seeds, Indian corn, rice, wheat, flour, hay, straw, gall-nuts, oak-galls, ginger, and pepper, and also collected in dead leaves and cut grass (Hinton, 1945; Halstead, 1968). The larva, which is flat and onisciform, with barbed setae, has been illustrated by Boving and Craighead (1931) and Halstead (1968), while the last author figured the pupal cocoon and gave additional information on life history and development.

Mychocerus Erichson

Mychocerus Erichson, 1845: 292. Type species, by monotypy, *M. ferrugineus* Erichson.

This New World genus contains five species, two of which occur in America north of Mexico. The described Seychelles species, *M. alluaudi* Grouvelle, was transferred to *Lapethus* by Hinton (1936). Grouvelle (1895) also included *Philothermus gibbulus* Reitter (1876), without giving his reasons; although Reitter's type has not been seen, the description of *gibbulus* could hardly apply to a species of *Mychocerus*. The species of *Mychocerus* may be distinguished by the small size and flattened form, 9-segmented antennae with a 1-segmented club, anteroventral antennal cavities, and seriate elytral punctation. The literature is somewhat confused as to the type species for this genus. In the original description, Erichson mentioned that three species were included in his genus, but he named one from Cuba, "*M. ferrugineus* Nob." Since the genus was described in the same paragraph, this must constitute the species description as well, and thus *M. ferrugineus* is the only included species and the type. We have not seen the Cuban species, but we are assuming that it is congeneric with *M. depressus*, which LeConte (1869) placed in *Mychocerus*, and which is usually considered the type.

Key to the North American *Mychocerus*

1. Sides of pronotum gradually converging near apex, not angulate; lateral lines of mesosternum subparallel for most of their lengths, abruptly converging anteriorly, each line posteriorly forming an abrupt angle (about 120°) with the metasternal line (fig. 2); apical edge of prosternum slightly emarginate; size smaller, length usually less than 1 mm.; eastern North America. *M. depressus* LeConte
- Sides of pronotum abruptly converging near apex, so that the lateral edge is more angulate; lateral lines of mesosternum converging from base to apex, each line posteriorly forming a wider angle (about 150°) with the metasternal line (fig. 3); apical edge of prosternum more deeply emarginate; size larger, length usually more than 1 mm.; Arizona and northern Mexico. *M. arizonensis*, n. sp.

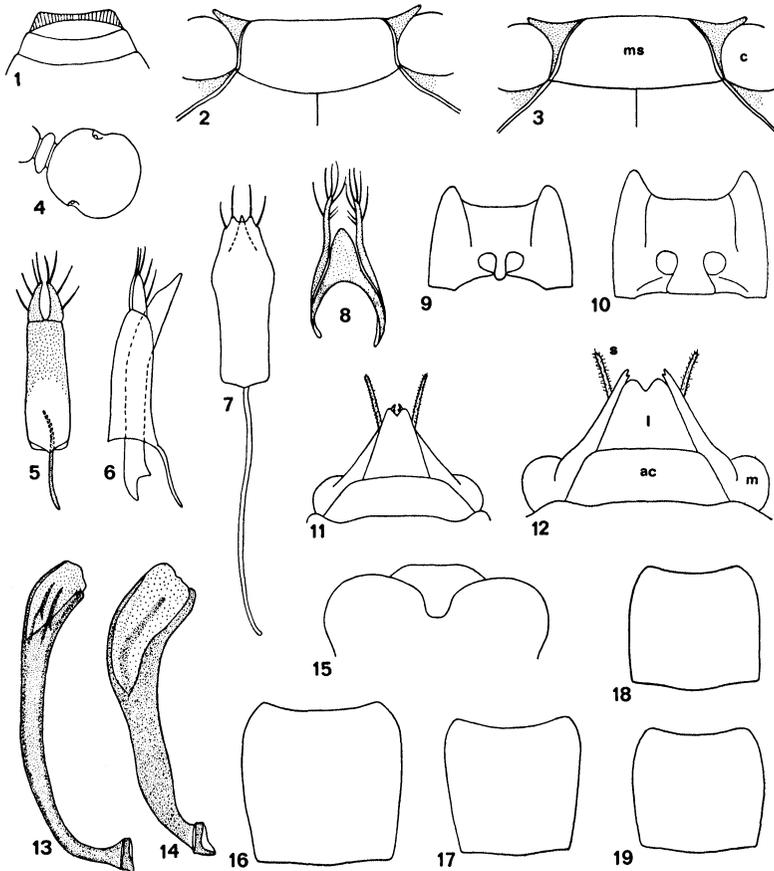


Fig. 1. *Cerylon unicolor* (Ziegler), fifth ventrite, posteroventral view. Fig. 2. *Mychocerus depressus* LeConte, mesosternum and portion of metasternum. Fig. 3. *Mychocerus arizonensis*, n. sp., same (ms = mesosternum; c = coxa). Fig. 4. *Ostomopsis neotropicalis*, n. sp., antennal club. Fig. 5. *Mychocerus arizonensis*, tegmen, dorsal view. Fig. 6. *M. arizonensis*, aedeagus, lateral view. Fig. 7. *Ostomopsis neotropicalis*, tegmen, dorsal view. Fig. 8. *Philothermus occidentalis*, n. sp., tegmen, dorsal view. Fig. 9. *P. occidentalis*, prothorax, ventral view. Fig. 10. *Cerylon unicolor* (Ziegler), prothorax, ventral view. Fig. 11. *Lapethus striatus* (Sen Gupta and Crowson), anterior portion of head, dorsal view. Fig. 12. *Lapethus discretus* Casey, same (ac = anteclypeus, l = labrum, m = mandible, s = maxillary stylet). Fig. 13. *Cerylon conditum*, n. sp., aedeagus, lateral view. Fig. 14. *Cerylon distans*, n. sp., same. Fig. 15. *Cerylon castaneum* Say, male, clypeus and labrum. Fig. 16. *Cerylon conditum*, male, pronotum. Fig. 17. *C. castaneum*, male, pronotum. Fig. 18. *C. unicolor*, female, pronotum. Fig. 19. *C. unicolor*, male, pronotum.

Myhocerus arizonensis, New Species

This species may be distinguished from either *M. depressus* or *M. pilifer* Lewis (1888: 241) by the larger size and by the shape of the pronotum, which is more abruptly narrowed apically. From *M. depressus* it also differs in the form of the mesosternal lines.

Description. Length 1.1-1.3 mm. Color reddish-brown; vestiture of short, fine, decumbent, yellow hairs, which are barely visible under 25 \times magnification. Antennae with segments 4-6 distinctly serrate, the club about 1.35 \times as long as wide. Pronotum about 0.48 \times as long as wide, sides subparallel for basal three-fourths, abruptly converging apically, the apical angles produced and subacute; lateral margins distinct and slightly elevated, especially towards base; disc slightly convex; punctation somewhat irregular, coarser than in *M. depressus*. Elytra about 1.15 \times as long as wide and 3.0 \times as long as pronotum, widest at apical fourth; rows of punctures lightly impressed and not distinct, the punctures smaller than those of *M. depressus*, intervals shiny, but with a fine reticulation. Apical edge of prosternum distinctly concave; mesosternal lateral lines gradually converging anteriorly, each line posteriorly forming an angle of about 150 $^{\circ}$ with the line of the metasternum (fig. 3). Aedeagus about 0.6 \times as long as abdomen, parameres longer and narrower than those of *M. depressus*, about 3 \times as long as wide at base (figs. 5-6).

Types. Holotype, 3 mi. NW Arivaca, Pima Co., ARIZONA, Dec. 21, 1969, under bark of mesquite (K. Stephan) [No. 32239 M.C.Z.]. Paratypes: ARIZONA: Pima Co.: 11, same data as holotype; 5, same locality, Jan. 25, 1970, under bark of mesquite (K. Stephan) [KS, MCZ, USNM]. Four other specimens were collected at East Stronghold, Cochise Co., Arizona, April, 1972 and 1973, by K. Stephan, and a single specimen was collected 10 mi. SE Alamos, Sonora, Mexico, Oct. 1972 (D. Chandler).

Distribution. Southeastern Arizona and southern Sonora, Mexico. In Arizona, known from low elevations in the extreme southern part of the state and from higher elevations in the Chiricahua Mountains.

Biology. Individuals from the lowland Arizona population were taken under dry mesquite bark and were not associated with running wounds. Those from the montane locality were collected under oak bark.

Mychocerus depressus (LeConte)

(Fig. 22)

Murmidius depressus LeConte, 1866: 376. Type locality: Washington, D.C. Holotype, No. 6829 M.C.Z.

This is the smallest cerylonid in our fauna, seldom exceeding 1 mm. in length. It is very similar to *M. arizonensis*, but may be distinguished by the smaller size, more gradually narrowed pronotal apex, subparallel mesosternal lines which form a more abrupt angle with the lines on the metasternum, and shorter, broader parameres (about twice as long as wide at base). The pronotal punctation in *M. depressus* is finer than that of *arizonensis*, while the elytral punctures are larger and more distinct. According to Lewis (1888), the Guatemalan species, *M. pilifer*, is about the same size, but has a differently shaped pronotum and less distinct elytral punctation.

Distribution. Known from scattered localities in eastern North America, from southern Ontario south to Florida and west to eastern Texas.

Biology. Adults have been collected under fungus-infested bark of oak, and also under bark of beech and hickory. The larva is unknown.

Botrodus Casey

Botrodus Casey, 1890: 319. Type species, by monotypy, *B. estriatus* Casey.

This New World genus contains only two described species, *B. estriatus*, discussed below, and *B. dufau* Grouvelle from Guadeloupe.

Botrodus estriatus Casey

Botrodus estriatus Casey, 1890: 320. Type locality: Columbus, Texas. Holotype, No. 48836 U.S.N.M.

This species resembles a small lapethine with respect to its oval and highly convex body, confused elytral punctation, and ventral, rather than dorsal antennal cavities. Its relationship to *Mychocerus* and *Murmidius* is indicated by the presence of a frontoclypeal suture, murmidiine mouthparts (galea and lacinia not elongate, terminal segment of maxillary palp not aciculate), and *Mychocerus*-like aedeagus. The species may be distinguished from the other murmidiines by the anteriorly rounded mesosternum, 8-segmented antennae, and lack of metasternal suture.

Distribution. Known only from Florida and Texas.

Biology. Habitat and immature stages unknown.

Ostomopsinae Sen Gupta and Crowson

This monotypic subfamily is considered to be a tribe of Murmiinae by Sen Gupta and Crowson (1973), but its relationship to the latter group is somewhat unclear. It is here treated as an independent subfamily.

Ostomopsis Scott

This genus was described by Scott (1922: 250-253, pl. 19, fig. 11) for the Seychelles species *O. solitaria*, and has been redescribed and illustrated by Sen Gupta and Crowson (1973: 400-402, figs. 43-49) on the basis of new material from New Caledonia and Florida. There is little to add to the generic description provided by the latter authors, except that the hind edge of the pronotum has a raised margin and the scutellum is transverse. Also the antennal club is broader than their illustration suggests, and it appears to be pinched in the middle due to the presence of lateral sensillae (see fig. 4).

Species of *Ostomopsis* may be distinguished from other Cerylonidae by the frontoclypeal suture, internally and externally open procoxal cavities, and 3-segmented tarsi, and the lack of femoral lines, antennal cavities, and a transverse line on the vertex. *Ostomopsis solitaria* Scott is known only from the Seychelles, but specimens appearing to be conspecific have been seen from New Caledonia and the Loyalty Islands. The Neotropical species described below extends the range of the genus into the New World.

***Ostomopsis neotropicalis*, New Species**

(Fig. 24)

This species may be distinguished from *O. solitaria* by the smaller size (less than 1.10 mm.), somewhat more elongate body, and narrower, less explanate, pronotal margins with more irregularly serrate edges.

Description. Length 0.95-1.10 mm. Color yellowish-brown; vesture of dense, suberect, yellowish hairs, which are about three-fifths as long as scutellar base, intermixed, especially at sides, with much longer hairs exceeding scutellar base in length. Antennal club (fig. 4) about as long as wide and twice as wide as the segment preceding it. Pronotum about 0.60 × as long as wide, widest at posterior third, sides weakly rounded, apical angles slightly produced and acute; lateral margins moderately broad and explanate, but less so than in *O. solitaria*, the edges coarsely and irregularly serrate; disc slightly

convex, slightly flattened mesially, punctation moderately coarse and dense, the interstices shiny. Scutellum transverse. Elytra about 1.42 \times as long as wide and 2.50 \times as long as pronotum; sides weakly rounded, almost parallel basally, the margins somewhat explanate, with finely, but sparsely and irregularly serrate edges; punctures of two types: large, somewhat rectangular ones, closely packed in regular rows, and very fine ones occurring in the intervals, both types bearing suberect hairs. Aedeagus about as long as abdomen; tegmen (fig. 7) with fused parameres and very long median strut; median lobe about as long as tegmen, very narrow, with long basal struts.

Types. Holotype, Fairchild Trail, Barro Colorado Island, CANAL ZONE, Jan. 28, 1959, berlese sample, B-180, heart of old palm on ground (H. S. Dybas) [FM]. Paratypes: MEXICO: San Luis Potosi: 2, 8 mi. N. Huichihuayan, June 20, 1941 (H. S. Dybas) [FM]. Veracruz: 1, Cordoba, Aug. 4, 1969, berlese sample, B-173, tropical evergreen forest (S. & J. Peck) [MCZ, on slide]. CANAL ZONE: 1, same data as holotype [JL].

Distribution. Florida and northern Mexico, south to the Isthmus of Panama. We have been unable to locate the specimen from Florida mentioned by Sen Gupta and Crowson, although we are assuming that it is conspecific with the Mexican and Central American specimens.

Biology. Possibly associated with rotten palm wood. Specimens of *O. solitaria* from New Caledonia and the Loyalty Islands were collected under bark.

Ceryloninae Billberg

This subfamily includes all of the remaining cerylonids, which are characterized by the lack of a frontoclypeal suture and the presence of relatively long and slender maxillary lobes, aciculate maxillary palps, and a distinctly crenulate margin on the last ventrite. The last feature, which may be present but much less obvious in certain murmidiines, is actually a series of vertical ridges on the inflexed margin of the ventrite (fig. 1); these form an interlocking mechanism with a corresponding series beneath the elytral apices. All known cerylonine larvae and adults in at least six genera have evolved highly modified, piercing mouthparts, with an elongate, pointed labrum, and mandibular and maxillary stylets (*see* p. 134).

Although there is little argument concerning the limits of the subfamily, whose distinguishing features are primarily derived, the interrelationships among the included genera and the limits of cer-

tain of these genera (*Cerylon*, *Philothermus*, *Lapethus*) are far from being understood. Sen Gupta and Crowson (1973) divide the group into three tribes: Lapethini, Cerylonini, and Aculagnathini. Members of the first group are distinguished by the oval or globose form and the presence of lateral antennal cavities on the anteroventral portion of the pronotum; three genera are included at present, but two of these are synonymized below. The remaining genus *Lapethus* is closely related to certain Cerylonini, and the larvae are more similar to those of *Philothermus* than the latter are to the larvae of *Cerylon*.

The Aculagnathini are a diverse group which have one feature in common — the possession of piercing mouthparts. In the Indo-Australian genus *Cautomus* and its relatives, the prosternum is raised in the middle, so that a shallow antennal cavity is formed on either side, and the dorsal surface of the body is relatively simple. The Asian and African *Axiocerylon*, *Dolosus*, and *Thyroderus*, on the other hand, are characterized by having the prosternum produced forward to form a chin-piece, which fits against the clypeus to conceal the mouthparts, and by the possession of deep antennal cavities, elytral ridges, and pronotal grooves. In both of the above groups, the labrum tapers to a sharp point, and a tube is formed to contain the mandibular and maxillary stylets (see p. 134). In the New World, *Cerylcautomus floridensis* resembles the *Cautomus* group in having shallow median antennal cavities and an acute labrum, but this species differs in the 1-segmented (instead of 2-segmented) antennal club. In Central America and the West Indies, a number of undescribed forms have been seen which resemble *C. floridensis* in most respects, but which vary considerably in the development of those characters considered to be diagnostic of the *Cautomus* group or of aculagnathines in general. In one case, the antennal cavities are absent and the labrum is elongate but not acute or tube-like, while in another the antennal cavities are well-developed but the mouthparts are not at all of the piercing type. Finally, the South American *Glyptolopus* resembles a large member of the *Axiocerylon* group, but the characteristic chin-piece and antennal cavities are absent, the antennae are 3-segmented, and the labrum is not acute. The great variation within this tribe, the existence of a number of forms with intermediate types of mouthparts, both within the tribe and within cerylonine genera, such as *Ectomicrus*, and the occurrence of piercing beaks in the lapethines and in cerylonine larvae, all suggest that the Aculagnathini may be polyphyletic and that the diagnostic piercing type of mouthparts may have arisen independently in

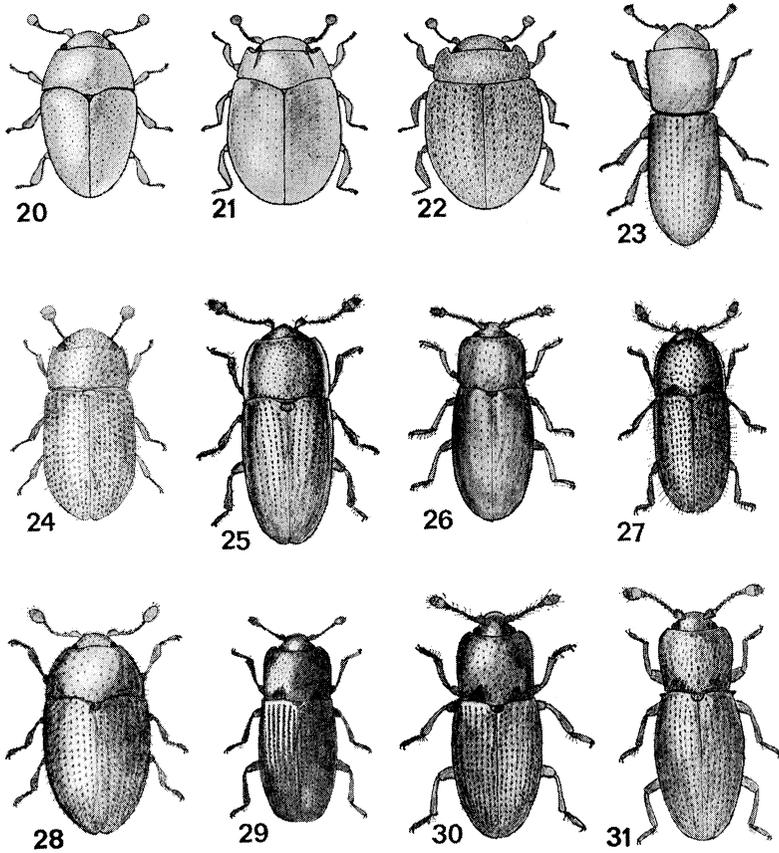


Fig. 20. *Hypodacne punctata* LeConte. Fig. 21. *Murmidius ovalis* (Beck). Fig. 22. *Mychocerus depressus* LeConte. Fig. 23. *Anommatus duodecimstriatus* (Müller). Fig. 24. *Ostomopsis neotropicalis*, n. sp. Fig. 25. *Philothermus glabriculus* LeConte. Fig. 26. *P. occidentalis*, n. sp. Fig. 27. *P. puberulus* Schwarz. Fig. 28. *Lapethus discretus* Casey. Fig. 29. *Cerylon distans*, n. sp. Fig. 30. *C. unicolor* (Ziegler). Fig. 31. *C. californicum* Casey. [Not drawn to same scale].

several phyletic lines. A more detailed analysis of the group and the related Cerylonini, based on characters unrelated to the feeding apparatus, may shed more light on the problem.

The Cerylonini include the remaining dozen or so cerylonine genera which have not been placed in the above tribes, and these also form a diverse assemblage. The large genera *Cerylon* and *Philothermus* are discussed below, while the smaller exotic groups are covered in Sen Gupta and Crowson (1973), Hinton (1942a), and Heinze (1944).

Philothermus Aubé

Philothermus Aubé, 1843: 93. Type species, by original designation, *P. montandoni* Aubé.

There has been considerable confusion concerning the constitution of this genus, and both Heinze (1944) and Sen Gupta and Crowson (1973) have attempted to clarify its limits and to distinguish the included species from those of *Cerylon*. The latter authors have defined the group primarily on the basis of prosternal characters and have included a number of forms with 10-segmented antennae and a 1-segmented club. Among these are members of the genus *Ectomicrus* Sharp (1885) and a group of African *Cerylon*-like forms. Although *Ectomicrus* was synonymized with *Philothermus* by Reitter (1890), Heinze (1944) found several characters to distinguish it, in addition to the 1-segmented antennal club. The African forms mentioned (at least *P. camerunense* Sen Gupta and Crowson) have well-developed femoral lines on the abdomen and appear to have more in common with *Philothermopsis* than *Philothermus*, in spite of tarsal differences. As presently conceived, *Philothermus* includes about 50 species, which are characterized by having a more or less elongate form, 4-segmented tarsi, no prothoracic antennal cavities, procoxal cavities open or narrowly closed behind, and the prosternal process not or only slightly widened and more or less rounded at apex. In addition, most of the species have 11-segmented antennae with a 2-segmented club and no femoral lines on the first ventrite. In North America, the genus is represented by a California and a Florida endemic and a widespread eastern species.

Key to the North American *Philothermus*

1. Body more elongate, PL/PW more than 0.82 and EL/EW more than 1.58; each elytron with 7 rows of punctures (not

- counting that along lateral edge); lateral margins of pronotum narrow; procoxal cavities narrowly closed behind; California. *occidentalis*, n. sp.
- Body shorter and broader, PL/PW less than 0.82 and EL/EW less than 1.58; each elytron with 8 rows of punctures; lateral margins of pronotum broad and explanate; procoxal cavities open behind; eastern North America. 2
2. Elytral vestiture consisting of numerous erect hairs, which are usually much longer than the diameter of an elytral puncture; pronotal punctation coarser and denser, the punctures usually separated by less than the diameter of one; lateral margins of pronotum distinct crenulate and lateral margins of elytra visible from above almost to apex; Florida..... *puberulus* Schwarz
- Elytral vestiture consisting of very short hairs, which are shorter than a puncture diameter, and a few scattered longer hairs; pronotal punctation finer and sparser, the punctures usually separated by more than the diameter of one; lateral margins of pronotum relatively smooth and lateral margins of elytra visible from above only for anterior half. *glabriculus* LeConte

Philothermus glabriculus LeConte

(Fig. 25)

Philothermus glabriculus LeConte, 1863: 69. Type locality: Pennsylvania. Lectotype, ♂, No. 6827 M.C.Z. (selected by J. F. Lawrence, April, 1975).

This species may be distinguished from the Floridian *P. puberulus* by the larger size (1.9-2.3 mm.) and somewhat broader form, shorter elytral hairs, finer and sparser pronotal punctation, and relatively smooth and even lateral pronotal margins. The western *P. occidentalis* is more elongate, with narrower pronotal margins and closed procoxal cavities. This is probably the most common cerylonid in eastern North America and it may occur with *Cerylon unicolor*, which is easily distinguished by the much narrower form and 1-segmented antennal club.

Distribution. Widespread throughout eastern North America from southern Ontario and Maine, south to northern Florida and west to Oklahoma and Texas.

Biology. Adults have been taken under the bark of *Acer*, *Carya*, *Fagus*, *Pinus*, *Quercus*, *Tsuga*, and *Ulmus*. Also taken under boards, in rotten logs, sawdust piles, malt traps, leaf litter, tree holes, and forest debris.

Philothermus occidentalis, New Species
(Fig. 26)

This species is characterized by the elongate body, narrow pronotal margins, 7 rows of elytral punctures, narrowly closed procoxal cavities, slightly expanded pronotal process, deeply concave mesosternum, and elongate metasternum.

Description. Length 1.8-2.2 mm. Color reddish-brown; vestiture of short, erect hairs, which are visible under $25\times$ magnification. Pronotum about $0.85\times$ as long as wide, widest at basal fourth, sides slightly converging to rounded apical angles; disc moderately convex, lateral margins narrow and somewhat irregular, the edge slightly crenulate at base; punctation fairly coarse and dense, punctures near center about $0.2\times$ as large as scutellar base and usually separated by less than a diameter; interstices smooth and shiny, with scattered very fine punctures. Elytra about $1.67\times$ as long as wide and $2.25\times$ as long as pronotum, widest at anterior third, each elytron with 7 rows of punctures (not counting marginal row), the punctures about as large as those on pronotum, deeply impressed, and fairly closely and irregularly spaced, intervals slightly convex, smooth and shiny, with scattered, very fine punctures. Prosternal process slightly narrower than a coxal diameter, very slightly expanded posteriorly and broadly rounded at apex; coxal cavities narrowly closed behind (fig. 9). Mesosternal concavity fairly deep, without a median carina, the process truncate at apex. Metasternum slightly longer than first ventrite. Aedeagus (fig. 8) with long, narrow parameres; median lobe about $0.75\times$ as long as abdomen.

Types. Holotype, Mather, Tuolumne Co., CALIFORNIA, June 15, 1969, sifting conifer debris (K. Stephan) [No. 32242 M.C.Z.]. Paratypes: CALIFORNIA: El Dorado Co.: 1, Blodgett Forest, July 24, 1972 (D. S. Chandler) [OSU]; 1, Lake Tahoe, 11.7 (Hubbard & Schwarz) [USNM]; 1, same, July 17-21, 1917 (H. C. Fall) [MCZ]; 1, Pollock Pines, May 21, 1970 (R. Belmont) [DSC]; 1, no specific locality, Aug. 7, 1970 (F. Andrews) [FA]. Mariposa Co.: 1, 10 mi. NW Yosemite, 6000', July 21, 1946 (H. P. Chandler) [CAS]. Placer Co.: 4, Forrest Hill, Mar. 1898 (E. C. VanDyke) [CAS]. Shasta Co.: 1, Hat Creek R. S., 3000', June 23, 1947 (H. P. Chandler) [CAS]; 1, Viola, June 18, 1972 (D. P. Levin) [KS]. Trinity Co.: 1, Trinity Center, June 15, 1972 (D. S. Chandler) [OSU]. Tuolumne Co.: 16, Mather, June 15, 1969, sifting conifer debris (K. Stephan) [KS, MCZ, USNM]; 1, Strawberry Valley, Aug. 6, 1912 (E. C. VanDyke) [CAS].

Distribution. Mountains of northern California and south in the Sierra Nevada at least to Mariposa County.

Biology. The Mather series was sifted from conifer debris together with *Cerylon californicum*.

Philothermus occidentalis is not very closely related to its eastern congeners, as evidenced by the prosternal and mesosternal characters, as by the elongate parameres, which are extremely reduced in both *puberulus* and *glabriculus*.

Philothermus puberulus Schwarz
(Fig. 27)

Philothermus puberulus Schwarz, 1878: 361. Type locality: Tampa, Florida. Holotype, No. 4512 U.S.N.M.

This species is easily distinguished from *P. glabriculus* by the vestiture of numerous, long, erect hairs and the distinctly crenulate lateral pronotal margins. It is also smaller in size (1.6-1.9 mm.) and somewhat more elongate, with coarser and denser pronotal punctation.

Distribution. Georgia, Florida, and the Greater Antilles. Reported by Hinton (1936) from Mexico, Guatemala, and Panama.

Biology. Adults collected under bark of *Pinus* and in a berlese sample from a swamp floor.

The Neotropical distribution of this species must remain tentative until a complete revision is undertaken, since there appears to be a complex of tropical species related to *P. puberulus*. Specimens from Cuba, Puerto Rico, and Hispaniola appear to be conspecific with the Floridian population, but most of the specimens we have examined from Mexico and Central America are not the same species. Horn (1878) also reported this species from Arizona, but we have seen no specimens to verify this record.

Cerylcautomus Sen Gupta and Crowson

Cerylcautomus Sen Gupta and Crowson, 1973: 439-441. Type species, by original designation, *C. floridensis* Sen Gupta and Crowson.

This genus was based on a single Floridian species and several unnamed forms from Jamaica, Hispaniola, Puerto Rico, Trinidad, and British Guiana. All members of the genus have at least vaguely defined antennal cavities, similar to those in *Cautomus*, located laterally on the prosternum (not on the hypomera) and defining a median, raised, prosternal plate. In addition, the procoxal cavities are open

behind, the antennae are 10-segmented with an elongate, 1-segmented club, and the labrum is elongate and narrowed, or sometimes acute, at the apex.

Cerylcautomus floridensis Sen Gupta and Crowson

Cerylcautomus floridensis Sen Gupta and Crowson, 1973: 441, figs. 205-213. Type locality: Chaires, Leon Co., Florida. Holotype, Field Museum.

This species is easily distinguished from other North American cerylonines by the small size (less than 1.25 mm.) and elongate form, 10-segmented antennae with a 1-segmented club, prosternal antennal cavities, and acute labrum.

Distribution. Known only from northern Florida.

Biology. Recorded from an old sawdust pile (more than 20 years old) at the edge of a cypress swamp. Other members of the genus have been extracted with Berlese funnels from forest litter and rotten logs.

Lapethus Casey

Lapethus Casey, 1890: 317. Type species, by monotypy, *L. discretus* Casey.

Lytopeplus Sharp, 1895: 494. Type species, by monotypy, *L. compactus* Sharp.

Brachylon Gorham, 1898: 256. Type species, by monotypy, *B. breve* Gorham.

Lapecautomus Sen Gupta and Crowson, 1973: 409. Type species, by original designation, *L. dybasi* Sen Gupta and Crowson. New Synonymy.

Sharp originally placed *L. compactus* in a separate genus because of the widely separated pro- and mesocoxae and the coadaptation of the pro- and mesosternum. Hinton (1936) pointed out that the differences were only a matter of degree and that certain *Lapethus*, such as *L. sharpi* Champion, displayed an intermediate condition; on this basis he synonymized *Lytopeplus* with *Lapethus*. Sen Gupta and Crowson, however, recently resurrected *Lytopeplus*, stating that the only difference between species of the genus and those of *Lapethus* is the slight closure of the procoxal cavities in the former. After examining a number of lapethines from Mexico and Central America, we are of the opinion that the features diagnosing *Lytopeplus* represent a general trend towards compaction throughout the group, and that these compact forms are not necessarily members of a single phyletic line. Likewise, the condition represented in the three described

species of *Lapecautomus* — piercing beak with mandibular and maxillary stylets — is one which occurs throughout the subfamily in both larvae and adults, so that a group, even at the generic level which is defined on the basis of this feature alone, may well be polyphyletic. Within the genus *Lapethus* (in the broad sense), there is a general trend towards the elongation of the labrum, and in most forms examined it is somewhat elongate and deeply emarginate at the apex, as in *L. discretus* (fig. 12). In *Lapethus* (= *Lapecautomus*) *striatus*, the labrum is even more elongate than in *discretus*, but it is still emarginate at the tip (fig. 11). In *L. dybasi*, however, the apex is pointed. A similar trend may be found in the mandibles and maxillae. With respect to other characters not involved in the piercing apparatus, the three species presently included in *Lapecautomus* do not appear to be closely related and may well be derived from two or more stocks of typical *Lapethus*. *Lapecautomus mexicanus*, for instance, is a globose, highly convex form, which is almost impunctate and glabrous, and which has the type of pro- and mesosternum characteristic of a *Lytopeplus*. In contrast, *L. striatus* is more elongate and flattened, with distinctly seriate elytral punctation, erect vestiture, and a raised lateral pronotal margin; in all these respects it resembles the type of *Lapethus*, *L. discretus*. For these reasons, we recognize the single genus *Lapethus*, and we suggest that the evolution of compact, globose forms and forms with piercing mouthparts represent two independent trends occurring in more than one lineage.

The genus *Lapethus*, as here delimited, contains about 25 described species, and a number of undescribed forms have been seen, especially in the New World. The group is primarily tropical, and the North American species are restricted to humid areas along the Pacific coast and in the mountains of the Southeast.

Key to the North American *Lapethus*

1. Pronotal punctation very fine and sparse, the punctures usually separated by at least two diameters; eyes reduced consisting of about 10 facets; labrum slightly longer than broad at base; size smaller, TL less than 1.75 mm.; Great Smoky Mountains and vicinity. *striatus* (Sen Gupta and Crowson)
- Pronotal punctation coarser and denser, the punctures usually separated by less than a diameter; eyes normal, with more than 30 facets; labrum slightly shorter than broad at base; size larger, TL more than 1.75 m.; California. *discretus* Casey

Lapethus discretus Casey
(Fig. 28)

Lapethus discretus Casey, 1890: 318. Type locality: Near Humboldt Bay, Humboldt Co., California. Holotype, No. 48835 U.S.N.M.

This species is characterized by the oval, somewhat flattened form, reddish color, distinctly seriate elytral punctation, fine, erect hairs easily visible under 10 \times magnification, distinct lateral pronotal margins, 8-segmented antennae with a 1-segmented club, and large antero-lateral antennal cavities on the underside of the pronotum. The procoxal cavities are fairly narrowly separated and distinctly open behind, while the prosternal process is parallel-sided and strongly rounded at apex. *Philothermus glabriculus* is superficially similar but more elongate and parallel sided, with different antennae and no antennal cavities. The species may be distinguished from the related *L. striatus* by the larger size (2.0-2.3 mm.), coarser and denser pronotal punctation, shorter labrum, and fully developed eyes and wings.

Distribution. Pacific Coast, from western Washington (King County) to central coastal California (Santa Cruz County) and the Sierra Nevada (Tuolumne and El Dorado Counties).

Biology. Collected in the Sierra Nevada by sifting rotten conifer logs in the red rot stage.

Lapethus striatus (Sen Gupta and Crowson), New Combination

Lapecautomus striatus Sen Gupta and Crowson, 1973: 412, fig. 178. Type locality: Below Ramsay Cascades, 3500', Great Smoky Mts. National Park, Sevier Co., Tennessee. Holotype, Field Museum.

This species is smaller than *L. discretus* (1.5-1.7 mm.), with the pronotum more finely and sparsely punctate, the eyes reduced to about 10 facets, and the wings completely absent. The labrum is also longer and narrower at the apex, and the mouthparts are more highly modified for piercing.

Distribution. Known only from the cove forests of the Great Smoky Mountains, Tennessee, and the nearby Joyce Kilmer Forest, North Carolina.

Biology. Adults have been collected in samples of leaf litter under *Rhododendron* and in mixed hardwood and *Tsuga* forest.

Cerylon Latreille

Cerylon Latreille, 1802: 228. Type species, by subsequent monotypy (Latreille, 1810: 431), *Lyctus histeroides* Fabricius.

Aphardion Gozis, 1886: 11.

This genus is distinguished by the broadly closed procoxal cavities and apically expanded prosternal process (fig. 10) and by the 10-segmented antennae with a 1-segmented club. In addition, the body is usually elongate and more or less parallel-sided, and the tegmen is reduced to a small ring at the base of the median lobe (figs. 13-14). Although the mouthparts in *Cerylon* are less modified than in *Philothermus* or *Lapethus*, the elongate, rigid body form, with complete posterior coxal closure, the extremely reduced tegmen, and the highly modified larval head all appear to be derived characters. There are about 75 species, but a number of them may have to be transferred to other genera with further study. The majority of species occur in the Holarctic, Ethiopian, and Oriental regions, while the group is poorly represented in the New World tropics and Australia. In North America, the genus is represented by two widely distributed, primarily northern and eastern species, and three western endemics.

Key to the North American *Cerylon*

1. Intercoxal process of mesosternum twice as wide as a mesocoxal cavity; prosternal process slightly concave; basal impressions of pronotum large and distinct; clypeus shallowly emarginate in both sexes; Arizona. *distans*, n. sp.
- Intercoxal process of mesosternum barely wider than a mesocoxal cavity; prosternal process flat or slightly convex; basal pronotal impressions obscure or absent. 2
2. Elytral vestiture distinct, easily visible at 10× magnification; size larger, length usually 3.0 mm. or more; elytral intervals flat or slightly convex; clypeus deeply notched in male; California. *californicum* Casey
- Elytral vestiture consisting of very short hairs, which are barely visible at 50× magnification; size smaller, length usually less than 2.7 mm. 3
3. Sides of pronotum (figs. 18-19) subparallel or slightly diverging for three-fifths of their lengths, strongly converging apically; antennal segment 3 more than 1.5 × as long as 4; body less elongate, TL/EW usually less than 2.42; clypeus shallowly emarginate in both sexes; widespread in the east and on the Pacific coast. *unicolor* (Ziegler)

- Sides of pronotum (figs. 16-17) slightly to strongly diverging for at least three-fourths of their lengths; antennal segment 3 less than $1.5 \times$ as long as 4; body more elongate, TL/EW 2.45 or more; clypeus deeply notched in male (fig. 15). 4
- 4. Sides of pronotum (fig. 17) strongly diverging for four-fifths of their lengths; elytral intervals flat; body usually smaller and more elongate (length usually less than 2.3 mm. and TL/EW greater than 2.50); northern part of continent. *castaneum* Say
- Sides of pronotum (fig. 16) slightly diverging for three-fourths of their lengths; elytral intervals convex; body usually larger and less elongate (length usually more than 2.3 mm. and TL/EW less than 2.50); Arizona and New Mexico. *conditum*, n. sp.

Cerylon californicum Casey

(Fig. 31)

Cerylon californicum Casey, 1890: 316. Type locality: Lake Tahoe, California. Holotype, No. 48834 U.S.N.M.

This is the most distinctive of the North American *Cerylon* because of its large size (3 mm. or more) and obvious vestiture. The body is also much stouter and more convex than in other species, although the elytral intervals are almost flat. It resembles *C. castaneum* and *C. conditum* in having a more elongate pronotum and deeply notched clypeus in the male, but both of those species are smaller, flatter, and subglabrous.

Distribution. Extending from southern Oregon into northern California and south in the Sierra Nevada to Tulare County.

Biology. Collected by sifting moist coniferous forest litter in July at medium elevation in the Sierra Nevada. *Philothermus occidentalis* was collected in this same habitat.

Cerylon castaneum Say

Cerylon castaneum Say, 1827: 259. Type locality: Canada. Neotype, ♂, No. 32238 M.C.Z. (designated by J. F. Lawrence, April, 1975).

Cerylon clypeale Casey, 1897: 636. Type locality: Kansas. Holotype, ♂, No. 48833 U.S.N.M. New Synonymy.

Cerylon sticticum Casey, 1897: 636. Type locality: Iowa City, Iowa. Holotype, ♀, No. 48832 U.S.N.M. New Synonymy.

Individuals of this species are the narrowest, flattest, and usually the smallest of the North American *Cerylon*. They may occur with *C. unicolor*, from which they may be distinguished by the apically expanded pronotum, elongate and flattened body, and deeply notched clypeus in the male (figs. 15 & 18).

Distribution. Northern and eastern North America, from south-eastern British Columbia and central Alberta to southern Quebec and Maine, and south to Texas and the Carolinas. More commonly collected in the northern part of the range.

Biology. Collected under bark of *Acer*, *Fagus*, and *Picea*, and in the following fungi: *Pleurotus* sp., *Fomes fomentarius*, *Phellinus igniarius*, and *Bjerkandera adusta*. Larvae collected in July in New Hampshire, under bark of hardwoods.

The name *Cerylon castaneus* has usually been associated with the species called *C. unicolor* in this paper, and in most collections these two names are confused, Casey's *clypeale* and *sticticum* being applied to specimens with expanded pronotum and notched clypeus. In Say's description, the point is made that the thorax is widely and slightly indented at base, each side of middle. This could refer to the basal narrowing of the pronotum, but it may also refer to discal impressions. Specimens under the name *castaneum* in the LeConte collection are definitely of the type with apically expanded pronotum and notched clypeus in the male, and we are considering this as Say's species. The first specimen in the series has an orange disc (referring to southern states) and it is a female. Two other specimens have faded discs, so that the locality is uncertain. A fourth specimen bears the label "Can." and is a male. Since the species is much more common in the northern part of the continent, we have chosen this last specimen as Neotype.

***Cerylon conditum*, New Species**

This species is in the size range of *C. distans*, but differs from that species by the more elongate pronotum, more approximate meso-coxae, and notched clypeus in the male. *Cerylon unicolor* is usually smaller, and less elongate, without the notched clypeus in the male, while *C. castaneum* differs in having the pronotum strongly expanded apically and the elytral intervals flat.

Description. Length 2.2-2.7 mm. Color dark reddish-brown; vestiture of very short, erect hairs, barely visible under 50 \times magnification. Antennae about 0.75 \times as long as pronotal width; segment 3 1.25 \times as long as 4; club 1.3 \times as long as wide. Clypeus slightly emarginate in $\text{\textit{f}}$, deeply notched in $\text{\textit{m}}$. Pronotum (fig. 16) 0.95 \times as long as wide, sides subparallel or slightly diverging, for basal three-fourths, converging apically to rounded angles; disc very slightly convex at middle, slightly sloping anterolaterally, with 2

broad and very shallow basal impressions; punctation relatively uniform, slightly finer at apex, punctures near center elongate, about $0.2 \times$ as long as scutellar base, and usually separated by less than a diameter; interstitial microsculpture distinct, consisting of longitudinal, sinuate rugulae. Scutellum finely granulate. Elytra about $1.67 \times$ as long as wide and $2.50 \times$ as long as pronotum, widest at anterior third; striae fairly deeply impressed, their punctures distinctly separated from one another; intervals moderately convex, shiny, and finely punctate. Prosternal process flat, about $1.5 \times$ as wide as a coxal diameter. Mesosternal process about $1.3 \times$ as wide as a coxal diameter, broadly rounded at apex. Metasternum $1.2 \times$ as long as first visible abdominal sternite. Aedeagus (fig. 13) about $0.8 \times$ as long as abdomen.

Types. Holotype, ♂, and allotype, ♀, Santa Catalina Mts., 8000', Pima Co., ARIZONA, June 16, 1968, under bark of conifer (K. Stephan) [No. 32240 M.C.Z.]. Paratypes: ARIZONA: Apache Co.; 1, Chuska Mts., 8500' Aug. 31, 1974, under bark of conifer (J. Lawrence, K. & B. Stephan) [KS]; 1, Springerville, Oct. 15, 1972 (K. Stephan) [KS]. Cochise Co.: 20, Chiricahua Mts., 8500', June 29, 1968, May 4, Aug. 3, 1969 (K. Stephan) [MCZ, KS]. Graham Co.: 12, Graham Mts., May 18, 1969 (K. Stephan) [KS]; 3, same 9200', Apr. 25, 1971 (K. Stephan) [KS]; 1, Hospital Flat, Mt. Graham, 9000', Aug. 6, 1949 (F. Werner and W. Nutting) [UAZ]. Pima Co.: 2, Santa Catalina Mts., 7000', May 5, 1968 (K. Stephan) [KS]; 44, same 8000', June 16, Sept. 7, Sept. 29, 1968, Apr. 12, 1969 (K. Stephan) [CAS, FM, MCZ, KS, USNM]; 1, same, Marshall Gulch, Aug. 1, 1959 (F. Werner) [UAZ]; 4, same, Mt. Bigelow, 8300', Aug. 11, 1968, under bark, (W. Suter) [WS]; 1, same, Aug. 27, 1974, under bark of conifer (J. Lawrence) [MCZ]; 4, same, Mt. Lemmon, May 16, June 13, 1970 (K. Stephan) [KS]. Santa Cruz Co.: 1, Santa Rita Mts., 6000', Dec. 8, 1968 (K. Stephan) [KS]. NEW MEXICO: San Miguel Co.: Las Vegas Hot Springs, 15.8 (Barber & Schwarz) [USNM].

Distribution. Mountains of Arizona and New Mexico, usually above 6000 ft.

Biology. Adults collected under the bark of conifer logs, especially those from which bark beetles have emerged. The beetles are usually found near the butt end in moist fungus-infested areas. Often taken in the same situations with *C. distans*.

***Cerylon distans*, New Species**

(Fig. 29)

The widely separated mesocoxal cavities will separate this species from all others in North America. In addition, the pronotum is much shorter and broader than in *C. conditum*, which also differs in having the clypeus notched in the male. The general form is similar to *C. unicolor*, in which the mesocoxae are more approximate, the size smaller, and the pronotal impressions shallower.

Description. Length 2.4-3.0 mm. Color dark reddish-brown to black; vestiture of very short, erect hairs, not visible under 50× magnification. Antennae relatively short, about 0.6 × as long as pronotal width; segment 3 1.4 × as long as 4; club only slightly longer than wide. Clypeus slightly to moderately emarginate, but never notched. Pronotum about 0.87 × as long as wide, sides subparallel for basal three-fourths, converging apically to rounded angles; disc moderately convex at middle, steeply sloping anterolaterally, with 2 broad and moderately deep basal impressions; punctuation variable, coarser at base than apex, punctures near center about 0.2 × as long as scutellar base and usually separated by less than a diameter; interstitial microsculpture very lightly impressed or absent, with scattered fine punctures. Scutellum transversely rugulose. Elytra about 1.6 × as long as wide and 2.35 × as long as pronotum, widest at middle; striae deeply impressed, their punctures elongate and subconfluent; intervals moderately convex, shiny, and finely punctate. Prosternal process slightly concave, about 1.8 × as wide as a coxal diameter. Mesosternal process 2 × as wide as a coxal diameter, truncate at apex. Metasternum 1.35 × as long as first visible abdominal sternite. Aedeagus (fig. 14) about 0.6 × as long as abdomen.

Types. Holotype, ♂, and allotype, ♀, Chiricahua Mts., 8500', Cochise Co., ARIZONA, May 4, 1969, under bark of conifer (K. Stephan) [No. 32241 M.C.Z.]. Paratypes: ARIZONA: Apache Co.: 3, Chuska Mts., 8500', Aug. 31, 1974, under bark of conifer (J. Lawrence, K. & B. Stephan) [KS, JL]. Cochise Co.: 24, Chiricahua Mts., Sept. 18, Aug. 6 (B. Malkin) [FM]; 1, same, June 23 (Hubbard & Schwarz) [USNM]; 3, same, July, 1936, from pine (E. S. Ross) [CAS]; 2, same, 5000', June 19, 1971 (K. Stephan) [KS]; 21, same, 8500', May 4, 1969 (K. Stephan) [FM, JL, USNM, KS]; 1, same, Aug. 3, 1969 (K. Stephan) [KS]; 1, Rustler Park, June 17, 1973, under bark (D. S. Chandler) [DSC]; 1, same, 8300', Sept. 16, 1962 (B. Malkin) [FM]; 8, same, 8400', June 13,

1956, pine (H. & A. Howden) [HH]; 8, Huachuca Mts., July (J. Knull) [OSU]. Coconino Co.: 3, Flagstaff, Hopk. U.S. 5007g,j, *Pinus ponderosa* (Webb) [USNM]; 1, same, July 7 (Barber & Schwarz) [USNM]; 1, Williams, May 27 (Barber & Schwarz) [USNM]; 1, same, (Hubbard & Schwarz) [USNM]; 3, same, (Wickham) [CAS, USNM]. Graham Co.: 16, Graham Mts., May 18, 1969, under bark of conifer (K. Stephan) [MCZ, KS]. Pima Co.: 1, Santa Catalina Mts., Sept. 26, 1907, Hopk. U.S. 5603g, *Pinus ponderosa* (J. L. Webb) [USNM]; 1, same, July 1, 1936 (E. S. Ross) [CAS]; 2, same, June 1, 1938 (Van Dyke) [CAS]; 8, same, 7000', May 12, 1968, under bark of conifer (K. Stephan) [KS]; 2, same, Apr. 5, 1969 (K. Stephan) [KS]; 23, same, 8000', May 12, May 23, Sept. 7, Oct. 20, Nov. 10, 1968, June 29, 1971 (K. Stephan) [KS]; 3, same, 8500', Oct. 4, 1971 (K. Stephan) [KS]; 9, same, Bear Canyon, Dec. 14, 1968, Jan. 25, Mar. 29, 1970 (K. Stephan) [KS]; 1, same, Bear Canyon, Mt. Lemmon Hwy., 6000', June 16, 1970 (D. S. Chandler) [DC]; 5, same, Mt. Lemmon, near Observatory, Mar. 1965, (M. L. Lindsey) [UAZ]; 11, same, Rose Canyon, Apr. 1965 (M. L. Lindsey) [UAZ]. Santa Cruz Co.: 1, Santa Rita Mts., 6000', Dec. 8, 1968 (K. Stephan) [KS]; 2, same, 7000', Apr. 20, 1969, under bark of conifer (K. Stephan) [KS].

Distribution. Mountains of Arizona, usually above 5000 ft.

Biology. Collected in the same situations as *C. conditum*, under the bark of old conifer logs, usually in moist, fungus-infested areas of the cambium.

Cerylon unicolor (Ziegler)

(Fig. 30)

Latridius unicolor Ziegler, 1845: 270. Type locality: Carolina. Holotype, ♀, No. 6825 M.C.Z.

Cerylon angustulum LeConte, 1863: 69. Type locality: Georgia. Lectotype, ♂, No. 6824 M.C.Z. (designated by J. F. Lawrence, April, 1975). New Synonymy.

Cerylon simplex LeConte, 1857: 39. Type locality: San Jose, California. Lectotype, ♂, No. 6826 M.C.Z. (designated by J. F. Lawrence, April, 1975). New Synonymy.

Cerylon sylvaticum Casey, 1897: 635. Type locality: Coeur d'Elene, Idaho. Holotype, No. 48821 U.S.N.M. New Synonymy.

This is the most commonly collected *Cerylon* in eastern North America and on the Pacific Coast. It may be distinguished from *C. castaneum*, with which it is sympatric throughout much of its range, by the shape of the pronotum, the slightly emarginate clypeus

in the male, and the less flattened form. *Cerylon distans* is larger, with more widely separated mesocoxae, while *C. conditum* is usually larger and more elongate, with a notched clypeus in the male. In California, this species is easily distinguished from *C. californicum* by the much smaller size, less distinct vestiture, and less robust form. *Cerylon unicolor* is the only species in which there appears to be pronounced sexual dimorphism in prothoracic shape, the sides in the female being parallel basally and convergent apically, while those in the male are slightly divergent at the base (figs. 18-19).

Distribution. Northern and eastern North America and the Pacific Coast. Extending from southern British Columbia, south through Washington, Oregon, Idaho, and California as far as Los Angeles County on the coast and Fresno County in the Sierra Nevada; east across southern Canada and the northern United States to southern Ontario and Maine; south on the Atlantic Coast to northern Florida, and west to the 100th meridian.

Biology. Adults collected under the bark of *Carya*, *Fagus*, *Liriodendron*, *Picea*, *Pinus*, *Platanus*, *Populus*, *Liquidambar*, *Salix*, and *Tsuga*. Also in rotten logs, leaf mold, at sap, in an ear of corn, at light, at malt traps, and in various fungi, including *Phellinus gilvus* and *Bjerkandera adusta*. Larvae found under bark of hardwood logs in Arkansas.

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