Keys to Families of Beetles in America North of Mexico

by Michael A. Ivie

These keys are specifically designed for North American taxa and may lead to incorrect identifications of many taxa from outside this region. They are aimed at the successful family placement of all beetles in North America north of Mexico, and as such will not always be simple to use. A key to the most common 50% of species in North America would be short and simple to use. However, after an initial learning period, most coleopterists recognize those groups on sight, and never again key them out. It is the odd, the rare and the exceptional that make a complex key necessary, and it is in its ability to correctly place those taxa that a key is eventually judged. Although these keys build on many previous successful efforts, especially those of Crowson (1955), Arnett (1973) and Borror *et al.* (1989), in many ways I have taken a new approach that owes more to Lawrence and Britton (1994) and Lawrence *et al.* (1999).

Nearly 60% of the families in *American Beetles* have had their membership redefined or ranks changed since the last comprehensive treatment of North American beetles (Arnett 1973). Over 35% of the families included in the last credible linear key to North American beetle families (Borror *et al.* 1989) have been redefined. Several taxa have even been moved since the most recent key, the Herculean computerized key to world taxa by Lawrence *et al.* (1999). So, this is the first attempt at a conventional family key to these particular taxa. Instead of simply modifying existing keys by adding couplets to further divide the old endpoints, I have started from the base and rebuilt the key structure around the new family concepts. The add-on approach would have resulted in keys totaling nearly 400 couplets that would have greatly obscured family concepts instead of the <200 couplet keys provided here. The success of this approach will be determined after testing by you, the users.

An effort has been made to key out a specific family in a single couplet, but when this was in conflict with making reliable identifications, it was overridden by practicality. This interface of goal and practicality sometimes causes considerable use of "and," "or," "if...then," and "usually." The keys are deliberately not phylogenetic, but when possible and practical I used shared derived features to facilitate the one-family, one-couplet goal. I hope the user will supply the patience needed to deal with the magnificent complexity of beetles as represented in the longer couplets presented below.

Several characters that have been traditionally favored for use in North American beetle keys are not emphasized here – especially tarsal formulae – and other characters that have rarely been used previously have been placed in critical couplets. These unfamiliar characters will undoubtedly cause some initial discomfort for experienced users until, through practice, they become familiar and proficient with them. However, I hope new users will find these characters an aid in understanding today's definitions of families. I have attempted to avoid characters requiring dissection and, where possible, overly long lists of options, but when necessary, I have erred on the side of directing the user to a correct identification.

No key will work on all specimens because of abnormalities of development, poor preservation, previously unknown species, sexes or variation, or simple errors in characterization. Furthermore, with more than 30,000 species to be considered, there are undoubtedly rare forms that escaped my notice and even possibly some common and easily collected species with exceptional characters that I overlooked. While this key should work for at least 95% of specimens collected and 90% of North American species, the specialized collector who delves into unique habitats or uses specialized methods may find a higher percentage of problems. Even in North America there are still many taxa to be discovered in specialized niches like deep soils, unique unsampled habitats, or with specialized techniques like flight intercept traps, soil washing, or Berlese funnels. These taxa will undoubtedly stretch our understanding of family characterizations in the North American fauna. Invasions by exotic species also will continue to introduce exceptions.

A high-quality microscope (at least 40X, preferably 60X) with good illumination is required to see many characters, especially those of small specimens. Specimens must be clean and properly mounted so that dorsal, ventral, and lateral surfaces are visible (see Borror *et al.* [1989] for a discussion of mounting). Card-mounted specimens with the venter obscured will prove mostly frustrating and should be remounted on points before attempting the key. In many cases, characters will be easier to see in dry specimens than in those preserved in liquid.

Dirty specimens should be cleaned before identification is attempted. First, place the specimen in hot, but not boiling, water for a minute or two, and then vibrate in an ammonia bath (household cleaning ammonia, available at grocery stores) using an ultrasonic cleaner (inexpensive to very expensive options are available from entomological suppliers, jewelry stores, and architectural supply houses) for 5-20 minutes works well for cleaning and degreasing. Resistant coatings of foreign material, particularly those encrustations secreted by the beetle itself, may require gentle abrasion under the microscope with a pin or camel's-hair brush between ammonia baths. To neutralize the base in the ammonia before mounting and drying for storage, the specimen should be rinsed in several baths of clean water in the ultrasonic cleaner, then in a final wash of high percentage alcohol to help dry the specimen (this last should NOT be done in the ultrasonic cleaner because of fire hazard).

Pubescent specimens may require further work to keep setae from matting after this treatment. Critical-point drying is the best method, but requires an expensive and complex critical-point drier. As an alternative for species with sparse, stiff setae, a dip in 100% ETOH and gentle blowing will usually return the setae to

their normal positions. If this does not work adequately, chemical drying is another option. Run the cleaned specimens through a dehydrating wash of 100% ETOH, one or two 30-minute soaks in hexamethyldisilazane (HMDS, available from chemical suppliers), and then place them in a shallow dish of HMDS, and allow it to evaporate (Brown 1993). HMDS must be used with adequate ventilation, see the material safety data sheet that comes with the chemical.

Legs and antennae should be positioned to allow for clear viewing of the total length of the structure itself, as well as coxal cavities and sternal surfaces. Critical characters of the pro- and mesocoxal cavities and thoracic sterna will prove difficult to see in specimens with the legs retracted. This instruction is easy to make, but frustrating to follow, as the need to see a particular structure is not obvious until after the specimen is mounted. In many cases, especially for small species, when at a critical juncture in the key, a specimen will be found to have the leg in just the wrong position to see a particular structure. A tiny amount of Barber's Relaxing Fluid (Peterson 1964) applied with a fine brush to the offending joint will usually allow enough movement of the structure in a dried specimen to avoid the need for relaxing.

Barber's Relaxing Fluid (Peterson 1964) is made with the following formula (parts by volume):

53 parts 95% Ethanol (ETOH)
49 parts distilled water
19 parts ethyl acetate (acetic ether)
7 parts benzol (benzene)

This solution must be used with adequate ventilation because of the presence of benzene, known to be a hazardous substance that may cause acute and chronic health effects, including cancer, in humans. Consult the material safety data sheet that accompanies the benzene.

Conventions. Figures are cited from the text throughout Volumes 1 and 2 with the convention of "x.Y" where "x" is the figure number and "Y" the chapter number, *e.g.*, "4.22" is Figure 4 of chapter 22. The introductory chapter is denoted "I," *i.e.*, "2.I" is the second figure in the Introduction. Figures in this Family Key Chapter are denoted "K", *i.e.*, "3.K" is the third figure in this chapter. A number before the family name at the end of a couplet refers to the chapter number for that family. Chapters I and 1-22 are in Volume 1, Chapters 23-131 and K are in Volume 2.

Qualifiers

Especially – Most strongly or often expressed.

IF...THEN – In the case denoted by IF, accompanied by the condition indicated by THEN.

Rarely – Character that occurs as an exception in a group, but may be encountered in less than ca. 2% of specimens seen by the normal user.

Seldom – Character that occurs as an exception in a group, but may be seen in a distinct minority of cases, expected to be in the 10% or less range.

Often – Character expected to be present in a large proportion of the specimens seen by the average collector or identifier, but may be absent in any given, or even a majority of, species or specimens encountered.

Usually – Character present in a majority (>51%) of species and specimens of the group, but exceptions occur.

Variable – Used when a character state in the opposing couplet occurs, along with other states of that character.

AND – When a capitalized AND is present, it means that all of the characteristics before and all of the characteristics after it must occur together.

AND/OR – meets either all the conditions before AND all of the characteristics after it; OR that either the characteristics before it or the characteristics after it apply.

OR – When a capitalized OR is present, it means that either the characteristics before it or the characteristics after it apply, but not necessarily both.

Morphological Terms

Most terms used can be interpreted using the introductory discussion of characters on pages 2 through 9 of Volume 1, or by reference to cited figures. It is assumed that the user is either familiar with basic insect morphology or has access to a general textbook such as Borror *et al.* (1989) and an entomological glossary such as Nichols and Schuh (1989). More detailed beetle-specific terminology follows Lawrence and Britton (1994) and/or Lawrence *et al.* (1999). A few specific and important terms are defined here because the user may not have access to these latter works. Some important usages unique to this key are also defined to avoid ambiguity.

Use of "Segment". The difference between true anatomical segments and apparent articulated joints in insect appendages causes considerable confusion. In an anatomical sense, the term "segment" should only be used in insects for the homologue of either a body metamere or the true segments of the primitive arthropod appendage (Nichols and Schuh 1989, Chapman 1998). However, the term is often misused in reference to antennae and tarsi (Chapman 1998), and its correct use for the palpi is uncertain in some cases. Therefore, the following terms are used in these keys (following Lawrence *et al.* 1999):

Antennomere vs. Antennal Segment. There are only 3 true segments in the beetle antenna (scape, pedicel, and flagellum) (Chapman 1998). The annulate sections of the flagellum are not true segments and should not be referred to as antennal segments. The technically correct use of scape, pedicel, and flagellomeres is unwieldy, so I use antennomere for the visible articulated parts of the antenna, numbered from proximal to distal. The scape is always antennomere 1, the pedicel is antennomere 2, etc.

Palpomere vs. Palpal Segment. The joints of the maxillary and labial palpi may be properly referred to as segments, being anatomically homologous to appendage segments (Chapman 1998). However, it is unclear if all of the situations

involving articulated pieces of beetle palpi may be correctly considered true segments, so the term palpomere is employed here.

Tarsomere vs. Tarsal Segment. There are 2 true segments involved in what is called the beetle tarsus: the true tarsus, usually subdivided in beetles into 2-4 pieces, and the apical claw-bearing pretarsus (Chapman 1998). Many authors refer to each of the articulated pieces of these 2 true segments as tarsal segments, but I prefer the term tarsomere to distinguish them from the correct use of segment.

Clicking Mechanism. This mechanism consists of a long prosternal intercoxal process with the dorsal or dorso-apical surface of the apex notched to fit against a slight projection on the anterior margin of the relatively large, deep mesocoxal cavity. In some compact species there is a plate-like, margined ventral face to the postcoxal portion of the intercoxal process that is tightly received by the deeply emarginate mesosternum. In these cases the true apex of the prosternum is hidden in a deep cavity between the mesocoxae. This later condition co-occurs with prosternal or hypomeral antennal grooves.

Connate Ventrites. These are abdominal ventrites that are fused and immovable relative to each other. This condition can often be detected as a difference in the quality of the suture between those ventrites that are connate and those that are not, by the absence of a membrane between the connate sternites (Figs. 4-5.106) vs. a distinct membrane clearly visible at the other sutures, or by a reduction in the depth of the suture itself, especially medially (Fig. 58.41). However, the easiest and most certain way to tell is to view the upturned lateral portion of the ventrite that is held against the elytron in repose. Connate ventrites will be obviously nonmovable in this view, and lack the hinged form of the free, movable state.

Mesocoxal Cavities Open or Closed. Closed mesocoxal cavities are defined as having the meso- and metasterna in contact laterad the mesocoxa (Fig. 12.58). Open mesocoxal cavities are defined as having the mesepimeron and/or the mesepisternum separating the meso- and metasterna and reaching the mesocoxa (Figs. 23.I, 13-14.58, 4.K).

Metacoxa Reaching the Elytra or Lateral Portion of the Body. This character is defined as having the metacoxa completely separating the visible portions of the metathorax and first abdominal ventrite all the way to the elytral epipleuron (Figs. 23.I, 17.70, 19.70, 1-2.K), or to the point where the side of the body is indicated in cases where the elytra are not tightly held against the body at this level. If the metasternite, metepisternum, or metepimeron is in visible contact with the anterolateral angle of the first ventrite (Fig. 3.K), even as a narrow lamina, the metacoxa is deemed to not reach the elytra or lateral portion of the body.

Posterior Face of Metacoxa. A distinct posterior face on the metacoxa can be detected by viewing the specimen from the side. If there is a "step" between the level of the metasternum and the first ventrite formed by an angle at a carina running across the coxa (or the presence of a distinct metacoxal flange that extends posteriorly from the coxa) and another angle where the coxa contacts the ventrite in a ¯|_ or ¯_ manner, it has a posterior face (Figs. 1.K, 3.K). If there is a distinct excavation on the posterior face overhung by a ventral flange, it is also considered to have a posterior face (Fig. 2.K). If the level of the anterior edge of the coxa is on a different level from the abdomen and the ventral face of the coxa (viewed half-way between median and lateral ends of the coxa) is S-shaped in longitudinal (antero-posterior) section, *i.e.*, evenly curved rather than angulate, it does not have a distinct posterior face.

Pro-, Meso-, and Meta-. These are used to denote anterior, middle, and hind segments, respectively, when referring to the thoracic segments and their appendages.

Ventrite. This term refers to a normally visible abdominal sternite numbered from the base of the abdomen irrespective of the true morphological segment it represents.

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I. Key to the Suborders of North American Coleoptera

1. Notopleural sutures present (Figs. 19.I, 11.6, 2.8, 4-5.10, 3.12); OR, abdomen with only 3 ventrites; body form hemispherical, minute beetles (length <1.3 mm) (Fig. 1.3); OR, small (length <2.6 mm), soft-bodied beetles (Fig. 1.2) with wings rolled in a spiral "cigar" manner (*i.e.*, not folded) 2
— Notopleural sutures absent; abdomen with 4 or more ventrites; wings folded or not, not rolled ..... **Polyphaga (Key D)**

2(1). Hind coxae immovably fused to metasternum, completely dividing first ventrite (Figs. 33.I, 11.6, 2.8, 4-5.10, 3.12, 13-17.12) .... **Adephaga (Key C)**
— Hind coxae free, first visible abdominal sternite extending entirely across venter behind them 3

3(2). Minute beetles, length 2 mm or less in length (Figs. 1.3, 1.4); antenna with short club of 1 to 3 antennomeres (Figs. 1.3, 1.4); wing folded in repose ..... **Myxophaga (Key B)**
— Minute to moderately large beetles, length 1.5 - 25 mm; antennae either filiform (Fig. 1-2.1), or sub-moniliform and gradually widening from 4th segment (Fig. 1.2); hind wings in repose spirally rolled in a spiral "cigar" manner .... **Archostemata (Key A)**

A. Key to the Families of North American Archostemata

1. Notopleural sutures present; elytra reticulate, long, covering pygidium (Figs. 1-2.1); body covered in scales; antennae filiform to subserrate (Figs. 1-2.1), length >4 mm ..... 1. Cupedidae
— Notopleural sutures absent, elytra smooth, short, leaving at least pygidium exposed (Fig. 1.2); body without scales; antennae sub-moniliform and gradually widened from 4th segment (Fig. 1.2); length <2.6 mm ..... 2. Micromalthidae

B. Key to the Families of North American Myxophaga

1. Body hemispherical (Fig. 1.3); elytra covering all terga; abdomen with 3 ventrites; antenna with 11 antennomeres, 9-11forming club .... 3. Microsporidae
— Body more elongate-oval and depressed dorsoventrally (Fig. 1.4); elytra short, 3-4 tergites exposed; abdomen with 6 or 7 ventrites; antenna with 9 antennomeres, antennomere 9 forming narrow club ..... 4. Hydroscaphidae

C. Key to the Families of North American Adephaga

1. Metacoxa greatly enlarged, a ventral plate concealing trochanter and basal half of femur, covering most of 3 basal ventrites (Fig. 2.8) .... 8. Haliplidae
— Metacoxa greatly enlarged or not (Figs. 11.6), IF metacoxa greatly enlarged, THEN all ventrites visible laterally, coxa not concealing trochanter, basal half of femur or first 3 ventrites (Figs. 4-5.10, 3.12, 17.12) 2

2(1). Metacoxa not reaching elytron laterally, metepimeron and first ventrite in contact laterad of metacoxa and mesad of elytral margin (Figs. 6.6, 12.6); antenna usually at least partly pubescent (in addition to scattered long sensory setae); procoxal cavities usually closed behind; IF metacoxa reaches elytron and procoxal cavities open (one tiny species, length 2 mm or less), THEN second ventrite (first behind metacoxa) 3 times as long as metacoxa at insertion of leg and last maxillary palpomere distinctly narrower than penultimate (aciculate) 3
— Metacoxa reaching elytron laterally, junction of metepimeron and first ventrite not visible with elytron in place; antenna not pubescent, with only scattered long sensory setae; procoxal cavities open behind; second ventrite less than 3 times as long as metacoxa; last maxillary palpomere not distinctly narrower than penultimate 4

3(2). Mentum expanded, fused laterally to head capsule, covering ventral mouthparts completely when mandibles closed, mentum extending anteriorly beyond other mouthparts to form cutting edge; outer angle of protibia with large inwardly curved uncus (Fig. 1.5); body cylindrical; antenna moniliform; head, pronotum, and elytra with deep canaliculate grooves (Fig. 1.5) ..... 5. Rhysodidae
— Mentum not fused laterally to head capsule or extending beyond other mouthparts, maxilla and labium with at least palpi visible (Figs. 5.I, 4.6, 45-48.6); outer angle of protibia with straight or outwardly curved teeth or spines (Figs. 10.6, 13.6, 33.6, 38.6, 43.6); head pronotum and elytra without deep canaliculate grooves; body form and antennae variable ... . 6. Carabidae

4(2). Protibia with antenna cleaner on inner apical angle (*cf.* Fig. 13.6); head with supraorbital setae (*cf.* Fig. 52.6) 9.Trachypachidae
— Protibia without antenna cleaner on inner apical angle; head lacking supraorbital setae 5

5(4). Pedicel of antenna greatly enlarged, offset from main line of antenna, flagellum very short and compact, not extended beyond hind margin of head; mid and hind legs very short; eyes usually divided into 2 isolated parts on each side, rarely with only a very narrow canthus extending between upper and lower portions .... 7. Gyrinidae
— Pedicel of antenna normal, antenna extended beyond hind margin of head; mid and hind legs not especially short; eyes not divided 6

6(5). Metafemur and metatibia narrow and subcylindrical in cross section; metatarsus shorter than metatibia and not tapered distally (Fig. 1.11); body not streamlined, outline of thorax and elytron discontinuous, base of pronotum distinctly narrower than elytra (Fig. 1.11); length 11-16 mm ..... 11. Amphizoidae

— Metafemur and metatibia more or less distinctly compressed, especially so in larger species (length 6 mm or greater); metatarsus usually as long or longer than metatibia (Fig. 3.12), distinctly tapering distally (Figs. 3-4.12); body streamlined, outline of pronotum and elytron usually conjointly rounded (Figs. 1.10, 4-5.10, 32-47.12); length 1-40 mm 7

7(6). EITHER scutellum not visible; protarsus with 5 distinct tarsomeres; eyes distinct and length 1.0-1.6 mm; OR scutellum not visible; protarsus with 5 distinct tarsomeres; length 1.9-5 mm; outer margin of protibia evenly curved and bearing a distinct comb of stout parallel and contiguous setae (Fig. 3.10); AND inner apical angle with large, curved protibial spur (Fig. 3.10) ..... 10. Noteridae

— Scutellum visible or not; protibia less evenly rounded on outer apical angle (Fig. 2.12), outer margin lacking setal comb (Figs. 2-4.12); inner angle without large inner protibia spur (Fig. 4.12); length 1.5-40 mm; IF less than 2 mm, THEN protarsus either pseudotetramerous (Figs. 7.12, 39.12) or eyes absent or greatly reduced and indistinct ..... 12. Dytiscidae

D. Key to the Families of North American Polyphaga (by Michael A. Ivie, couplets 3-13 by Mary Liz Jameson and Brett Ratcliffe).

[Does not include unrecognized females of the Telegeusidae. Expected to be anelytrous or larviform, they will probably key out to couplet 183.]

1. Elytra present, complete, short, or reduced to flap-like stubs on the mesothorax 2

— Elytra totally absent 182

2(1). Antenna with strongly asymmetrical, usually lamellate club of 3-8 antennomeres (Figs. 17.I, 2.23, 3.23, 2.31, 2.34, 56-57.34, etc.); procoxae large, strongly transverse or conical and projecting below prosternum; procoxal cavities closed; trochantins concealed (except in Diphyllostomatidae); protibiae flattened with one or more teeth on outer edge; tarsi with 5 distinct tarsomeres, none of which are lobed or densely pubescent 3

— Antenna not lamellate, or coxae, tibiae or tarsi not as above 14

3(2). Antennae with 11 antennomeres 4

— Antennae with fewer than 11 antennomeres ... 5

4(3). Antennal club with 4-7 elongate antennomeres (Fig. 1.28) ..... 28. Pleocomidae

— Antennal club with 3 circular or oval antennomeres (Fig. 2.29) ..... 29. Geotrupidae

5(3). Body capable of being rolled into contractile ball (Fig. 2.32); middle and posterior tibiae flattened and dilated ..... 32. Ceratocanthidae

— Body oblong, not capable of being rolled into ball; middle and posterior tibiae not significantly flattened and dilated 6

6(5). Longer apical spur of mesotibia pectinate along one edge (*cf*. Fig. 2.30) ..... 30. Ochodaeidae

— Longer apical spur of mesotibia simple, not pectinate (*cf*. Fig. 3.30) 7

7(6). Antennomeres of antennal club not capable of being tightly closed together (Figs. 1-3.23, 1.24, 1.25) 8

— Antennomeres of antennal club capable of being closed together (Figs. 13.I, 2.31, 1.33, 2.34, 56.34, etc.) 10

8(7). Abdomen with 7 ventrites, first divided by metacoxa; head strongly constricted behind eyes; protibia lacking apical spurs; trochantin exposed; mesocoxae conical and projecting; length 5-9 mm ..... 24. Diphyllostomatidae

— Abdomen with 5-6 ventrites, first not divided; head not strongly constricted behind eyes; protibia with one or 2 apical spurs; trochantin not visible; mesocoxae not projecting; length 8-60 mm 9

9(8). Mentum with apex deeply emarginate; mesocoxal cavities closed laterally; body distinctly flattened dorsally (Fig. 1.25) ..... 25. Passalidae

— Mentum with apex simple, not deeply emarginate; mesocoxal cavities open laterally; body evenly convex dorsally (Fig. 1.23) ..... 23. Lucanidae

10(7). Antennal club with 3 antennomeres, first hollowed out to receive second (Fig. 2.31) ..... 31. Hybosoridae

— Antennal club with 3-7 antennomeres, first simple, not hollowed out to receive second (*e.g.*, Fig. 2.34) 11

11(10). Abdomen with 5 ventrites; dorsal surface roughened or tuberculate, not shining (Figs. 1.26, 1-3.27) 12

— Abdomen with 6 ventrites (Fig. 5.34); dorsal surface variably sculptured, shining or not 13

12(11). Eyes not divided by canthus; clypeus with sides narrowing apically; color brown, gray, or black; metafemora and metatibia not enlarged, not covering abdomen ..... 27. Trogidae

— Eyes divided by prominent canthus; clypeus with sides subparallel to divergent anteriorly; color testaceous to light reddish brown; metafemora and metatibia enlarged, covering most of abdomen ..... 26. Glaresidae

13(11). Elytra shortened and widely divergent at apex (except in *Lichnanthe lupina*), not covering pygidium (Fig. 1.33); eighth morphological abdominal segment with spiracle ..... 33. Glaphyridae

— Elytra not shortened or widely divergent at apex, pygidium exposed or not; eighth morphological abdominal segment lacking spiracle (Fig. 90.34) ..... 34. Scarabaeidae

14(2). Tarsi with 2-5 tarsomeres, not pseudotetramerous on ALL legs (*i.e.*, third of 5 tarsomeres on hind leg not lobed and enclosing small fourth, any other configuration possible); antennae, mouthparts, femora, and metacoxae variable; OR tarsi pseudotetramerous and metacoxa with distinct

posterior face (at least medially) set off from ventral surface by a carina or flange; OR tarsi pseudotetramerous, head not at all rostrate, and antennae strongly or weakly clubbed but not geniculate 15

— Tarsi pseudotetramerous on all legs, with apparent penultimate tarsomere lobed below, enclosing and nearly hiding true fourth tarsomere (Figs. 31.I, 3.120, 36-37.124, 57-59.124, etc.); often with long antennae (Fig. 1.120), rostrate head (Figs. 1.125, 1.127, 1.128, 1.129, 1.130), or enlarged hind femora (Fig. 54-56.124); metacoxa without exposed posterior face 16

15(14). Palps very short, usually immovably fixed and not visible; head rostrate, prolonged into a variously developed beak (Figs. 1.125, 1.127, 1.128, 1.129, 1.130) AND/OR antennae geniculate with compact club (Fig. 18.I) 16

— Palps longer, flexible, and usually evident (*e.g.*, Figs. 6-7.I); head usually not prolonged into a beak but if rostrate or antennae elbowed and club compact, then palps longer and flexible 26

16(14,15). Antenna usually without distinct club, filiform, moniliform, serrate or pectinate (Figs. 8-12.I); head not rostrate; if antenna distinctly clubbed, club of 5 or more antennomeres and length of head from top to clypeal margin less than or equal to width of head just behind eyes.... 17

— Antenna distinctly clubbed with 4 or fewer antennomeres in club (Figs. 15-16.I, 18.I); OR if antennae moniliform, head distinctly rostrate (Fig. 1.129); OR if club with 5 or more antennomeres, length of head from vertex to clypeal margin greater than width of head just behind eyes 20

17(16). Antenna usually more than half length of body, often inserted on prominence, capable of being reflexed backward over body (Fig. 1.120); tibiae with 2 obvious apical spurs (Fig. 5.120); first antennomere usually several times longer that second; pygidium never sclerotized and exposed; length 3-75 mm .... 120. Cerambycidae

— Antenna usually less than half length of body, seldom inserted on prominence, not reflexible back over body; tibiae without or with one or two apical spurs; first antennomere seldom more than 2-3 times length of second; pygidium of some species sclerotized and exposed; length usually less than 12 mm 18

18(17). All tibiae with 2 distinct apical spurs AND front without "X" grooves; mesonotum with or without stridulatory file; ligula large, membranous and bilobed; aedeagus with median struts and tegmen bilobed 19

— At least one tibia without 2 apical spurs OR front with deep "X" grooves (Figs. 5-6.124); mesonotum without stridulatory file; ligula normal; aedeagus without median struts .... 124. Chrysomelidae

[NOTE: The Bruchinae, treated in Chapter 121, key out here. See Status of Classification and subfamily key in Chapter 124]

19(18). Head with short but distinct temple behind eye, set off from narrowed neck (Fig. 1.122); apex of mandible bidentate; ligula with a single lobe; mesonotum with stridulatory file .... 122. Megalopodidae

— Head lacking temples, evenly narrowed from behind eyes to neck (Fig. 1.123); apex of mandible unidentate or bidentate; ligula bilobed; mesonotum without stridulatory file .... 123. Orsodacnidae

20(16). Antenna geniculate (rarely appearing straight or nearly so), club compact (Figs. 1-2.131, 69-77.131); metatrochanter not cylindrical, femur attached obliquely (Fig. 3.129) .... 131. Curculionidae

— Antenna straight (very rarely geniculate), club loose or not evident; metatrochanter variable but if antenna geniculate, trochanter cylindrical and squarely attached to femur (Fig. 4.129) 21

21(20). Labrum visible and free (Fig. 6-9.125, 2-3.126); second tarsomere not spongy beneath (Figs 2-3.125); maxillary palpi normal 22

— Labrum never free; tarsi variable; maxillary palpi rigid 23

22(21). Antenna situated adjacent to eye or laterally near base of short dorsoventrally flat rostrum; apex of third antennomere reaching well beyond front margin of eye; all tibiae lacking spurs or spurs vestigial; notosternal sutures indistinct to obsolete ..... 126. Anthribidae

— Antenna situated distally on long cylindrical rostrum; apex of third antennomere not or barely reaching front margin of eye; all tibiae with spurs; notosternal sutures distinct .... 125. Nemonychidae

23(21). Antenna either moniliform and body elongate (Fig. 1.129, 7.129, 9-11.129, 14.129) (Brentinae, Cyphagoginae, Trachelizinae); OR antenna straight and clubbed, body pear-shaped (Fig. 2.129, 15-17.129, 31.129) and metatrochanter cylindrical, squarely joined to femur (Fig. 4.129) (Apioninae, Nanophyinae); OR antenna geniculate, body pear-shaped and metatrochanter cylindrical, squarely joined to femur (Fig. 4.129) (Nanophyinae) OR antenna with 9-10 antennomeres and body elongate-cylindrical (Fig. 5.129) (Cyladinae, Nanophyinae) .... 129. Brentidae

— Antenna straight, not geniculate, with 11 antennomeres, club distinct; metatrochanter triangular or diamond-shaped, obliquely joined to femur (Fig. 3.129); body form variable 24

24(23). Gena produced anteriorly on each side, visible in frontal view as large tooth on each side of apex of rostrum, laterad mandible; dorsal surface with obvious, recumbent, scale-like setae; body surface lacking metallic sheen; length 12 mm or more ..... 130. Ithyceridae

— Gena not produced anteriorly; upper surface glabrous or with fine hair-like setae; body surface often with distinct metallic sheen; length variable, mostly less than 10 mm 25

25(24). Antenna situated at least length of antennomere 1 from eye, positioned laterally on long quadrate rostrum (Fig. 1.128) OR very close to eye at base of short, robust rostrum (Fig. 3.128); protibia with anterior face apically flat, simple, not distinct from rest of surface (Figs. 5-6.128); metafemur with dorsal margin slightly to moderately arched (Figs. 2-4.128); pygidium oblique to vertical (Figs. 2-4.128); elytron often with a scutellary striole (Fig. 1.128); body surface often with distinct metallic sheen ..... 128. Attelabidae

— Antenna situated immediately in front of eye at base of long cylindrical rostrum (Fig. 1.127); protibia with front face at apex with shallow grooved area filled with short, fine pilosity (Fig. 1.127); metafemur with dorsal margin markedly arched, paddle-like in shape, femur almost as wide as long; pygidium nearly horizontal; elytron lacking scutellary striole; body surface lacking metallic sheen ..... 127. Belidae

26(15). Length 1.2 mm or less; antenna long, thin, with loose to indistinct club (Figs. 1.17, 77.17); antennomeres each with a whorl of long setae at apex; wing fringed with long setae that are longer than width of wing (Figs. 2-4.17, 77.17), or wing absent ..... 17. Ptiliidae

— Length variable, antenna not as above, wings rarely with fringe longer than width of wing 27

27(26). Head with paired ocelli (Figs. 89-92.22) 28

— Head without paired ocelli (a single median ocellus may be present) 30

28(27). Anterior edge of scutellum abruptly and sharply elevated above mesoscutum; metepisternum reaching mesocoxal cavity and contacting first ventrite to separate metacoxa from elytral edge ..... 66. Derodontidae

— Anterior edge of scutellum not abruptly elevated, continuous with mesoscutum; metepisternum variable 29

29(28). Elytra completely covering abdomen; antenna short, not reaching middle of pronotum, antenna with 9 antennomeres, club of 5 pubescent antennomeres (Figs. 3-4.16); ventral surface with hydrofuge pubescence (Ochthebiinae) ..... 16. Hydraenidae

— Elytra usually exposing 1 or more abdominal terga (Fig. 6.22); antenna short to long, reaching beyond middle of pronotum in species with long elytra (Fig. 2.22); antennal club, if present, not involving 5 antennomeres; underside of body without hydrofuge surface (Omaliinae) .... 22. Staphylinidae

30(27). Elytra very short, leaving 3 or more abdominal tergites exposed (Figs. 1.22, 3.22, 3.102, 7.102, etc.) 31

— Elytra longer, leaving no more than 1 or 2 abdominal tergites exposed 51

31(30). Metatarsus with 1 fewer tarsomere than mesotarsus 32

— Metatarsus and mesotarsus with same number of tarsomeres 35

32(31). Body greatly flattened dorsoventrally, abdomen with 5 ventrites (Inopeplinae) .... 116. Salpingidae

— Body not greatly flattened, abdomen with 6-7 ventrites 33

33(32). Antenna strongly serrate to pectinate, flabellate, bipectinate or biflabellate (Figs. 8-18.102) .... 102. Ripiphoridae

— Antenna, at most, very weakly serrate 34

34(33). Tarsal claw with long, acute process or blade arising from base, usually more than half as long as claw (Figs. 13-16.111), rarely (*Hornia*) reduced to hyaline spine; antenna filiform; body corpulent and soft ..... 111. Meloidae

— Tarsal claw simple; antenna weakly clubbed; body cylindrical (Fig. 31.22) (Euaesthetinae) .... 22. Staphylinidae

35(31). Eyes large, separated frontally by less than diameter of third antennomere; wings well developed, folded longitudinally at rest; maxillary palp complex; antenna with antennomeres 9-11 less than half the width of antennomeres 3-5 (*Atractocerus*) ..... 71. Lymexylidae

— Eyes separated by more than diameter of third antennomere; wings, if well developed, usually folded transversely; maxillary palpi simple; antenna not as above 36

36(35). Scutellary striole present; 2 basal ventrites connate, suture not diminished medially; antennae of males pectinate to flabellate or plumose; serrate in females (Xenorhipidina) .... 41. Buprestidae

— Scutellary striole absent; ventrites all free or 4 ventrites connate; antennae variable 37

37(36). Antenna with distinct club (Figs. 13.I, 15-18.I) 38

— Antenna not clubbed (Figs. 8-12.I, 14.I) 43

[NOTE: The myxophagan family Hydroscaphidae will key out here if an easily made mistake is made in the suborder key (above). These tiny (length 1.0-1.2 mm) beetles can be recognized by the elongate, narrow last antennomere (Fig. 1.4) which does not fit either the "distinct club" or "not clubbed" choice, as well as by the presence of notopleural sutures.]

38(37). Mesotarsus with 2, 3 or 4 tarsomeres .... 22. Staphylinidae

— Mesotarsus with 5 tarsomeres 39

39(38). Antenna with 4 apical antennomeres expanded into asymmetrical club, first antennomere shining, other 3 tomentose (Fig. 1.21); elytra usually some combination of black and orange but occasionally all black; fifth tergite with pair of longitudinal carinae topped by stridulatory files; 12 mm or greater in length, usually more than 15 mm (Nicrophorinae) ..... 21. Silphidae

[*Thanatophilus* (Silphidae) may key here for individuals with an extended abdomen; it lacks the stridulatory files of the fifth tergite and is 8-14 mm in length, but otherwise fits here because of antennal configuration.]

— Antenna not as above; fifth tergite without stridulatory files; color variable; length 13 mm or less, usually less than 10 mm 40

40(39). Antenna with 3 antennomeres; pronotum with antennal pockets anterolaterally above lateral margins; dorsoventrally flattened, louse-like parasites of beaver (Fig. 23.19) (*Platypsyllus*) ..... 19. Leiodidae

— Antenna with 9-11 antennomeres; pronotum without antennal pockets 41

41(40). Procoxal cavities open ..... 22. Staphylinidae

— Procoxal cavities closed 42

42(41). Lateral margins of pronotum complete; 5 ventrites ..... 77. Nitidulidae

— Lateral margins of prontum incomplete; 6 ventrites (*Cylidrella*) ..... 72. Trogossitidae

43(37). Mesotarsus with 4 or fewer tarsomeres ..... 22. Staphylinidae

— Mesotarsus with 5 tarsomeres 44

44(43). Antenna with 12 antennomeres; antenna biserrate, bipectinate or biramose (Fig. 1.61) ..... 61. Phengodidae

— Antenna with fewer than 12 antennomeres; antennal type variable 45

45(44). Last maxillary and labial palpomere long, nearly as long as, or longer than, antenna (Fig. 1.60) ..... 60. Telegeusidae

— Last maxillary and labial palpomeres much shorter than antenna 46

46(45). Head covered above by pronotum (Fig. 9.62); often with luminous organs on abdomen (Fig. 19.62) ..... 62. Lampyridae

— Head visible from above; never with luminous organs 47

47(46). Anterior edge of scutellum abruptly elevated, with distinct step to mesoscutum (female *Anorus*) ..... 38. Dascillidae

— Anterior edge of scutellum in same plane as mesoscutum 48

48(47). Pronotum with lateral eversible vesicles (Fig. 2.74) (Malachiinae) ..... 74. Melyridae

— Pronotum without eversible vesicles 49

49(48). Mesosternum medially excavated, forming a cavity to receive extended prosternal process; Southwestern USA (female Cebrioninae) ..... 58. Elateridae

— Mesosternum not excavated to receive extended prosternal process; widespread 50

50(49). Elytra individually rounded, not meeting apically at suture (Fig. 4.64); mandible long and narrow (Figs. 25-26.64) ..... 64. Cantharidae

— Elytra truncate, meeting at suture apically (Figs. 5-40.22); mandible often short and broad ..... 22. Staphylinidae

[NOTE: The archostematan family Micromalthidae will key out to this couplet if an easily made mistake is made in the suborder key. They are exceptional for non-polyphagans in lacking notopleural sutures. At this couplet they will match neither choice because of the individually rounded elytra character of the cantharids, and the short mandible of the staphylinids. The combination of a concealed trochantin and posteriorly emarginate scutellum will further distinguish this family at this point. The rolled wing exhibited by the micromalthids is unique to the Archostemata. See Chapter 2.]

51(30). Apices of penultimate 2 or 3 antennomeres each completely ringed with microsetose groove (periarticular gutters) (Fig. 9.18) (must be viewed distally, difficult to see in very small specimens or in those with very compact antennal club); antenna with distinct to indistinct loose club; prothorax with sharp lateral margins; 5 or 6 ventrites; protrochantin exposed or hidden, if hidden and antenna with 11 antennomeres, antennomere 8 smaller than 7 or 9 52

— Antennae usually lacking periarticular gutters on antennal club; other characters variable; if complete periarticular gutters present, protrochantin hidden, antenna with 11 antennomeres AND antennomere 8 not smaller than 7 and 9 53

52(51). Metatibial spurs subequal in length (Figs. 16-18.19); small (1-6 mm), round to elongate oval, shining, granulate or transversely strigulate beetles; elytra glabrous or pubescent, striate or not; prothorax as broad as elytra (Figs. 1-5.19); procoxae strongly projecting and constricted by procoxal cavity; often capable of retracting into a ball-shape by curling head and prothorax under body; antenna distinctly clubbed, often with 11 antennomeres, 5 of which are involved in club and antennomere 8 smaller than 7 or 9. Some genera with 10 or 11 antennomeres and with distinct club of 3 or 4 antennomeres (Fig. 12.19); these latter with flattened, externally flanged hind femora, apical portion of which are excavate to receive tibiae; tarsal formula highly variable, 3-3-3, 4-4-4, 5-4-4, 5-5-4 or 5-5-5; one genus (*Colon*) with 11 antennomeres and somewhat gradually clubbed antenna that lacks small eighth antennomere (Fig. 7.19) has elytra pubescent, with characteristic shape and sutural stria (Fig. 2.19) (see also, couplet 112) ..... 19. Leiodidae

[NOTE: Three very aberrant and ecologically restricted genera that lack distinctly clubbed antennae belong here. *Glacicavicolla* is restricted to ice caves in Idaho and Wyoming and characterized by elongate head, pronotum and elytra, each separately constricted; cuticle translucent, shining; eyes absent, and with elongate, slender legs and antennae. Two genera of Platypsyllinae are associated with mammal nests or mammals and are characterized by oval, strongly dorsoventrally flattened body (Fig. 5.19), recumbent pubescence, an occipital crest overlapping anterior margin of pronotum (Fig. 5.19) and eyes absent or barely indicated.]

— Metatibial spurs distinctly unequal; moderately sized (4-14 mm), somewhat flattened shining beetles; elytra striate and glabrous; pronotum somewhat narrowed relative to elytra (Figs. 2-3.18); procoxae strongly projecting or transverse; body not retractile; antenna long, club loose and indistinct, eighth antennomere never smaller than 7 and 9; femora simple; tarsi 5-5-5 ..... 18. Agyrtidae

53(51). Mesotarsus with 3 apparent tarsomeres, either clearly with 3 tarsomeres, or second tarsomere strongly lobed and hiding small penultimate

(third) tarsomere (Figs. 5.92, 40.93, 43-44.93) 54

— Mesotarsus with 4 or 5 distinct tarsomeres OR first tarsomere distinctly lobed, engulfing very small second and small third of four, appearing to have 2 or 3 tarsomeres 62

54(53). Mesotarsus pseudotrimerous, with second tarsomere strongly lobed, hiding small penultimate (third) tarsomere (Figs. 5. 92, 40.93, 43-44.93) 55

— Mesotarsus truly with 3 tarsomeres, second tarsomere not greatly lobed 57

55(54). Procoxal cavities closed (except in *Holopsis*); head small, usually covered by hood-like pronotum (Figs. 1-9.94); if head exposed from above (Figs. 10-11.94), procoxal cavities closed; mostly tiny beetles less than 2 mm ... . 94. Corylophidae

— Head visible from above in front of pronotum; procoxal cavities open; size variable, up to 11 mm 56

56(55). Frontoclypeal suture distinctly impressed; all ventrites free; first ventrite without postcoxal lines; pronotum often with sublateral lines (Figs. 6-8.92) ..... 92. Endomychidae

— Frontoclypeal suture absent; 2 basal ventrites connate, first ventrite with postcoxal lines (Figs. 49-55.93); pronotum lacking sublateral lines ..... 93. Coccinellidae

57(54). Eyes absent (Fig. 8.90) (*Anommatus*) .... 90. Bothrideridae

— Eyes present 58

58(57). Head gradually narrowed behind eyes, without distinct temples or neck; procoxal cavities open; oval or elongate oval with base of pronotum subequal to elytral base 59

— Head sharply narrowed behind eyes or temples, with distinct neck; procoxal cavities open or closed, elongate or elongate oval, with base of pronotum distinctly narrower than elytra ... 60

59(58). Antennal scape normal, shorter than club; funicle longer than entire club; posterior edge of last ventrite crenulate (*Ostomopsis*) .... 91. Cerylonidae

[NOTE: The myxophagan family Microsporidae will key out here if an easily made mistake is made in the suborder key (above). They will match the antennal characters, but lack the crenulation on the last ventrite. These tiny (length 0.5-1.2 mm) beetles can be easily recognized, having only 3 ventrites (5 in *Ostomopsis*). See Chapter 3.]

— Antennal scape large, subequal to length of club; funicle with 3 antennomeres, shorter than first antennomere of club (*Micropsephodes*) .... 92. Endomychidae

60(58). Abdomen with six ventrites, head narrowed immediately behind eyes (Fig. 10.22), lacking temples; procoxal cavities open; lateral margin of pronotum coarsely dentate; trochantin exposed; mesocoxal cavities open (*Dasycerus*) ..... 22. Staphylinidae

— Abdomen with five ventrites; head behind eyes with distinct temples; procoxal cavities open or closed; lateral margin of pronotum simple to finely dentate or absent; trochantin concealed; mesocoxal cavities variable 61

61(60). Abdomen very short, half length of metasternum; pronotum not margined laterally; mesocoxal cavities unstudied in North American species; scutellum not visible; elytron at base with pit at end of impressed groove (Fig. 1.65); 2 rare species known from Florida .... 65. Jacobsoniidae

— Abdomen longer than metasternum (except *Akalyptoischion*, California); lateral margin of pronotum absent to finely dentate; mesocoxal cavities closed; scutellum small but visible; elytra usually striate; common and widespread ..... 95. Latridiidae

62(53). Antenna with 9 antennomeres, last 5 involved in club (Figs. 3-4.16); 6 or 7 ventrites; tiny intercoxal sclerite between metacoxae; maxillary palp long relative to antenna (Fig. 4.16); ventral surface with hydrofuge pubescence; 3.0 mm or less ..... 16. Hydraenidae

— Antenna not as above; other characters not in combination above 63

63(62). Antenna with 7-9 antennomeres, antennomeres 7-9 usually forming loose, tomentose club (Figs. 25-26.13), antennomere 6 often forming a cupule at base of club (Figs. 8.13, 10.13); maxillary palp often as long or longer than antenna (Figs. 1.13, 16.13, 19.13), always more than 1/2 antennal length (Figs. 27.13, 38.13); metacoxa with ventro-posterior carina setting off convex posterior face (Fig. 1.K) that rotates against anterior excavation of first ventrite; planes of ventral surface of metacoxa and first ventrite discontinuous; metatrochanter inserted on ventral (not posterior) surface of metacoxa (Figs. 40.13, 42.13), femur held against ventral face of coxa, not against posterior face of coxa or flat to abdominal surface when fully retracted ..... 13. Hydrophilidae

— Antenna variable but not as above; maxillary palp usually much shorter than antenna; metacoxa configured differently 64

64(63). Metacoxa with distinct posterior face (at least medially) set off from ventral surface by carina or flange (Fig. 3.K), posterior face often excavated (Fig. 2.K); ventral surface of metacoxa not co-planar with first ventrite; metafemur inserted on posterior face of metacoxa and femur held posterior to coxa when retracted (Figs. 2-3.K); procoxal cavities open; meso and metatarsi with equal number of tarsomeres 65

— Metacoxa without distinct posterior face; metatrochanter often inserted on ventral surface or on small medial projection of coxa, never received in coxal excavation and resting ventrad of metacoxa in retracted position; ventral surface of metacoxa more-or-less continuous with first ventrite OR metatarsus with one fewer tarsomere than mesotarsus; procoxal cavities open or closed 106

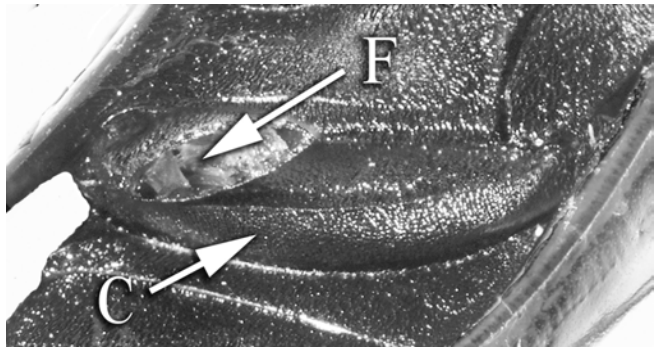

FIGURE 1.K. *Tropisternus* sp. (13. Hydrophilidae) metacoxa, oblique posterior view. C – posterior face of metacoxa. F – base of metacoxa (remainder removed).

65(64). Abdomen with 7-8 ventrites, metatarsus with 5 tarsomeres 66
— Abdomen with 6 or fewer ventrites, metatarsus with 5 or 4 tarsomeres 71

66(65). Head with median ocellus (male *Thylodrias*) .... 68. Dermestidae
— Head without median ocellus 67

67(66). Antenna with 12 antennomeres, biramose (Fig. 2.61) (male *Zarhipis*)..... 61. Phengodidae
— Antenna with 11 antennomeres, simple to uniramose or biramose 68

68(67). Mesothoracic coxae distinctly separated; elytra often reticulate (Fig. 1.59, 5.59), at least feebly costate; femur and/or tibia compressed; pronotum with distinct longitudinal median carina (Fig. 1.59), groove (Fig. 4.59) or cell (Fig. 5.59), occasionally restricted to base or disc ..... 59. Lycidae
— Mesocoxae contiguous or nearly so; elytra not reticulate; femur and tibia seldom compressed; pronotum rarely with distinct longitudinal median carina, groove or cell..... 69

69(68). Pronotum extended forward, covering head in dorsal view (Figs. 1.62, 8-9.62 18.62, 20.62, 23-36.62); 1 or more ventrites often with luminous organs (most obvious in males) (Fig. 19.62); separation of antennal insertions equal to or less than diameter of antennal fossa (Fig. 22.62) .. .. 62. Lampyridae

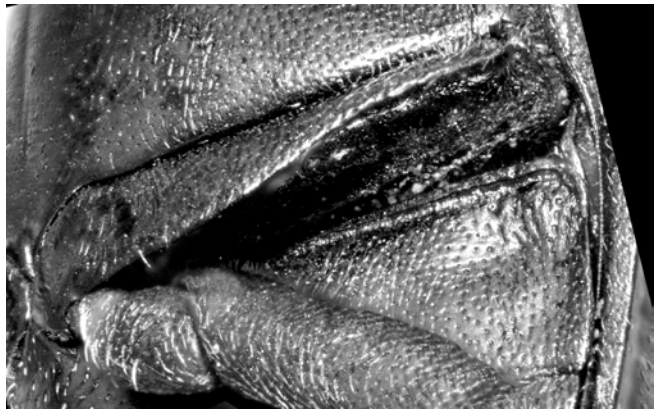

FIGURE 2.K. Elateridae metacoxa, oblique posterior view.

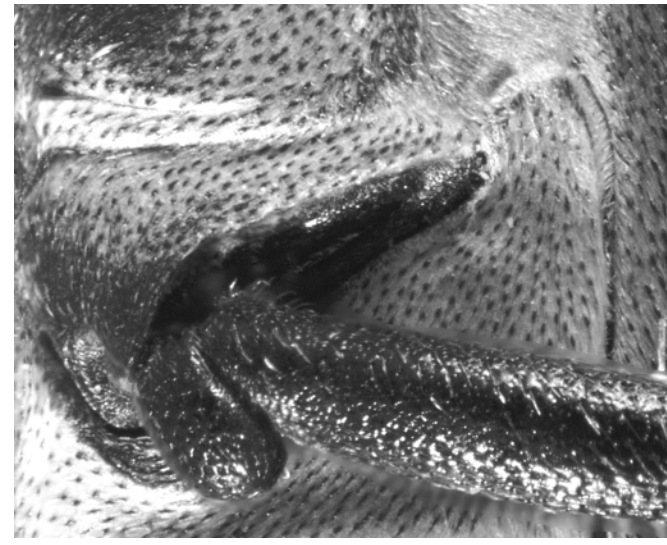

FIGURE 3.K. *Helichus immsi* Hinton (44. Dryopidae) metacoxa, oblique posterior view.

— Head exposed in dorsal view when extended, OR if covered by pronotum, antennae separated by nearly twice diameter of antennal fossa; abdomen lacking luminous organs .. 70

70(69). Labrum not distinct, membranous and often hidden beneath clypeus (Figs. 8-9.64); abdomen with paired glandular openings on lateral edge of tergites (Fig. 24.64); tarsomere 4 with bifid ventral lobe (Figs. 27-28.64) .. 64. Cantharidae
— Labrum distinct and sclerotized; abdomen lacking paired glandular openings on tergites; tarsomeres 3 and 4 with bifid ventral lobes ... . 63. Omethidae

71(65). Posterior angles of prothorax acute, embracing elytral humeri (Figs. 1-2.56,1.57, 1-3.58); metatarsus with 5 tarsomeres; 3 or more ventrites connate; prothorax dorsoventrally mobile relative to mesothorax; intercoxal process of prosternum long, notched dorsally, received in deep mesocoxal cavity as a clicking mechanism; IF clicking mechanism cannot be seen because visible portion of intercoxal process is flat ventrally and received tightly in deeply emarginate mesosternum, THEN sternopleural suture or hypomeron grooved to receive antennae 72
— Posterior angles of prothorax not acute and embracing elytral humeri, or rarely somewhat acute and weakly embracing humeri (Fig. 1.54, etc.); metatarsus with 5 or 4 tarsomeres; ventrites variable; prosternal process variable, but if large and received in deeply emarginate mesosternum, apex of prosternal process not notched dorsally nor capable of clicking; if large prosternal process received tightly in deep mesocoxal cavity AND underside of prothorax grooved to receive antennae, then metatarsus with 4 tarsomeres 74

72(71). Labrum not externally visible; abdomen with 5 connate ventrites ..... 35. Eucnemidae

— Labrum free and visible; abdomen with 3, 4 or 5 connate ventrites 73

73(72). Antenna indistinctly to distinctly clubbed (Fig. 1.57), apex received in margined cavity on posterolateral portion of hypomeron, just anterior to retracted foreleg; metasternum with or without oblique margined groove for mesotarsus; prosternum with click mechanism hidden by plate-like ventral surface of postcoxal intercoxal process which fits tightly against exposed portion of mesosternal cavity; elytra strongly striate and covered with silky, subrecumbent setae; abdomen with 5 connate ventrites; length 1-5 mm ..... 57. Throscidae

— Antenna variable (filiform, serrate, pectinate, etc.), but not clubbed; antennal groove, if present, at or near sternopleural suture; metasternum without margined groove for mesotarsus; IF click mechanism hidden as above, THEN elytra not strongly striate and setae suberect; abdomen with 3 or 4 connate ventrites; length 1-60 mm ..... 58. Elateridae

74(71). Mesocoxal cavities closed laterally, the mesosternum and metasternum meeting laterad mesocoxa OR antenna elongate, antennomeres 3–8 with long rami, 9-11 flattened, elongate-serrate (Fig. 27.70); pronotum often hood-like, covering head from above (Figs. 1.69, 4.69, 11-13.69) 75

— Mesocoxal cavities open laterally, the mesosternum and metasternum separated laterad mesocoxa by the mesepimera or mesepimera and mesepisternum; antennae not as above; pronotum variable 76

75(74). Metatrochanter cylindrical, short to long, squarely attached to femur, distinctly separating coxa and tibia (Fig. 29.I) ..... 70. Anobiidae

— Metatrochanter short, triangular, obliquely attached to femur so that femur and coxa are adjacent to narrowly separated, on one side (Figs. 5-7.69) ..... 69. Bostrichidae

76(74). Anterior margin of scutellum with abrupt, carinate elevation that fits against posterior margin of pronotum, or scutellum absent or not visible 77

— Anterior margin of scutellum not abruptly elevated, fitting under overlapping posterior margin of pronotum 101

77(76). Procoxae strongly and distinctly projecting ventrad of prosternum, 1/3 or more of dorsoventral length ventrad of intercoxal process (Figs. 2-3.49, 3.67), procoxae usually conical or transversely conical 78

— Procoxae not or weakly projecting ventrad of prosternum; if procoxae conical, then lying longitudinally and not or weakly projecting ventrally ventrad of intercoxal process 85

78(77). Tarsi with 4 distinct tarsomeres; metacoxal plates greatly expanded, hiding most of first ventrite; hind wing, when developed, often fringed with long setae; length 0.7-2 mm ..... 36. Clambidae

— Tarsi with 5 distinct tarsomeres; metacoxal plates distinct but not hinding most of first ventrite; wing not fringed; size variable 79

79(78). Antenna with distinct, simple club of 3 antennomeres (Figs. 1.14, 1.67, 4.68, 7.68) 80

— Antenna variously constructed, but without a simple club of 3 compact antennomeres ... 82

80(79). Elytra truncate; pygidium sclerotized and completely or nearly completely exposed (Fig. 1.14) ..... 14. Sphaeritidae

— Elytra complete; pygidium not sclerotized, completely covered or with only small portion exposed 81

81(80). Upper surface of body glabrous; body contractile; protibia held anterior to profemur and covering antenna in hypomeral cavity when contracted (Fig. 3.67) (Orphilinae) .... 67. Nosodendridae

— Upper surface of body variously pubescent, setose or scaled (Fig. 1.68); body not strongly contractile; protibia held posterior to profemur and antennal club not covered by leg when contracted (Fig. 4.68) ..... 68. Dermestidae

82(79). Base of pronotum crenulate; scutellum usually medially notched on anterior margin; antennal insertions not elevated; mandibles moderate and evenly curved; labrum large, sclerotized and dorsal to mandibles .... 49. Ptilodactylidae

— Base of pronotum simple; anterior margin of scutellum not notched; dorsal margin of antennal insertions elevated and protuberent; mandibles large, abruptly curved mesad at nearly right angle; labrum either short and membraneous or extending between and below mandibles 83

83(82). Empodium not obvious, hidden between bases of claws or absent; base of pronotum nearly straight (Fig. 1.38) ..... 38. Dascillidae

— Empodium large, 1/3 length of claw, obviously plurisetose; base of pronotum strongly trisinuate around scutellum (Fig. 1.39, 1.52) 84

84(83). Tarsomeres 1-4 with large, membranous, divided lobes; antenna lamellate (males) or increasingly serrate apically (females) ..... 39. Rhipiceridae

— Tarsi simple, without ventral lobes; antennae serrate to pectinate ..... 52. Callirhipidae

85(77). Head with single median ocellus (Fig. 4.68) .... 68. Dermestidae

— Head without ocellus 86

86(85). Antenna short, not reaching middle of pronotum, scape and pedicel (antennomeres 1-2) relatively large, together 1/3 or more of total length; antennomeres 3 to last transverse; body covered in dense tomentum 87

— Antenna short to long, scape and pedicel (antennomeres 1-2) not 1/3 of total length; antennomeres 3 to last variable; body vestiture variable 89

87(86). Head distinctly prognathous, mandibles strongly projecting forward (Fig. 1.47); profemur widened medially and armed externally with strong spines (Fig. 1-2.47); mesotarsus with 4 tarsomeres ..... 47. Heteroceridae

— Head distinctly hypognathous, mandibles either directed ventrad or hidden (Figs. 1.44, 1.45); profemur simple, neither widened medially nor armed with large spines; mesotarsus with 5 tarsomeres 88

88(87). Metasternite with postcoxal lines delimiting retractile position of mesotibia; antenna hidden in subocular groove and cavity between head and pronotum; body oval (Fig. 1.45) .... 45. Lutrochidae

— Metasternite without postcoxal lines; subocular groove absent or very weakly developed, antenna not hidden in pronotum; body nearly parallel-sided (Fig. 1.44) ..... 44. Dryopidae

89(86). Scape and pedicel received in deeply excavate pro- and mesosterna between pro- and mesocoxae (Fig. 2.50); pedicel longer than scape, scape and pedicel together more than 2/3 length of serrate flagellum (Fig. 2-3.50); body strongly contractile, all legs received in cavities (Fig. 2.50); mesotarsus with 5 tarsomeres, with long lobe on third tarsomere, fourth small and sometimes difficult to see (pseudotetramerous) ..... 50. Chelonariidae

— Antennae not received in excavations between pro- and mesocoxae; antennae not as above; mesotarsus usually not pseudotetramerous 90

90(89). Head with subgenal ridges that fit against procoxae when head deflexed .. 37. Scirtidae

— Head without subgenal ridges, genae not in contact with procoxae 91

91(90). Two basal ventrites connate, either with suture between them partially obliterated medially OR if suture between ventrites 1 and 2 not medially indistinct, sternopleural sutures at least moderately grooved to receive antennae 92

— Ventrites all free, OR 3 or 5 ventrites connate; ventrital and sternopleural sutures variable 94

92(91). Suture between 2 basal sternites distinct medially; mesotarsus with small, bisetose empodium; antenna filiform to distinctly clubbed; body strongly convex ..... 42. Byrrhidae

— Suture between 2 basal sternites weak to absent medially (Figs. 9.41, 58.41, etc.); mesotarsus lacking visible empodium; antenna usually serrate, pectinate or flabellate (Figs. 7-8.41, 28.41, 46-48.41); body weakly dorsoventrally flattened 93

93(92). Fourth tarsomere with long lobe beneath, completely divided into 2 parts; metepisternum broad, approximately twice as long as wide .. .. 40. Schizopodidae

— Fourth tarsomere with variable entire, undivided lobe beneath (Figs. 4-6.41, 54-55.41); metepisternum narrow, at least 3 times as long as wide (Figs. 9.41, 11.49, 18-19.41, etc.) or almost completely concealed under elytra (Fig. 15.41) ..... 41. Buprestidae

94(91). Legs retractile, rotated forward in repose, with tibia held anterior to femur; profemur with flange on posterior face covering tibial excavation, protibia grooved to receive tarsus; usually with margined excavations on propleuron, mesosternite, and ventrites to receive legs 95

— If legs retractile, protibia held posterior to or ventral to femur; profemoral flange, if present, located on anterior face 96

95(94). Mentum strongly sclerotized, expanded, covering labium and maxillae (Fig. 2.67); head not deflexible; antenna covered by prolegs in broad sternopleural pocket (Fig. 2.67); ventrites 1 and 2 excavate for metathoracic leg; mesotibia with marginal spines; length 4-9 mm ..... 67. Nosodendridae

— Mentum normal, head usually retractable into pronotum to anterior margin of eyes (one exception) (Fig. 1.46); antennae received in internal pronotal cavities beneath head, external anterior pronotal cavities or partly in sternopleural grooves and partly under legs against hypomeron; excavation for metathoracic leg, if present, limited to ventrite 1; margin of mesotiba not spinose; length 1-2 mm .. .. 46. Limnichidae

96(94). Elytra with thumb-like process on inner lateral surface near subapical curve, locking into ventrite 5 ..... 53. Artematopodidae

[NOTE: Elytra must be separated from side of abdomen to see this character.]

— Elytra without such a locking device 97

97(96). Posterior angles of pronotum with short discal carinae (Fig. 1.54); procoxal cavity with narrow lateral extension at pleurosternal suture .... 54. Brachypsectridae

— Posterior angles of prontum without short discal carinae; procoxal cavity broad at pleurosternal suture 98

98(97). Propleuron extended mesad behind procoxa for approximately half length of trochantin; length 10-15 mm 99

— Margin of propleuron curved laterad posteriorly, not extended mesad posterior to procoxa; length 1-8 mm 100

99(98). Posterior margin of pronotum crenulate; mesotibial spines subequal in size, smooth; antenna compressed serrate (Fig. 1.51); tarsomeres simple; empodium large and setose ..... 51. Eulichadidae

— Posterior margin of pronotum simple; mesotibial spines unequal in size, finely serrate; antenna cylindrical-serrate (Fig. 1.38); tarsomeres 1-4 with large, divided membranous lobes; empodium absent ..... 38. Dascillidae

100(98). Posterior edge of pronotum simple; last tarsomere much longer than others, usually half or more total length of tarsus ..... 43. Elmidae
— Posterior edge of pronotum crenulate; last tarsomere subequal in length to first .... 48. Psephenidae

101(76). Head with subgenal ridges that fit against procoxae when head deflexed; prosternum in front of coxa narrow, shorter than intercoxal process ..... 37. Scirtidae
— Head without subgenal ridges, genae usually not in contact with procoxae; prosternum in front of coxae nearly as long as or longer than intercoxal process 102

102(101). Metacoxal plates large, plate-like, longer medially than metasternite, hiding most of metafemur, even when fully extended (Figs. 8-9.35) ..... 35. Eucinetidae
— Metacoxal plates narrow, forming either a parallel plate or simple carina; metafemur fully visible 103

103(102). Length of body 4 or more times maximum width (Fig. 1-2.71); male maxillary palp complex, multilobate ..... 71. Lymexylidae
— Length of body 2.5 or less times maximum width; maxillary palp not branched 104

104(103). Prosternal intercoxal process complete, reaching behind procoxa to level of mesosternum; posterior portion of hypomeron not extending behind procoxa; elytral epipleuron with an internally carinate edge complete to suture; head with face narrowed; clypeal margin straight; 3 basal ventrites connate ..... 48. Psephenidae
— Prosternal intercoxal process incomplete, not reaching beyond midpoint of procoxa; posterior portion of hypomeron variable behind procoxa; elytral epipleuron narrowed before reaching suture (complete in one genus); head with face not greatly narrowed; clypeal margin emarginate (Figs. 5-6.21, 11.21); all ventrites free 105

105(104). Elytra with 9 or 10 punctate striae (Figs. 1-4.18); posterior portion of hypomeron extending up to half the distance to mesal edge of procoxa; length 7-14 mm ..... 18. Agyrtidae
— Elytra without punctate striae, otherwise variable, irregularly punctate (Fig. 1.21), with complex low sculpture (Fig. 2.21) or up to 3 carinate costae (Fig. 3.21); posterior portion of hypomeron not extending behind procoxa or extending only a short distance mesad of lateral edge of procoxa (Figs. 9-10.21); length 7-45 mm ..... 21. Silphidae

106(64). Hind coxae widely separated by broad, truncate intercoxal process of first ventrite 107
— Intercoxal process of first ventrite absent, acute or rounded 109

107(106). Mesocoxal cavities open laterally, closure involving mesepisterna (Georissinae) .... 13. Hydrophilidae
— Mesocoxal cavities open or not; if open, closure solely involving mesepimeron 108

108(107). Antenna geniculate, club usually of 3 antennomeres; elytra short and truncate, exposing 2 non-flexing terga; body compact .... 15. Histeridae
— Antenna not obviously geniculate, clubbed or not; elytra rarely exposing 2 terga, IF 2 terga exposed, THEN exposed abdominal segments flexible, body not oval or body cylindrical and compact 109

109(106,108). Procoxae with exposed trochantin 110
— Trochantin concealed or absent 128

110(109). Metacoxa extending laterally to reach elytral epipleuron or side of body, no visible contact between metathorax and first ventrite 111
— Metacoxa not reaching elytron, first ventrite and metathorax visibly in contact laterad coxa 116

111(110). Hind tarsus with 5 tarsomeres 112
— Hind tarsus with 4 tarsomeres 157

112(111). Head with temples and occipital ridge distinct, occipital ridge closely fitting against pronotum, constricted behind to a distinct neck (difficult to see when head is retracted with ridge and temples against pronotum); elytra with strong characteristic sutural stria, no other striae evident (Fig. 2.19); 11 antennomeres, gradual club of 3-4 antennomeres (Fig. 7.19); 4 (females) or 5 (males) ventrites (*Colon*, see couplet 52) .... 19. Leiodidae
— Head without ridge and constricted neck that fits against pronotum; elytra striate or not, but not as above; antenna variable; at least 5 ventrites 113

113(112). Prosternal process between coxae distinctly elevated above level of prosternum, apex strongly curved dorsally, reaching level of postcoxal extensions of hypomeron; cervical sclerites absent; antenna not clubbed; elytra glabrous or subglabrous; length 8-20 mm .... 120. Cerambycidae
— Prosternal process not elevated between coxae nor with apex strongly curved dorsad; cervical sclerites present; antenna clubbed or not; elytra densely to sparsely setose, subglabrous or glabrous; length 1-24 mm 114

114(113). Procoxae not projecting distinctly below intercoxal process, large and transverse; antenna distinctly clubbed; prothorax with sharp lateral margins; IF procoxae slightly projecting, THEN antenna distinctly clubbed and tarsi not lobed beneath; not bright red .... 72. Trogossitidae
— Procoxae projecting distinctly below intercoxal process, conical or transverse (Figs. 21.73, 116-117.73); antennae variable; margins of prothorax variable; IF procoxae are only slightly projecting, THEN antennae feebly clubbed (Fig. 6.73), tarsi lobed beneath (Fig. 8.73) AND color bright red 115

115(114). Tarsi not lobed beneath; procoxal cavity strongly transverse; labrum subtruncate to convex, rounded or acute (Figs. 18-19.74); eye not emarginate (Figs. 18-19.74); antenna rarely with distinct apical club, and if so, club of 5 or more antennomeres; elytra usually confusedly punctate; pronotum and abdomen sometimes with eversible glands (Fig. 2.74) ..... 74. Melyridae

— Tarsi with lobes on multiple tarsomeres (Figs. 8-9.73, 50.73, 87.73); procoxal cavity circular (Figs. 21.73, 54.73), elongate or slightly transverse (Fig. 13.73); labrum subtruncate to concave or deeply emarginate (Fig. 77.73); eye often emarginate (Figs. 19-20.73, 77.73, 114-115.73); antenna usually apically clubbed, club of 1 or more antennomeres (Figs. 5-7.73, 30-37.73, 42-43.73, 88-97.73, 104-112.73); elytra often punctate-striate (Fig. 1.73); pronotum and abdomen never with eversible glands ..... 73. Cleridae

116(110). Elytra short, completely exposing 1 or more tergites (Figs. 1.76, 5-6.77, 1.78, 2.79) 117

— Elytra covering all of abdomen or exposing apex of 1 tergite 120

117(116). Procoxal cavities broadly open (by more than half width of coxa); labium with 2 palpomeres; abdominal intercoxal process truncate; pygidium and last ventrite longer than preceding 4 combined (Fig. 1.78) ..... 78. Smicripidae

— Procoxal cavities closed or narrowly open (by less than half width of coxa); labium with 3 palpomeres or non-articulated; abdominal intercoxal process acute to broadly rounded or absent; pygidium variable 118

118(117). Labial palps non-articulated; prosternal process elevated between procoxae and strongly curved dorsally behind .... 76. Brachypteridae

— Labium with 3 palpomeres; prosternal process flat or elevated between procoxae, but not strongly curved dorsally behind 119

119(118). Antenna with 10 antennomeres, club of only 1 antennomere; elytra more than twice as long as wide (Rhizophaginae) ..... 79. Monotomidae

— Antenna with 10 or 11 antennomeres, club of 3 or more antennomeres; elytra less that twice as long as wide ..... 77. Nitidulidae

120(116). Mesotarsus with 4 tarsomeres; tarsal lobes, if present, small, not obscuring penultimate tarsomere 121

— Mesotarsus with 5 tarsomeres, fourth possibly obscured by enlarged lobe of third (pseudotetramerous) 123

121(120). Lateral margin of pronotum crenulate (Fig. 4.98), antennal insertions concealed from above (*Sphindocis*) ..... 98. Ciidae

— Lateral margins of pronotum smooth or minutely denticulate, antennal insertions visible from above 122

122(121). Body nearly spherical, capable of being rolled into a ball; mandibles resting against metasternum in retracted position (*Cybocephalus*) ..... 77. Nitidulidae

— Body flattened-cylindrical, not at all spherical (Fig. 1.96) (Mycetophaginae) ..... 96. Mycetophagidae

123(120). Antenna with 10 antennomeres, one involved in club (Fig. 1.79) (Rhizophaginae) ..... 79. Monotomidae

— Antenna with 10 or 11 antennomeres, if clubbed, club of 2 or more antennomeres 124

124(123). Body extremely flattened; elytra nearly parallel-sided, disc almost perfectly flat between rounded lateral carinae running from humeri to near apex, setting off vertical sides and guttered epipleural margin (Fig. 1.82); either large (>10 mm) and red with expanded temples (Fig. 1.82) or small (<5 mm) and dull brown without temples ..... 82. Cucujidae

— Body not so distinctly flattened; elytra distinctly transversely arched, not fitting other combinations above 125

125(124). Dorsal face of mandible with tubercle that fits into cavity on clypeus, setose cavity at base, hidden when mandibles are closed (mycangium) (Fig. 3.75); elytra with scutellary striole (Figs. 8-11.80, 1.75); antenna with 2 or 3 antennomeres forming club (Figs. 1.75, 4-5.75, 8-11.75); body oval to cylindrical (Figs. 1.75, 8-11.75) ..... 75. Sphindidae

— Mandible without dorsal mycangium; elytra without scutellary striole; antenna and body shape variable 126

126(125). Antenna with a distinct club AND meso- and metatarsi with equal numbers of tarsomeres ... 127

— Metatarsus with one fewer tarsomere than mesotarsus; antenna distinctly clubbed or not 157

127(126). Pygidium at least partially exposed, strongly sclerotized, punctate, distinctly different from other tergites (Figs. 1.77, 7-8.77); tibiae usually spinose or denticulate on external margin ..... 77. Nitidulidae

— Pygidium not exposed, not strongly sclerotized, similar to other tergites (Fig. 1.88); tibiae smooth on external margin ..... 88. Byturidae

128(109). Antennal insertions concealed from above by lateral expansion of frons (Figs. 7-10.106, 53-54.106, 65-67.106, etc.); AND 3 basal ventrites connate (Figs. 4-5.106), fourth and fifth movable (Figs. 138-139.106); AND procoxal cavities closed by the mesad extension of the posterior portion of the hypomeron; AND procoxal process not expanded laterally at apex to close procoxal cavities (Figs. 131-132.106, 135-137.106); antenna usually with 11 antennomeres (rarely with 9 or 10 antennomeres) . ..... 106. Tenebrionidae

— Without this combination of characters 129

129(128). Abdomen with first 4 ventrites connate 130

— Abdomen with fewer than 4 ventrites connate 131

130(129). Antenna serrate or pectinate (Fig. 1.55); antennal insertions exposed from above (Fig. 1.55); metacoxa laterally reaching epipleuron; intercoxal process of prosternum with long, notched, apical projection, received in deep mesosternal cavity to form clicking mechanism; last ventrite without submarginal groove; mentum without setose pit ..... 55. Cerophytidae

— Antenna moniliform, clavate or capitate (Figs. 3.104, 5.104, 1-2.105, 8.105); antennal insertions concealed from above (Fig. 5.104); metacoxa not reaching elytron, first ventrite and metepimeron in contact laterad coxa and mesad epipleuron; prosternal process broad, widened apically (Figs. 2.104, 4.104, 5-7.105); last ventrite usually with submarginal groove; males often with median setose pit on mentum ..... 105. Zopheridae

[NOTE: The Monommatini, treated in Chapter 104, key out here. See Status of Classification and the key in Chapter 105]

131(129). Metatarsus with 5 tarsomeres, first reduced, often difficult to see; metatarsomere 1 either hidden in apical excavation of metatibia OR, IF metatarsal insertion fully exposed, THEN first metatarsomere less than 1/4 length of second and obliquely attached under second (may only be visible from below in oblique distal angle); elytra covering pygidium; antenna with distinct club of 2-4 capitate to elongate-loose antennomeres (Figs. 14-16.69, 21-22.69, 31-33.69); AND one of the following combinations: 1) head somewhat to distinctly hypognathous; pronotum hood-like, projecting anteriorly (or ventrally in some fully hypognathous species) beyond anterolateral angles above head (Figs. 1.69, 2.69, 4.69,11-13.69,17-20.69) (Bostrichinae, Dinoderinae, Endecatominae); 2) head prognathous (Figs. 27-30.69); intercoxal process of first ventrite truncate, metacoxae widely separated, metacoxa reaching elytra laterally, separating metathorax and first ventrite (Lyctinae); OR 3) head prognathous (Fig. 3.69); procoxae transversly cylindrical, projecting at sides, proleg attached and directed laterally, femur and trochanter large (Polycaoninae) ..... 69. Bostrichidae

— First tarsomere not so reduced; other characters variable; if first metatarsomere is reduced relative to second, pronotum not hood-like, head not hypognathous AND/OR metatarsus of 4 tarsomeres, pygidium exposed, first ventrite not widely truncate between metacoxae; procoxae not transversely cylindrical and projecting at sides 132

132(131). Mesotarsus with 4 distinct tarsomeres 133

— Mesotarsus with 5 tarsomeres, or tarsi pseudotetramerous 144

133(132). Mesocoxal cavities closed laterally 134

— Mesocoxal cavities open laterally 140

134(133). Antennal insertions concealed from above 135

— Antennal insertions exposed from above 136

135(134). Eyes usually present; IF eyes absent, THEN elytra with flat tubercles (Fig. 11.103) ..... 103. Colydiidae

— Eyes absent; elytra smooth (*Aglenus*) ..... 116. Salpingidae

136(134). Genae with pair of anteriorly directed horns extending beyond labium, visible from above ... . 107. Prostomidae

— Genae lacking gular horns 137

137(136). Abdomen with 6 ventrites; pronotum usually large, hood-like, covering or nearly covering head (Figs. 1-9.94); pygidium usually exposed (Figs. 6-7.94, 10-11.94); epipleuron incomplete; frontoclypeal suture absent; length less than 2 mm ..... 94. Corylophidae

— Abdomen with 5 or 6 ventrites; pronotum never hood-like, head visible from above; pygidium, epipleuron and frontoclypeal suture variable; IF with 6 ventrites, THEN length 4 mm or greater and frontoclypeal suture present 138

138(137). Antenna longer, reaching to or beyond middle of pronotum, club loose; pronotum usually with pair of sublateral discal carinae or grooves, running from base laterad of basal pits (Fig. 1.92); body usually round to ovoid ..... 92. Endomychidae

— Antenna shorter, not reaching beyond middle of pronotum, club compact; IF pronotum with discal carinae or grooves, THEN usually a median groove or pit and body elongate 139

139(138). Posterior margin of last ventrite crenulate OR body distinctly oval, length no more than twice maximum width; antenna with 8, 9, or 10 antennomeres; hind trochanter obliquely attached to femur, but distinctly separating coxa from femur ..... 91. Cerylonidae

— Posterior margin of last ventrite never crenulate, antenna with 10-11 antennomeres; body elongate, at least 2.75 times maximum width; hind trochanter offset so that femur and coxa are in contact or nearly so ..... 90. Bothrideridae

140(133). Metacoxae separated by more than 1/2 transverse coxal diameter 141

— Metacoxae separated by less than 1/2 transverse coxal diameter 142

141(140). Procoxal cavities narrrowly closed; pro- and mesocoxae strongly transverse; mandible tucked into cavity when closed, not visible from side; antenna with 9 antennomeres, last 5 forming club (Fig. 3.94); pronotum not grooved or carinate on disc (Fig. 3.94); small beetles, less than 2 mm in length (*Orthoperus*) ..... 94. Corylophidae

— Procoxal cavities narrowly to widely open; pro- and mesocoxae circular to slightly transverse; mandible visible from side; antenna with 8-11 antennomeres, if clubbed, club of 1, 2 or 3 antennomeres (Figs. 1-3.92); pronotum usually with submarginal grooves or carinae, especially basally (Figs. 6-8.92); size 1-10 mm; IF less than 2 mm and lacking grooves or carinae on pronotum (*Eidoreus*), THEN antenna with 10-11

antennomeres, 1 or 2 of which form a distinct club ..... 92. Endomychidae

142(140). Intercoxal process of first ventrite absent, no part of ventrite extending between coxae to contact metaventrite; first ventrite lacking margined metacoxal cavitites; metacoxae conical and projecting; body soft; small triangular part of morphological abdominal sternite 2 usually visible laterad of metacoxa (*i.e.*, ventrite 1 small, divided); often colorful, with red, yellow or metallic blue/green markings (Fig. 10.69); length 5-12 mm (Psoinae)..... 69. Bostrichidae

— Intercoxal process of first ventrite complete; first ventrite with margined coxal cavities; metacoxae transverse; body fully sclerotized; ventrite 1 closing anterolateral angle between metacoxa and abdomen, not divided by metacoxae; never metallic; length 0.5-6.5 mm 143

143(142). Body elongate-oval and somewhat cylindrical; pronotum usually very convex in transverse section, edges often directed ventrally (Figs. 1.98, 6.98, 10.98, 20.98, 36-42.98); pronotum without basal pits or impressions; head or pronotum of male often with horns or tubercles (Figs. 13-14.98, 33.98, 36.98, 39-40.98, 42.98, 43-45.98); antenna with 8-10 antennomeres and club of 2-3 antennomeres; males often with pubescent median fova on first ventrites; head without distinct temples or neck. One species from California has relatively flat pronotum with crenulate margins directed laterally (Fig. 4.98), antenna with 11 antennomeres and 3 antennomeres in club, but 2 basal sternites are connate ..... 98. Ciidae

— Body oval to elongate oval, usually somewhat dorsoventally depressed; pronotum usually weakly convex transversely, edges directed laterally; pronotum with 2 basal pits or impressions laterad scutellum (Fig. 1.96) (sometimes in posterior marginal groove and difficult to discern); head and pronotum without horns or tubercles; antenna with 11 antennomeres, last 2-5 forming club; all ventrites free, without median fovea. One genus (length less than 2 mm) somewhat cylindrical, with very convex pronotum in transverse section, with head abruptly constricted behind short temples to form distinct neck..... 96. Mycetophagidae

144(132). Abdomen with six ventrites AND metatarsi with five tarsomeres; terminal maxillary palpomere (4) shorter and narrower than penultimate (Figs. 2-8.20); shape rather characteristic (Figs. 25-46); length 0.6-2-7 mm ..... 20. Scydmaenidae

— Abdomen with four or five ventrites; tarsi variable; terminal maxillary palpomere (3 or 4) as wide or wider AND/OR as long or longer than penultimate; size variable 145

145(144). Pregular area on each side with a laterally facing surface bearing setose pit or cavity near end of distinct antennal groove; first ventrite with postcoxal lines ..... 89. Biphyllidae

— Pregular area without laterally facing setose pit; antennal grooves and postcoxal lines variable 146

146(145). First ventrite much longer than second (measured behind coxa); elytra without punctate or impressed striae (traces of striae occasionally visible through cuticle, but not expressed on the surface); epipleuron distinct in basal half, not reaching apex (usually narrowed at level of third ventrite); genae carinate and projecting ventrally between eye and mentum; apex of elytra with double suture or "subapical gap" caused by wide flange of elytral coupling system; elytra complete, exposing at most tip of last tergite..... 85. Cryptophagidae

[NOTE: Two genera of tiny (<1.3 mm) cryptophagids (*Amydropa*, Baja California, and *Hypocoprus*, Rocky Mountain region) lack the subgenal carinae. *Hypocoprus* has the first 2 ventrites subequal and the pygidium exposed while *Amydropa* lacks the double suture on the elytra. The other characters fit these 2 rare genera. *Ambydropa* has greatly reduced eyes (10 facets or fewer) and *Hypocoprus* has distinct temples.]

— Not fitting this combination of characters, EITHER with the first ventrite short, elytra striate, epipleuron complete to apex, gena flat between eye and mentum, OR elytra not covering most of pygidium 147

147(146). Metatrochanter transversely or obliquely attached to femur, distinctly separating femur from coxa (Figs. 28-29.I) 148

— Metatrochanter obliquely attached to femur, offset so that femur abuts coxa (Fig. 26-27.I) 157

148(147). Antennal insertions approximate or separated by less than 1/2 width of head behind eyes AND pronotum without lateral carinae; metatarsus with 5 tarsomeres; metatrochanter elongate, cylindrical (Fig. 29.I, 69.70, 74.70) (Ptininae).. ..... 70. Anobiidae

— Without combination of narrowly separated antennal insertions and no lateral carina on pronotum; other characters variable..... 149

149(148). Pronotum with sublateral lines or grooves that extend from base anterad midpoint, often to anterior margin (Figs. 1-11.83); head usually with sublateral lines from median margin of eye to pronotum; lateral margins of pronotum smooth or wavy or with few obtuse angles (Figs.1-11.83), not acutely denticulate or serrate; head not sharply constricted to a distinct neck; body oval to elongate, subcylindrical to strongly dorsoventrally flattened (Figs. 1-11.83) .... 83. Laemophloeidae

— Pronotum usually without sublateral lines that extend from base anterad midpoint; head variable; IF pronotum with sublateral lines that extend from base to or beyond midpoint, THEN lateral margins of pronotum sharply denticulate, anterior angles acutely projecting AND/OR head sharply constricted behind small temples (Figs. 17.80, 19.80, 22.80); body variable 150

150(149). Mesocoxal cavities open laterally..... 151

— Mesocoxal cavities closed laterally 153

151(150). Antenna with 10 antennomeres, distinctly clubbed; elytra shortened, exposing all of pygidium (Fig. 2.79); head abruptly constricted to form neck; 1-4 mm ..... 79. Monotomidae
— Not fitting one or more of above characters 152

152(151). Body elongate, flattened (Figs. 1.80, 16-25.80); meso- and metatarsi with same number of tarsomeres; head usually with distinct temples before abrubtly constricted neck (Figs. 1.80, 4.80, 16-25.80); procoxae either closed behind (Fig. 3.80) or, if open (Brontinae, Fig. 2.80), elytra transversely flat or slightly concave between slightly to distinctly raised interstria between stria 6 and 7; elytron with scutellary striole; base of mandible with dorsal setose pit (mycangium) hidden beneath clypeus when closed; antenna filiform, with scape more than 3 times length of pedicel ..... 80. Silvanidae
— Metatarsus with one tarsomere fewer than mesotarsus; other characters variable 157

153(150). Body shining, oval and strongly convex; pronotum tightly embracing elytra (Fig. 1.84), pronotum laterobasally with a vaguely transparent, thin flange which slides over a smooth area on base of humeral angle of elytron, this area on elytron delimited posteriorly by a thin carina; pronotum and elytra with wide propleura and epipleura, lateral margins sharp, explanate, strongly directed ventrally so that lateral margins are far below level of procoxa and mesad epipleural margin, dorsal surface forming an inverted "U" in transverse section; tarsal claw toothed or appendiculate ..... 84. Phalacridae
— Body usually not so evenly oval, pronotum not coadapted to pronotum in the above manner, without described flanged basal angles of pronotum or associated elytral area; lateral margins of pronotum and elytra laterad, rather than ventrad, to procoxa and eplipleura; tarsal claws toothed only in groups with pronotum narrowed behind 154

154(153). Meso- and metatarsi with same number of tarsomeres; face often with beaded lateral margins (Figs. 1.81, 3-4.86, 9-10.87) 155
— Mesotarsus with one more tarsomere than metatarsus; face without beaded lateral margins 157

155(154). Gular sutures confluent; genae expanded anteriorly, plate-like, concealing maxillae (Fig. 4.81) ..... 81. Passandridae
— Gular sutures separate or absent; genae not so expanded 156

156(155). Procoxal cavities usually open behind (Fig. 8.86); terminal maxillary palpomere narrow, elongate; IF procoxal cavities closed behind (Fig. 7.86), THEN closure by mesad extension of hypomeron, length less than 3 mm and pronotum somewhat narrowed near base (*Cryptophilus*) .... 86. Languriidae
— Procoxal cavities closed behind by laterad expansion of the prosternal process (Figs. 5-6.87); terminal maxillary palpomere often securiform (Figs. 5-6.87), or narrow and elongate (Fig. 4.87); length 3-22 mm ..... 87. Erotylidae

157(111,126,147,152,154).Last visible segment of abdomen forming a terminal spine (Fig. 1.101); body wedge-shaped, humpbacked; head retracted to hypognathous position (Fig. 1.101); metatibia and metatarsus usually with oblique or transverse, comb-like serrate ridges subapically on lateral faces (Figs. 2-7.101) .. 101. Mordellidae
— Abdomen not prolonged into a terminal spine; body otherwise variable; metatibia and metatarsus without comb-like serrate ridges as above, IF similar combs are present, THEN they are apical 158

158(157). Tarsal claw with a ventral blade or elongate lobe beneath (Figs. 13-16.111) (reduced to a large fused tooth ending about 2/3 length of upper blade in *Phodaga* [Fig. 15.111] SW-USA); head sharply or gradually constricted behind eyes to distinct neck 159
— Tarsal claw without ventral blade or elongate lobe beneath, if claw toothed or apendiculate, not as in Fig. 15.111; head constricted or not 160

159(158). Ventral appendage of tarsal claw usually lobe-like, membranous, occasionally blade-like and sclerotized; elytra usually meeting along suture to very near apex, which may be narrowly separately rounded (Fig. 1.110); lateral margin of pronotum absent, complete (Fig. 2.110), or indicated only at base (Fig. 3.110); mesocoxal cavities usually narrowly separated, occasionally contiguous; maxillae not forming sucking tube; antenna without club or with vague to distinct club of 3 antennomeres; hind wing with well-developed radial cell; if pronotal margin completely absent, antenna with at least vague indication of club in last 3 antennomeres and mesocoxal cavities narrowly separated; if elytra broadly separately rounded, pronotum with lateral carina at base (Fig. 3.110) .... 110. Stenotrachelidae
— Ventral appendage of tarsal claw blade-like and sclerotized (Figs. 13-16.111); elytra usually diverging along suture before apex, broadly separately rounded (Fig. 1.111); pronotum lacking marginal carina laterally; antenna without club of 3 antennomeres; mesocoxal cavities contiguous; maxillae usually normal; radial cell absent in hind wing; if elytra meeting on suture to very near apex, maxillae modified into sucking tube that extends beyond mandibular apices ..... 111. Meloidae

160(158). Base of pronotum with marginal groove (Fig. 2.117, 6.117) that extends laterally onto hypomeron, ending in a pit near posterior margin of coxa (Fig. 3.117); pronotum narrowed posteriorly, not margined laterally (Figs. 2.115, 1-3.117); head sharply narrowed behind distinct temples to form narrow neck (Figs. 2.115, 1-3.117, 18-20.117); elytra sparsely to densely setose 161

— Basal groove of pronotum, if present, not ending in pit on hypomeron; pronotum margined laterally or not; elytra with or without setae 162

161(160). Antenna with last 3 antennomeres forming elongate apical club, club more than 1/2 total length of antenna (Fig. 2.115) (*Anisotria*) .... 115. Pyrochroidae

[Note: *Anisotria* was moved to the Anthicidae by Lawrence *et al.* 1999.]

— Antenna not clubbed, with weak, short club, with last 3 antennomeres shorter than 1/2 total length of antenna (Fig. 1.117) OR with only last antennomere long (subequal to antennomeres 7-10) ..... 117. Anthicidae

162(160). Mesocoxal cavities closed laterally 163
— Mesocoxal cavities open laterally 165

163(162). Basal 3 ventrites connate; antenna with 11 antennomeres, submoniliform/triangular, filiform, serrate to subflabellate (Figs. 1-7.112, 9-10.112); cervical sclerites present .... 112. Mycteridae

— Two or no ventrites connate; antenna with 10 to 11 antennomeres, moniliform to capitate (Figs. 1-5.116, 12-13.116); cervical sclerites absent 164

164(163). Prothorax with pleurosternal suture ending in a large setose pit at antero-lateral margin of procoxal cavity; 2 basal ventrites connate; 11 antennomeres; 1.5-3.8 mm; deserts of western USA from Idaho to Mexican border (*Cononotus*) ..... 115. Pyrochroidae

— Prothorax with or without pleurosternal suture, lacking large setose pit on anterior margin of procoxal cavity; all ventrites usually free, or 2 basal ventrites connate (*Aegialites*); 10-11 antennomeres; length 1.5-7 mm; widespread in forests and Pacific beaches (*Aegialites*); if in deserts, antenna with 10 antennomeres (*Dacoderus*) ..... 116. Salpingidae

165(162). Body deep, mildly to distinctly wedge-shaped (Figs. 1-2.102, 4-6.102); antenna serrate, pectinate or flabellate, often bipectinate or biflabellate (Figs. 8-18.102); vertex often inflated and narrowed above eyes in frontal view; vertex usually extending dorsally above plane of pronotum in lateral view, vertex and pronotum at least coplanar; tarsi toothed, bifid or pectinate; maxillary lobes sometimes stylet-like, extending beyond tips of mandibles .... 102. Ripiphoridae

— Body usually not deep and wedge-shaped, IF body deep and wedge-shaped, THEN antenna simple and head coplanar with or slipping under front margin of pronotum; tarsi variable; maxillary lobes not stylet-like 166

166(165). Pronotum lacking lateral carina 167
— Pronotum with complete or incomplete lateral carina 171

167(166). Metacoxa extending laterally to elytron or side of body, completely separating metepisternum and first ventrite 168

— Metacoxa not reaching elytron or side of body, metepisternum and first ventrite in contact laterad metacoxa 170

168(167). Tarsi appearing 4-4-3 (actually 5-5-4, pseudotetramerous/pseudotrimerous); eyes coarsely faceted, appearing hairy, interfacetal setae as coarse, long and dense as those on front and sides of head adjacent to eyes; 1-4 mm ..... 118. Aderidae

— Tarsi distinctly 5-5-4; eyes with or without interfacetal setae, IF interfacetal setae present, THEN setae not as coarse, long or obvious as on front and sides of head adjacent to the eyes; 4-21 mm 169

169(168). Head prognathous, not abruptly constricted to a narrow neck, lacking distinct temples (Fig. 1.109); anterior portion of prosternum as long or longer than prosternal process; first 2 ventrites connate ..... 109. Oedemeridae

— Head distinctly declined, abruptly constricted to form narrow neck behind distinct temples; anterior portion of prosternum shorter than prosternal process (Eurygeniinae) .... 117. Anthicidae

170(167). Elytra distinctly setose; eye emarginate anteriorly; penultimate tarsomere with large lobe beneath (Figs. 1.115, 3.115) .... 115. Pyrochroidae

— Elytra glabrous; eye not emarginate; penultimate tarsomere simple (Fig. 1.114) (*Pytho* and *Priognathus*) ..... 114. Pythidae

171(166). Metacoxa extending laterally to elytra or side of body, completely separating metepisternum and first ventrite; mesotibial spurs serrate, pectinate or pubescent 172

— Metacoxa not reaching elytra or side of body, metathorax and first ventrite at least narrowly closing metacoxal cavity laterally; mesotibial spurs variable 174

172(171). Head vertically narrowed behind eyes to form narrow neck, head not received into prothorax, either bulging beyond pronotal margin, or fitting closely against pronotal margin so that head in lateral view has a posterior carina or crest meeting anterior margin of pronotum (Fig. 5.K) ..... 119. Scraptiidae

— Head gradually narrowed behind eyes, fitting into pronotum in a telescoping manner 173

173(172). Tarsus without lobes on penultimate tarsomere; sutural stria deeply impressed near apex of elytra, distinctly more so than in basal half; 2 basal ventrites connate; metatibia longer than first metatarsomere; prosternal intercoxal process level with ventral surface of non-projecting procoxae; EITHER intercoxal process long, parallel-sided, reaching behind procoxae OR prosternal process incomplete, narrowed apically between coxae; length 7-13 mm .... 108. Synchroidae

— Tarsus with penultimate tarsomere lobed beneath (Figs. 1.100, 21-22.100) OR metatibia shorter than first metatarsomere; IF sutural stria deeply impressed near apex, THEN also impressed on

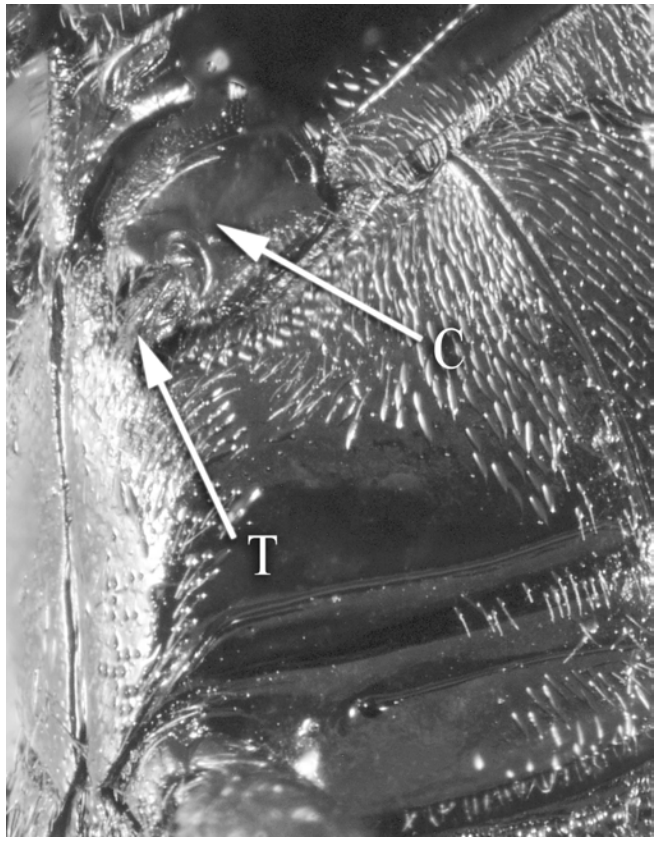

FIGURE 4.K. *Eustrophinus arizonensis* (Horn) (99. Tetratomidae) meso- and metacoxa, ventral view. C – polished ventral face of mesocoxa. T – mesotrochanter, femur removed.

basal half (Fig. 1.100); 2 basal ventrites connate or all free; prosternal process incomplete, not reaching behind procoxae, narrowed apically, resting below ventral surface of usually projecting procoxae; length 2-20 mm .... 100. Melandryidae

174(171). Procoxal cavities closed behind; first 2 ventrites connate; body strongly rounded (Fig. 1.97)... ..... 97. Archeocrypticidae
— Procoxal cavities open behind; ventrites connate or free; body form variable, often elongate 175

175(174). Elytra with sutural and epipleural margins elevated; strongly elevated carina running from humeral angle to near apex resulting in distinctly concave elytral disc; pronotum with median longitudinal elevated carina on basal 1/3, deep transverse grooves with pits at each end on either side of carina (*Ischalia*) .... 117. Anthicidae
— Elytra and pronotum without strongly elevated carinae, elytral disc convex 176

176(175). Prosternal intercoxal process incomplete or absent, not separating procoxae 177
— Prosternal intercoxal process complete, fully separating procoxae 178

177(176). Antenna filiform; terminal labial and maxillary palpomeres expanded apically; prosternum shorter than diameter of procoxae; mesotibial spurs pubescent or serrate; tarsi lobed on penultimate tarsomeres (Fig. 22.100) (Osphyinae) ..... 100. Melandryidae
— Antenna with long, serrate club of last 3 antennomeres (Figs. 7-8.114); terminal labial and maxillary palpomeres cylindrical; prosternum as long as procoxal diameter; mesotibial spurs smooth; tarsi not lobed (*Trimitomerus*) ..... 114. Pythidae

178(176). Tarsi simple, lacking lobes below 179
— At least some tarsomeres distinctly lobed below 181

179(178). Median longitudinal line (discrimen) of metasternum short, extended from hind margin less than 1/2 total length of ventrite; mesocoxa normal, convex and punctate anterior to trochanteral insertion 180
— Median longitudinal line (discrimen) of metaventrite longer, extended from hind margin more than 1/2 total length of ventrite (Fig. 4.K); mesocoxa with unique, polished, ventral face anterior to trochanteral insertion (Fig. 4.K) (this polished area is rubbed by flat opposing surface of trochanter and base of femur when leg rotated is forward) ..... 99. Tetratomidae

180(179). Antenna short, not reaching middle of pronotum; apical 3 antennomeres forming a distinct, rather abrupt club ..... 113. Boridae
— Antenna longer, reaching base of elytron; apical antennomeres somewhat wider than basal antennomeres, not forming abrupt club (*Sphalma*) ..... 114. Pythidae

181(178). Antenna filiform; setae on elytra very short and indistinct, shorter than diameter of punctures; elytra uniform in color; California and Nevada (*Tydessa*) ..... 115. Pyrochroidae
— Antenna strongly serrate; setae on elytra conspicuous, several times longer than diameter

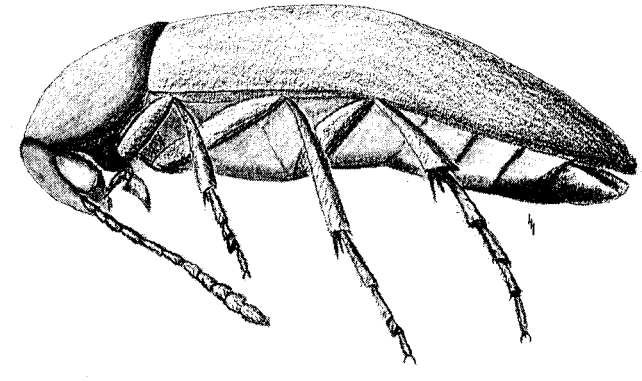

FIGURE 5.K. *Anaspis atrata* Champion (119. Scraptiidae), lateral view (modified from Hatch 1965).

of punctures; elytra reddish with dark markings, a macula around scutellum and transverse band at apical 1/3, usually joined by line along suture; south Texas .... *Polypria cruxrufa* Chevrolat

[NOTE: Family placement *incertae sedis*, see end of Chapter 100.]

182(1). One tarsal claw; eye reduced to a single ommatidium 183
— Two tarsal claws; compound eye normal, reduced or with single ommatidium 184

183(182). Gonopore present (females) ... 61. Phengodidae
— Gonopore not present..... ..... Larvae (not further keyed)

184(182). Head with median ocellus (female *Thylodrius*)... ..... 68. Dermestidae
— Head without ocellus 185

185(184). Head prognathous; pronotum expanded anteriorly, extending over head in retracted position (*Phausis*, *Microphotus*) or head retractile into tubular prothorax (*Pterotus*); distinctly to slightly dorso-ventrally flattened; antenna with 9 or fewer antennomeres; some, possibly all, bioluminescent; widespread (females)..... ..... 62. Lampyridae
— Head hypognathous, not retractile into prothorax; body globular-cylindrical; antenna with 11 antennomeres; not bioluminescent; Florida or near ports of entry (female Ripidiinae, North American females unknown)..... ..... 102. Ripiphoridae

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