

Introduction to the Identification of Beetles (Coleoptera)

P. M. Choate, 1999

The order Coleoptera may contain the largest number of described species of any insect order. They are to be found in almost every habitat, and range in size from 1 – 100mm. in length. The heaviest known insect is a scarab beetle.

The diversity of this order contributes to the complexity of writing classification keys that encompass all exceptions. Frequently keys that are written to cover all species become so complex and lengthy that even experts get bogged down in details. In order to introduce you to this order without adding to the difficulty of identification I have constructed a key to the 50+ families of beetles that you should be able to identify (Florida). Keep in mind that there are more than 100 families of beetles, and that this key is only intended to introduce you to the terminology and morphology that you will use in other, more comprehensive keys.

The keys that follow are **dichotomous**, meaning that each couplet has 2 paragraphs of characters from which you are to pick the best match. Through process of elimination you should be able to work your way through this key to a reasonable identification choice. If you find that every couplet seems to be a difficult choice, you have likely made a mistake *or* the specimen you are trying to identify belongs in a family not included in the key. When you arrive at a tentative identification, look at examples of the family to see if you have a specimen that fits members of that family. Realize that some of the larger families have many different morphotypes, so be cautious here!

Terminology: Beetle identification requires you to become familiar with **antennal shapes, tarsi** (*formulas, shapes of segments*) **mouthparts** (*labial and maxillary palpi*), **ventral characters** (*sterna, pleura, coxae*), and other morphological characters. Size and color of specimens will not usually help you identify beetle families unless you are already familiar with the morphological characters that identify each family. Therefore, do not try to remember families from pictures or by size and color. There is too much variation. Learn the morphology that sets each family apart.

Suborder Adephaga

- Carabidae** - ground beetles, includes *Rhysodidae* and *Cicindelidae*
- Cicindelidae* - tiger beetles now treated as **Carabidae, tribe Cicindelini**
- Rhysodidae* - now placed in **Carabidae**
- Haliplidae** - aquatic
- Noteridae** - aquatic
- Dytiscidae** - aquatic
- Gyrinidae** - aquatic, surface inhabitants only

Suborder Polyphaga

- Staphylinidae** - rove beetles, elytra reduced, exposing several abdominal tergites
- Silphidae** - carrion beetles
- Pselaphidae** - short-winged beetles (very small, <3mm).
- Hydrophilidae** - mostly aquatic, maxillary palpi appear as antennae when viewed from above, antennae shorter than palpi, with well developed club.
- Histeridae** - clubbed antennae, many species very convex and capable of retracting legs into grooves.
- Scirtidae** - (= **Helodidae**) small (<7mm), pubescent species, with swollen femora for jumping.
- Lucanidae** - stag beetles; antennae elbowed, large beetles (>20mm.) 3 genera in Florida, found in panhandle only.
- Passalidae** - Large shining black beetles, adults and larvae occur in colonies in rotting logs. Both sexes with horns
- Scarabaeidae** - "June", "dung", flower inhabiting beetles. One of the largest families of Coleoptera. Lamellate antennae, size quite variable.
- Buprestidae** - metallic wood borers. Closely resemble click beetles but lack clicking mechanism. Many species brightly colored or at least with metallic reflection.
- Callirhipidae** - (= **Rhipiceridae**)
- Elmidae** - aquatic
- Dryopidae** - aquatic
- Heteroceridae** - semi-aquatic
- Ptilodactylidae** - unusual antennal shapes in males of some species
- Elateridae** - click beetles
- Eucnemidae** - false click beetles
- Cebrionidae** - males fly when its raining, females are brachypterous.
- Lycidae** - net winged beetles

- Phengodidae** - glow worms; males fly, female larviform
- Lampyridae** - fireflies
- Cantharidae** - soldier beetles
- Dermestidae** - skin beetles
- Bostrichidae**
- Anobiidae** - death watch beetles
- Lyctidae**
- Cleridae**
- Trogossitidae**
- Nitidulidae**
- Cucujidae** - flat bark beetles
- Languriidae** - lizard beetles
- Coccinellidae** - lady bugs
- Endomychidae** - pleasing fungus beetles
- Melandryidae** - false darkling beetles
- Anthicidae** - ant-like flower beetles
- Tenebrionidae** - darkling beetles, frequently misidentified as ground beetles by beginning students.
- Mordellidae** - Tumbling flower beetles
- Meloidae** - blister beetles
- Rhipiphoridae** -
- Lagriidae** -
- Cerambycidae** - "long horned beetles"
- Bruchidae** - seed weevils
- Chrysomelidae** - leaf beetles, with 4 distinctly different body shapes.
- Curculionidae** - "weevils"
- Anthribidae**
- Brentidae**
- Platypodidae**
- Scolytidae** - bark beetles

In order to identify these families you must first be able to separate them into 2 major suborders (**Adephaga** and **Polyphaga**). Beetle family keys are numerous, frequently regional, and rarely comprehensive. A few of the more comprehensive are:

References

- Arnett, R. H., Jr.** 1960 - 1963. The beetles of the United States. Washington, DC. Catholic University Press. xii + 1110p.(includes keys to all of the genera for all families in USA).
- Blatchley, W. S.** 1910. An illustrated Descriptive Catalogue of the Coleoptera or beetles known to occur in Indiana. Indianapolis. 1386p.
- Downie, N. M., and R. H. Arnett.** 1996. The beetles of Northeastern North America. Vol. 1: Introduction; Suborders Archostemata, Adephaga, and Polyphaga, thru superfamily Cantharoidea. The Sand Hill Crane Press, Gainesville, Florida.880p.(includes species keys for all families).
- Edwards, J. G.** 1949. Coleoptera or Beetles East of the Great Plains. Edwards Brothers, Inc. Ann Arbor, Michigan.181p.
- Woodruff, R. E.** 1973. The scarab beetles of Florida. (Coleoptera: Scarabaeidae) Part 1. The Laparosticti (sub-

families: Scarabaeinae, Aphodiinae, Hybosorinae, Ochodaeinae, Geotrupinae, Acanthocerinae). Arthropods of Florida and Neighboring Land areas. Volume 8. 220p.

Young, F. N. 1954. The water beetles of Florida. University of Florida Press, Gainesville. 238p.

Coleoptera: sub-order Adephaga or Polyphaga?

These 2 sub-orders are based on the positions of the hind coxal cavities in relation to the 1st visible sternite. If the hind coxae divide the 1st visible abdominal sternite (**Figs. 1, 4**), the specimen belongs in **Adephaga**. If hind coxae do not completely divide the 1st visible sternite (**Fig. 2**), the specimen belongs in **Polyphaga**.

Once you are satisfied that you have correctly placed the specimen into its correct sub-order, proceed to the next level of keys (to family).

1st visible sternite

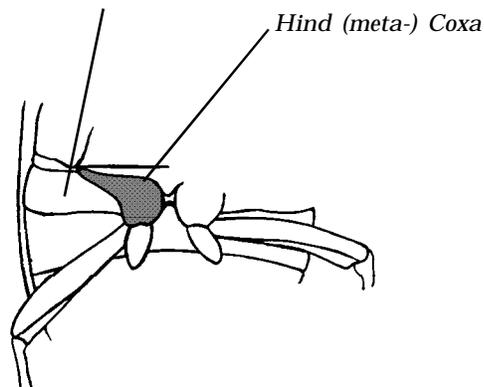


Fig. 1. Adephaga - coxa divides 1st visible sternite

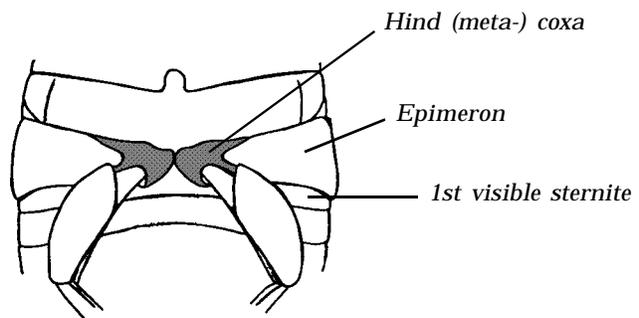


Fig. 2. Polyphaga - coxa does not divide 1st sternite; be sure not to confuse the epimeron with the coxae.

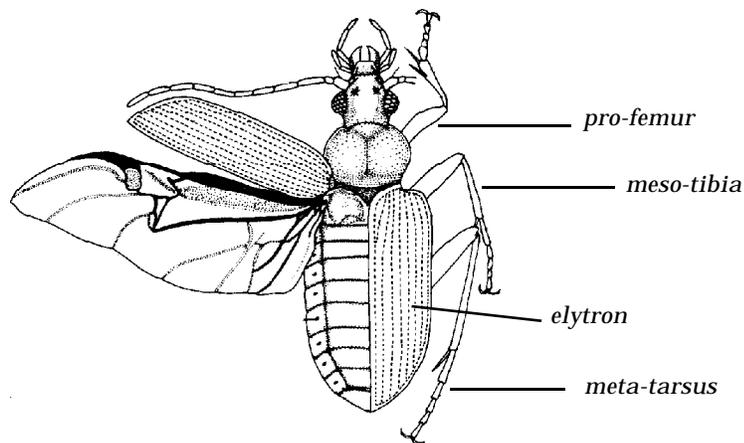


Fig. 3. Dorsal view of Adephaga beetle, Carabidae. Tarsal formula 5-5-5. Antennae filiform.

A few reasons why we can't generalize about beetle families:

- There are many long-horned beetles that do not have long horns.
- There are snout beetles without snouts.
- There are beetles with snouts that are not weevils.
- There are "June beetles" that appear in August.
- There are ground beetles that live in trees.
- There are aquatic beetles that never go near water (some Hydrophilidae live in dung).
- There are ectoparasitic beetles.
- Many beetles have fused elytra, with flight wings reduced to small pads.
- There are blind, eyeless subterranean beetles.
- There are beetles other than fireflies (Lampyridae) that produce light.
- The same family may have species that range in size from 1mm to 100mm.
- The same genus may have brightly colored species as well as dull, uniformly colored species.
- There are many volumes of literature dealing with the classification of beetles, but rarely do they agree on higher classification.

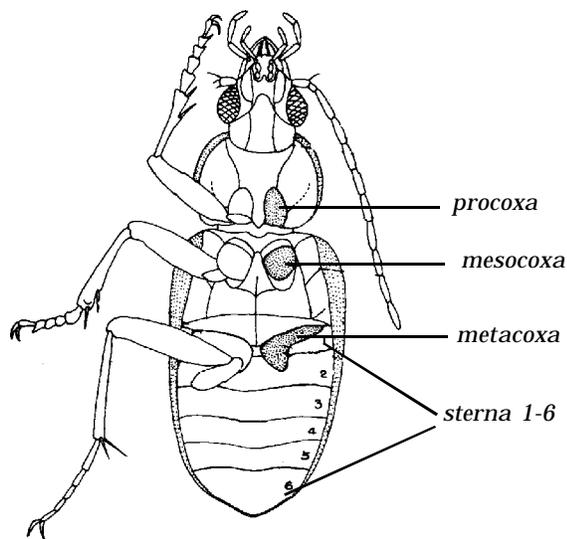


Fig. 4. Ventral view of Adephaga beetle, Carabidae.

Having said all of this, we will introduce you to the diversity of beetles, while emphasizing that this diversity will initially make it seem difficult to become familiar with these families.

Key to some Florida families of Adephaga Coleoptera

- 1. Hind coxae greatly enlarged, forming a plate that covers attachment of hind legs. Body size 3mm., pale with dark spots (**Fig. 5**) **Haliplidae**
 - Hind coxae not greatly enlarged into plates. Size and color various 2
- 2. Eyes divided into 2 portions by lateral margin of head; one dorsal and one ventral when viewed from the side (**Fig. 6**). Body dorsally flattened. Antennae reduced to short peg-like structures. Whirligig beetles **Gyrinidae**
 - Eyes not divided by lateral margin of head. Antennae variously shaped 3
- 3. Hind legs modified for swimming, posterior margin with fringes of hairs (**Fig. 7**. Antennae long and moniliform or filiform 4
 - Legs not modified for swimming. Antennae moniliform **Carabidae** (**Figs. 3, 4**) (including *Cicindelidini*, *Rhysodini*) *see keys to Florida ground beetles.
- 4. Scutellum visible(**Fig. 8c**) **Dytiscidae** (in part)
 - Scutellum hidden (**Figs. 8 a, b**) 5
- 5. Hind tarsi with 2 curved claws (**Fig. 9**) of equal length; abdomen with 5 visible sterna; front coxal cavities closed behind (small beetles, 1-5mm) **Noteridae**
 - Hind tarsi with 1 straight claw; abdomen with 6 visible sterna; front coxal cavities open behind; size usually over 5mm **Dytiscidae** (in part)

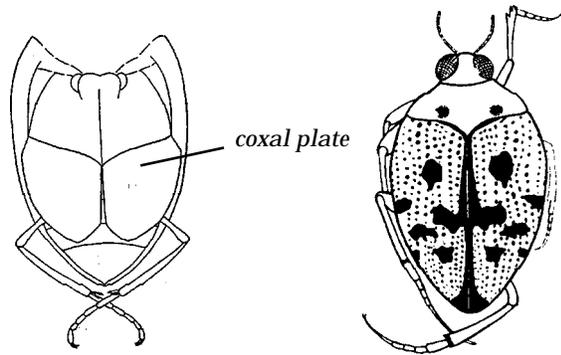


Fig. 5. Adult **Haliplidae**. Left - ventral aspect showing coxal plates; right - dorsal aspect.

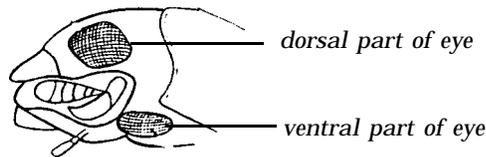


Fig. 6. Side view of *Gyrinidae* head. Eyes are split into 2 sections.

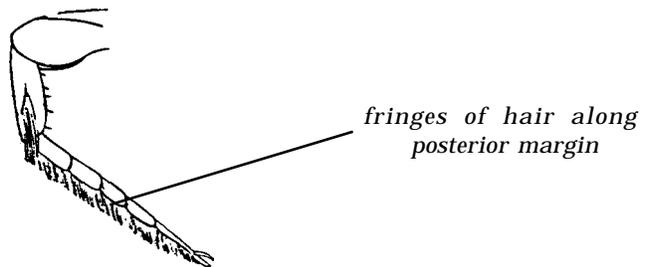


Fig. 7. Hind leg of *Dytiscidae* showing fringed posterior margin.

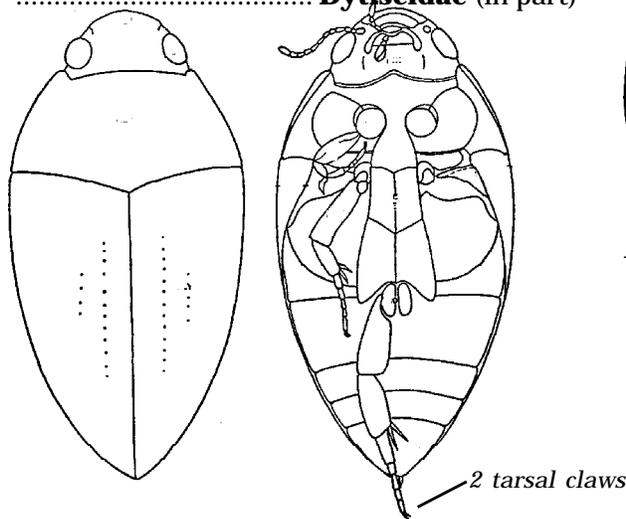


Fig. 9. Adult *Noteridae*. Note 5 visible sterna, 2 claws on hind tarsi. Superficially similar in shape to *Dytiscidae*, their small size (<5mm) and above characters should make them fairly easy to identify.

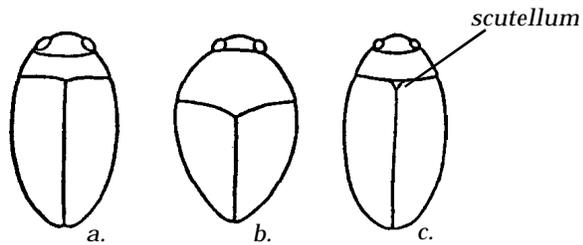


Fig. 8. Adult *Dytiscidae* and *Noteridae*. Note **scutellum** that is visible in many *Dytiscidae* (c.).

Key to some Florida families of Polyphaga Coleoptera

1. Abdomen with at least 3 segments corneous (chitinous) dorsally; 1 or more segments exposed by shortened elytra (**Fig. 11**). Antennae variable, but never lamellate (**Fig. 10**) 2
 - Abdomen at most with 2 segments corneous dorsally; elytra completely covering abdomen 5
2. Elytra very short, dorsally exposing 4-7 abdominal segments 3
 - Elytra covering most of abdomen, dorsally exposing 1-2 segments 4
3. Abdomen flexible, with 7 or 8 segments visible ventrally **Staphylinidae**
 - Abdomen not flexible, only 5 or 6 ventral segments visible (**Fig. 11**) **Pselaphidae**
4. Hind tarsi 5 segmented, antennae elbowed and clavate (**Fig. 12a**) **Histeridae**
 - Hind tarsi 4 segmented, middle and front tarsi 4-5 segments; antennae not elbowed (**Fig. 12b**) **Silphidae**
5. Antennae with lamellate club (**Fig. 10**) 6
 - Antennae variable but not with lamellate club 8
6. Plates composing antennal club flattened and capable of close apposition **Scarabaeidae**
 - Plates of antennal club not capable of closing, and not flattened 7
7. Large black **shining** beetles; antennae curved; both sexes with short curved horn (**Fig. 13**) on head; elytra deeply striated **Passalidae**
 - Large, dull beetles (>20mm); Antennae elbowed (**Fig. 14**); head without horns; in species with brown coloration, elytra smooth and not striated; if black species, elytra dull and unevenly carinate or shallowly striate **Lucanidae**
8. All tarsi apparently 4 segmented; 1st 3 segments dilated and brush-like beneath; 3rd segment deeply bi-lobed (**Fig. 15**) 9
 - Tarsi variable; one or more pair with 3, or 5 segments; if segment bi-lobed, usually 2nd or 4th segment 17
9. Head not prolonged into beak 10
 - Head prolonged into beak (**Figs. 16, 17, 18**) which may be short and inconspicuous 13
10. Antennae filiform or nearly so 11



Fig. 10. Lamellate antenna, scarab genus **Polyphylla**.

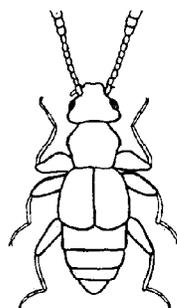


Fig. 11. Dorsal view of **Pselaphidae**.

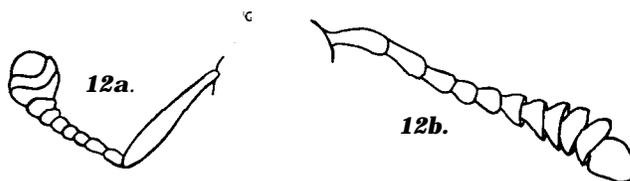


Fig. 12. a. Antenna of **Histeridae**; **b.** **Silphidae**

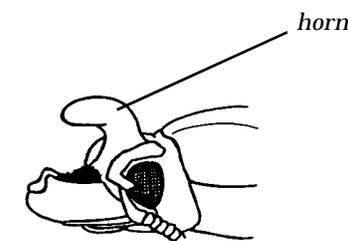


Fig. 13. Head of **Passalidae**.



Fig. 14. Geniculate antenna of **Lucanidae**

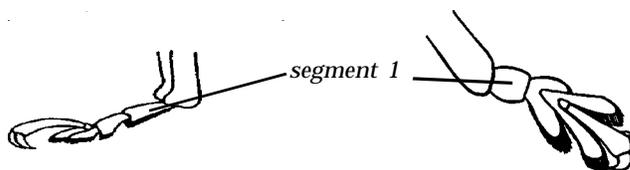


Fig. 15. Tarsus of **Chrysomelidae**. Apparently 4 segmented, with pads beneath each segment. Segment 3 deeply bi-lobed.

– Antennae distinctly clavate **Erotyliidae**

11. Oval, compact beetles; antennae and body usually with scales; elytra shortened, exposing pygidium; antennae serrate, rarely pectinate; head prolonged into broad "muzzle" **Bruchidae**

– If oval, not with above combination of characters 12

12. Body elongate; antennae frequently longer than body, inserted on frontal prominence; pronotum unmarginated; tibial spurs well developed;
..... **Cerambycidae**

– Body shape various, rarely elongate; Antennae moderate, not longer than body; not inserted on frontal prominence; prothorax frequently margined; tibial spurs absent;
..... **Chrysomelidae**

13. Beak extremely short and broad; tibiae with series of teeth externally or front tibiae anteriorly produced forming stout curved process at apex; antennae short with broad club; small, oval or cylindrical beetles 14

– Beak conspicuous, frequently elongate (**Fig. 16**); tibiae simple, without teeth externally or at apex; antennae clubbed or not 15

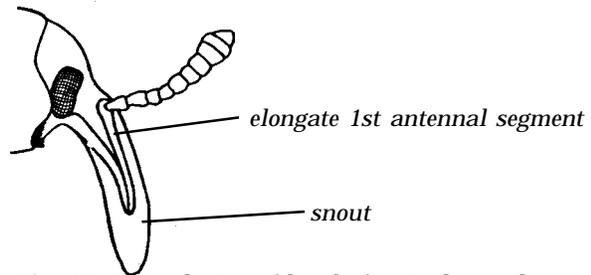


Fig. 16. Lateral view of head of typical weevil

14. First segment of anterior tarsi shorter than 2nd, third, and 4th combined; eyes oval, emarginate, or divided; head narrower than thorax.....
..... **Scolytidae**

– First segment of anterior tarsi very long, longer than 2+3+4 combined; eyes round; head broader than prothorax **Platypodidae**

15. Antennae straight, without distinct club; beak present at least in female and pointing directly forward (**Figs. 17, 18**); body shape elongate and narrow **Brentidae**

– Antennae straight or geniculate, always with a distinct club 16

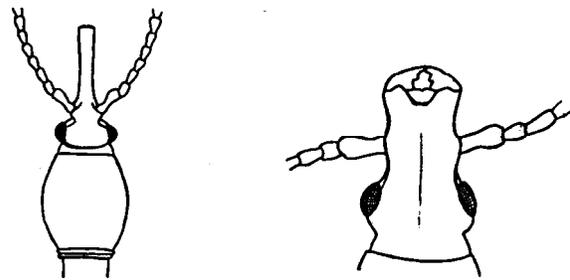


Fig. 17 Female Brentidae **Fig. 18.** Male Brentidae

16. Palpi flexible; beak short and broad; thorax with transverse raised line which is ante-basal or basal; antennae long, with small but distinct apical club; **Anthribidae**

– Palpi rigid; beak well developed, frequently long and downward curved; **Curculionidae**

17. Hind tarsi clearly 5 segmented 18

–Hind tarsi apparently 3 or 4 segmented 38

18. Maxillary palpi as long as or longer than antennae. (**Fig. 19**) Antennae with terminal 3-4 segments forming a distinct club. Many species with elongate sternal spine **Hydrophilidae**

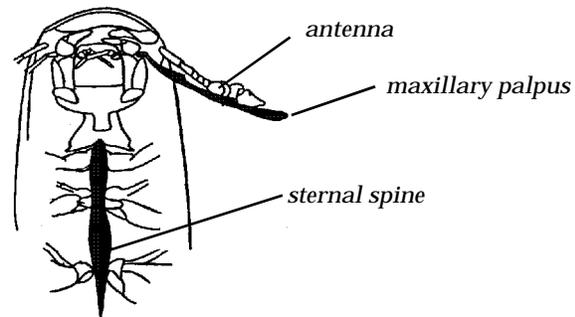


Fig. 19. Ventral view of Hydrophilidae beetle.

- Palpi length "normal". If sternum spined, it is confined to prosternum only 19
- 19. Tarsal claws elongate, large; abdominal segments 1-3 fused ventrally (**Fig. 20**) 20
 - Tarsal claws normal 21
- 20. Anterior coxae transverse, with distinct trochantin **Dryopidae**
 - Anterior coxae rounded, lacking trochantin **Elmidae**
- 21. Abdomen with no more than 5 segments 22
 - Abdomen with at least 6 segments 34
- 22. Hind femur joined at apex of trochanter 23
 - Hind femur joined to side of trochanter 25
- 23. Tibia without spines **Anobiidae**
 - Tibia with spines 24
- 24. Ventral segment 1 (sternum) more or less equal to sternum 2 **Bostrichidae**
 - Ventral segment 1 elongate, more than segment 2 **Lyctidae**
- 25. Anterior coxae globular or transverse, projecting but little from coxal cavity 26
 - Anterior coxae conical, projecting prominently from coxal cavity 32
- 26. Anterior coxae transverse 27
 - Anterior coxae globular 28
- 27. Tarsi more or less dilated; segment 1 not shorter; antennae 11 segmented, terminating in a 3 segmented club **Nitidulidae**
 - Tarsi slender, 1st segment short, antennae with apical segments expanded into pseudo-club ... **Trogossitidae**
- 28. Prosternum with posterior process extending backwards into a groove in mesosternum (**Fig. 21**) 29
 - Prosternum without process received by the mesosternum, although it may be prolonged so as to meet mesosternum 31
- 29. Abdominal segments 1+2 fused on ventral side **Buprestidae**
 - All abdominal segments free on ventral side 30
- 30. Prothorax loosely joined to mesothorax; front coxal cavities ending in prosternum; antennae inserted distant from eyes, insertion narrowing the front **Eucnemidae**

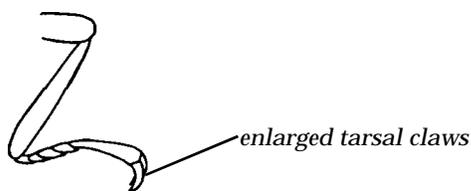


Fig. 20. *Dryopidae* tarsal claws

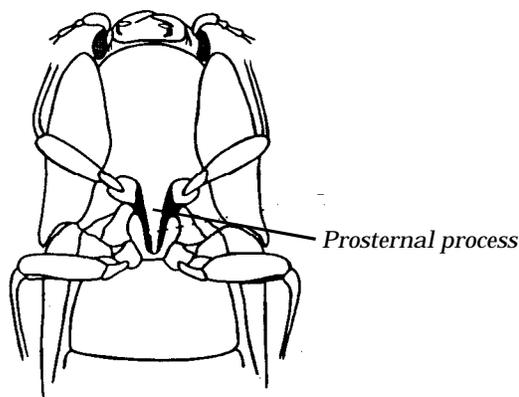


Fig. 21. Prosternal process extending back into mesosternum.

– Prothorax firmly joined to mesothorax; antennae inserted under margin of front ... **Elateridae**

31. Body flattened, depressed (size generally small, less than 5mm for most species); middle coxal cavities not closed externally by a meeting of mesosternum and metasternum .. **Cucujidae**

– Body convex; middle coxal cavities entirely surrounded by sterna **Erotylidae**

32. Posterior coxae dilated into plates partly protecting femora, at least at their sides 33

– Posterior coxae not dilated into plates partly protecting femora; Posterior coxae flat, not prominent, covered by femora in repose; tarsi with 4th segment of normal size **Cleridae**

33. Antennae serrate or flabellate (**Fig. 22**) **Callirhipidae** (= Rhipiceridae)

– Antennae with last 3 segments forming a distinct club; tarsi simple **Dermestidae**

34. Anterior coxae globular; tibial spines well developed **Cebrionidae**

– Anterior coxae conical 35

35. Middle coxae contiguous; epipleura distinct 36

– Middle coxae distant; epipleurae lacking; elytra reticulated (**Fig. 23**) **Lycidae**

36. Episterna of metathorax not sinuate on inner side; epipleura usually wide at base 37

– Episterna of metathorax sinuate on inner side; epipleura narrow at base **Cantharidae**

37. Head more or less covered by pronotum when viewed from above; antennae approximate or moderately distant (they almost touch at base); metathorax epimeron long; many species with glowing organ **Lampyridae**

– Head exposed when viewed from above; antennae distant; metathorax epimera wide; male antennae fimbriate (**Fig. 24**) **Phengodidae**

38. Hind tarsi clearly with 3 segments; or 4 segmented, with 3rd segment small and concealed in a notch at end of 2nd segment (**Fig. 15**); or all tarsi with 4 segments (**Fig. 25**) 39

– Front and middle tarsi with 5 segments; hind tarsi with 4 distinct and unconcealed segments 45

39. All tarsi clearly 4 segmented (**Fig. 25**) 40

– Hind tarsi appearing to have 3 segments 43

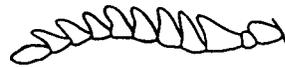


Fig. 22. Antenna of *Zenóa picea*, Callirhipidae.

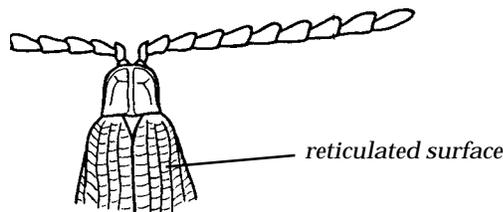


Fig. 23. Lycidae, showing reticulated elytral sculpturing.

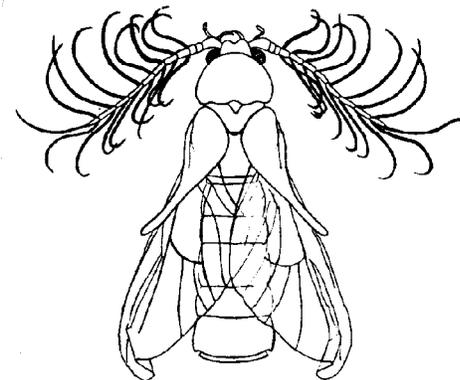


Fig. 24. Phengodidae male showing fimbriate antennae.



Fig. 25. Hind tarsus of Heteroceridae.

- 40. First 4 abdominal segments fused on venter; tibiae dilated, armed with rows of spines, fitted for digging (**Fig. 26**) **Heteroceridae**
 – Ventral segments not fused 41
- 41. Tarsi slender; tibiae not armed with rows of spines **Endomychidae**
 – Tarsi dilated, spongy beneath 42
- 42. Frontal coxal cavities closed behind by epimeron (**Fig. 27**); pronotum with or without moderate prebasal impressions; body elongate oval
 **Erotylidae**
 – Frontal coxal cavities open behind; pronotum without distinct, paired prebasal impressions; body elongate, slender **Languriidae**
- 43. Tarsi with 2nd segment dilated 44
 – Tarsal claws simple; elytra truncate; first and fifth abdominal segments longer than others
 **Nitidulidae**
- 44. Tarsal claws toothed or appendiculate (**Fig. 28**); first ventral segment with distinct curved coxal lines **Coccinellidae**
 – Tarsal claws simple; first ventral segment without coxal lines **Endomychidae**
- 45. Anterior coxal cavities closed behind (**Fig. 27**) 46
 – Anterior coxal cavities open behind (**Fig. 27**) 47
- 46. Tarsal claws simple; front of head with protruding rim extending from eye to eye, hiding antennal insertion when viewed from above
 **Tenebrionidae**
 – Tarsal claws pectinate (**Fig. 29**) ... **Alleculidae**
- 47. Head not suddenly and strongly constricted at base 48
 – Head strongly constricted at base 50
- 48. Middle coxae very prominent . **Oedemeridae**
 – Middle coxae not very prominent 49
- 49. Metasternum long; epimera of metathorax visible **Melandryidae**
 – Metasternum quadrate; epimera of metathorax covered **Cucujidae**
- 50. Prothorax with side pieces not separated from pronotum by a suture 51
 – Lateral suture of prothorax distinct; base of prothorax as wide as elytra 56

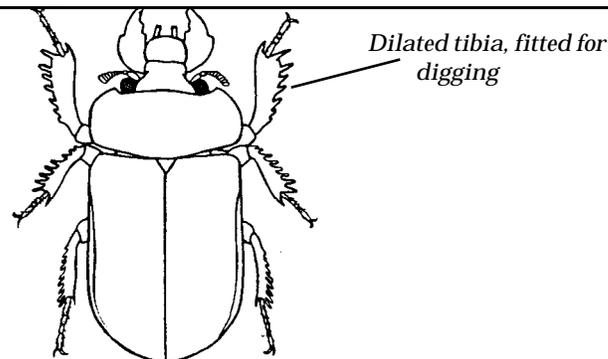


Fig. 26. Dorsal view of Heteroceridae.

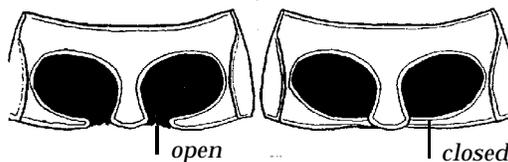


Fig. 27. Open behind and closed behind anterior coxal cavities.

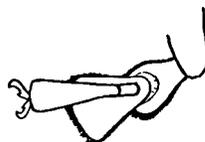


Fig. 28. Toothed tarsal claw, Coccinellidae.

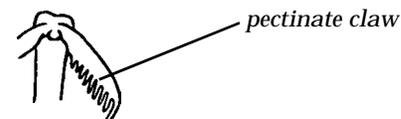


Fig. 29 Tarsal claw, Alleculidae.

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51. Prothorax at base as wide as elytra
 **Rhipiphoridae**
 – Prothorax at base narrower than elytra 52
52. Hind coxae not prominent 53
 – Hind coxae large, prominent; tarsal claws cleft or
 toothed **Meloidae**
53. Anterior coxae globular, not prominent
 **Cucujidae**
 – Anterior coxae conical, prominent 54
54. Abdomen consisting of 5 free segments, tarsi with
 penultimate segment lobed beneath 55
 – Abdomen consisting of 4 free segments, the first
 formed from 2 fused segments; tarsi with ante-
 penultimate segment lobed beneath
 **Euglenidae**
55. Eyes large, oval, finely faceted **Pedilidae**
 – Eyes small, coarsely faceted **Anthicidae**
56. Antennae filiform 57
 – Antennae flabellate in male, subserrate in female
 **Rhipiphoridae**
57. Hind coxae plate-like **Mordellidae**
 – Hind coxae not plate-like **Melandryidae**

