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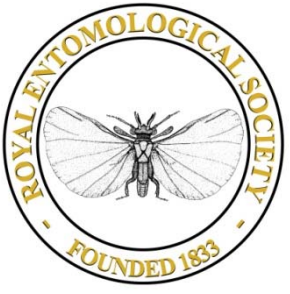

HANDBOOKS FOR

THE IDENTIFICATION

OF BRITISH INSECTS

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HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS

COLEOPTERA

INTRODUCTION AND KEYS TO FAMILIES

By

R. A. CROWSON

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HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS

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COLEOPTERA

General Introduction and Keys to Families.

By R. A. Crowson.

The Coleoptera of the British Islands have been treated in a series of comprehensive works, the most important of which are Stephens' *Manual of British Coleoptera* (1839), Cox's *Handbook of Coleoptera* (1874), Fowler's great *Coleoptera of the British Islands* (1887–1891), and Joy's *Practical Handbook of British Beetles* (1932). Numerous British works of more limited scope have been published. Similar works on the Coleoptera of adjacent areas, including almost all the British species, are Reitter's *Fauna Germanica: Käfer* (1908–1916) and Portevin's *Histoire Naturelle des Coléoptères de France* (1929); the Dutch and Danish beetle faunas have also been the subject of systematic works. The French and German works, like the British, are now out of print and more or less difficult to obtain, and even the most recent of them are more than twenty years old. The last twenty years have seen some important advances in our knowledge of the relationships of the groups of Coleoptera, and some not inconsiderable additions to our knowledge of the beetle fauna of Great Britain.

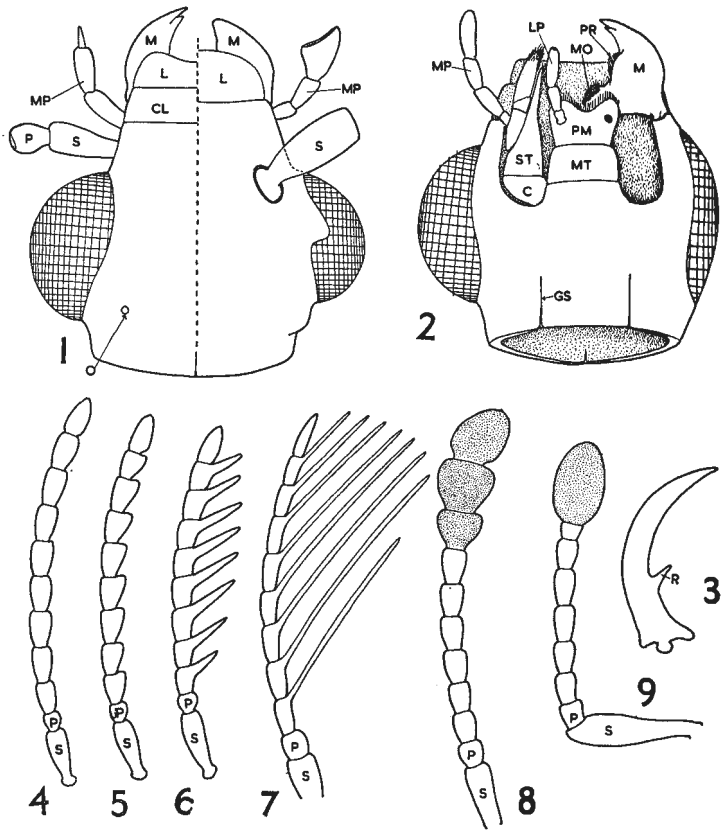
General Characters of Coleoptera.

The Coleoptera may be defined as insects with a complete metamorphosis (Endopterygota), having the mesothoracic wings modified into hard elytra or into haltere-like structures, the metathoracic wings alone providing propulsion in flight; the mouth-parts are of the biting type and the head has a distinct gular region below. Coleopterous larvae are of the oligopod or apodous types and lack labial (spinning or salivary) glands; beetle pupae are usually of the exarate type and they never possess true functional mandibles. There are reasons for believing that the Coleoptera are most nearly related to the Megaloptera (particularly the Sialoidea) and rather less closely to the Neuroptera proper (Planipennia).

Structure of Adult Coleoptera.

(1) The Head (figs. 1–9).—The labrum (fig. 1 L) may be freely articulated, more or less fused to the clypeus, or reduced and hidden under the front margin of the clypeus. The clypeus (fig. 1 CL) may be separated from the frons by a complete transverse groove (fronto-clypeal suture), or the groove may be incomplete, indistinct, or absent. The frons is normally not separated by a distinct suture from the vertex, which may occasionally bear one or two ocelli (fig. 1 O); the posterior or occipital part of the vertex may exhibit a median longitudinal suture (usually only visible when the head is

pulled out of the prothorax), which occasionally may divide anteriorly to form a pair of widely diverging sutures (" frontal sutures " of some authors) extending towards the antennal insertions—simulating, but probably not truly homologous with, the " ecdysial suture " of larvae. The head capsule may or may not be constricted behind the eyes to form a neck (fig. 1) ; its posterior part is invariably more or less retracted into the prothorax. The

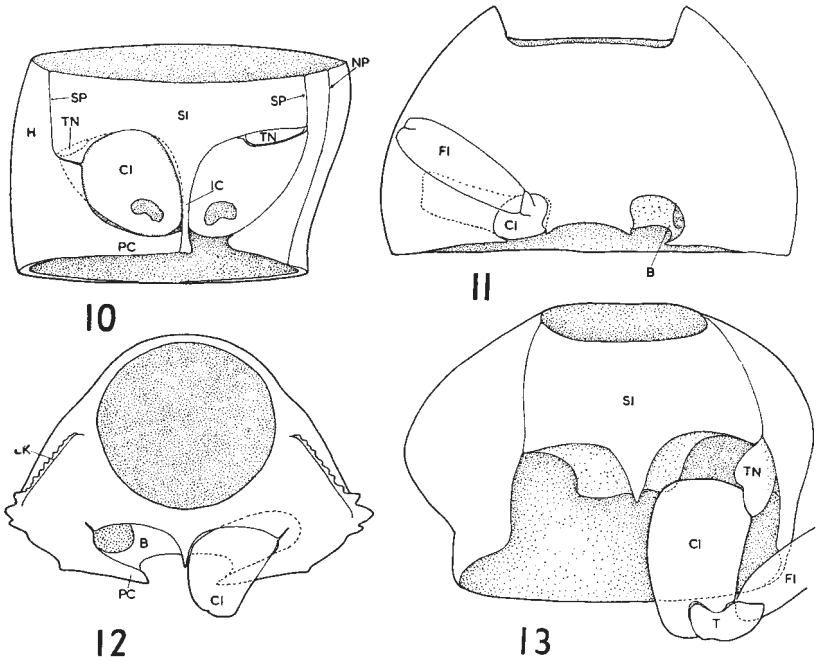


FIGS. 1–9.—*Head structures in Coleoptera.* 1, Composite head in dorsal view : left side showing entire eye, aciculate maxillary palp (*MP*), apically bifid mandible, distinct clypeus, antennae inserted under sides of front ; right side showing head capsule contracted behind eye, emarginate eye, securiform maxillary palp (*MP*), clypeus not distinct, apically blunt mandible. 2, Composite head in ventral view : left side showing protuberant eye, normal maxillary and labial palpi ; right side showing non-protuberant eye, mandible with bifid apex, fringed prostheca (PR) and distinct molar part (*MO*). 3, Falcate mandible with retinaculum (*R*). 4, Filiform antennae. 5, Serrate ditto. 6, Pectinate ditto. 7, Flabellate ditto. 8, Clavate antenna with loose 3-segmented club. 9, Geniculate antenna with 1-segmented club.

C, cardo ; *CL*, clypeus ; *GS*, gular suture ; *L*, labrum ; *LP*, labial palp ; *M*, mandible ; *MP*, maxillary palp ; *MO*, molar ; *MT*, mentum ; *O*, ocellus ; *P*, pedicel ; *PM*, prementum ; *PR*, prostheca ; *R*, retinaculum ; *S*, scape ; *ST*, stipes.

compound eyes are sometimes more or less reduced or even absent, the corneal lenses of the ommatidia, forming their outer surface, may be very small and almost flat (" finely faceted eyes," more characteristic of sun-loving diurnal types) or larger and more or less strongly convex (" coarsely faceted eyes," generally found in nocturnal species) ; the outer surface of the eyes may form a smooth continuation of the outline of the head (fig. 2, R. side), or they may be more or less markedly protuberant (fig. 2, L. side). The antennae have a fundamental number of 11 segments, often reduced to 10, 9, 8 or even less, but quite rarely increased to 12 or more. Segments 1 (scape) and 2 (pedicel) are usually more or less differentiated from the succeeding ones forming the flagellum ; in geniculate antennae (fig. 9) the scape is very elongate and the rest of the antenna makes a sharp angle with it. If the segments of the flagellum are all more or less similar, elongate and cylindrical, the antenna is said to be filiform (fig. 4) ; if the flagellum resembles a string of beads it is called moniliform. If the segments of the flagellum are expanded on one side to give a more or less saw-like outline, the antennae are called serrate (fig. 5), if the outgrowths are longer they are said to be pectinate (fig. 6), if the outgrowths are extremely long the term is flabellate (fig. 7). Clavate (clubbed or capitate) antennae have from 1 to 5 of the apical segments enlarged and thickened and more or less sharply set off from the preceding ones (figs. 8, 9) ; the enlarged segments are normally dull and pubescent, bearing concentrations of sensillae. The antennal insertions vary from a completely lateral position under the sides of the frons (fig. 1, L. side) to a dorsal position on the front (fig. 1, R. Side)—in extreme cases the antennal insertions may only be separated by a narrow keel. The length of the antennae varies greatly, from much more than the whole length of the body to less than the width of the head. The mandibles are always distinct and generally of the opposed, biting type ; they may be very slender and curved with sharp tips (falcate mandibles (fig. 3)), there may be a sharp tooth (retinaculum (fig. 3 R)) or a more or less soft hairy lobe (prostheca (fig. 2PR)) at the middle of their inner edge, the base of the inner edge may be expanded into a ridged or asperate crushing part (mola (fig. 2 MO)), the tips of the mandibles may be simple and acute, or blunt, or bifid, or bidentate, or pluridentate. The maxillae normally have all the typical parts (fig. 2), with a 4-segmented palp borne on a large palpiger, 2-segmented galea, and distinct lacinia ; the apical segment of the palp may be enlarged and triangular (securiform palpi, fig. 1, R. side) with its distal margin wide and covered with a sensilla-rich membrane, or the apical segment may be very small and pointed (aciculate palpi, fig. 1, L. side) ; the galea may be palpiform, or hairy and lobiform, the lacinia is more usually pointed at the apex, or sometimes lacking (1-lobed maxillae). The labium is composed of two main parts, a distal one bearing the palpi and known as the prementum (mentum of some authors, fig. 2 PM), and a basal one articulating with the head capsule known as the mentum (submentum of some authors, fig. 2 MT) ; the labial palpi usually consist of two or three small segments, the terminal one of which may vary much as it does in the maxillary palpi ; the prementum often bears in front a more or less membranous and bilobed ligula (fig. 2). Behind the labium lies the gular region of the head-capsule, bounded laterally by the gular sutures (fig. 2 GS) which are typically more or less parallel (fig. 2) but may converge or become partly or wholly confluent.

(2) THE PROTHORAX (figs.10–13).—The term pronotum is usually applied only to the dorsal surface of the prothorax, which is commonly separated from the ventral surface by more or less sharp side-edges ; the occurrence in Adephaga (and Archostemata) of noto-pleural sutures (fig. 10 NP) on the ventral surface some distance from the side-edges suggests that in Polyphaga too the pronotum should strictly be taken to include part of the hypomeron (ventral surface outside the sterno-pleural sutures, fig. 10 H). However, in this study the term pronotum will be used to refer to the dorsal surface only of the prothorax. The most consistent dividing lines on the ventral side of the prothorax are the sterno-pleural sutures (fig. 10 SP) which extend forwards from the outer angles of the front coxal cavities and separate



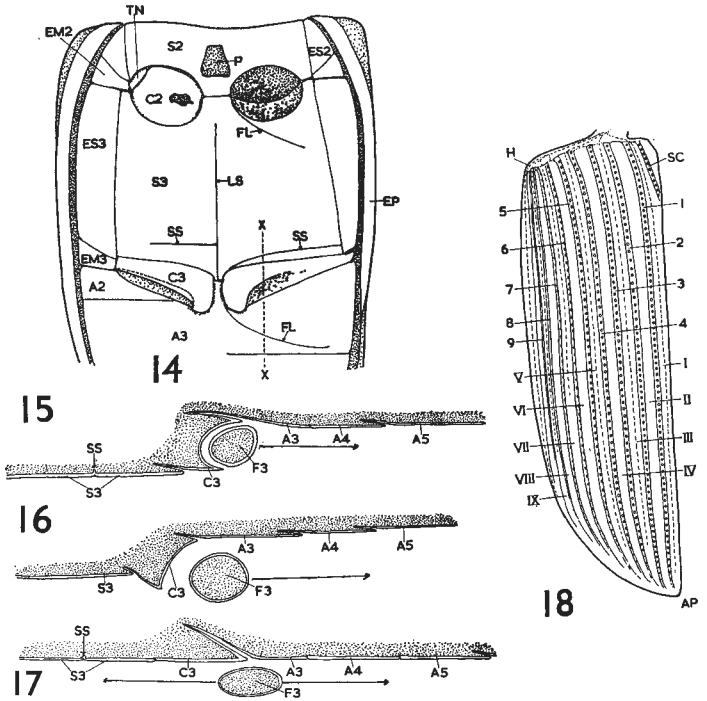
FIGS. 10–13.—*Prothoraces, ventral view.* 10, Composite type, with ovate front coxae, left side (of figure) showing trochantin (*TN*) concealed, coxal cavity closed behind, no notopleural suture ; right side with exposed trochantin, coxal cavity open (partially closed) behind, notopleural suture (*NP*) distinct. 11, Showing widely separated front coxae, the exposed parts of which are small and rounded but have hidden lateral extensions, cavities open behind, no distinct notopleural or sterno-pleural sutures. 12, Bostrychoid type with anterior orifice facing ventrally, front coxae (*C1*) projecting, their cavities partially closed behind, side edges (*LK*) distinct, sternopleural sutures obsolete. 13, Type with completely open front coxal cavities, strongly projecting front coxae with exposed trochantins, and distinct sternopleural sutures.

B, bar closing front coxal cavity internally ; *C1*, front coxa ; *F1*, front femora ; *H*, hypomeron ; *IC*, prosternal process ; *LK*, side border of prothorax ; *NP*, notopleural suture ; *PC*, postcoxal process ; *S1*, prosternite ; *SP*, sternopleural suture ; *T*, trochanter ; *TN*, trochantin.

a median ventral sclerite—the prosternum (fig. 10 s1)—from the hypomera. The prosternum extends posteriorly between the front coxae as the prosternal process (fig. 10 IC), which may be of knife-edge thinness or even invisible externally in a few cases ; its apex may extend little or not at all beyond the hind borders of the front coxae, or be prolonged and received into a pit in the mesosternum, or extend over and more or less conceal the latter sclerite. Processes of the hypomera (post-coxal processes, fig. 10 PC) may extend inwards behind the front coxae forming a partial (fig. 10, R. side) or, if they reach the prosternal process (fig. 10, L. side), a complete posterior closure of the front coxal cavities ; these processes may incidentally more or less occlude the front pair of spiracles, which occur in the inter-segmental membrane in this vicinity. The front coxae may be of various sizes and shapes (figs. 10–13) ; often the outer part of an apparently small and rounded coxa is enclosed, so that it has a hidden lateral extension (fig. 11) ; the trochantins (fig. 10 TN) at the outer front angles of the coxae may or may not be externally visible.

(3) MESOTHORAX AND ELYTRA (figs. 14–18).—The mesothorax in Coleoptera is almost always smaller than the prothorax and metathorax ; when the insect is not in flight, the mesonotum is normally, except for a small median part known as the scutellum (fig. 31 SC), hidden by the elytra and the hind margin of the pronotum—the median anterior part of the mesonotum may sometimes bear a single or paired stridulatory files working against a ridge under the hind margin of the pronotum. The mesosternum (fig. 14 s2) is usually similarly shaped to the prosternum, with a median posterior intercoxal process and lateral wings in front of the middle coxae. The mesopleuron is composed of episternum (fig. 14 ES2) and epimeron (fig. 14 EM2), the former very rarely reaching the coxal cavities, the latter sometimes doing so (fig. 14, L. side) and sometimes not (fig. 14, R. side), in the latter case the middle coxal cavities are said to be closed outwardly (by the meeting of the meso- and metasterna). In some Adephaga the met-episterna (ES3) impinge on the middle coxal cavities, e.g. in DYTISCIDAE. The elytra in beetles (fig. 18) frequently have 9 or 10 striae or rows of punctures with an additional short stria (scutellary striole, SC) close to the scutellum ; the interstices and striae are usually numbered as shown in fig. 18—the alternate ones (I, III, V, VII, IX) are commonly underlain by tracheae and appear to represent primary wing-veins (respectively 2A, 1A, Cu, M, and R) ; they may bear articulated setae (e.g. in many CARABIDAE). The infolded costal margin of the elytron (also with a trachea, probably corresponding to C + Sc) is commonly delimited by a sharp outer edge, and is then known as the epipleuron (fig. 14 EP) ; the surface of the epipleuron may be flat and horizontal, or sloping downwards (inclined epipleura) or reflexed upwards and concave ; it may extend the full length of the elytron or only part of it. The apices of the elytra in repose commonly form a conjoint rounded or slightly pointed outline, smoothly continuing the line of their outer edges, but they may be more or less sharply truncate at the apex, in which case they usually leave a part of the abdomen uncovered (cf. fig. 59). On the lower (inner) face of the elytron there may be a more or less strong flange some distance from the costal margin (e.g. in DYTISCIDAE and CURCULIONIDAE).

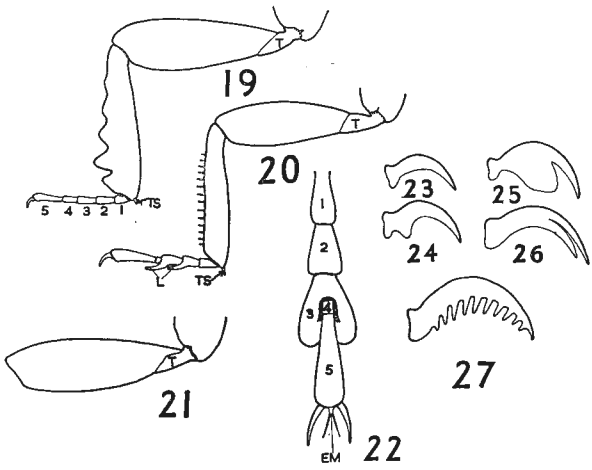
(4) THE METATHORAX AND WINGS.—In normal Coleoptera the metanotum is completely covered by the elytra in repose ; in fully winged species



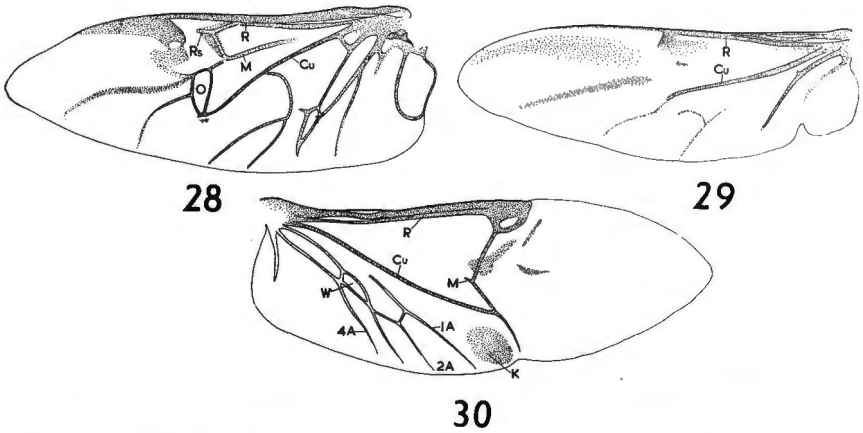
FIGS 14–18.—*Meso- and Metathorax.* 14, Composite meso- and metathorax, ventral view: on left side mes-epimeron (*EM2*) reaching middle coxal cavity (so latter not closed outwardly by sterna), trochantin (*TN*) of middle coxae (*C2*) exposed, metasternum (*S3*) with transverse suture (*SS*) crossing middle line, met-episternum (*ES3*) parallel-sided, epimeron (*EM3*) exposed ventrally, hind coxae (*C3*) excavate posteriorly, extending laterally as far as outer edge of metasternum, dividing first visible abdominal sternite (*A2*), epipleuron (*EP*) extending whole length of elytron; on right side, middle coxal cavity closed outwardly by meeting of meso- and metasterna, metasternum with femoral line (coxal line, *FL*), its transverse suture (*SS*) not crossing middle line, metepisternum narrowed posteriorly, met-epimeron not exposed ventrally, hind coxa not excavate posteriorly, extending laterally to meet elytral epipleuron, not dividing first visible abdominal sternite (*A3*), latter with femoral line (*FL*), epipleuron ending opposite first visible abdominal sternite. 15–17, Diagrammatic vertical longitudinal sections on a line corresponding approximately to XX in fig. 14; 15, showing excavate hind coxa (*C3*), first 2 visible abdominal sternites (*A3–A4*) connate, the third (*A5*) movably articulated; 16, showing somewhat projecting but not excavate hind coxa (*C3*), metasternum (*S3*) without transverse suture, first 3 visible abdominal sternites (*A3, A4, A5*) all movably articulated; 17, showing flat hind coxa, metasternum (*S3*) with transverse suture (*SS*), first 3 visible abdominal sternites (*A3–A5*) connate. 18, Typical elytron with punctured striae and scutellary striole, not truncate at apex, tracheae indicated by broken lines.

A2, A3, A4, A5, sternites of abdominal segments 2–5; *AP*, apical angle of elytron; *C2, C3*, middle and hind coxae; *FL*, femoral lines (coxal lines); *EM2, EM3*, meso- and meta-epimera; *ES2, ES3*, meso- and meta-episterna; *EP*, epipleuron; *F3*, hind femur; *H*, humeral protuberance; *LS*, longitudinal suture of metasternum; *P*, pit in mesosternum receiving tip of prosternal process; *S2, S3*, meso- and metasterna; *SC*, scutellary striole; *SS*, transverse suture of metasternum; *TN*, trochantin; *X–X*, line of section; 1–9, serial numbering of elytral striae; *I–IX*, serial numbering of elytral interstices. The arrows in 15–17 indicate range of movement of hind femur.

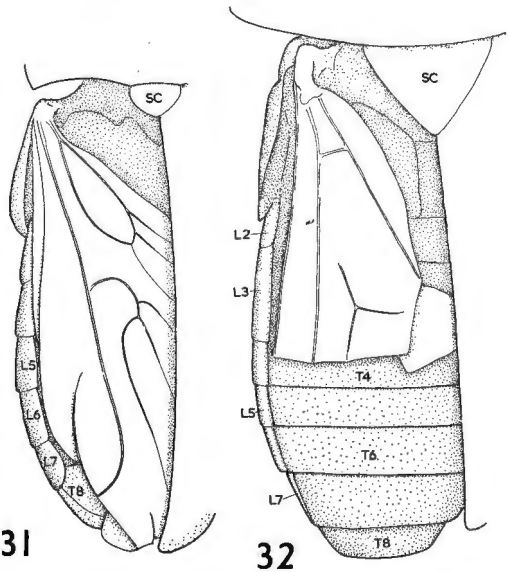
it is usually the largest of the thoracic terga, but undergoes reduction in flightless forms. The metasternum (fig. 14 s3) is normally a large, more or less rectangular sclerite, produced in the middle posteriorly as the inter-coxal process and emarginate on each side of its front edge to fit against the middle coxae. Its lateral margins may be parallel or more or less convergent anteriorly, and abut upon the elongate met-episterna (fig. 14 ES3) which in turn commonly meet the elytral epipleura in the resting position. The met-epimera (fig. 14 EM3) are in large part hidden by the elytra, but portions of them may or may not be exposed at the outer ends of the hind coxae. The hind coxae (fig. 14 c3) are normally transverse and extend laterally at least as far as the outer edges of the metasternum, sometimes far enough to meet the elytral epipleura in repose (cf. L. and R. sides of fig. 14); their inner ends may be almost contiguous (i.e. inter-coxal process very narrow) or more or less widely separated (broad inter-coxal process). The apparent front margins of the hind coxae are usually fairly straight, less often convex. The main outer surface of the coxae may lie in one plane with the metasternum and first visible abdominal sternite (fig. 17)—giving "flat" hind coxae, or there may be an anterior horizontal part in the plane of the metasternum separated by an angle or ridge from an inclined posterior part sloping down (as seen from below) to the plane of the first visible abdominal sternite —"inclined" hind coxae (fig. 16), or the posterior part may become vertical and concave and separated from the horizontal part by a distinct flange—"excavate" hind coxae (fig. 15). The hind wings show three main types of venation (figs. 28, 29, 30); their folding patterns are characteristic in various



FIGS. 19–27.—*Legs*. 19, Leg showing normal trochanter (*T*), dentate tibia, 5-segmented filiform tarsus. 20, Leg showing long trochanter (*T*), spinose tibia, pseudotetramerous tarsus with ventral lobes (*L*) on segments 2–3. 21, Base of leg showing heteromeroid trochanter. 22, Pseudotetramerous tarsus in dorsal view, showing small fourth segment connate to base of 5 and received in excavation of 3, large bisetose empodium (*EM*) between tarsal claws. 23, Simple claw. 24, Basally toothed claw. 25, Appendiculate claw. 26, Split claw. 27, Pectinate claw. *EM*, empodium; *L*, lobes of tarsal segments; *T*, trochanter; *TS*, tibial spur; 1–5, numbering of tarsal segments.



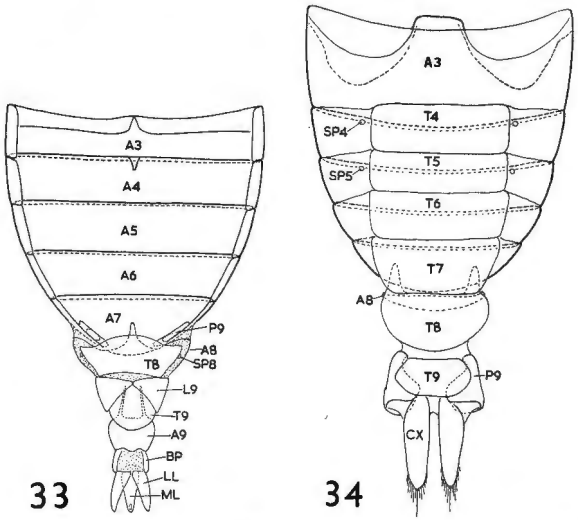
FIGS. 28–30.—*Wing Venation.* 28, Adephagan type (*Blethisa multipunctata*). 29, Staphylinoid type (*Pteroloma forsströmi*). 30, Cantharoid type (*Tetratoma fungorum*). *Cu,* cubitus; *K,* sub-cubital fleck; *M,* media; *O,* oblongum; *R,* radius; *Rs,* radial sector; *W,* Wedge cell (anal cell); *1A, 2A, 4A,* 1st, 2nd and 4th anal veins.



FIGS. 31–32.—*Wing folding patterns, left elytron removed.* 31, Cantharoid type (*Dascillus cervinus*). 32, Staphylinoid type (*Xylodrepa quadripunctata*).
L2–L7, pleurites of abdominal segments 2–7; *Sc,* scutellum; *T4, T6, T8,* tergites of abdominal segments 4, 6, 8.

groups (cf. figs. 31, 32); in some species they may be reduced (brachypterous) or even absent (apterous).

(5) THE LEGS.—The variation in the coxae has already been dealt with in treating the thoracic segments. The trochanters may vary in structure in different pairs of legs of the same beetle as well as between corresponding legs of different groups; their typical and presumably primitive form is illustrated in fig. 19—with the trochantero-femoral junction very oblique and the dorsal edge of the trochanter very short. In a number of groups we meet with "long" trochanters (e.g. *Apion*)) in which the trochantero-



FIGS. 33–34.—*Abdominal structure.* **33,** Male abdomen of a primitive Coleopteron, dorsal view with soft parts and tergites of segments 1–7 removed, genitalia extruded. **34,** Female abdomen of a higher Coleopteron, soft parts and tergites of segments 1–3 removed, ovipositor extruded; coxites (*CX*) with only rudimentary styli at tips.

A3, A4, A5, A6, A7, A8, A9, sternites of abdominal segments 3 to 9; *BP,* basal piece of aedeagus; *CX,* coxite; *LL,* lateral lobe (paramere) of aedeagus; *ML,* median lobe (penis) of aedeagus; *P9,* paraproct (pleurite of ninth segment); *SP4, SP5, SP8,* spiracles of abdominal segments 4, 5, 8; *T4, T5, T6, T7, T8, T9,* tergites of abdominal segments 4–9.

femoral junction is less oblique than usual (fig. 20) and the dorsal edge of the trochanter relatively long; in some forms the femur appears to extend dorsally round the trochanter to meet the coxae ("heteromeroid" trochanters, fig. 21). The femora may exhibit spines along the ventral edges, their shape is variable and the posterior pair are not infrequently inflated—commonly in connection with the development of the *extensor tibialis* muscle for jumping. The tibiae are usually broadened towards their apices, on the inner side of which they typically bear two (more rarely one or none) tibial spurs (fig. 19 TS); their outer edges may bear dentations (fig. 19) or articulated spines distinct from the general pubescence (spinose tibiae, fig.

20). The tarsi in Coleoptera provide many useful classificatory characters—the most obvious of which is the " tarsal formula," which may be exemplified as *x–y–z*, where *x* represents the number of segments in the front tarsi, *y* that of the middle tarsi, and *z* that of the hind tarsi—the " *y* " is always the same as the *x* or the *z*, which themselves very rarely differ by more than 1. A tarsal formula of 5–5–5 would be described as pentamerous, 4–4–4 as tetramerous, 3–3–3 as trimerous ; the term heteromerous could be taken to mean that any one pair of tarsi had a different number from the others, but is usually restricted to the formula 5–5–4. The tarsal formula sometimes differs in the sexes of the same species, in which case it is almost always the male which has the lower formula. Certain tarsal segments, particularly the basal and penultimate ones, are specially liable to reduction, and may become so small that they are only visible under high magnification ; the intermediate (second to ante-penultimate) segments are liable to develop adhesive hairs below and to develop ventral extensions (lobes, see fig. 20L) which may themselves be bilobed apically (fig. 22). If segment 3 has such a lobe below while segment 4 is minute and connate to the base of 5, the tarsus is said to be pseudotetramerous (cryptopentamerous of some authors (fig. 22)); a similar tarsus with one fewer segment (hence formula 4–4–4 but appearing 3–3–3) is called pseudotrimerous. The tarsal claws may be simple (fig. 23). toothed (fig. 24), appendiculate (fig. 25), split (fig. 26), pectinate (fig. 27), unequal, connate basally, or reduced to one on each tarsus ; there may be a bi- or plurisetose empodium (fig. 22EM) between the claws, or a pair of long lobiform (fig. 105) or bristle-like appendages below them.

The Collection and Identification of Coleoptera.

Adult beetles may be collected at all seasons of the year and in all types of habitat where any insect life is found. They may be killed in cyanide killing bottles such as are used by collectors of other insects, by exposure to the vapours of chloroform, ethyl acetate (acetic ether), and many other organic reagents, by brief immersion in boiling water, or by the old-fashioned laurel bottle. For the beginner, it is probably best to determine the specimens as far as the families as soon as they are killed, before mounting them in any way ; this will be essential if it is desired to mount the specimens gummed flat on cards in the usual English style. If the specimens are pinned, or glued to the points of pieces of card in such a way that at least one side of the ventral surface can be seen, it should be possible to use the present key for determining the families at any later time. It is strongly advised that the beginner should acquire a few reliably identified examples of some of the commoner families as soon as possible, and check them against this key in order to familiarize himself with the characters used in it ; if these suggestions are followed conscientiously at the beginning, it should not be long before the student finds himself able to dispense with the superfamily and family keys in the great majority of cases.

Immature Stages of Coleoptera.

The larvae of beetles are almost as diverse in their habits and adaptations as the adults, and their study is a particularly interesting and rapidly developing branch of Coleopterology at the present time. There are many impor-

tant types of Coleoptera occurring in Britain whose larvae are quite unknown (e.g. *Sphaerites, Sphaerius, Pseudopsis, Phloeophilus, Euaesthetus*), many of our genera and the large majority of our species are in a similar position; the feeding habits of very many of our species are not or very inadequately known. Here then are fields in which amateur entomologists in Britain are in a position to do important original work. Keys to beetle larvae are not within the scope of the present work; students are recommended to refer to the papers by F. van Emden published in the *Entomologists' Monthly Magazine*. The rearing of adult beetles from eggs or larvae is usually rather more difficult than the corresponding operation in Lepidoptera, and the techniques involved differ considerably in different groups of the order. Helpful information on this and other matters will be found in the *Coleopterists' Handbook* of the Amateur Entomologists' Society. Some species are much more easily found as larvae than as adults—in such cases rearing may be worth while from the ordinary collector's point of view, while to the serious entomologist the interest attaching to rearing experiments should be great enough to justify a considerable amount of effort in carrying them through.

Glossary of Special Taxonomic Characters Used.

Bostrychoid prothorax: characterised by a long and usually more or less humped notum, the anterior opening facing more downwards than forwards, the prosternum very short, e.g. in Anobiids, Ptinids, Cisids, Scolytids etc. (Figs. 12, 62.)

Clubbed antennae: with from 1 to 5 of apical segments broadened and marked off from the preceding ones by a distinct discontinuity, e.g. in Silphids and Crytophagids but not in *Byrrhus* or Bruchids which have the antennae simply thickened towards the apex. (Figs. 8, 9, 47, 74.)

Connate abdominal sternites: sternites between which the sutures have lost the usual telescoping mobility, e.g. first three sternites in Tenebrionids, first two in Curculionids, etc. (Figs. 15, 17.)

Dentate front tibiae: with the outer edges jagged or toothed, e.g. in Scarabaeoids, Histerids, most Scolytids, many Nitidulids, etc. (Fig. 19.)

Eighth abdominal segment: in Polyphagan beetles, where there are five visible abdominal sternites (ventrites) they belong to segments 3–7, where there are six ventrites the sternite of the eighth segment is also exposed. By lifting up the elytra of a relaxed specimen slightly it is usually easy to tell whether the last visible tergite belongs to the same segment as the last visible sternite or to the segment behind it. Chrysomelids normally have the eighth segment completely concealed (fig. 61), Hydrophilids and Elaterids will provide examples with only the tergite of the eighth segment exposed, Silphids and Staphylinids will illustrate exposed tergite and sternite of the eighth segment (fig. 60).

Excavate hind coxae: with a more or less vertical posterior face which is in some degree hollowed out to receive the retracted femur, e.g. in Dermestids or Elaterids. (Figs. 14, L. side, 15, 63, 65.)

Femoral plates: extensions of the postero-ventral edges of excavate hind coxae partially or wholly covering the retracted femora, e.g. in Byrrhids, Clambids, Trixagids, etc.

Femoral lines : raised ridges on the metasternum and first visible abdominal sternite extending backwards and outwards from inner ends of middle and hind coxae, as in Coccinellids, Biphyllids, etc. (Figs. 14, 91, 92.)

Flabellate antennae : with segments (except basal 2 and 3 and sometimes last) with long outgrowths on one side, usually at least half as long as whole flagellum, e.g. in Rhipiphorids. (Figs. 7, 108.)

Flat hind coxae : main surface of hind coxa lying almost or quite in same plane as metasternum and first visible abdominal sternite, permitting a long unimpeded sweep of hind femora, e.g. in Dytiscids, Scarabaeids, Curculionids etc. (Figs. 17, 88, 92.)

Front coxal cavities completely open behind : propleuron (hypomeron) with no trace of processes projecting inwards behind front coxae, e.g. in Elaterids, Cantharids. (Figs. 13, 63, 66.)

Front coxal cavities partially closed behind : propleuron with processes projecting inwards behind front coxae but not extending far enough to meet each other or the tip of the prosternal process, e.g. in many Heteromera (not Tenebrionids, Lagriids or Alleculids). (Figs. 11, 12.)

Heteromeroid trochanters : upper basal angle of femur extending round dorsal side of trochanter and nearly or quite meeting coxa, e.g. in most Heteromera. (Fig. 21.)

Long trochanters : femoro-trochanteral junction not as oblique as usual, upper edge of trochanter almost or quite as long as width of trochanter at its junction with femur, e.g. in *Apion*, *Cerylon*, Anobiids, Ptinids. (Fig. 20.)

Pectinate antennae : segments (except from 2 to 4 of basal ones) with lateral outgrowths about as long as length of segments, e.g. in *Pyrochroa*, *Corymbites*. (Figs. 6, 52, 107.)

Pseudotetramerous tarsi : appearing 4-segmented from extreme reduction of true fourth segment, segment 3 and usually 2 with ventral adhesive lobes at apex, e.g. in Chrysomelids, Curculionids. (Figs. 22, 109–111.)

Pseudotrimerous tarsi : similar to pseudotetramerous tarsi but with one less basal segment, e.g. Coccinellids.

Securiform palpi : with last segment more or less hatchet-shaped or triangularly widened to its apex, e.g. in Coccinellids, many Heteromera etc. (Fig. 1, R. side.)

Serrate antennae : with segments (except basal 2 or 3) slightly expanded on one side only, giving a saw-like outline, e.g. in most Elaterids. (Fig. 5.)

Wing-venation : the Staphylinoid (figs. 29, 32) and Cantharoid (figs. 30, 31) types can usually be distinguished in the folded wing if an elytron is lifted up (figs. 31, 32) ; compare a Silphid with a Chrysomelid in this way. The same procedure permits observation of the terminal abdominal tergites.

The Classification of Coleoptera.

It would hardly be an exaggeration to say that it is impossible to find any two systematists working on Coleoptera who have used the same classification of the order. This state of affairs is confusing to the amateur and the non-specialist, and plays into the hands of those who accuse taxonomy of being a subjective and sterile pursuit of little or no scientific value. The system used in this part is true to this unfortunate tradition in that it does not follow those of any previous writers ; I have published previously an

exposition of its theoretical basis (Crowson, 1955). For convenience of cross-reference, there is appended at the end of the part (p. 46) a conspectus of the system adopted, with indication of the names of the corresponding groups in Fowler's *Coleoptera of the British Islands*, Reitter's *Fauna Germanica: Käfer*, Joy's *Practical Handbook of British Beetles*, Imm's *General Textbook of Entomology*, and Kloet and Hincks' *Check List of British Insects* (the Coleoptera section of which does not itself follow any previously published system).

The Suborders of Coleoptera.

The suborders **Adephaga** and **Polyphaga** have been recognised by nearly all serious students of classification in beetles during the present century; the addition of a third (**Archostemata,** not represented in Europe) has become fairly widely accepted in recent years. As first recognised by Forbes (1926) there are some grounds for separating three small families (Cyathoceridae, Sphaeriidae and Hydroscaphidae) from Polyphaga to form a fourth suborder, which I have elsewhere named **Myxophaga** (Crowson 1955). In the present work, however, these forms will be treated as a superfamily in Polyphaga. The two generally recognised suborders in Britain may be distinguished thus:

Hind coxae large, immovably articulated to metasternum, completely dividing first visible abdominal sternite (fig. 14, L. side); first three visible abdominal sternites connate; prothorax with notopleural sutures usually distinct (fig. 10, R. side); antennae nearly always filiform and 11-segmented, tarsi nearly always filiform and 5-segmented; maxillary galea 2-segmented, palp-like; length never less than 1·5 mm. ..... 1. **ADEPHAGA**

Hind coxae usually movably articulated to metasternum, very rarely completely dividing first visible abdominal sternite; prothorax very rarely with distinct noto-pleural suture, if so, length less than 1 mm.; antennae and tarsi various; maxillary galea not palp-like ..... 2. **POLYPHAGA**

Suborder 1.—**ADEPHAGA.**

A single superfamily Caraboidea.

CARABOIDEA.

1 Insects not aquatic, with projecting sensory bristles (cf. fig. 35) at fixed points on body; antennae pubescent with 1 to 4 basal segments glabrous; hind coxae not extending laterally to meet elytral epipleura (fig. 14, L. side). Geodephaga auctt. ..... 1. CARABIDAE..2

Insects aquatic, without such projecting setae; antennae with all segments similarly sculptured and practically glabrous; hind coxae extending laterally to meet elytral epipleura (figs. 14, R. side, 39). Hydradephaga auctt. 5

2 Antennal insertions somewhat approximated on frons, clypeus extending laterally in front of them (fig. 37); both spurs of front tibiae quite terminal, no trace of an antenna-cleaning excavation on front tibia; side margins of prothorax obsolete; length at least 9 mm. ..... Subfamily 1. CICINDELINAE

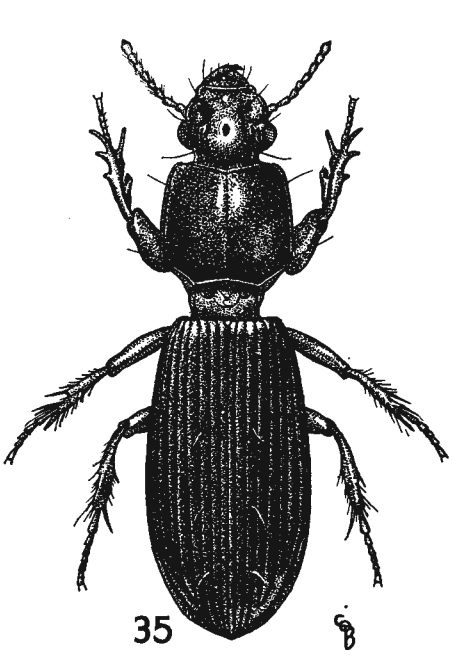
Antennal insertions not so approximated, clypeus not extending in front of them..3

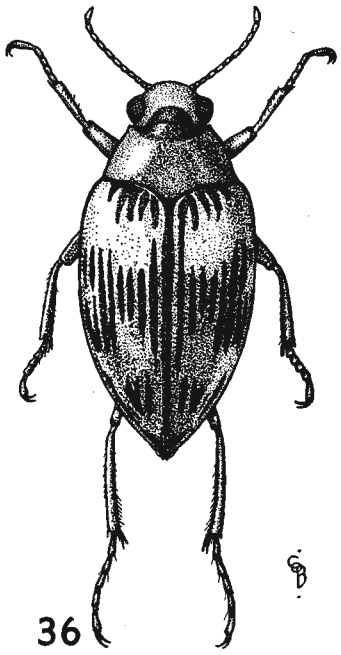
3 Antennae with segments 1–4 glabrous; metepimeron normally not exposed ventrally; antenna-cleaning excavation on inner side of front tibia often not or little developed; front coxal cavities often open behind
Subfamily 2. CARABINAE

Antennae with not more than three basal segments glabrous; metepimeron always exposed ventrally (fig. 14, L. side); front tibiae always with well-developed antenna-cleaning excavation (fig. 38); front coxal cavities closed behind. 4

4. Mesepimera reaching middle coxal cavities (fig. 14, L. side); species of fossorial adaptations with pedunculate mesothorax (fig. 35) and strongly dentate front tibiae; antennae rather stout and inserted in deep grooves
Subfamily 3. SCARITINAE
Mesepimera not reaching middle coxal cavities (cf. fig. 14, R. side); species not or less adapted for fossorial life; antennae less stout..Subfamily 4. HARPALINAE

5 Compound eyes completely divided on each side; antennae very short and broad with segment 2 very large; middle and hind legs forming short very broad paddles ..... 6. GYRINIDAE
Compound eyes not completely divided; antennae longer, segment 2 not very large; middle and hind legs longer.....6



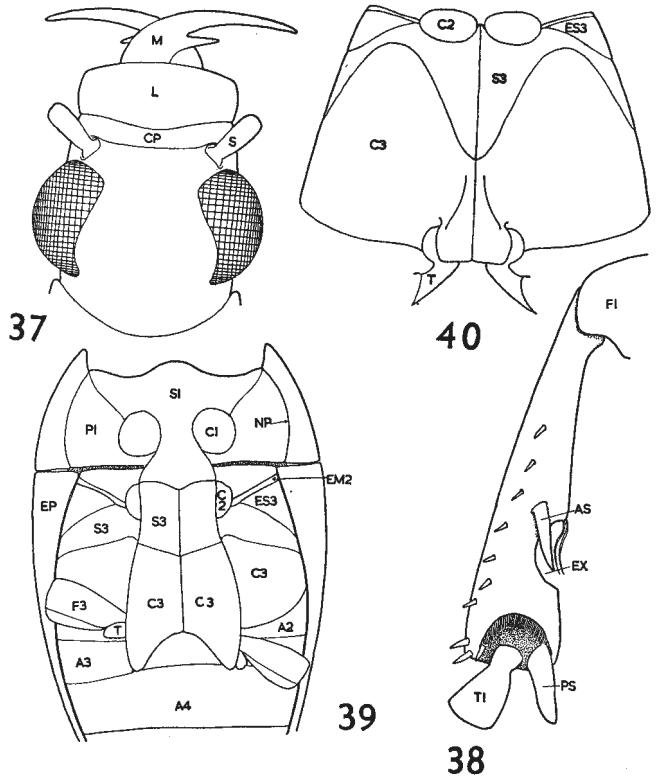


FIGS. 35–36.—35, *Clivina fossor* L.; 36 *Haliplus obliquus* F.

6 Postero-ventral edgs of hind coxae produced into large plates covering basal abdominal sternites, elytra with large punctures in regular rows, facies characteristic (fig. 36); scutellum hidden.....2. HALIPLIDAE
Postero-ventral edges of hind coxae not so developed; elytra without such regular rows of punctures.....7

7 Hind coxae relatively small, metasternum with a distinct transverse suture in front of them (cf. fig. 14, L. side); head strongly exserted with very convex eyes; species with very convex dorsal and ventral surfaces and fairly large size (length 8–10 mm.).....3. HYGROBIIDAE
Hind coxae much larger (figs. 39–40), metasternum without a transverse suture; head less exserted, eyes not or little projecting beyond its general outline.....8

8 Upper surface very convex, lower surface almost flat; antennae short, somewhat thickened; scutellum hidden; metasternum and hind coxae characteristically shaped (fig. 39).....4. NOTERIDAE
If upper surface so convex, lower surface also very convex; antennae not thickened, usually longer; metasternum and hind coxae differently shaped (fig. 40)
5. DYTISCIDAE



FIGS. 37–40.—37, *Cicindela campestris* L., antero-dorsal view of head. 38, *Harpalus* sp., R. front tibia, anterior view. 39, *Noterus clavicornis* Deg., thorax, ventral view. 40, *Laccophilus minutus* L., metathorax, ventral view.

A2, *A3*, *A4*, visible abdominal sternites 1–3; *AS*, anterior spur; *C1*, *C2*, *C3*, front, middle and hind coxae; *CP*, clypeus; *EM2*, mes-epimeron; *EP*, elytral epipleuron; *ES3*, met-episternum; *EX*, antenna cleaning excavation; *F1*, *F3*, front and hind femora; *L*, labrum; *M*, mandible; *NP*, notopleural suture; *PS*, posterior spur; *S*, scape of antenna; *S1*, *S3*, pro- and metasterna; *T1*, basal tarsal segment; *T*, trochanter.

Suborder 2.—**POLYPHAGA.**

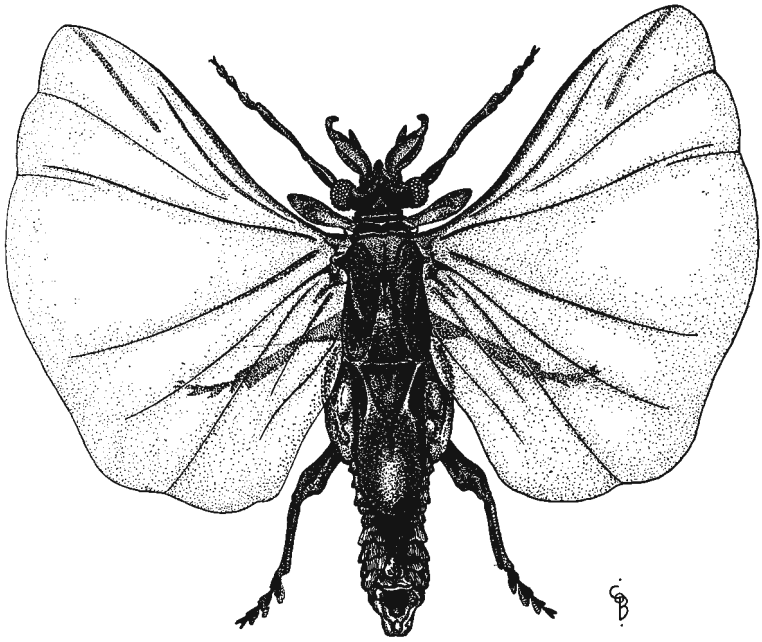
KEY TO SUPERFAMILIES.

1 *Male*: elytra reduced to small haltere-like structures (fig. 41), wings fully developed prothorax small, head completely exserted; antennae 5–7 segmented, at least segment 3 with a flattened lateral outgrowth; tarsal formula 4–4–4 or 3–3–3, claws absent. *Female:* apterous and legless, remaining in puparium in body of larval host. (Order STREPSIPTERA auctt.).....19. **Stylopoidea** (p. 45)

Male with elytra not or less reduced, prothorax larger; female always with legs....2

2 Abdomen with only three visible sternites; prothorax with distinct noto-pleural sutures; hind coxae with very large femoral plates; antennae clubbed; species very small (length less than 1 mm.), of very convex short oval form
1. **Sphaerioidea** (p. 26)

Abdomen with more than three visible sternites; prothorax without distinct noto-pleural sutures..... 3



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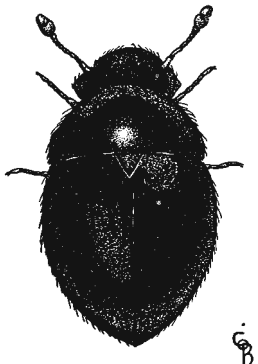

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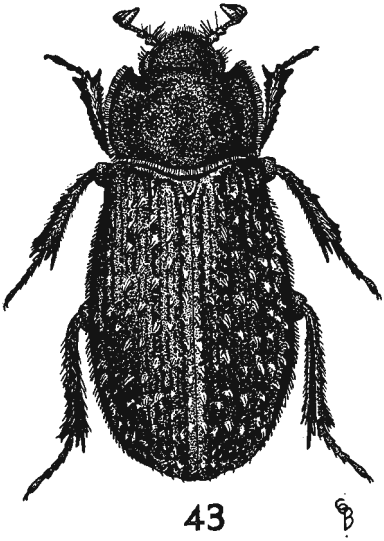

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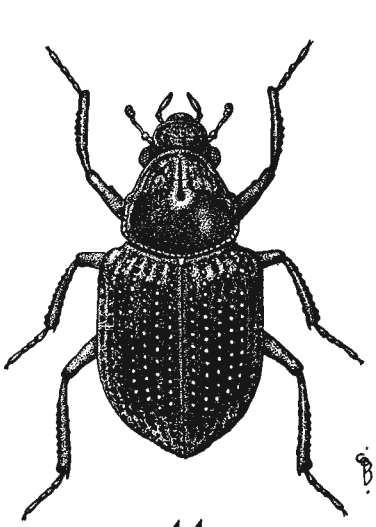
FIGS. 41–43.—41, *Stylops* sp., male. 42, *Clambus pubescens* Redt. 43, *Trox scaber* L.

3. Head very large, nearly or quite as broad as prothorax, capable of being reflexed against underside of thorax; hind coxae with very broad femoral plates; antennae 10-segmented with 2-segmented club; tarsal formula 4–4–4, legs slender; species of short ovate and convex form (fig. 42)
6. **Dascilloidea** in part (p. 30)

If head nearly or quite as wide as prothorax, hind coxae without femoral plates and antennae different 4

4 Antennae usually 9–10 (rarely 11) segmented, the apical 3–5 (rarely 6 or 7) segments expanded on one side to form a lamellate club (fig. 46), segment 8 not smaller than 7; tarsal formula almost always 5–5–5, segments never lobed below; front tibiae with outer edge more or less dentate (cf. fig. 19), only one apical spur; front coxae very large, transverse or projecting, hind coxae very large, quite flat (cf. fig. 17); general form stout, length at least 2·5 mm.
5. **Scarabaeoidea** (p. 29)

Antennae various, if with apical three segments so formed. segment 8 smaller than 7 or hind coxae excavate 5



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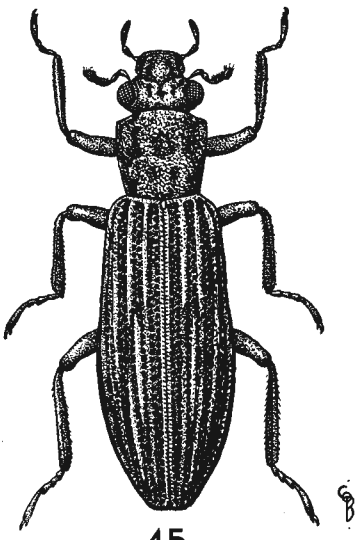

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FIGS. 44–45.—44, *Georissus crenulatus* Rossi. 45, *Hydrochus elongatus* Schall.

5 Antennae very short, usually less conspicuous than the prominent maxillary palpi (fig. 47), 7–9 segmented, the last 3–5 segments forming a dull pubescent club; tarsi filiform, formula 5–5–5 but sometimes appearing 4–4–4 through extreme reduction of basal segment; tibiae more or less spinose on outer edges (cf. fig. 20); species usually glabrous and strongly convex above, under side more or less flat and with characteristic close tomentum; clypeus large, usually extending over antennal insertions (fig. 47), vertex usually with median impressed line
2. **Hydrophiloidea** (p. 26)

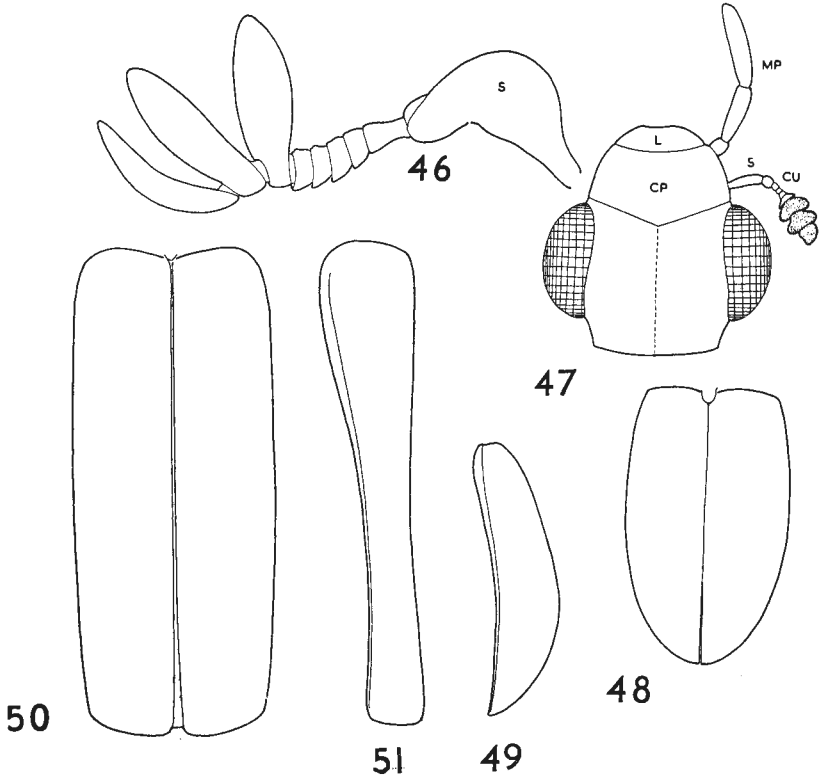
Antennae not so constructed, nearly always more conspicuous than maxillary palpi; clypeus smaller 6

6 Tarsi pseudotetramerous on all legs (fig. 22), the true fourth segment often extremely minute; if antennae clubbed, head rostrate or basal abdominal sternites connate; front coxal cavities wholly or partially closed behind (cf. figs. 10, 12); prothorax often without distinct side borders; hind coxae flat or slightly inclined (cf. fig. 17); abdomen rarely with more than five visible sternites 7

If tarsi pseudotetramerous on all legs, antennae clubbed, head not rostrate and all abdominal sternites free, or front coxal cavities completely open behind and hind coxae more or less excavate.....8

7. Antennae filiform or slightly thickened apically, not inserted in grooves or pits; head not or slightly rostrate; gular sutures distinct and separate; middle coxal cavities rarely closed outwardly by sterna, if so all abdominal sternites freely articulated.....17 **Chrysomeloidea** (p. 41)

Antennae more or less clubbed, often geniculate, inserted in pits or grooves; head more or less rostrate, gular sutures nearly always obsolete or confluent (fig. 110); middle coxal cavities almost always closed outwardly by sterna; abdomen with at least two basal sternites more or less connate....18 **Curculionoidea** (p. 43)

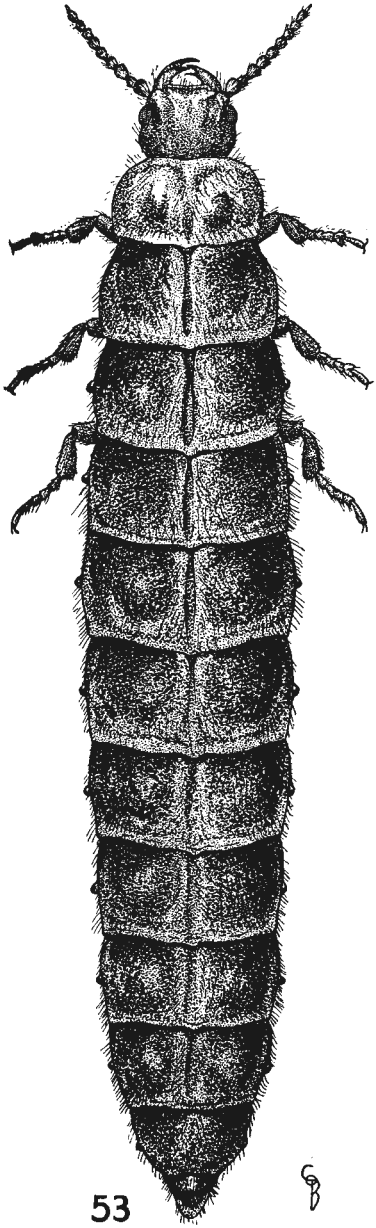


FIGS. 46–51.—46, Scarabaeid antenna. 47, Hydrophilid head, dorsal view. 48, Helodid elytra, dorsal view. 49, Ditto, lateral view. 50, Cantharid elytra, dorsal view. 51, Ditto, lateral view.

CP, clypeus; *CU*, cupule; L, labrum; *MP*, maxillary palp; *S*, scape.

8 Species elongate, long-legged, soft-bodied and pubescent above (figs. 52–55), general colour never black; tarsal formula always 5–5–5, segment 4 usually somewhat lobed below, segment 1 not shorter than 2; antennae filiform, rarely pectinate; all coxae more or less projecting, hind coxae not or scarcely excavate behind (cf. fig. 16); front coxal cavities usually completely open behind; usually six to seven visible abdominal sternites; female sometimes with elytra and wings reduced or absent (Malacodermata auctt.).....9

If species of such shape and vestiture, tarsi or antennae different.....12



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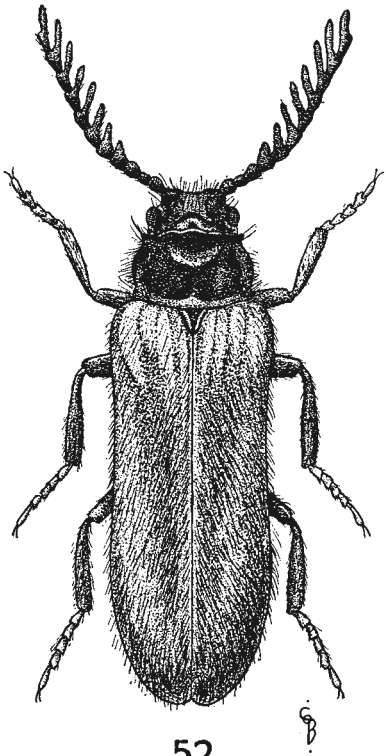

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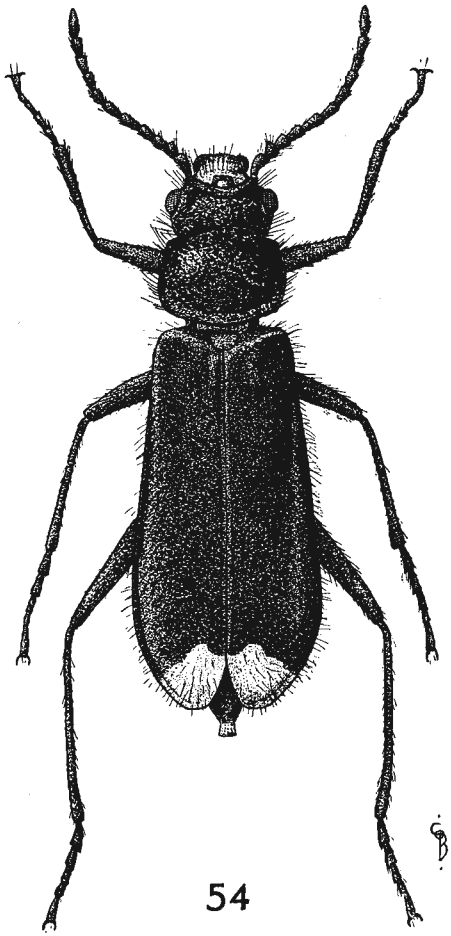
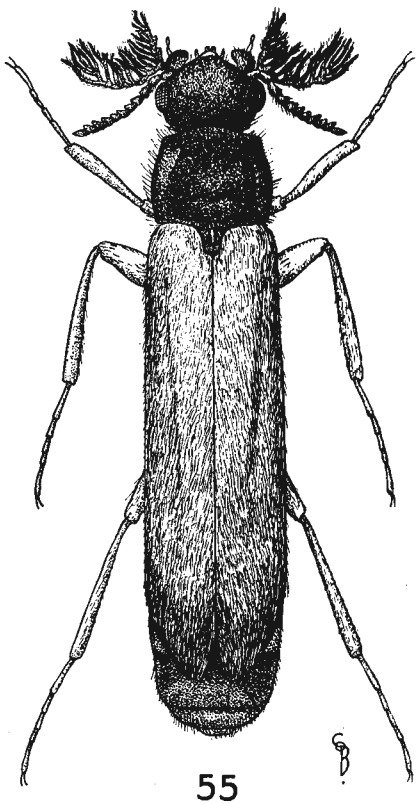
FIGS. 52–53.—52, *Drilus flavescens* Geoff., male. 53, ditto, female.

9 Projecting bristly hairs present on some parts of the body, usually on margins of prothorax and elytra (fig. 54); coloration often partly metallic, elytra often spotted or banded; front coxal cavities often partially closed behind; both sexes fully winged, elytra always covering folded wings..14. **Cleroidea** (p. 34)
Projecting bristly hairs absent; coloration very rarely metallic, elytra rarely spotted or banded.....10

10. Tarsi very long and thin, filiform; antennae short, serrate (fig. 55); females fully winged, males with extraordinarily developed maxillary palpi (fig. 55); general form cylindrical, hardly at all flattened.....15. **Lymexyloidea** (p. 34)
Tarsi shorter, penultimate segment more or less lobed below; antennae longer; male maxillary palpi normal; general form more flattened.....11

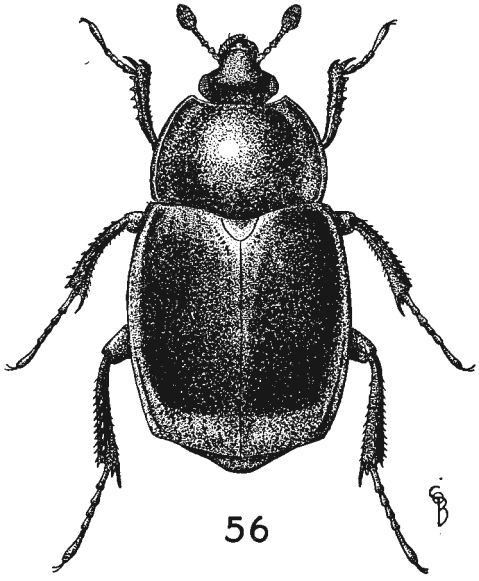


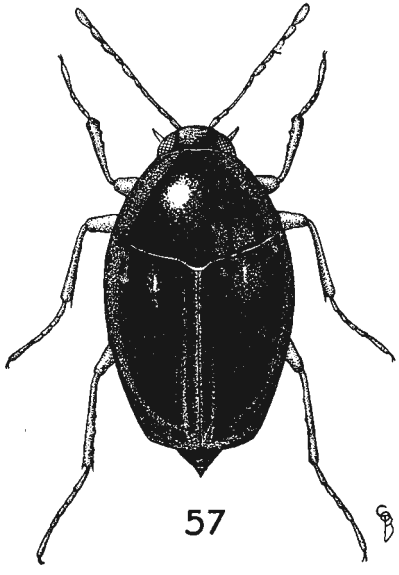


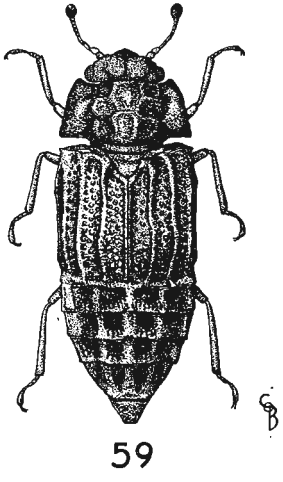
FIGS. 54–55.—54, *Malachius bipustulatus* L. 55, *Hylecoetus dermestoides*, L., male.

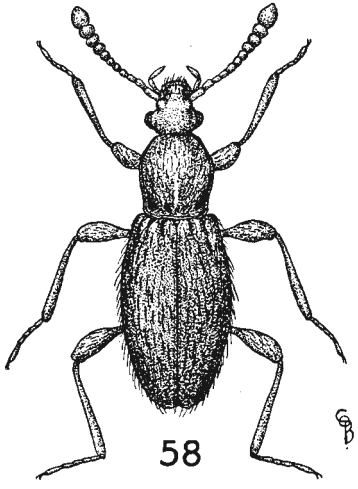
11 Apices of elytra forming a smooth slightly acuminate outline (fig. 48), fairly strongly and smoothly deflexed in side view (fig. 49); general form broader and more convex dorsally; hind coxa distinctly excavate; five visible abdominal sternites 6. **Dascilloidea** (p. 30)

Apices of elytra more or less truncate or obtuse (fig. 50), not smoothly deflexed in side view (fig. 51); general form narrower, less convex; hind coxae not distinctly excavate; usually six to seven visible sternites.....11. **Cantharoidea** (p. 32)







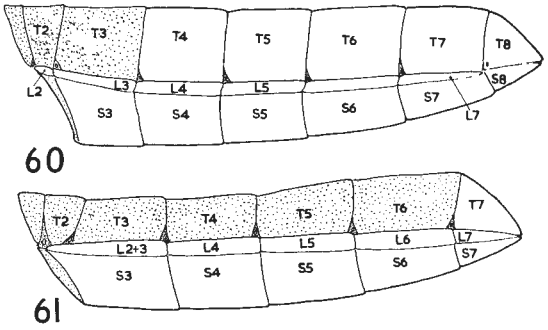


FIGS. 56–59.—56, *Sphaerites glabratus* F. 57, *Scaphisoma agaricinum* L. 58, *Neuraphes elongatulus* Muell. 59, *Micropeplus porcatus* F.

12 Tarsi 5–5–4 segmented in both sexes; antennae never geniculate, nor with Anisotomid type of club (cf. fig. 75); elytra, if truncate, never leaving more than one abdominal tergite uncovered (Heteromera auctt.).....16. **Cucujoidea** (p. 34)
If tarsal formula 5–5–4 in both sexes, elytra truncate leaving two abdominal tergites uncovered, or antennae with Anisotomid type of club (fig. 75).....13

13 Elytra truncate leaving at least one, usually two, abdominal tergites uncovered; species with hard integument, glabrous above, usually black and shining (fig. 56); tarsi without lobed segments; front tibiae dentate (fig. 19) or spinose outwardly; hind coxae flat; abdomen with five visible sternites, the last visible tergite belonging to same (seventh) segment as last visible sternite (cf. fig. 61)
3. **Histeroidea** (p. 27)
If elytra truncate leaving one or more tergites uncovered, tarsi with lobed segments or abdomen with at least six visible sternites.....14

14 Elytra truncate leaving at least three abdominal tergites not covered; antennae rarely with apical segments forming a well-marked club; tarsi usually without lobed segments; tergite and sternite of abdominal segment 8 (corresponding to sixth or seventh visible sternite) exposed; front coxae more or less projecting
4. **Staphylinoidea** in part (p. 27)
If elytra truncate leaving three or more tergites uncovered, antennae strongly clubbed 15



FIGS. 60–61.—*Abdomens, lateral view.* 60, Haplogastran abdomen, showing separate pleurite (*L2*) of segment 2, and exposed tergite and sternite (*T8*, *S8*) of segment 8; spiracles of segments 2—8 indicated. 61, Symphiogastran abdomen, showing no separate pleurite of segment 2, tergite and sternite of segment 8 concealed, spiracles of segments 2–7 indicated.
L, pleurites; *S*, sternites; *T*, tergites—numbered according to segments.

15 Hind coxae distinctly excavate behind; antennae rarely with apical 3–5 segments forming a distinct club; front coxal cavities completely open behind (cf. fig. 11); prosternal process with its apex received in mesosternum (figs. 63, 65–66); species never very minute, length at least 1·5 mm.; upper surface almost always pubescent, very rarely black.....16
If hind coxae distinctly excavate behind, antennae strongly clubbed and front coxal cavities partly or wholly closed behind; prosternal process rarely received in mesosternum; front coxal cavities usually at least partly closed behind....21

16 Front coxae projecting; prosternal process narrow, not deeply received in mesosternum; hind angles of prothorax not acute.....17
Front coxae transverse or rounded; prosternal process broader, more deeply received in mesosternum (figs. 63, 65–66); hind angles of prothorax usually acute (figs. 66–68, 70–71).....18

17 Prothorax not strongly hooded over head; elytra never with distinct scutellary striole; trochanters not long; last three antennal segments never differentiated from preceding ones.....6. **Dascilloidea** (p. 30)

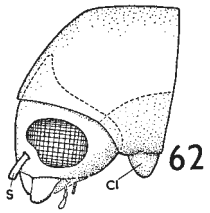
Prothorax strongly hooded over head (fig. 62); elytra, if striate, with distinct scutellary striole; trochanters long (cf. fig. 20); last three antennal segments often differentiated from preceding ones.....13. **Bostrychoidea** (p. 33)

18 Antennae very short, segments 4–11 strongly broadened (figs. 64, 69); tarsi filiform with segment 5 very long, or formula 4–4–4; form short, broad, parallel-sided (fig. 69).....8. **Dryopoidea** (p. 30)

Antennae less broad, usually longer; tarsi and shape different.....19

19 Shape short ovate and very convex above (fig. 67), upper surface always pubescent; antennae usually thickened towards apex but never serrate; tarsi usually with middle segments more or less lobed below; front coxae large, transverse (fig. 63); head and appendages closely retractable under body....7. **Byrrhoidea** (p. 30)

Shape different, if nearly as short and convex, upper surface glabrous and antennae serrate.....20



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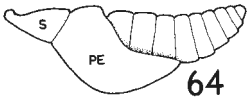

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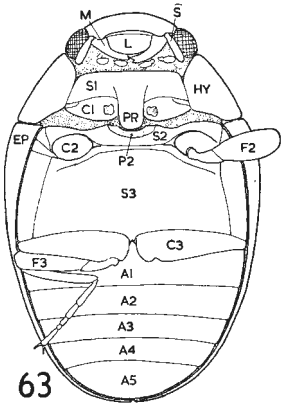

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FIGS. 62—64.—62, Bostrychoid head and prothorax, lateral view. 63, *Simplocaria semistriata* F., whole insect, ventral view (most of legs removed). 64, *Dryops auriculatus* Geoff., antenna.

A1, A2, A3, A4, A5, visible abdominal sternites (ventrites) 1–5; *C1, C2, C3*, pro-, meso- and meta-thoracic coxae; *F2, F3*, middle and hind femora; *EP*, elytral epipleuron; *HY*, hypomeron; *L*, labrum; *M*, mandible; *P2*, pit in mesosternum receiving tip of prosternal process; *PE*, pedicel; *PR*, prosternal inter-coxal process; *S*, scape; *S1, S2, S3*, pro-, meso- and meta-sterna.

20 Abdomen with two basal sternites strongly connate, the suture between them partly obliterated (fig. 65); head strongly deflexed; antennae very short, serrate; tarsi with segments 1–4 more or less lobed below; species often more or less glabrous above.....9. **Buprestoidea** (p. 31)

Abdomen with four basal sternites more or less connate, but all the sutures well-marked; head less strongly deflexed; antennae longer; species pubescent above.....10. **Elateroidea** (p. 31)

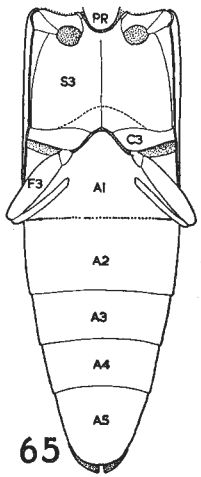
21 Hind coxae excavate behind; antennae strongly clubbed; head often with median ocellus on vertex; upper surface closely pubescent; hind angles of prothorax more or less acute; shape short ovate and convex; length at least 1·5 mm...22

If hind coxae excavate behind, length less than 1·5 mm. and hind angles of prothorax not acute.....23

22 Prosternal process deeply received in mesosternum, middle coxae widely separated (fig. 63); antennae weakly clubbed; tarsi often with segment 3 distinctly lobed below; head without ocellus; elytra usually with distinct striae, no scutellary striole.....7. **Byrrhoidea** (p. 30)

Prosternal process not deeply received in mesosternum, middle coxae not widely separated; antennae strongly clubbed; tarsi without lobed segments; head often with median ocellus; elytra, if striate, with a scutellary striole
12. **Dermestoidea** (p. 33)

23 Prothorax of Bostrychoid shape (figs. 12, 62); tarsal formula 5 5–5, segment 4 not or scarcely smaller than 3; front coxae nearly always projecting (fig. 12); trochanters long (cf. fig. 20) or first tarsal segment very short; elytra always completely covering abdomen; middle coxal cavities closed outwardly by sterna; five visible abdominal sternites.....13 **Bostrychoidea** (p. 33)
If prothorax so shaped, tarsi 4–4–4 segmented or pseudotetramerous, trochanters normal and first tarsal segment not very short.....24



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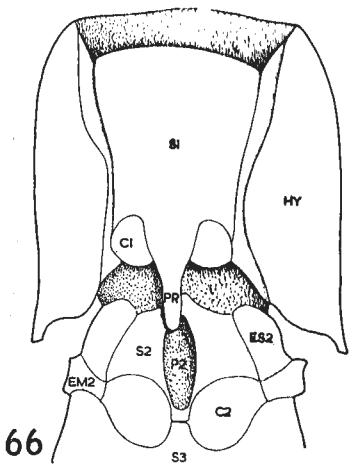

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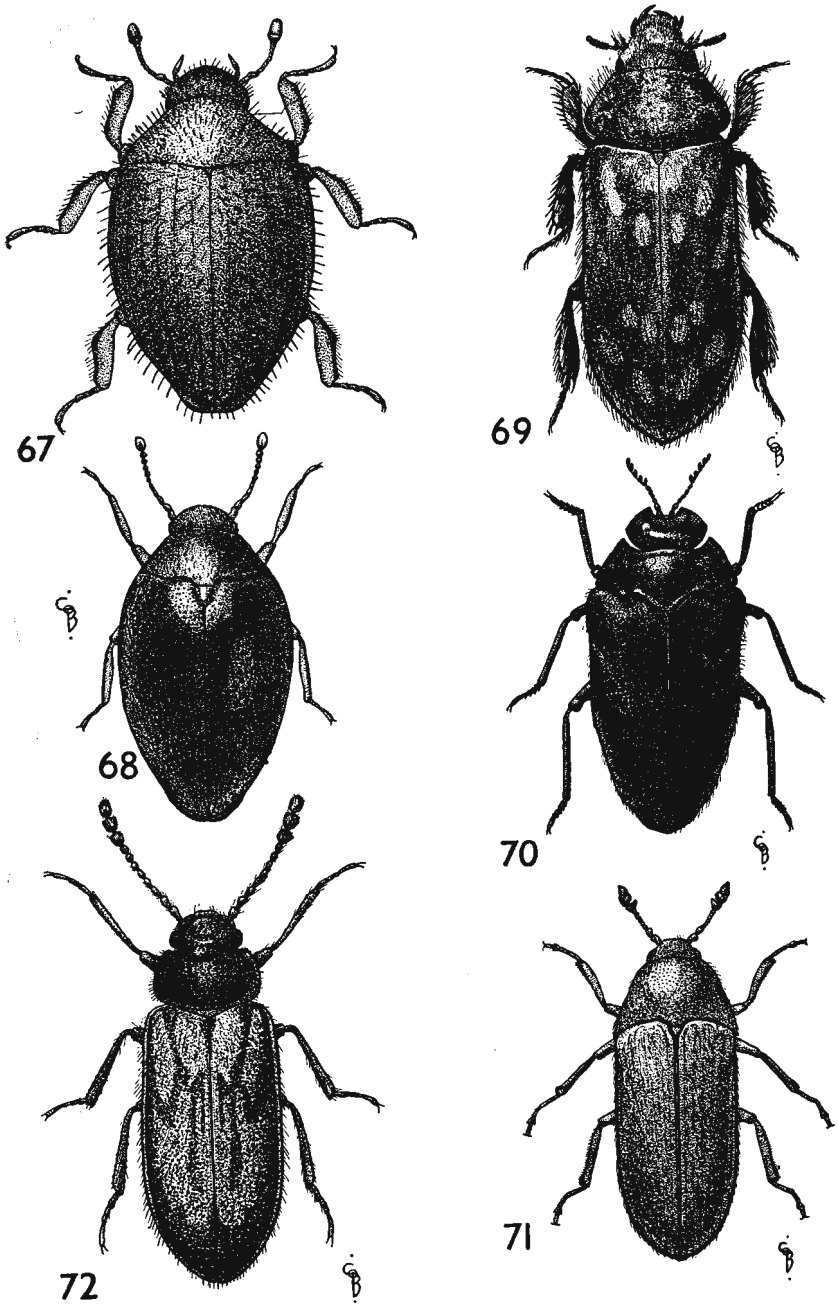
FIGS. 65–66.—65, Buprestid metathorax and abdomen, ventral view. 66, *Agriotes* sp. pro- and mesothorax, ventral view.
A1, A2, A3, A4, A5, visible abdominal sternites 1–5; *C1, C2, C3*, front, middle and hind coxae; *EM2*, mes-epimeron; *ES2*, mes-episternum; *F3*, hind femur; *HY*, hypomeron; *P2*, pit in mesosternum receiving tip of prosternal process; *PR*, prosternal inter-coxal process; *S1, S2, S3*, pro-, meso- and meta-sterna.

24 Antennae filiform, tarsal formula 5–5–5, segment 5 and claws very large; prosternal process broadly and deeply received in mesosternum; front coxae rounded; ventral surface with characteristic close tomentum.....8. **Dryopoidea** (p. 30)
If antennae filiform, tarsi different.....25

25 Front coxae projecting; at least some part of body with outstanding bristly hairs (cf. fig. 54); species never black; elytra completely covering abdomen
14. **Cleroidea** (p. 34)
If front coxae projecting, body without outstanding bristly hairs or elytra not fully covering abdomen.....26

26 Front coxae distinctly projecting; antennae often with four or five apical segments involved in a club, segment 8 often smaller than 7 (fig. 75); tergite (fig. 60) and usually sternite (sixth visible sternite) of abdominal segment 8 exposed; wing-venation and folding of Staphylinoid type (figs. 29, 32); if hind tarsi with lobed segments, head with two dorsal ocelli; species often black..4. **Staphylinoidea** (p. 27)
Front coxae transverse or rounded; antennal club rarely involving more than three apical segments; tergite of abdominal segment 8 usually hidden (fig. 61); wing-venation and folding rarely of Staphylinoid type (cf. figs. 30, 31); tarsi often pseudotetramerous or pseudotrimerous.....16. **Cucujoidea** (p. 34)



FIGS. 67–72.—67, *Syncalypta striatopunctata* Steff. 68, *Limnichus pygmaeus* Sturm. 69, *Heterocerus obsoletus* Curt. 70, *Trachys minuta* L. 71, *Trixagus dermestoides* L. 72, *Phloiophilus edwardsi* Steph.

Superfamily 1.—SPHAERIOIDEA.

I have elsewhere (Crowson 1955) treated this group as constituting a suborder (Myxophaga mihi) of its own; of the three families constituting it, only one is represented in Britain. Another British genus (*Calyptomerus* Redt.) has very similar wing-folding and venation to that of Sphaerioidea, and on that account I have previously (*loc. cit.*) assigned it to this superfamily, but so far no definite confirmation of this has been forthcoming from other structural features of the imagines or of the larvae (which have recently been bred); for the present it seems best to leave *Calyptomerus* near *Clambus*.

Family 1.—SPHAERIIDAE.

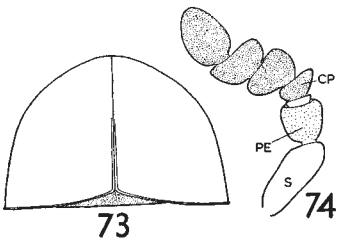
The family comprises a single genus *Sphaerius* Waltl, represented in Britain by *S. acaroides* Waltl. The species has been found under pieces of wood, etc. in wet places on areas of alkaline peat (the true Fens of the plant ecologists) in Central and Eastern England, but I have been able to find no records of its occurrence during the last thirty years.

Superfamily 2.—HYDROPHILOIDEA.

Certain ANISOTOMIDAE (Staphylinoidea) might be mis-traced here; they never exhibit the characteristic large clypeus of the Hydrophiloidea (fig. 47) and their antennal club is usually characteristic (fig. 75).

1 Antennal club 5-segmented; abdomen with six or seven visible sternites; size small (length less than 3 mm.); species not of very convex or rounded form ..... 1. HYDRAENIDAE

Antennal club usually 3-segmented, if apparently 5-segmented, form very broad and convex dorsally; abdomen with five (rarely six) visible sternites 2



FIGS. 73–74.—73, *Spercheus emarginatus* Schall., outline of elytra viewed from behind. 74, ditto, antenna. *S*, scape; *PE*, pedicel; *CP*, cupule.

2. Front coxae very large and projecting, concealing prosternum; tarsi 4–4–4 segmented; first two visible abdominal sternites connate; antennal insertions not hidden by sides of clypeus; species small, of characteristic shape (fig. 44) ..... 4. GEORISSIDAE (*Georissus* Latr., *G. crenulatus* Rossi = *pygmaeus* F.)

Front coxae transverse or slightly projecting, not concealing prosternum; tarsi 5–5–5 segmented; first two abdominal sternites not connate 3

3 Antennae apparently with 4-segmented club (fig. 74), the cupule being enlarged and pubescent; form short ovate, somewhat conically convex dorsally (fig. 73); front margin of head emarginate in middle; a large plurisetose empodium between tarsal claws ..... 2. SPERCHEIDAE

Antennal club 3-segmented, cupule small and glabrous (fig. 47); tarsi without conspicuous empodium; front of head not emarginate in middle.....4

4 Antennae 7-segmented, their insertions completely exposed; front coxal cavities visibly closed behind; general form characteristic (fig. 45)....3. HYDROCHIDAE

Antennae nearly always 9-segmented, their insertions hidden under sides of clypeus (fig. 47); front coxal cavities not visibly closed behind; shape different 5. HYDROPHILIDAE

Superfamily 3.—HISTEROIDEA.

Certain NITIDULIDAE (Cucujoidea) might be referred here; they may be distinguished by having tarsal segment 3 always somewhat lobed and with a pubescent pad below. PLATYPODIDAE (Curculionoidea) have much larger and more projecting front coxae and a more deflexed head (fig. 115).

1 Elytra with nine regular rows of punctures, leaving only one abdominal tergite uncovered (fig. 56); antennae not geniculate, club clearly 3-segmented; front tibiae spinose but not dentate outwardly (cf. fig. 20).....1. SPHAERITIDAE (*Sphaerites* Dufts., *S. glabratus* F.)

Elytra never with nine regular rows of punctures, nearly always leaving two abdominal sternites uncovered; antennae geniculate, club often solid (fig. 9); front tibiae dentate outwardly (cf. fig. 19).....2. HISTERIDAE

Superfamily 4.—STAPHYLINOIDEA.

If the wings are not examined, certain Cucujoidea (e.g. some MYCETOPHAGIDAE) might be mistraced here; some NITIDULIDAE may be distinguished by their lobed third tarsal segment and strongly clubbed antennae; certain Cantharoidea with reduced elytra and some MELYRIDAE (Cleroidea) might be sought here if their Malacoderm features have been overlooked. THORICTIDAE (Dermestoidea—fig. 85), if traced to this superfamily, would be taken to the vicinity of SCYDMAENIDAE, from which *Thorictodes* differs *inter alia* in having a very broad and compact 3-segmented antennal club. CLAMBIDAE (Dascilloidea, fig. 42) and SPHAERIIDAE (Sphaerioidea) were formerly referred to Staphylinoidea but both differ in having very broad femoral plates to the hind coxae. The Cucujoid CORYLOPHIDAE, also commonly grouped here hitherto, are included in the key below; MICROPEPLIDAE are treated as a family here but were treated as a subfamily of STAPHYLINIDAE by Tottenham in the present series. If the elytra can be lifted up, Staphylinoid beetles may usually be recognised by the Staphylinoid wing-venation and folding (figs. 29, 32), and by the Haplogastran type of abdomen, with the pleurites of abdominal segments 2 and 3 separate (figs. 32, 60, cf. 31, 61). This type of abdominal structure is also found in the two previous superfamilies, and in the Scarabaeoidea. All these groups have on this account been placed in series Haplogastra by some.

1 Species very small (length rarely more than 1 mm.), prothorax large and semicircular in outline (fig. 95), partly or wholly hiding head; hind coxae widely separated, without trace of femoral plates; elytra somewhat truncate but almost or quite covering abdomen; tarsal formula 4–4–4, more or less pseudotrimerous (Superfamily Cucujoidea fam. CORYLOPHIDAE)

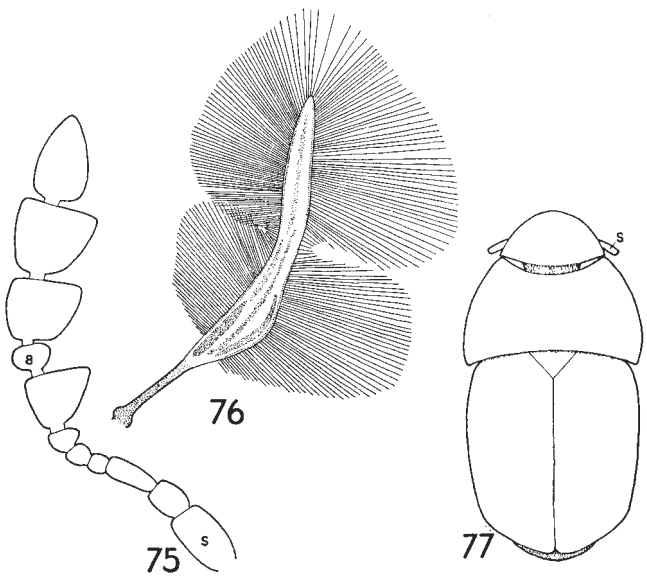
If species very small, prothorax or hind coxae different; tarsi never pseudotrimerous 2

2 Species very small (length not more than 1·3 mm.), antennae slender with segments 1–2 thick and a loose 3-segmented club, segments bearing whorls of projecting hairs; hind coxae with femoral plates on inner half; all coxae more or less widely separated; wings characteristic (fig. 76), fringed with long hairs
1. PTILIIDAE

If species very small, hind coxae without trace of femoral plates; wings broader, without such long fringing hairs 3

3 Eyes greatly reduced; head with a narrow neck; species of broad rather parallel-sided and flattened form (fig. 77); front coxae small, rounded; tarsal formula 5–5–5; antennae with segments 7–11 slightly enlarged, 8 smaller than 7 and 9
2. LEPTINIDAE
(*Leptinus* Mueller, *L. testaceus* Muell.)

If eyes reduced, form different 4



FIGS. 75–77.—75, Anisotomid antenna. 76, Ptiliid wing. 77, *Leptinus testaceus*, outline of body. *S*, scape. 8, eighth segment of antenna.

4 Form more or less short ovate and convex, base of prothorax as broad as base of elytra; elytra not or slightly truncate, completely covering abdomen; antennae usually with segments 7–11 enlarged to form an asymmetrical interrupted club (fig. 75); hind coxae practically contiguous; front coxal cavities often visibly closed behind; last segment of maxillary palpi not or little smaller than penultimate; size small or moderate (length not more than 7 mm.) ... 3. ANISOTOMIDAE

If form short ovate and convex, other characters different; antennae very rarely with Anisotomid type of club 5

5. Elytra completely covering abdomen, or leaving 1–2 tergites uncovered; all coxae distinctly separated; tarsal formula 5–5–5; pronotum usually with characteristic pre-basal pits (fig. 58); last segment of maxillary palpi usually small; length not more than 2 mm. ..... 4. SCYDMAENIDAE

If elytra so constructed and tarsi 5–5–5, coxae nearly contiguous and pronotum without such pre-basal pits 6

6 Antennae strongly clubbed; elytra truncate leaving three abdominal tergites uncovered; size large (length at least 10 mm.) ..... 5. SILPHIDAE in part

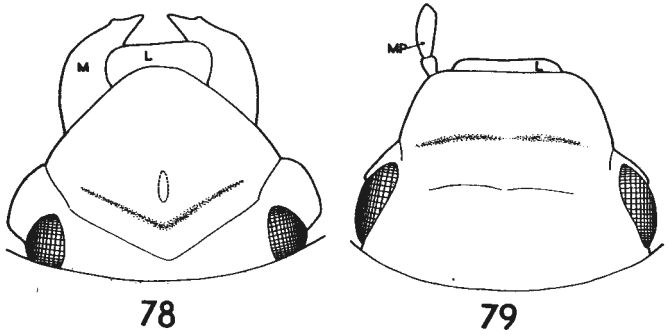
If antennae clubbed, elytra or size different 7

7. Antennae with well-marked 4–5 segmented club; elytra somewhat truncate but normally fully covering abdomen; size rather large (length at least 9 mm.); form rather flattened; species not very shining.....5. SILPHIDAE
Antennal club indistinct, or 1–3 segmented, or absent; elytra truncate leaving at least one tergite uncovered.....8
8 General shape characteristic (fig. 57), very convex dorsally and ventrally; species glabrous and very shining; antennae with weak 5-segmented club
6. SCAPHIDIIDAE
Shape different; elytra normally leaving more than one abdominal tergite uncovered; antennae usually filiform.....9
9 Antennae 9-segmented with 1-segmented club; prothorax and elytra with characteristic raised ridges (fig. 59); front coxae transverse, scarcely projecting
7. MICROPEPLIDAE
Antennae nearly always 11-segmented, usually filiform; front coxae more or less projecting; prothorax and elytra without such raised ridges.....10
10 Abdomen fully flexible; tarsal formula rarely 3–3–3, claws almost always equal; body rarely with deep cuticular pits; general form almost always more elongate
8. STAPHYLINIDAE
Abdomen with very limited flexibility; tarsal formula 3–3–3, claws usually unequal or reduced to 1; body with deep cuticular pits at definite points; general form less elongate.....9. PSELAPHIDAE

Superfamily 5.—SCARABAEOIDEA.

Certain ANISOTOMIDAE and perhaps some HYDROPHILIDAE-Sphaeridiinae might be referred here; neither group has the dentate front tibiae of Scarabaeoids; the characteristic antennal club of the Anistomids (fig. 75) and the head structure (fig. 47) of the Hydrophiloids will usually suffice to distinguish them.

1 Antennae more or less geniculate, segments of club not closely co-applicable; species of more or less parallel-sided shape, glabrous above, elytra not striate; five visible abdominal sternites.....1. LUCANIDAE
Antennae not geniculate, segments of club closely co-applicable; if species so shaped, abdomen with six visible sternites.....2
2 Sculpture of elytra very rough, interstices with tufts of hairs or scales or with tubercles (fig. 43); elytra striate; five visible abdominal sternites; antennae 10-segmented with dull 3-segmented club.....2. TROGIDAE
Elytra not so sculptured; abdomen with six visible sternites.....3



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FIGS. 78–79.—78, *Geotrupes vernalis* L., head, antero-dorsal view. 79, *Amphimallon solstitialis* L., head, antero-dorsal view. *L.*, *labrum*; *M*, mandible; *MP*, maxillary palp.

3. Antennae 11-segmented; labrum and mandibles fully visible in dorsal view (fig. 78); antennal club dull and pubescent.....3. GEOTRUPIDAE
Antennae 9–10 segmented (cf. fig. 46); if antennal club dull and pubescent, labrum and mandibles largely hidden from dorsal view (fig. 79).....4. SCARABAEIDAE

Superfamily 6.—**DASCILLOIDEA.**

CLAMBIDAE are transferred here from Staphylinoidea on account of the evident affinity shown by adult and larval *Clambus* to the non-British genus *Eucinetus*, which itself has affinities to HELODIDAE. In the present state of uncertainty over the true relationships of *Calyptomerus*, it seems best to leave the genus in CLAMBIDAE. *Eubria*, included under HELODIDAE in almost all previous British works, is here transferred to the Dryopoid family PSEPHENIDAE.

1 Species very small (length less than 1·5 mm.), head almost as broad as prothorax, antennae with 2-segmented club; tarsal formula 4–4–4, segments not lobed below; hind coxae with very broad femoral plates; general appearance characteristic (fig. 42).....1. CLAMBIDAE
Species larger, antennae filiform to pectinate; head much narrower than prothorax; tarsal formula 5–5–5; femoral plates narrower.....2
2 Tarsal segments 1–4 strongly lobed below; length at least 8 mm.; shape more elongate and parallel-sided.....3. DASCILLIDAE
(*Dascillus* Latr., *D. cervinus* L.)
Tarsi with only segment 4 lobed below; size smaller; shape less elongate.....3
3. Tarsal segment 4 distinctly lobed below; elytra without distinct impressed striae; maxillary palpi normal; middle coxae narrowly separated.....2. HELODIDAE
Tarsal segment 4 simple; elytra with characteristic lines of impressed punctures (fig. 80); maxillary palpi unusually exserted (fig. 81); middle coxae rather widely separated.....(Superfamily Dryopoidea, PSEPHENIDAE)

Superfamily 7.—**BYRRHOIDEA.**

With a single family, BYRRHIDAE.

Most previous authors have included here the genus *Limnichus* (see fig. 68) (Dryopoidea: LIMNICHIDAE), which, as pointed out by Hinton (1938), may be separated from BYRRHIDAE by the distinct fronto-clypeal suture *inter alia*. The Sphindid genus *Aspidiphorus* (also placed here by Fowler) is at once separable from Byrrhids by the partially closed front coxal cavities and the completely un-excavate hind coxae. The Buprestid *Trachys* (fig. 70) has strongly lobed tarsal segments and serrate antennae. Some similarly shaped Cucujoids (e.g. *Ephistemus*), Chrysomeloids (e.g. *Lamprosoma*) and Hydrophiloids (e.g. *Megasternum*), etc., may be excluded from Byrrhoidea by the flat hind coxae.

Superfamily 8.—**DRYOPOIDEA.**

1 Front coxae projecting; maxillary palpi characteristic (fig. 81); antennae long, pectinate; species soft-bodied; elytra with characteristic rows of punctures (fig. 80).....1. PSEPHENIDAE
(*Eubria* Germ., *E. palustris* Germ.)
Front coxae rounded or transverse; species of more compact structure; maxillary palpi normal.....2
2. Tarsal formula 4–4–4; front tibiae with strongly spinose outer edges; shape characteristic (fig. 69); antennae very short and thick; species closely pubescent all over.....2. HETEROCERIDAE
Tarsal formula very rarely 4–4–4; front tibiae not spinose; shape different.....3

3 Antennae very short and thick (fig. 64); species densely pubescent all over; form more or less rectangular and parallel-sided; hind coxae excavate; length at least 3 mm. . . . . 4. DRYOPIDAE
Antennae slender, usually filiform; species often glabrous above; length usually less than 3 mm. 4
4. Form very convex, Byrrhid-like (fig. 68); hind coxae excavate; upper surface finely pubescent; last tarsal segment shorter than preceding ones taken together 3. LIMNICHIDAE
(*Limnichus* Latr., *L. pygameus* Sturm)
Form not Byrrhid-like; hind coxae not distinctly excavate; upper surface glabrous; last tarsal segment as long as preceding ones together. . . . 5. ELMIDAE

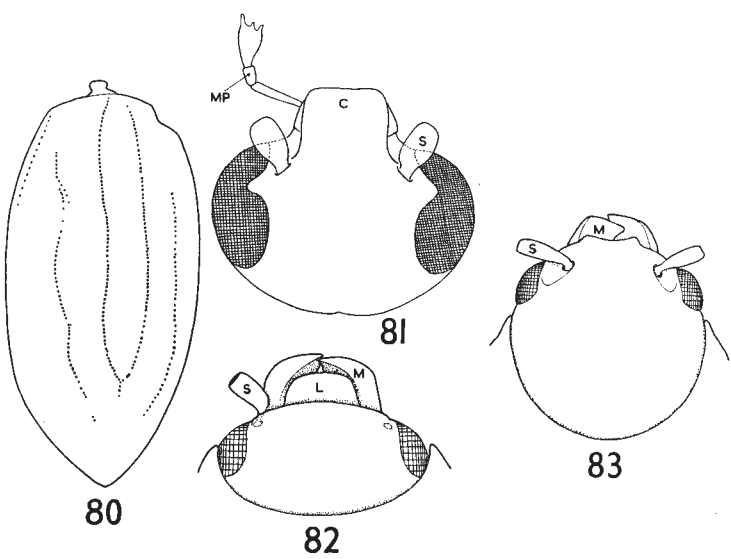
Superfamily 9.—**BUPRESTOIDEA.**

With a single family, BUPRESTIDAE.

Superfamily 10.—**ELATEROIDEA.**

This superfamily and the last together form the old group Sternoxia.

1 Antennae with 3-segmented serrate club, reflexible into deep recesses in propleuron; prosternal process broad; species of rather broad form (fig. 71), without power of "clicking". . . . . 2. TRIXAGIDAE
Antennae with apical segments not differentiated; prosternal process narrower; form narrower, species usually able to "click". 2
2 Labrum externally visible (fig. 82), antennal insertions close to eyes; abdominal sternites not evidently connate. . . . . 1. ELATERIDAE
Labrum not externally visible, antennal insertions somewhat distant from eyes (fig. 83); abdominal sternites evidently connate. . . . . 3. EUCNEMIDAE



FIGS. 80–83.—80, *Eubria palustris* Germ., L, elytron, dorso-lateral view. 81, *Eubria palustris* Germ., head, antero-dorsal view. 82, *Cryptohypnus riparius* F., head, antero-dorsal view. 83, *Melasis buprestoides* L., head, antero-dorsal view.
C, clypeus; *L*, labrum; *M*, mandible; *MP*, maxillary palp; *S*, scape.

Superfamily 11.—CANTHAROIDEA.

The Dermestid genus *Thylodrias* might be traced here; it differs from all Cantharoids in having a median dorsal ocellus and some differentiation of the apical antennal segments. The Cleroid MELYRIDAE (which greatly resemble the present group in the external features of the adults, and have generally been placed in it hitherto) can be distinguished either by the presence of long appendages below the tarsal claws (cf. fig. 105) or by having outstanding bristly hairs on some parts of the body (cf. fig. 54).

1 *Male:* prosternum long in front of coxae; tarsi with segment 4 scarcely lobed below; antennae strongly pectinate (fig. 52), their insertions widely separated, lateral. *Female:* apterous and larviform (fig. 53), with hairy processes on ninth abdominal tergite; without luminous organs.....1. DRILIDAE
(*Drilus* Oliv., *D. flavescens* Geoff.)

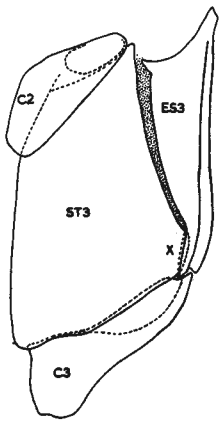


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FIG. 84.—*Silis ruficollis* F., metasternum, latero-ventral view. *C2, C3,* middle and hind coxae; *ES3,* met-episternum; *ST3,* metasternum; *X,* angulation of side border of metasternum.

Male: prosternum much shorter in front of coxae; antennal insertions less widely separated, often frontal. *Female:* if apterous, without hairy processes on ninth abdominal tergite and usually with luminous organs.....2

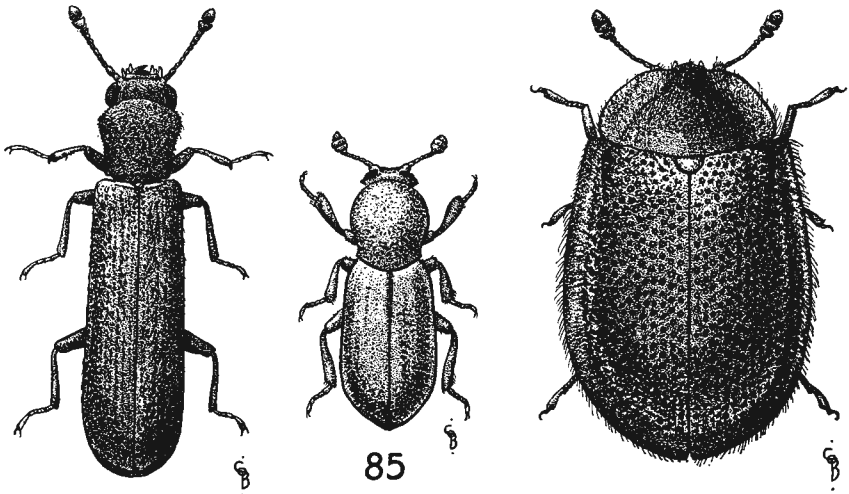
2 Luminous organs usually present on posterior abdominal segments; sexual dimorphism strong, females without wings and with elytra reduced or absent, males with very large eyes partially concealed under front margin of pronotum; side margins of metasternum straight; trochanters normal.....2. LAMPYRIDAE
Luminous organs absent; sexual dimorphism slight or absent; side margins of metasternum characteristically bent (fig. 84) or trochanters long (cf. fig. 20)....3

3 Antennal insertions not very closely approximated; trochanters normal; side margins of metasternum obtusely angled behind middle (fig. 84); ventral lobe of tarsal segment 4 bilobed.....3. CANTHARIDAE
Antennal insertions very closely approximated; trochanters long (cf. fig. 20); side margins of metasternum not angled; lobe of tarsal segment 4 entire
4. LYCIDAE

Superfamily 12.—DERMESTOIDEA.

1 Hind coxae small, not appearing to extend as far laterally as margins of metasternum; hind angles of prothorax blunt (fig. 85); ocellus absent; ventral surface without silky pubescence; size small (length less than 1·5 mm.)
2. THORICTIDAE
(*Thorictodes* Reitt., *T. heydeni* Reitt.)

Hind coxae large, extending laterally at least as far as margins of metasternum; hind angles of prothorax acute; dorsal ocellus often present.....2



FIGS. 85–87.—85, *Thorictodes heydeni* Reitt. 86, *Lyctus brunneus* Steph. 87, *Thymalus limbatus* F.

2 Antennae various, never with 3-segmented serrate club; head with median dorsal ocellus, or lower surface with close silky pubescence; prosternal process not or slightly received in mesosternum; elytra, if striate, with a scutellary striole....2
1. DERMESTIDAE

Antennae with 3-segmented serrate club; dorsal ocellus absent, lower surface without such silky pubescence; prosternal process broadly and deeply received in mesosternum; shape characteristic (fig. 71)...(Elateroidea fam. TRIXAGIDAE)

Superfamily 13.—BOSTRYCHOIDEA.

This grouping, often together with Lymexyloidea and CISIDAE, comprised the Teredilia of older authors. The Hydrophiloid *Georissus* might be mis-traced here; its facies (fig. 44) and water-side habitat should suffice to distinguish it. Many SCOLYTIDAE (Curculionoidea) much resemble BOSTRYCHIDAE; they may usually be separated by their tarsi with segment 4 (instead of 1) greatly reduced and by their completely closed front coxal cavities. The Cucujoid CISIDAE and SPHINDIDAE differ from Bostrychids notably in having a strongly bordered prothorax.

1 Hind coxae excavate, or antennal insertions closely approximated; trochanters long (cf. fig. 20); tarsal segment 1 not or scarcely shorter than 2; antennae various, never with normal club 2
Hind coxae almost flat; antennal insertions widely separated; trochanters normal; antennae clubbed 3
2 Antennal insertions not closely approximated; hind coxae distinctly excavate; prothoracic side-borders often distinct ..... 1. ANOBIIDAE
Antennal insertions closely approximate; hind coxae not distinctly excavate; prothorax without side borders ..... 2. PTINIDAE
3 Front coxae not at all projecting, their cavities completely closed behind; antennae 11-segmented with 2-segmented club; base of prothorax (fig. 86) much narrower than elytra at shoulders ..... 4. LYCTIDAE
Front coxae more or less projecting (fig. 12); antennae never with 2-segmented club; base of prothorax not or scarcely narrower than elytra at shoulders
3. BOSTRYCHIDAE

Superfamily 14.—CLEROIDEA.

1 Front coxae transverse, not at all projecting; antennae clubbed; body without projecting bristles; cuticle hard, facies "Clavicorn"; tarsi without lobed segments, segment 1 very short, a well-marked bisetose empodium between claws ..... 1. TROGOSITIDAE
Front coxae more or less projecting; if antennae clubbed, tarsi usually with lobed segments; body with projecting bristles at some point; cuticle more or less soft, facies "Malacoderm" 2
2 Tarsi almost always with one or more lobed segments; antennae often clubbed; tarsi without long appendages below claws; prothorax often without distinct side-borders ..... 2. CLERIDAE
Tarsi without lobed segments; antennae very rarely clubbed; long appendages often below tarsal claws (cf. fig. 105); side borders of prothorax usually well-marked 3
3 Antennae filiform or slightly serrate; outstanding bristly hairs present at least on head (fig. 54); appendages present below tarsal claws ..... 3. MELYRIDAE
Antennae with loose 3-segmented club; body without outstanding bristly hairs (fig. 72); tarsal claws simple ..... 4. PHLOIOPHILIDAE
(*Phloiophilus* Steph., *P. edwardsi* Steph.)

Superfamily 15.—LYMEXYLOIDEA.

The single family LYMEXYLIDAE (LYMEXYLONIDAE auctt.) has generally been classed with either "Malacodermata" or "Teredilia," but shows much closer relationships to Cucujoidea. Some MELYRIDAE (Cleroidea) might be referred here, but may be distinguished by the appendages below the tarsal claws and by the different type of colouration (brownish to fuscous in Lymexylids).

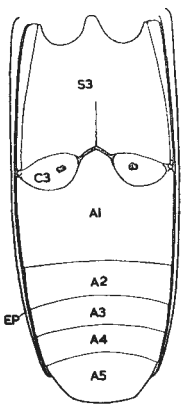
Superfamily 16.—CUCUJOIDEA.

A very large and diverse group, comprising the Heteromera plus most of the Clavicornia of older authors. A number of genera belonging to other superfamilies might be mis-traced here, e.g. the Anisotomid *Triarthron* which has an ordinary 3-segmented antennal club. This genus differs from any Cucujoidea in combining very transverse front coxae, filiform 5–5–5 tarsi, and spinose front tibiae. Another Staphylinoid, *Leptinus*, may be recognised by its general form (fig. 77) and by combining filiform 5–5–5 tarsi with vestigial eyes. The Bostrychoid *Lyctus* also has a distinctive facies (fig. 86); the combination of completely filiform 5–5–5 tarsi with segment 1

minute, a 2-segmented antennal club, the prothorax markedly produced over the head, and middle coxal cavities closed outwardly by the sterna, will separate it from any Cucujoidea. The Cleroid TROGOSITIDAE are very Clavicorn-like (e.g. *Thymalus*, fig. 87); the completely filiform 5–5–5 tarsi with segment 1 very small and a large bisetose empodium between the claws, together with the very transverse front coxae and the 9–10 segmented antennae with an asymmetrical club, should suffice for their recognition. *Phloiophilus* (fig. 72), here attributed to Cleroidea, has also possible affinities to the Cucujoid BIPHYLLIDAE and BYTURIDAE.

1 Tarsi various, never 5–5–4 in female; antennae nearly always with well-marked club; abdomen never with three basal sternites connate; front coxae never projecting; tarsi often more or less pseudotetramerous (fig. 22), never with penultimate segment lobed; side borders of prothorax nearly always distinct (Clavicornia auctt.) 2

Tarsal formula 5–5–4 in both sexes; antennal club often weak or absent; tarsi often with penultimate segment more or less lobed, rarely of pseudotetramerous type; prothorax often without distinct side borders (Heteromera auctt.) 21



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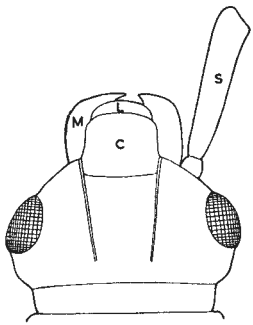

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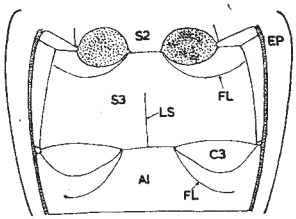

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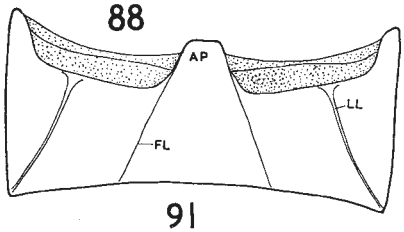

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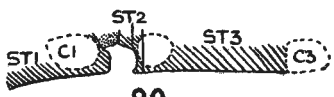

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FIGS. 88–92.—88, *Rhizophagus bipustulatus* F., metathorax and abdomen, ventral view 89, *Pediacus dermestoides* F., head, dorsal view. 90, *Phalacrus* sp., diagrammatic median longitudinal section of thoracic venter. 91, *Biphyllus lunatus* F., 1st abdominal sternite, ventral view. 92, Coccinellid metathorax and base of abdomen, ventral view. *A1*, *A2*, *A3*, *A4*, *A5*, visible abdominal sternites 1–5; *AP*, anterior inter-coxal process of basal abdominal sternite; *C*, clypeus; *C1*, *C2*, *C3*, front, middle and hind coxae; *EP*, elytral epipleuron; *ES2*, mes-episternum; *FL*, femoral lines; *L*, labrum; *LL*, lateral line; *LS*, longitudinal suture of metasternum; *M*, mandible; *PC*, post-coxal process of hypomeron; *S*, scape; *S1*, *S2*, *S3*, pro-, meso- and meta-sterna.

2 Elytra truncate leaving last abdominal tergite uncovered; antennae 10-segmented with 1-segmented club; form rather elongate and parallel-sided; first visible abdominal sternite considerably longer than following ones (fig. 88); tarsal formula 5–5–4 in males, ante-penultimate segment very slightly lobed below ..... 2. RHIZOPHAGIDAE

If elytra truncate leaving last abdominal tergite uncovered, antennae and tarsi different 3

3 Front coxae very transverse with large exposed trochantins (cf. fig. 10 R side), middle coxae also with large trochantins; antennae with strong 3-segmented club; elytra often more or less truncate (fig. 93); tarsal segments 2–3 more or less lobed below, formula 5–5–5 in both sexes; outer edges of front tibiae more or less dentate ..... 1. NITIDULIDAE.

Middle coxae never with large exposed trochantins; if front coxae very transverse, elytra not truncate 4

4 Tarsal formula 5–5–5 (sometimes 5–5–4 in males), penultimate segment often more or less reduced and ante-penultimate lobed below 5

Tarsal formula 4–4–4 (sometimes pseudotrimerous) or 3–3–3 13

5 Form very smoothly ovate and convex dorsally, dorsum glabrous; mesosternum short, anterior face of mesosternum concave to receive the ventro-apical portion of the prosternum (fig. 90); antennae with compact 3-segmented club; tarsi pseudotetramerous ..... 3. PHALACRIDAE

Form not so smoothly ovate and convex; mesosternum not so shaped 6

6 Pronotum with characteristic raised longitudinal lines at sides (fig. 99); antennae clubbed; front coxae transverse, their cavities visibly closed behind; trochanters heteromeroid (fig. 21); first visible abdominal sternite with femoral lines; elytral epipleura well-marked ..... 10. BIPHYLLIDAE

Pronotum without such raised lines, or front coxae different 7

7 Front coxae transverse with exposed trochantins, their cavities visibly closed behind; trochanters heteromeroid (fig. 21); upper surface closely pubescent (fig. 100); elytra without distinct striae, epipleurae distinct at least in basal half; tarsi pseudotetramerous ..... 11. BYTURIDAE

Front coxae rarely with exposed trochantins, if so their cavities open behind 8

8 Antennae 10-segmented with weak 2–3-segmented club; tarsi without lobed segments; front coxae transverse; form not flattened; elytra with indistinct epipleurae, scutellary striole distinct ..... 6. SPHINDIDAE

Antennae nearly always 11-segmented; if front coxae transverse and elytra without distinct epipleurae, elytra without distinct scutellary striole 9

9 Front coxae small, rounded, their cavities broadly closed behind: side edges of prothorax more or less dentate; general form elongate and more or less depressed; antennae rather short and thick, club weak or absent; tarsal formula 5–5–5 in both sexes, segment 4 smallest, 3 more or less lobed below ..... 5. SILVANIDAE

If front coxae small and rounded and with closed cavities, sides of prothorax not dentate 10

10 Tarsi with segment 1 much shorter than 2, formula often 5–5–4 in male; front coxae small, rounded; species strongly flattened, parallel-sided; antennae often long and more or less filiform; head more or less sharply contracted behind temples (fig. 89) ..... 4. CUCUJIDAE

Tarsi with segment 1 nearly or quite as long as 2; shape less flattened; if front coxae small and rounded, antennae strongly clubbed 11

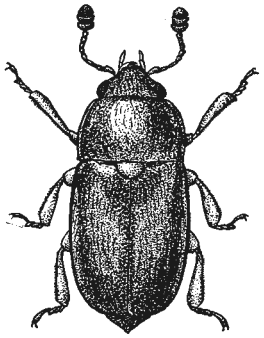
11 Front coxae rounded or somewhat ovate, their cavities closed behind; elytral epipleurae distinct and complete; tarsal formula 5–5–5 in both sexes, more or less pseudotetramerous; upper surface nearly always glabrous; antennal club strong ..... 9. EROTYLIDAE

Front coxae more transverse, their cavities open behind 12

12 Front coxal cavities nearly closed behind; tarsal formula 5–5–5 in both sexes; elytra somewhat truncate, not completely covering last abdominal tergite (fig. 94); prothorax practically as long as wide; species less than 1·5 mm. long; antennal insertions widely separated ..... 7. HYPOCOPRIDAE (*Hypocoprus* Mots., *H. quadricollis* Reitt.)

Front coxal cavities widely open behind; tarsi usually 5–5–4 in male; prothorax transverse; elytra not truncate, completely covering abdomen; if length less than 1·5 mm., antennal inserted approximations ..... 8. CRYPTOPHAGIDAE

13 Species very minute (length not more than 1mm.); form broad and smoothly ovate, not very convex (fig. 95), prothorax more or less semicircular in outline, usually hiding head; antennal segments 1–2 much wider than 3–5; usually six visible abdominal sternites.....14. CORYLOPHIDAE
If species not more than 1 mm. long, shape different.....14
14 Front coxae distinctly transverse; tarsal formula 4–4–4 or 3–4–4, without lobed segments; form more or less oblong, usually pubescent.....15
If front coxae distinctly transverse, tarsi pseudotrimerous.....16
15 Prothorax of Bostrychoid type (cf. fig. 12); antennae 8–10 segmented with loose normal 3-segmented club; elytra without regular striae; trochanters normal (cf. fig. 19).....18. CISIDAE
Prothorax not of Bostrychoid shape; antennae 11-segmented with 3–4 segmented club; trochanters heteromeroid (fig. 21); tarsal formula 3–4–4 in male
20. MYCETOPHAGIDAE
16 Tarsi 4–4–4, segment 2 not lobed below; front coxae small, rounded; elytra usually more or less striate.....17
Tarsi more or less pseudotrimerous or 3–3–3 segmented.....18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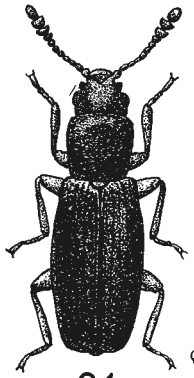
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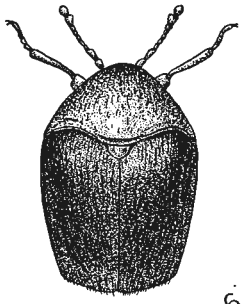
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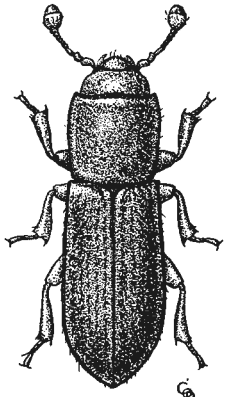
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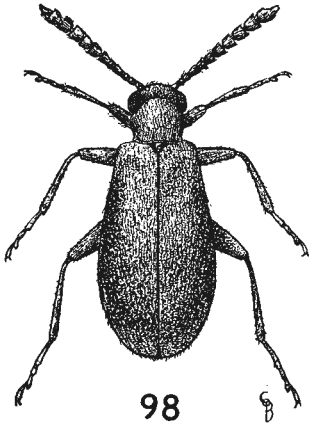
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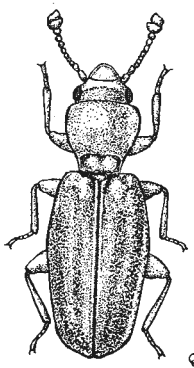
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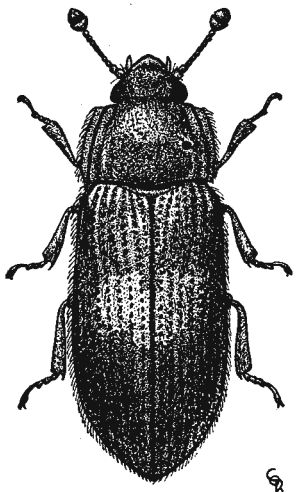
FIGS. 93–98.—93, *Laria dulcamarae* Scop. 94, *Hypocoprus quadricollis* Reitt. 95 *Sericoderus lateralis* Gyll. 96, *Anommatus 12-striatus* Muell. 97, *Holoparamecus caularum* Aubé. 98, *Aderus populneus* Panz.



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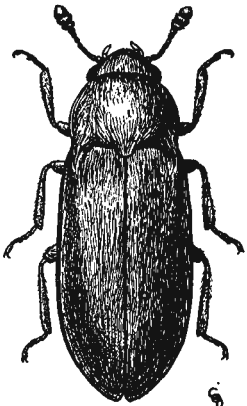

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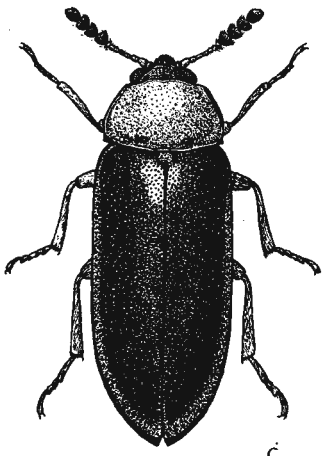

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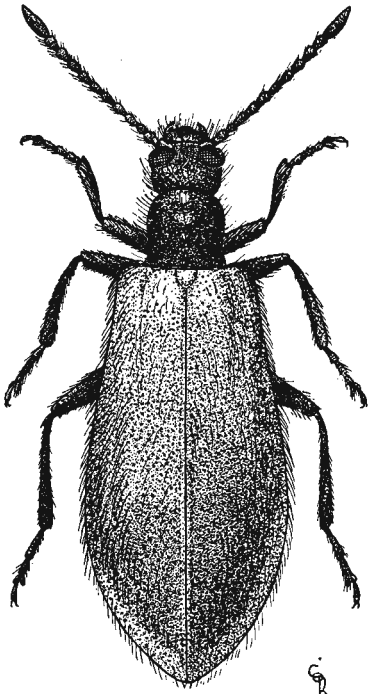

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FIGS. 99–102.—99, *Biphyllus lunatus* F. 100, *Byturus tomentosus* Deg. 101, *Tetratoma fungorum* F. 102, *Lagria hirta* L.

17 Apical segment of maxillary palpi at least as large as penultimate, not pointed at apex; trochanters more or less heteromeroid (fig. 21), sometimes scarcely visible in ventral view; antennal insertions often hidden under sides of front; if general form broad, dorsal surface rough, dull and more or less pubescent
19. COLYDIIDAE

Apical segment of maxillary palpi smaller than penultimate, pointed at apex (cf. fig. 1L); trochanters more or less long (cf. fig. 20); antennal insertions not hidden under sides of front; form rather short and broad, upper surface glabrous and shining ..... 15. CERYLONIDAE

18 Tarsi pseudotrimerous; front coxae more or less transverse; form short, ovate and more or less convex.....19

Tarsal formula 3–3–3, segment 2 not lobed below; front coxae small, rounded; form usually more oblong and depressed.....20

19 Last segment of maxillary palpi not or scarcely securiform; antennae not very short; metasternum and first visible abdominal sternite without femoral lines; front coxae ovate.....12. ENDOMYCHIDAE

Last segment of maxillary palpi securiform (cf. fig. 1); antennae very short; metasternum and first visible abdominal sternite with femoral lines (fig. 92); front coxae more strongly transverse.....13. COCCINELLIDAE

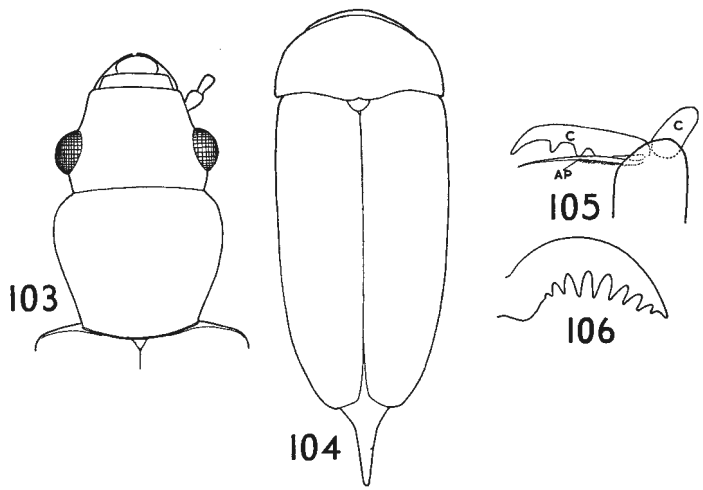
20 Upper surface smooth, glabrous (figs. 96, 97); middle coxal cavities closed outwardly by sterna; prosternal process relatively broad; upper surface of head smooth, clypeus in same plane as frons, separated from it by a normal suture
16. MEROPHYSIIDAE

Upper surface more or less rugose or strongly punctured or closely pubescent; middle coxal cavities not closed outwardly by sterna; upper surface of head more or less uneven, clypeus not in the same plane as frons...17. LATHRIDIIDAE

21 First three visible abdominal sternites connate (cf. fig. 17); front coxal cavities visibly closed behind.....22

Abdomen with not more than two basal sternites connate; front coxal cavities not visibly closed behind.....24

22 Elytra with long outstanding pubescence; prothorax without distinct side borders (fig. 102); front coxae projecting, prosternal process evanescent between them
23. LAGRIIDAE

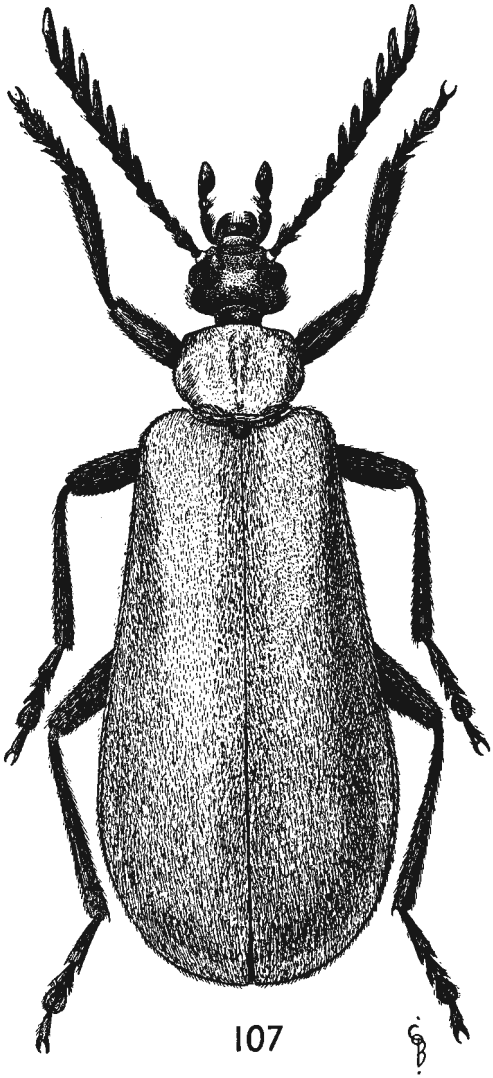


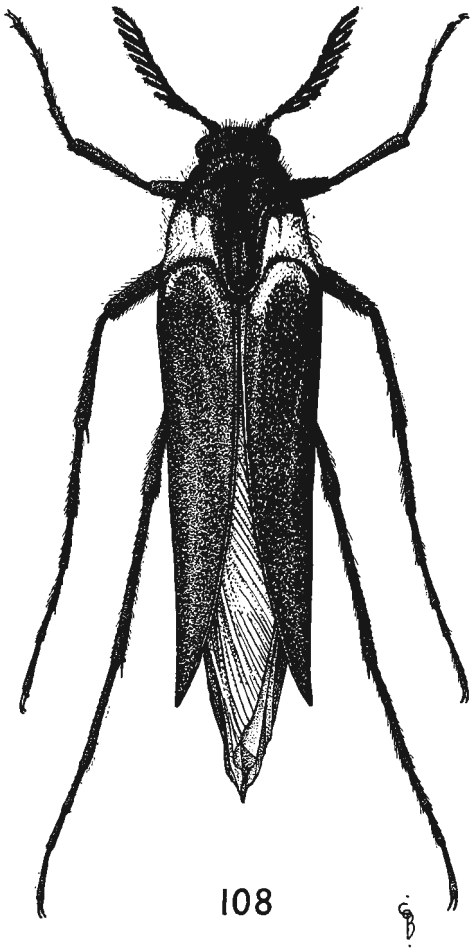
FIGS. 103–106.—103, *Sphaeriestes castaneus* Panz., head and prothorax, dorsal view. 104, *Mordella aculeata* L., outline of body, dorsal view. 105, Mordellid tarsal claws. 106, Alleculid tarsal claw. *AP*, appendages below claws; *C*, claw.

Elytra without long outstanding pubescence; side borders of prothorax usually well-marked, its base not or little narrower than elytra at shoulders; front coxae not distinctly projecting, prosternal process easily visible between them 23

23 Tarsal claws pectinate (fig. 106); penultimate tarsal segment often more or less lobed; front coxae more transverse ..... 24. ALLECULIDAE

Tarsal claws simple; penultimate tarsal segment not lobed below; front coxae not or less transverse ..... 22. TENEBRIONIDAE



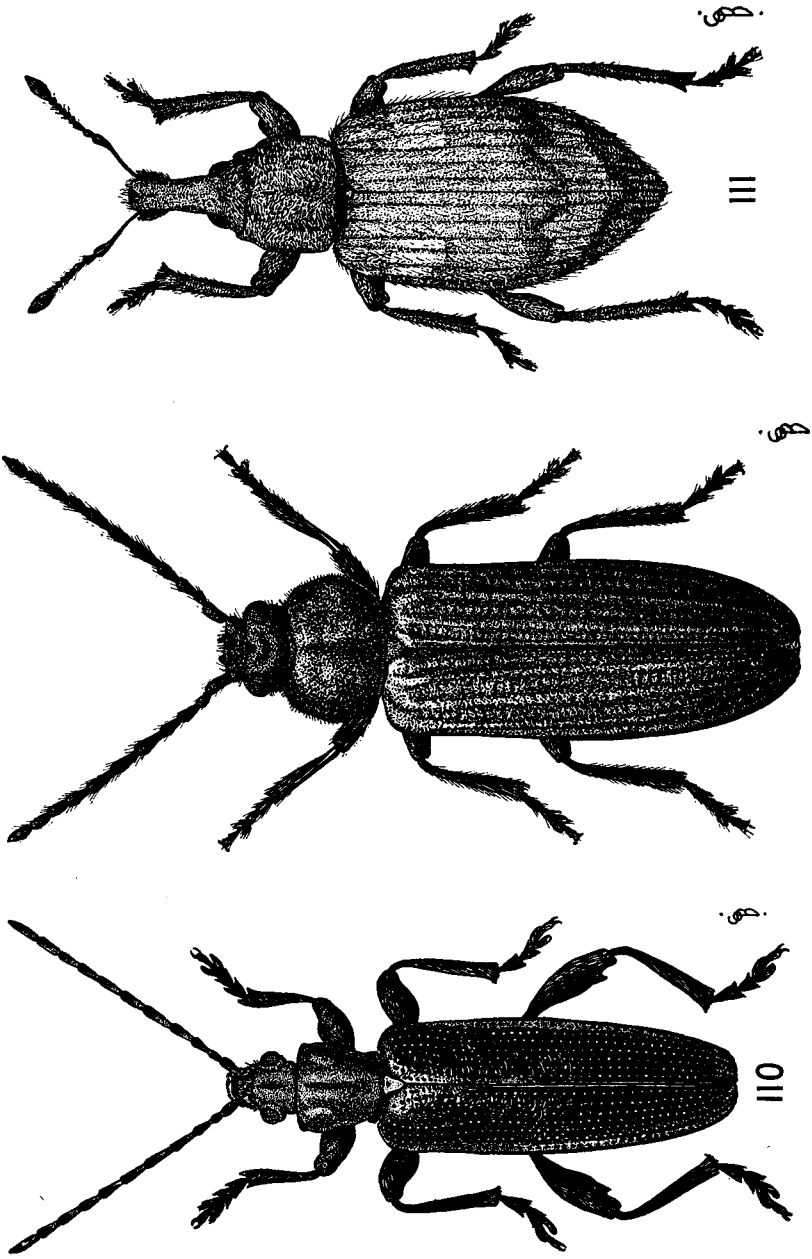


FIGS. 107–108.—107, *Pyrochroa coccinea* L. 108, *Metoecus paradoxus* L.

24 Prothorax with side-edges distinct, at least in basal half, its basal margin nearly or quite as wide as elytra at shoulders ; antennae never flabellate.....25
Prothorax without distinct side edges.....28
25 Antennae with strong 4-segmented club ; general form broad and rectangular (fig. 101) ; front coxae transverse with large exposed trochantins 21. TETRATOMIDAE
Antennae without a strong 4-segmented club ; general form more or less navicular (cf. fig. 104).....26
26 Head with a very broad neck ; antennae often more or less clubbed 30. MELANDRYIDAE
Head with a narrow neck, its posterior face excavate to fit closely against prothorax ; antennae never clubbed.....27
27 Last abdominal tergite produced into a posteriorly-directed spine (fig. 104) ; outer face of hind tibiae with characteristic oblique or transverse rows of spinules 32. MORDELLIDAE
Last abdominal tergite not produced into a spine ; outer face of hind tibiae without such spinules.....31. SCRAPTIIDAE
28 Antennae distinctly clubbed ; head more or less rostrate ; tarsi without lobed segments ; size small.....26. SALPINGIDAE
Antennae filiform to flabellate ; if head rostrate, tarsi with penultimate segment lobed.....29
29 Head strongly rostrate, without distinct neck ; two basal abdominal sternites strongly connate ; general form ovate and very convex.....25. MYCTERIDAE (*Mycterus* Schall., *M. curculioides* F.)
Head not rostrate ; if two basal abdominal sternites connate, head with a narrow neck 30
30 Form much flattened ; antennae short, moniliform ; prosternum long in front of coxae ; tarsi without lobed segments ; head without distinct neck..27.PYTHIDAE (*Pytho* Latr., *P. depressus* L.)
Form less flattened ; antennae longer ; head with a narrow neck, or penultimate tarsal segment lobed below 31
31 Antennae flabellate (fig. 108) ; prothorax at base almost as wide as elytra at shoulders ; elytra not meeting along suture, not fully covering wings in repose (fig. 108) ; head with a narrow neck.....33. RHIPIPHORIDAE
Antennae not flabellate ; prothorax at base much narrower than elytra at shoulders ; if elytra not meeting along suture, head with broad neck or wings vestigial..32
32 Head not strongly deflexed, neck relatively broad (fig. 107) 33
Head strongly deflexed, neck very narrow (fig. 98).....34
33 Neck distinct though broad (fig. 107) ; antennae more or less serrate ; eyes deeply emarginate ; form rather broad and somewhat flattened....28. PYROCHROIDAE
Head without distinct neck ; antennae filiform ; eyes not or weakly emarginate ; general form narrower, less flattened.....29. OEDEMERIDAE
34 Size large (length at least 7 mm.) ; tarsi without lobed segments, with long appendages below claws ; elytra often not fully covering abdomen.....34. MELOIDAE
Size small (length less than 5 mm.) ; penultimate or ante-penultimate tarsal segment more or less lobed, without appendages below claws ; elytra always fully covering abdomen.....35
35 Antennae simple, filiform ; eyes relatively small ; tarsi with penultimate segment more or less lobed below ; segment 1 of hind tarsus little longer than next 2 together .....35. ANTHICIDAE
Antennae more or less pectinate or thickened apically ; eyes very large (fig. 98) ; ante-penultimate tarsal segment lobed, penultimate small ; segment 1 of hind tarsus much longer than next 2 together.....36. ADERIDAE

Superfamily 17.—CHRYSOMELOIDEA.

Any species with a really definite antennal club can be excluded from this group and sought under Cleroidea, Cucujoidea or Curculionoidea. Some SILVANIDAE (Cucujoidea) which might be sought here can be distinguished by their small size, testaceous to fuscous colouration, and dentate side of

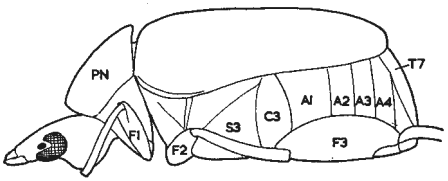


FIGS. 109–111.—109, *Asemum striatum* L. 110, *Plateumaris sericea* L. 111, *Alophus triguttatus* F.

the prothorax ; certain CLERIDAE (Cleroidea) with Chrysomeloid-like tarsi and antennae are distinguished by their outstanding bristles, projecting front coxae, and six visible abdominal sternites.

1 Antennae nearly always long, never at all thickened towards apex, inserted on distinct tubercles (fig. 109), usually capable of being reflexed backwards over body ; general form elongate (fig. 109), size moderate to large ; elytra never with regular striae or rows of punctures ; tarsal claws rarely split, never appendiculate ; first visible abdominal sternite not or little longer than second....1. CERAMBYCIDAE
Antennae usually shorter, not inserted on tubercles (cf. fig. 110), not flexible backwards over body ; general form nearly always less elongate.....2

2 Eyes not extending far on to ventral surface of head ; if hind femora toothed below, prothorax not margined at sides ; ventral surface not very convex ; antennae not very thick.....3. CHRYSOMELIDAE
Eyes extending far on to ventral surface of head (fig. 112) ; hind femora inflated, more or less toothed below ; side margins of prothorax distinct ; elytra with regular striae, no scutellary striole, somewhat truncate, not covering last abdominal tergite (fig. 112) ; ventral surface very strongly convex..2. BRUCHIDAE



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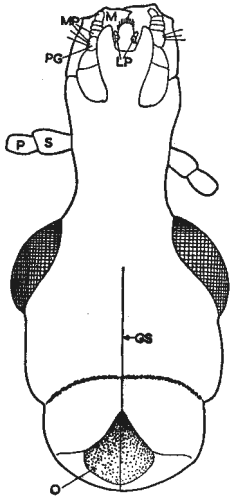

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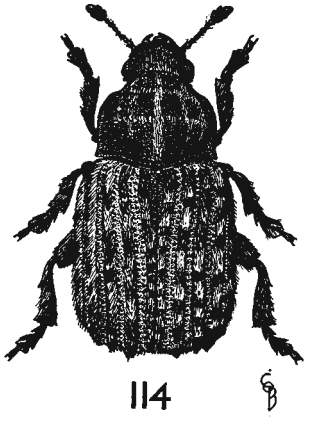
FIGS. 112–113.—112, *Bruchus rufimanus* Boh., outline of body, lateral view. 113, *Deporaus betulae* L., head, ventral view. *A1, A2, A3, A4*, visible abdominal sternites 1–4 ; *C3*, hind coxa ; *F1, F2, F3*, front, middle and hind femora ; *GS*, fused gular sutures ; *LP*, labial palp ; *M*, mandible ; *MP*, maxillary palp ; *P*, pedicel ; *PG*, palpiger ; *PN*, pronotum ; *S*, scape ; *S3*, metasternum ; *O*, occipital foramen ; *T7*, last visible abdominal tergite.

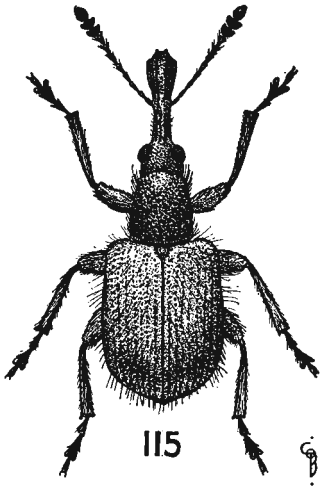
Superfamily 18.—CURCULIONOIDEA.

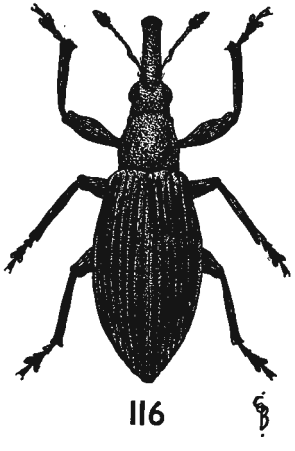
Some approach to the Curculionoid rostrum is met with in the Cucujoid SALPINGIDAE and MYCTERIDAE, and to a less degree in the Chrysomeloid BRUCHIDAE ; conversely a weak or non-existent rostrum is seen in the Curculionoid SCOLYTIDAE and PLATYPODIDAE, also some ANTHRIBIDAE.

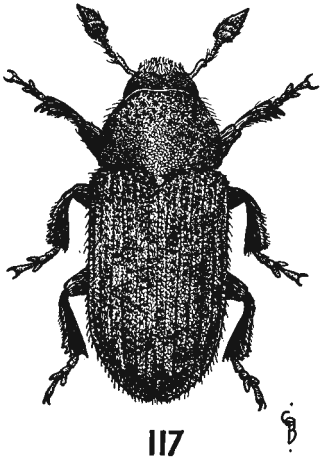
The Scolytids and Platypodids, also certain Curculionids, show reduction or loss of the lobing of the third segment.

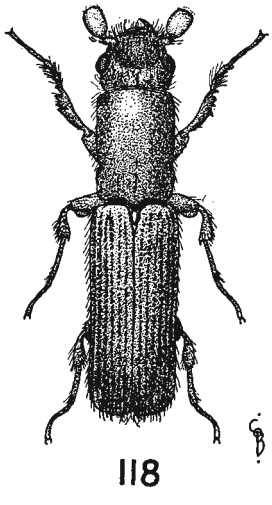
1 Rostrum very short; antennae not geniculate, with loose 3-segmented club; prothorax with a basal or pre-basal transverse keel which extends forwards on each side forming a more or less imperfect side-border (fig. 114); four basal abdominal sternites connate; labrum distinct; maxillary palpi exserted, flexible; tarsal segment 3 more or less deeply enclosed in lobes of 2
2. ANTHRIBIDAE











FIGS. 114–118.—114, *Brachytarsus fasciatus* Först. 115, *Caenorhinus aequatus* L. 116, *Apion radiolus* Kirby. 117, *Hylesinus fraxini* Panz. 118, *Platypus cylindrus* F.

If rostrum very short, antennae geniculate and with a compact club ; if prothorax with side borders, not more than two abdominal sterna connate.....2

2 Labrum free ; maxillary palpi exserted, flexible ; all abdominal sternites free; antennae not at all geniculate, with a very weak 3-segmented club ; rostrum fairly long ; claws free ; elytra not striate.....1. NEMONYCHIDAE (*Cimberis* Gozis., *C. attelaboides* F.)

Labrum not distinct ; maxillary palpi concealed, rigid ; at least two basal abdominal sternites connate ; antennal club more compact ; elytra nearly always striate.....3

3 Antennae straight, club very distinctly segmented (fig. 115) ; tarsal claws connate or mandibles toothed on outer edges (fig. 113) ; upper surface shining, often glabrous, never with scales ; if trochanters long, rostrum very short 3. ATTELABIDAE

Antennal club compact ; if antennae straight, tarsal claws free and mandibles not toothed on outer edge ; upper surface rarely so shining, often with scales.....4

4 Rostrum more or less distinct ; tibiae never with dentate outer edges, prothorax never with distinct side borders.....5

Rostrum vestigial or absent (figs. 117–118) ; tibiae with dentate outer edges or prothorax with distinct side borders.....6

5 Trochanters long ; antennae straight or prothorax at base almost as wide as elytra at shoulders ; rostrum more or less long (fig. 116).....4. APIONIDAE

Trochanters normal ; antennae nearly always geniculate ; base of prothorax much narrower than elytra at shoulders (fig. 111).....5. CURCULIONIDAE

6 Tarsi with segment 4 very small ; general shape less elongate and cylindrical (fig. 117).....6. SCOLYTIDAE

Tarsi with segment 4 at least half as long as 3 ; shape elongate and cylindrical (fig. 118).....7. PLATYPODIDAE

Superfamily 19.—**STYLOPOIDEA.**

With a single family, STYLOPIDAE

CONSPECTUS OF THE CLASSIFICATION ADOPTED IN THIS PART.

Cross-referenced to the equivalent groupings in Fowler's *Coleoptera of the British Islands* (followed by Beare's *Catalogue of the Coleoptera of the British Isles*), Reitter's *Fauna Germanica: Käfer*, Imms' *General Textbook of Entomology*, Joy's *Practical Handbook of British Beetles*, van Emden's *Larvae of British Beetles* (1939–1949), and Kloet and Hincks' *Check list of British Insects*. Where not specifically cited, a work may be assumed to use the same name for the same grouping as this Part, or (in the case of Imms) to make no reference to the group at all.

Suborder **ADEPHAGA** (Geodephaga + Hydradephaga + Gyrinia Joy)

Superfamily **Caraboidea** (Geodephaga + Hydradephaga + Gyrinia Joy ; Caraboidea + Hydradephaga Kloet & Hincks).

1. CARABIDAE (Cicindelidae + Carabidae Fowler, Reitter, Joy, Imms, van Emden).
2. HALIPLIDAE.
3. HYGROBIIDAE (Pelobiidae Fowler, Imms).
4. NOTERIDAE (Dytiscidae—Noterina Fowler; -Noterini Reitter; -Noterinae Joy, van Emden, Kloet & Hincks).
5. DYTISCIDAE (Dytiscidae auctt. minus *Noterus*).
6. GYRINIDAE.

Suborder **POLYPHAGA**.

Superfamily 1.—**Sphaerioidea** (Clavicornia pars Fowler, Joy ; Staphylinoidea pars Reitter, Imms, van Emden, Kloet & Hincks).

1. SPHAERIIDAE.

Superfamily 2.—**Hydrophiloidea** (Clavicornia pars Fowler ; Diversicornia pars Imms ; Palpicornia + Georyssidae Reitter, Joy, Kloet & Hincks ; Hydrophiloidea van Emden minus Histeridae).

1. HYDRAENIDAE (Hydrophilidae-Hydrochina minus *Hydrochus* + *Limnebius* Fowler ; -Hydraeninae minus *Hydrochus* + *Limnebius* Reitter ; -Hydraeninae + Limnebiinae Kloet & Hincks ; Hydraenidae-Hydraeninae minus *Hydrochus* + Hydrophilidae-Limnebiinae Joy ; Hydrophilidae pars Imms, van Emden).
2. SPERCHEIDAE (Hydrophilidae-Spercheina Fowler ; -Spercheinae Reitter, Kloet & Hincks, van Emden ; Hydraenidae-Spercheinae Joy).

3. HYDROCHIDAE (Hydrophilidae-Hydrochinae *Hydrochus* Fowler; -Hydraeninae *Hydrochus* Reitter; -Hydrochinae Kloet & Hincks, van Emden; Hydraenidae-Hydraeninae *Hydrochus* Joy).
4. GEORISSIDAE (Georyssidae Fowler, Reitter, Joy, Imms).
5. HYDROPHILIDAE (Hydrophilidae auctt. minus Hydraeninae, Limnebiinae, Spercheinae, Hydrochinae).

Superfamily 3.—**Histeroidea** (Clavicornia pars Fowler, Joy; Necrophaga pars + Histerida pars Reitter; Staphylinoidea-Histeridae + Diversicornia-Sphaeritidae Imms; Staphylinoidea-Histeridae plus Claviconia-Sphaeritidae Kloet & Hincks; Hydrophiloidea-Histeridae van Emden).

—. SPHAERITIDAE (Silphidae-Sphaeritina Fowler; -Sphaeritini Reitter).
2. HISTERIDAE.

Superfamily 4.—**Staphylinoidea** (Clavicornia pars Fowler; Staphylinoidea minus Clambidae, Corylophidae, Sphaeridae, Hydroscaphidae, Silphidae-Sphaeritini, Histeridae Reitter; Staphylinoidea minus Hydroscaphidae, Sphaeriidae, Corylophidae, Histeridae, Silphidae-Clambinae Imms; Brachelytra + Clavicornia pars Joy; Staphylinoidea minus Clambidae, Orthoperidae, Sphaeriidae, Histeridae Kloet & Hincks).

1. PTILIIDAE (Trichopterygidae Fowler, Imms, van Emden).
2. LEPTINIDAE (Silphidae - Leptininae Kloet & Hincks).
3. ANISOTOMIDAE (Silphidae-Anisotomina + Cholevinae Fowler; Silphidae-Cholevinae + Liodidae Reitter; Silphidae pars Imms, van Emden; Anisotomidae + Cholevidae Joy; Silphidae-Bathysciinae + Catopinae + Coloninae + Leiodidae Kloet & Hincks).
4. SCYDMAENIDAE.
5. SCAPHIDIIDAE.
6. MICROPEPLIDAE (Staphylinidae-Micropeplinae Reitter, Imms, Joy; Staphylinidae-Oxytelinae *Micropeplus* Kloet & Hincks).
7. STAPHYLINIDAE (Staphylinidae minus *Micropeplus* Reitter, Imms, Joy, Kloet & Hincks).
8. PSELAPHIDAE.

Superfamily 5.—**Scarabaeoidea** (Lamellicornia Fowler, Reitter, Imms, Joy, van Emden, Kloet & Hincks).

1. LUCANIDAE
2. TROGIDAE (Scarabaeidae - Laparosticti - Trogina Fowler ; Scarabaeidae-Coprophaginae-Trogini Reitter ; Scarabaeidae-Coprophaginae *Trox* Joy ; Scarabaeidae - Troginae Imms, van Emden, Kloet & Hincks).
3. GEOTRUPIDAE (Scarabaeidae - Laparosticti - Geo - trupina Fowler ; Scarabeidae - Coprophaginae-Geotrupini Reitter ; Scarabaeidae - Coprophaginae *Odontaeus* + *Ceratophyus* + *Geotrupes* Joy ; Scarabaeidae - Geotrupinae Imms, van Emden, Kloet & Hincks).
4. SCARABAEIDAE (Scarabaeidae auctt. minus Troginae, Geotrupinae).

Superfamily 6.—**Dascilloidea** (Malacodermata-Dascillidae minus *Eubria* + Silphidae-Clambina Fowler ; Malacodermata pars + Necrophaga-Clambidae Reitter ; Diversicornia pars + Staphylinoidea-Clambinae Imms ; Malacodermata pars + Clavicornia-Clambidae Joy ; Fossipedes minus *Eubria* + Staphylinoidea-Clambidae Kloet & Hincks ; Dascilloidea-Dascillidae + -Helodidae + Staphylinoidea-Clambidae van Emden).

1. CLAMBIDAE (Silphidae-Clambina Fowler).
2. HELODIDAE (Dascillidae-Cyphonina minus *Eubria* Fowler ; Helodidae-Helodinae Reitter; Helodidae minus *Eubria* Joy ; Helodidae pars Imms).
3. DASCILLIDAE (Dascillidae - Dascillina Fowler ; Dascillidae pars Imms ; Dascillidae minus *Eubria* Kloet & Hincks).

Superfamily 7.—**Byrrhoidea** (Clavicornia pars Fowler, Joy ; Brachymera pars Reitter, Kloet & Hincks ; Diversicornia pars Imms ; Dascilloidea-Byrrhidae van Emden).

1. BYRRHIDAE (Byrrhidae minus *Aspidiphorus* and *Limnichus* Fowler ; -Byrrhini Reitter ; Byrrhidae pars Imms ; Byrrhidae minus *Limnichus* Joy, Kloet and Hincks).

Superfamily 8.—**Dryopoidea** (Malacodermata-*Eubria* + Clavicornia-Heteroceridae, Parnidae and *Limnichus* Fowler ; Malacodermata-Eubriinae + Brachymera-Limnichini + Hygrophili minus Georyssidae Reitter ; Malacodermata-*Eubria* + Clavicornia-Parnidae, Helmidae, Heteroceridae and *Limnichus* Joy ; Diversicornia pars Imms ; Macrodactylia minus Georissidae + Fossipedes-*Eubria* + Brachymera-*Limnichus* Kloet & Hincks ; Dascilloidea-Dryopidae + Heteroceridae van Emden).

1. PSEPHENIDAE (Dascillidae - Cyphonina - *Eubria* Fowler; Helodidae-Eubriinae Reitter; Helodidae-*Eubria* Joy; Dryopidae pars Imms; Dascillidae-*Eubria* Kloet & Hincks).
2. HETEROCERIDAE.
3. LIMNICHIDAE (Byrrhidae-*Limnichus* Fowler, Joy, Kloet & Hincks; -Limnichini Reitter).
4. DRYOPIDAE (Parnidae-Parnia Fowler; Dryopidae-Dryopini Reitter; Dryopidae pars Imms; Parnidae Joy; Dryopidae-Dryopinae Kloet & Hincks).
5. ELMIDAE (Parnidae-Elmina Fowler; Dryopidae-Potamophilini + Helminthinae Reitter; Helmidae Joy; Dryopidae pars Imms; Dryopidae-Elminae Kloet & Hincks).

Superfamily 9.—**Buprestoidea** (Sternoxi pars Fowler; Sternoxia pars Reitter, Joy, Kloet & Hincks; Diversicornia pars Imms; Sternoxia-Malacodermata pars van Emden).

1. BUPRESTIDAE.

Superfamily 10.—**Elateroidea** (Sternoxi pars Fowler; Sternoxia pars Reitter, Joy, Kloet & Hincks; Diversicornia pars Imms; Sternoxia-Malacodermata pars van Emden).

1. ELATERIDAE (Elateridae-Elaterinae Imms; Elateridae minus *Trixagus*, *Melasis*, *Dirhagus* and *Eucnemis* Joy).
2. TRIXAGIDAE (Throscidae Fowler, Imms; Elateridae-*Trixagus* Joy).
3. EUCNEMIDAE (Elateridae - Eucneminae Imms; Elateridae genn. *Melasis*, *Dirhagus* and *Eucnemis* Joy).

Superfamily 11.—**Cantharoidea** (Malacodermata - Cantharidae minus Malachiinae Reitter; Diversicornia pars Imms; Malacodermata pars Fowler, Joy, Kloet & Hincks; Malacodermata-Sternoxia pars van Emden).

1. DRILIDAE (Cantharidae-Drilinae Reitter, Imms; Cleridae-*Drilus* Joy; Telephoridae-Drilinae van Emden).
2. LAMPYRIDAE (Cantharidae-Lampyrinae Reitter, Imms; Telephoridae-Lampyrinae van Emden)
3. CANTHARIDAE (Telephoridae Fowler; Cantharidae-Cantharinae Reitter, Imms; Cantharidae pars Joy; Telephoridae-Telephorinae van Emden).
4. LYCIDAE (Cantharidae-Lycinae Reitter, Imms; Telephoridae-Lycinae van Emden).

Superfamily 12.—**Dermestoidea** (Clavicornia pars Fowler, Joy; Brachymera pars Reitter, Kloet & Hincks; Diversicornia pars Imms; Dascilloidea-Dermestidae + Teredilia-Thorictidae van Emden).

1. THORICTIDAE.
2. DERMESTIDAE.

Superfamily 13.—**Bostrychoidea** (Ptinoidea minus Sphindidae, Cisidae Fowler; Teredilia + Clavicornia-Lyctidae Reitter; Diversicornia pars Imms; Teredilia minus Orthoceridae + Clavicornia-Lyctidae Joy; Teredilia Kloet & Hincks; Teredilia minus Cisidae and Mordellidae van Emden).

1. ANOBIIDAE (Anobiidae + Ptinidae-*Hedobia* Fowler; Anobiidae-Anobiides Imms; Anobiidae + Dorcatomidae + Xyletinidae + Ptinidae-*Hedobia* Joy).
2. PTINIDAE (Ptinidae minus *Hedobia* Fowler, Joy; Anobiidae-Ptinides Imms).
3. BOSTRYCHIDAE (Bostrichidae Fowler, Imms, Kloet & Hincks).
4. LYCTIDAE.

Superfamily 14.—**Cleroidea** (Clavicornia-Trogositidae + Malacodermata pars Fowler, Reitter, Kloet & Hincks; Diversicornia pars Imms; Clavicornia pars + Malacodermata pars Joy; Sternoxia-Malacodermata-Melyridae, Trogositidae and Cleridae van Emden).

1. TROGOSITIDAE (Ostomidae Reitter; Ostomatidae Kloet & Hincks; Cucujidae-Trogositinae +Colydiidae-*Nemosoma* + Mycetophagidae-Thymalinae Joy).
2. CLERIDAE (Cleridae Joy minus *Drilus*).
3. MELYRIDAE (Melyridae minus Phloeophilina Fowler; Cantharidae-Malachiinae + Dasytinae minus *Phloeophilus* Reitter; Melydridae Imms; Cantharidae pars Joy; Malachiidae + Dasytidae minus *Phloiophilus* Kloet & Hincks).
4. PHLOIOPHILIDAE (Melyridae-Phloeophilina Fowler; Cantharidae-Dasytinae-*Phloeophilus* Reitter; Mycetophagidae - Mycetophaginae - *Phloeophilus* Joy; Dasytidae - *Phloiophilus* Kloet & Hincks).

Superfamily 15.—**Lymexyloidea** (Malacodermata pars Fowler, Reitter, Joy, Kloet & Hincks; Diversicornia pars Imms; Clavicornia-Heteromera pars van Emden).

1. LYMEXYLIDAE (Lymexylonidae Fowler, Reitter, Imms, Joy).

Superfamily 16.—**Cucujoidea** (Clavicornia pars + Ptinoidea pars + Heteromera Fowler ; Staphylinoidea-Corylophidae + Clavicornia minus Ostomidae and Lyctidae + Heteromera Reitter ; Staphylinoidea-Corylophidae + Diversicornia pars + Heteromera Imms ; Heteromera and Teredilia-Orthoceridae + Clavicornia pars Joy ; Staphylinoidea-Orthoperidae + Clavicornia minus Sphaeritidae and Ostomatidae + Heteromera Kloet & Hincks ; Clavicornia-Heteromera minus Lymexylidae + Teredilia-Cisidae and Mordellidae van Emden).

1. NITIDULIDAE (Nitidulidae minus Rhizophagina Fowler ; Nitidulidae minus Rhizophaginae Reitter, Imms ; Nitidulidae-Nitidulinae + -Erotylinae-*Glischrochilus* + Cateretidae + Colydiidae-*Pityophagus* Joy).
2. RHIZOPHAGIDAE (Monotomidae + Nitidulidae-Rhizophaginae Fowler, Reitter, Imms ; Monotomidae + Colydiidae-*Rhizophagus* Joy ; Rhizophagidae + Cucujidae-*Monotoma* Kloet & Hincks ; Monotomidae + Rhizophagidae van Emden).
3. PHALACRIDAE.
4. CUCUJIDAE (Cucujidae-Cucujina + -Hyliotina Fowler ; Cucujidae-Cucujinae minus Silvanini, Psammoechini, Prostomini Reitter ; Cucujidae pars Imms, van Emden ; Cucujidae-Uleiotinae + Cucujinae Joy ; Cucujidae genn. *Uleiota*, *Pediacus*, *Dendrophagus* and *Laemophloeus* Kloet & Hincks).
5. SILVANIDAE (Cucujidae-Psammoechina + -Silvalina Fowler ; -Silvanini + -Psammoechini Reitter ; Cucujidae pars Imms, van Emden ; Cucujidae-Psammoecinae + Cryptophagidae-Silvaninae Joy ; Cucujidae genn. *Nausibius*, *Ahasuerus*, *Oryzaephilus*, *Silvanus*, *Silvanoprus*, *Cryptamorpha* and *Psammoecus* Kloet & Hincks).
6. SPHINDIDAE (Sphindidae + Byrrhidae-*Aspidiphorus* Fowler ; Sphindidae + Mycetophagidae-Aspidiphorinae Joy ; Sphindidae + Aspidiphoridae Kloet & Hincks).
7. HYPOCOPRIDAE (Cucujidae-Hypocoprinae Fowler ; Cryptophagidae-Hypocoprini Reitter ; Lathridiidae-*Hypocoprus* Joy ; Cucujidae-*Hypocoprus* Kloet & Hincks).
8. CRYPTOPHAGIDAE (Cryptophagidae minus Diphyllina Fowler ; Cryptophagidae-Telmatophilini minus *Cryptophilus* + -Cryptophagini minus *Pharaxonotha* + Atomariini Reitter ; Cryptophagidae pars Imms ; Cryptophagidae-

Cryptophaginae minus *Diplocoelus* + Mycetophagidae-Atomariinae + Lathridiidae-*Paramecosoma* and *Telmatophilus* + Mycetophagidae *Antherophagus* Joy).

9. EROTYLIDAE (Erotylidae minus Languriinae Imms ; Nitidulidae-Erotylinae genn. *Tritoma*, *Triplax* and *Dacne* Joy ; Erotylidae minus *Biphyllus* and *Diplocoelus* Kloet & Hincks ; Erotylidae minus *Diphyllus* and *Tetratoma* van Emden).
10. BIPHYLLIDAE (Cryptophagidae-Diphyllina Fowler ; -Diphyllini Reitter ; Cryptophagidae-Cryptophaginae-*Diplocoelus* + Nitidulidae-Erotylinae-*Diphyllus* Joy ; Erotylidae-*Biphyllus* + *Diplocoelus* Kloet & Hincks ; Erotylidae-*Diphyllus* van Emden).
11. BYTURIDAE (Mycetophagidae-Byturinae Joy).
12. ENDOMYCHIDAE (Endomychidae + Lathridiidae-*Mycetaea* + Mycetophagidae-Sphaerosominae Joy ; Endomychidae minus Murmidiinae van Emden).
13. COCCINELLIDAE.
14. CORYLOPHIDAE (Orthoperidae Kloet & Hincks).
15. CERYLONIDAE (Colydiidae-Cerylonina + -Murmidiina Fowler ; -Ceryloninae-Cerylonini + -Murmidiinae Reitter ; Colydiidae pars Imms ; Colydiidae-*Cerylon* Joy ; Colydiidae-Ceryloninae-*Cerylon* + -Murmidiinae Kloet & Hincks; Endomychidae - Murmidiinae van Emden).
16. MEROPHYSIIDAE (Lathridiidae-Merophysiina Fowler ; Colydiidae-Ceryloninae-Anommatini + Lathridiidae - Holoparamecini Reitter ; Colydiidae-*Anommatus* + Lathridiidae-*Holoparamecus* Joy ; Lathridiidae-Holoparamecinae + Colydiidae - Ceryloninae - *Anommatus* Kloet & Hincks).
17. LATHRIDIIDAE (Lathridiidae minus Merophysiina Fowler ; -Lathridiini + -Corticariini Reitter ; Lathridiidae minus *Mycetaea*, *Myrmecoxenus*, *Ditoma*, *Hypocoprus*, *Paramecosoma*, *Telmatophilus* and *Holoparamecus* Joy ; -Lathridiinae Kloet & Hincks ; Lathridiidae minus *Holoparamecus* van Emden).
18. CISIDAE (Cisidae Fowler ; Cioidae Imms ; Ciidae Kloet & Hincks).
19. COLYDIIDAE (Colydiidae-Deretaphrina + Synchitina + Langelandiina Fowler ; Colydiidae-Colydiinae + -Ceryloninae-Bothriderini and -Deretaphrini Reitter ; Colydiidae pars Imms ; Orthoceridae + Lathridiidae-*Ditoma* and -*Myr-*

mecoxenus + Colydiidae minus *Anommatus*, *Cerylon*, *Nemosoma*, *Pityophagus* and *Rhizophagus* Joy ; Colydiidae-Colydiinae + -Cryloninae-*Teredus* and -*Oxylaemus* Kloet & Hincks ; Colydiidae minus *Cerylon* van Emden)

20. MYCETOPHAGIDAE (Mycetophagidae - Mycetophaginae minus *Antherophagus* and *Phloeophilus* Joy).
21. TETRATOMIDAE (Melandryidae - Tetratomina Fowler ; Tetratomini Reitter ; Melandryidae-*Tetratoma* Joy ; Serropalpidae-*Tetratoma* Kloet & Hincks ; Erotylidae-*Tetratoma* van Emden).
22. TENEBRIONIDAE.
23. LAGRIIDAE.
24. ALLECULIDAE (Cistelidae Fowler, Imms, Joy).
25. MYCTERIDAE (Pythidae - Mycterina Fowler ; -Mycterini Reitter ; -*Mycterus* Kloet & Hincks).
26. SALPINGIDAE (Pythidae-Salpingina Fowler ; -Salpingini Reitter ; Pythidae pars Imms ; Pythidae minus *Pytho* Joy ; Pythidae minus *Pytho* and *Mycterus* Kloet & Hincks).
27. PYTHIDAE (Pythidae-Pythina Fowler ; -Pythini Reitter ; Pythidae pars Imms ; Pythidae-*Pytho* Joy, Kloet & Hincks).
28. PYROCHROIDAE.
29. OEDEMERIDAE.
30. MELANDRYIDAE (Melandryidae-Melandryina Fowler ; Melandryidae minus Tetratomini, Stenotrachelini and Hallomenini - *Mycetoma* Reitter ; Melandryidae pars Imms ; Melandryidae minus *Tetratoma* Joy ; Serropalpidae minus *Tetratoma* Kloet & Hincks ; Melandryidae + Synchroidae van Emden).
31. SCRAPTIIDAE (Scraptiidae + Mordellidae - Anaspina Fowler ; Mordellidae-Scraptiinae + -Mordellinae-Anaspini Reitter ; Mordellidae-Scraptiinae + -Mordellinae-*Anaspis* Joy ; Scraptiidae + Mordellidae-*Anaspis* Imms, van Emden, Kloet & Hincks).
32. MORDELLIDAE (Mordellidae-Mordellina Fowler ; -Mordellini Reitter ; -Mordellinae minus *Anaspis* Joy ; Mordellidae minus *Anaspis* Imms, van Emden, Kloet & Hincks).
33. RHIPIPHORIDAE (Rhipidophoridae Fowler).
34. MELOIDAE.
35. ANTHICIDAE (Anthicidae-Anthicinae Reitter).

36. ADERIDAE (Xylophilidae Fowler, Imms, Kloet & Hincks; Anthicidae-Hylophilinae Reitter; van Emden; Hylophilidae Joy).

Superfamily 17.—**Chrysomeloidea** (Longicornia + Phytophaga Fowler, Joy; Phytophaga Reitter, Imms, van Emden, Kloet & Hincks).

1. CERAMBYCIDAE (Prionidae + Cerambycidae + Lamiidae Fowler; Prionidae + Cerambycidae + Tetropiidae + Lamiidae Joy).
2. BRUCHIDAE (Lariidae Reitter, Joy).
3. CHRYSOMELIDAE (Cryptostomidae + Chrysomelidae Joy).

Superfamily 18.—**Curculionoidea** (Rhynchophora Fowler, Reitter, Imms, van Emden, Kloet & Hincks; Rhynchophora + Clavicornia-Choragidae Joy).

1. NEMONYCHIDAE (Rhinomaceridae Fowler; Curculionidae-Rhynchitinae-Nemonychini Reitter; Curculionidae pars Imms; Curculionidae-Rhynchitinae-Nemonychini Reitter; Curculionidae pars Imms; Curculionidae-Rhynchitinae-*Rhinomacer* Joy, Kloet & Hincks).
2. ANTHRIBIDAE (Platyrrhinidae Fowler; Anthribidae + Choragidae Joy; Platystomidae Kloet & Hincks).
3. ATTELABIDAE (Curculionidae-Attelabinae Fowler; -Rhynchitinae minus Nemonychini Reitter; Curculionidae pars Imms, van Emden; -Rhynchitinae minus *Rhinomacer* Joy; -Rhynchitinae minus *Rhinomacer* + Attelabinae + Apoderinae Kloet & Hincks).
4. APIONIDAE (Curculionidae-Apioninae + -Curculioninae-Cionina-*Nanophyes* Fowler; -Apioninae Reitter; -Apioninae + -Nanophyinae Joy; Curculionidae pars Imms, van Emden; -Apioninae + -Mecininae-*Nanophyes* Kloet & Hincks).
5. CURCULIONIDAE (Curculionidae-Brachyrrhininae + -Curculioninae minus *Nanophyes* Fowler; -Adelognatha + -Phanerognatha minus Apioninae and Rhynchitinae Reitter; Curculionidae minus Rhynchitinae, Apioninae and Nanophyinae Joy; Curculionidae pars Imms, van Emden; Curculionidae minus Rhynchitinae, Attelabinae, Apoderinae, Apioninae and Mecininae-*Nanophyes* Kloet & Hincks).
6. SCOLYTIDAE (Ipidae Reitter; Scolytidae + Platypodidae Kloet & Hincks, van Emden).
(*Note:* in a strictly natural classification the last two families should probably be merged.)

Superfamily 19.—**Stylopoidea** (Abnormal Coleoptera Fowler; not treated by Reitter or Joy; Order Strepsiptera Imms, Kloet & Hincks; Clavicornia-Heteromera-Stylopidae van Emden).

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