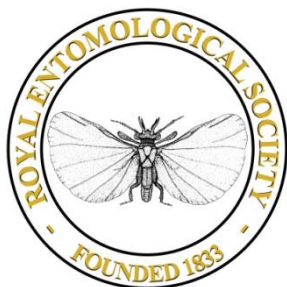


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HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS

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HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS



COLEOPTERA
SCARABAEOIDEA
(LUCANIDAE, TROGIDAE, GEOTRUPIDAE, SCARABAEIDAE)

By
E. B. BRITTON

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HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS

The aim of this series of publications is to provide illustrated keys to the whole of the British Insects (in so far as this is possible), in ten volumes, as follows :

I. Part 1. General Introduction.

- „ 2. Thysanura.
- „ 3. Protura.
- „ 4. Collembola.
- „ 5. Dermaptera and
Orthoptera.
- „ 6. Plecoptera.
- „ 7. Psocoptera.
- „ 8. Anoplura.

Part 9. Ephemeroptera.

- „ 10. Odonata.
- „ 11. Thysanoptera.
- „ 12. Neuroptera.
- „ 13. Mecoptera.
- „ 14. Trichoptera.
- „ 15. Strepsiptera.
- „ 16. Siphonaptera.

II. Hemiptera.

III. Lepidoptera.

IV. and V. Coleoptera.

VI. Hymenoptera : Symphyta and Aculeata.

VII. Hymenoptera : Ichneumonidae.

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IX. Diptera : Nematocera and Brachycera.

X. Diptera : Cyclorrhapha.

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3929
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COLEOPTERA

SCARABAEOIDEA

LUCANIDAE, TROGIDAE, GEOTRUPIDAE and SCARABAEIDAE.

By E. B. BRITTON.

INTRODUCTION.

THE superfamily *Scarabaeoidea*, also known as the *Lamellicornia*, includes some of the most striking beetles in the British fauna. It is the most clearly defined major unit of the Coleoptera and it is represented in the world by more than 20,000 species. In the British Isles there are 68 species known, representing four families, the LUCANIDAE (Stag Beetles), TROGIDAE, GEOTRUPIDAE (Dor Beetles) and SCARABAEIDAE (Dung Beetles and Chafers).

BIOLOGY.

The larvae are adapted to a life buried in the soil or in decaying vegetable matter, including wood. The adult beetles almost all show adaptations for digging, e.g., the flattened, toothed anterior tibiae, the spinose, expanded posterior tibiae, the stout, powerful build and heavy sclerotisation. Almost all species are winged and capable of flight. The larvae are C-shaped, white or greyish, with a yellow head and three pairs of fairly long legs. The larvae feed upon roots (in Melolonthinae), decaying vegetable matter (in Cetoniinae), dung (in Geotrupidae, Scarabaeinae, Aphodiinae), decaying wood (in Lucanidae), or in dry carcasses (Trogidae). Larval life is long in comparison with the active adult life (e.g. three and a half years in *Lucanus cervus*, two and a half years in *Melolontha melolontha*, in contrast to an active adult life of one or two weeks. Total adult life in these species is, however, not short, as the perfect insect leaves the pupal skin in late summer and remains inert in the pupal cell until the following June or July.) Adult Geotrupidae dig deep burrows which they stock with dung for their larvae. A single egg is laid on the plug of dung in each burrow and the dung provided is sufficient for the larva to reach maturity. In spite of their solitary life, Geotrupid larvae have well developed sound producing organs. They produce a high pitched rasping noise (stridulation) by rubbing a row of teeth situated on the shortened hind leg over a series of fine close ridges at the base of the second leg. The purpose of this stridulation is not known, but it has been assumed that the vibration serves to deter predators and parasites. The larva of *Lucanus* also stridulates, in this case by rubbing some hard ridges on the third pair of legs over a rough area at the bases of the second pair of legs. Adult Geotrupidae also stridulate, but the mechanism is not obvious. It is not caused, as has been stated, by the rubbing of a finely ridged area on the hind coxa on the sharp edge of the coxal cavity, as *Geotrupes stercorosus* deprived of hind coxae has been observed to stridulate (H. E. Hinton, *personal communication*).

In *Copris* the two sexes co-operate in excavating a large chamber which is stocked with dung. The adult female remains in the chamber and tends her brood until they reach maturity. The elaborate behaviour of some Scarabaeoid beetles in connection with the care of their offspring is dealt with in detail in *Die Brutfürsorge und Brutpflegeinstinkte der Käfer* by H. von Lengerken, Leipzig, 1954, 383 pp.

The larvae of *Cetonia* are noteworthy for the ease with which they "walk" upon their backs when they are placed on a surface.

The very large mandibles of the males of *Lucanus cervus* are used solely in wrestling with others of the same sex.

The only species of importance as pests are *Melolontha melolontha* and *Amphimallon solstitialis*. These are occasionally sufficiently abundant to cause damage to pasture, strawberry plants and to trees in forest nurseries, by feeding upon the roots. The larvae of *Phyllopertha horticola* and *Cetonia aurata* also occasionally cause damage to strawberry plants.

Much remains to be discovered concerning the biology of the British Scarabaeoid beetles. This is a field which is well suited to investigation by amateur entomologists.

Van Emden (1941, *Ent. mon. Mag.* 77: 117-127, 181-192) has provided keys to the larvae of most of the genera and to about two-thirds of the British species. The following is a list (kindly provided by Dr. F. van Emden) of the species of which the larvae have yet to be discovered: *Trox sabulosus*, *perlatus*; *Onthophagus* (all spp. except *vacca*); *Odontaeus armiger*; *Geotrupes pyrenaeus*; *Aphodius subterraneus*, *brevis*, *putridus*, *zenkeri*, *quadrinaculatus*, *equestris*, *conspurcatus*, *paykulli*, *distinctus*, *obliteratus*, *sphacelatus*, *consputus*, *porcus*, *scrofa*, *merdarius*, *pusillus*, *coenosus*, *aestivalis*, *scybalarius*, *lapponum*, *borealis*, *constans*, *tenellus*, *nemoralis*, *sordidus*, *plagiatus*, *niger*, *lividus*; *Heptaulacus sus*, *testudinarius*; *Psammobius sulcicollis*, *porciciollis*; *Diastictus vulneratus*; *Pleurophorus caesus*; *Rhyssemus germanus*; *Aegialia arenaria*; *Rhysothorax rufus*.

CORRELATION OF NAMES WITH THOSE USED BY FOWLER, JOY, AND KLOET AND HINCKS.

As a result of the application of the International Rules of Zoological Nomenclature, a few changes of names of species have unavoidably been made, so that the same species is sometimes known by different names in the various works on British beetles. The following table gives the names by which these species are known in the various works. It is hoped that this may be of assistance in dealing with older collections, etc.

Fowler., 1887-1913	Joy, 1932.	Kloet and Hincks, 1945.	Present Handbook.
<i>Odontaeus mobilicornis</i> (F.)	<i>O. armiger</i> (Scop.)	<i>O. armiger</i> (Scop.)	<i>O. armiger</i> (Scop.)
<i>Geotrupes typhoeus</i> (L.)	<i>Ceratophyus typhoeus</i> (L.)	<i>Typhaeus typhoeus</i> (L.)	<i>T. typhoeus</i> (L.)
<i>Geotrupes sylvaticus</i> Panz.	<i>G. stercorosus</i> (Scrib.)	<i>G. stercorosus</i> (Scrib.)	<i>G. stercorosus</i> (Scrib.)
<i>Plagiogonus arenarius</i> (Ol.)	<i>Aphodius rhododactylus</i> (Marsh.)	<i>A. arenarius</i> (Ol.)	<i>A. putridus</i> (Fourcr.)
<i>Aphodius sticticus</i> (Panz.)	<i>A. sticticus</i> (Panz.)	<i>A. equestris</i> (Panz.)	<i>A. equestris</i> (Panz.)
<i>Aphodius tessulatus</i> (Payk.)	<i>A. tessulatus</i> (Payk.)	<i>A. tessulatus</i> (Payk.)	<i>A. paykulli</i> Bedel

Fowler, 1887-1913.	Joy, 1932.	Kloet and Hincks, 1945.	Present Handbook.
<i>Aphodius inquinatus</i> (F.)	<i>A. inquinatus</i> (F.)	<i>A. distinctus</i> (Muell.)	<i>A. distinctus</i> (Muell.)
<i>Aphodius punctatosulcatus</i> Sturm	<i>A. punctatosulcatus</i> Sturm	<i>A. sphacelatus</i> (Panz.)	<i>A. sphacelatus</i> (Panz.)
<i>Aphodius foetens</i> (F.)	<i>A. foetens</i> (F.)	<i>A. aestivalis</i> Steph.	<i>A. aestivalis</i> F.
<i>Aphodius foetidus</i> (F.)	<i>A. putridus</i> (Herbst)	<i>A. tenellus</i> Say	<i>A. tenellus</i> Say
<i>Aphodius rufescens</i> F.	<i>A. rufus</i> (Moll.)	<i>A. rufescens</i> F.	<i>A. rufescens</i> F.
<i>Oxyomus porcatus</i> (F.)	<i>O. sylvestris</i> (Scop.)	<i>O. sylvestris</i> (Scop.)	<i>O. sylvestris</i> (Scop.)
<i>Aegialia rufa</i> (F.)	<i>A. rufa</i> (F.)	<i>A. rufa</i> (F.)	<i>Rhysothorax rufus</i> (F.)
<i>Aegialia sabuleti</i> (Panz.)	<i>A. sabuleti</i> (Panz.)	<i>A. sabuleti</i> (Panz.)	<i>Psammoporus sabuleti</i> (Panz.)
<i>Psammobius caesus</i> (Panz.)	—	<i>Pleurophorus caesus</i> (Creutz.)	<i>P. caesus</i> (Creutz.)
<i>Ammoecius brevis</i> (Er.)	<i>Aphodius brevis</i> (Er.)	<i>Aphodius brevis</i> (Er.)	<i>Aphodius brevis</i> (Er.)
<i>Rhizotrogus solstitialis</i> (L.)	<i>Amphimallus solstitialis</i> (L.)	<i>Amphimallus solstitialis</i> (L.)	<i>Amphimallon solstitialis</i> (L.)
<i>Melolontha vulgaris</i> (F.)	<i>M. melolontha</i> (L.)	<i>M. melolontha</i> (L.)	<i>M. melolontha</i> (L.)
<i>Anomala frischeri</i> (F.)	<i>A. aenea</i> (Degeer)	<i>A. dubia</i> var. <i>aenea</i>	<i>A. dubia</i> (Scop.)
<i>Cetonia aurata</i> (L.)	<i>C. aurata</i> (L.)	<i>C. aurata</i> var. <i>nigra</i>	<i>C. aurata</i> (L.)
<i>Cetonia floricola</i> (Herbst)	<i>C. cuprea</i> (F.)	<i>Potosia cuprea</i> var. <i>metallica</i>	<i>C. cuprea</i> (F.)

CHARACTERS OF ADULT SCARABAEOID BEETLES.

Adult beetles of the four families represented in the British fauna are characterised by the form of the antennal club which is formed by a one-sided expansion of the three or more end segments (figs. 3, 4), by the teeth on the outer edge of the anterior tibiae which also have only one apical spur, by the absence of a short stria from the base of the first (inner, or sutural) interval of the elytra, and by the articulation of the outer end of the cylindrical anterior coxa on the internal face of the pronotum. The point of articulation of the coxa is usually visible as a depression or a discoloration of the pronotum close to each lateral margin about one half of the length of the pronotum from the base.

The parts of a typical Scarabaeoid beetle are identified in figs. 1 and 2.

NOTES ON THE KEYS.

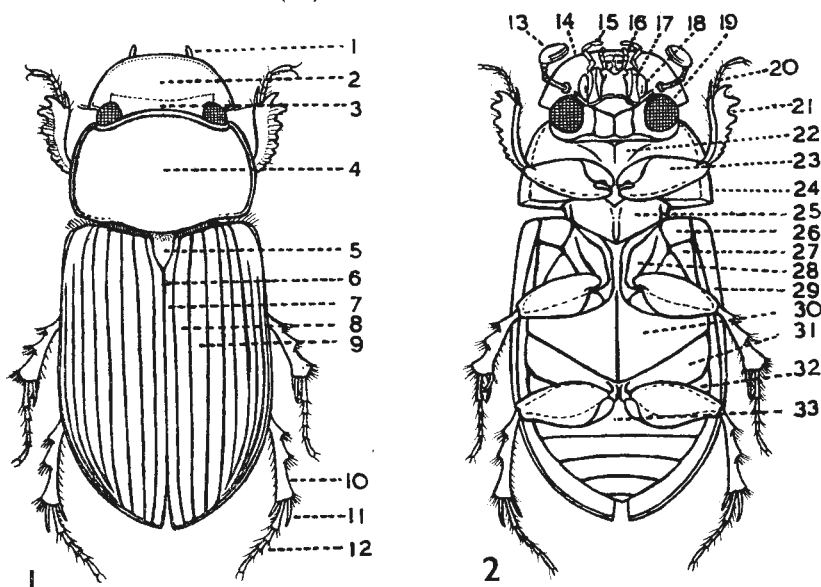
The number in brackets after the number of each couplet indicates the couplet preceding in the use of the key. This has been inserted to enable the user to return readily to earlier couplets for checking when necessary.

In the key to the genus *Aphodius* some species have been inserted on both sides of one or more couplets. This has been done where a character is decisive for a number of species, but may possibly fail (due to variation or difficulties of interpretation) in the case of one species.

Accuracy of identification has been the only object in view in the preparation of the keys. For this reason the use of the subgenera (in particular in *Aphodius*) adopted in other works has been avoided. The subgenera of *Aphodius* are in any case much in need of review and their use at present would serve no real purpose. Similarly no reference is made to named colour varieties where these are only arbitrary parts of a continuous variation.

I am indebted to Miss Enid Tozer, Mr. M. E. Bacchus and Mr. L. S. Whicher for their help in testing the keys.

The drawings of whole insects and a number of other drawings have been made by Mrs. C. O'Brien.



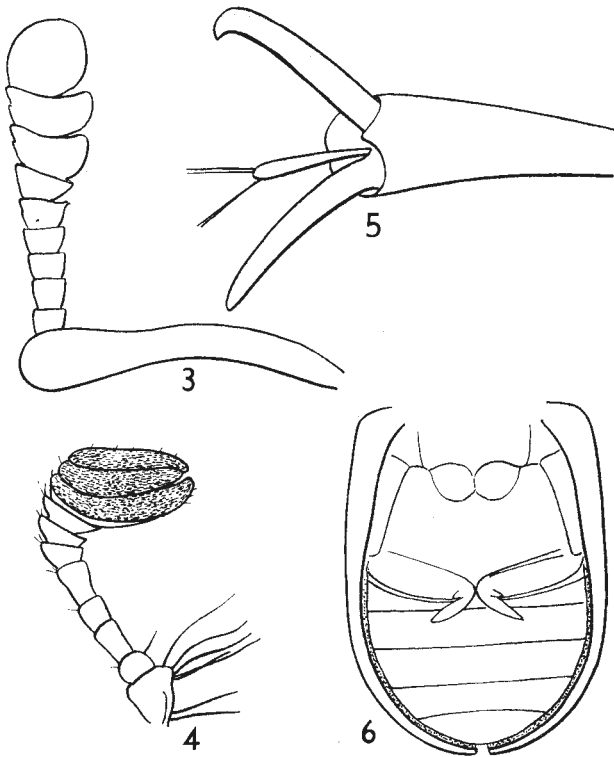
FIGS. 1-2.—*Aphodius rufipes*. 1.—Dorsal view: (1) maxillary palp; (2) clypeus; (3) frons; (4) pronotum; (5) scutellum; (6) elytral suture; (7) sutural or first interval of the elytra; (8) second interval; (9) third interval; (10) posterior tibia; (11) spur; (12) posterior tarsus. 2.—Ventral view: (13) antenna; (14) clypeus; (15) maxillary palp; (16) labial palp; (17) maxilla; (18) mandible; (19) eye; (20) anterior tarsus; (21) anterior tibia; (22) prosternum; (23) anterior femur; (24) pronotum; (25) mesosternum; (26) mesepimeron; (27) metepisternum; (28) middle coxa; (29) elytral epipleuron; (30) metasternum; (31) posterior coxa; (32) first visible abdominal segment; (33) second visible abdominal segment.

Superfamily SCARABAEOIDEA.

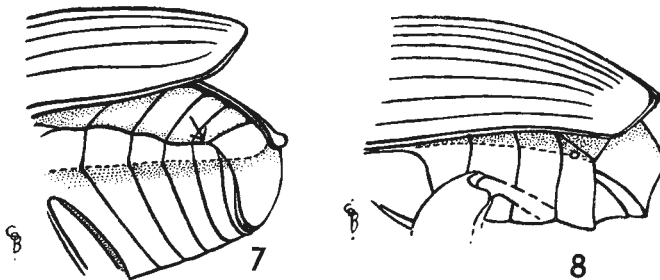
A key to the families of Scarabaeoidea has already been given in the introductory handbook to the Coleoptera (Crowson, 1956, *Handbooks for the Identification of British Insects* 4(1)), but for convenience it is repeated here in a slightly modified form.

KEY TO FAMILIES.

- 1 Abdomen with five visible ventrites (fig. 6).....2
- Abdomen with six visible ventrites (figs. 7, 8).....4
- 2 (1) Tarsi each with a well developed peg-like empodium between the claws (fig. 5); mandibles more or less large and freely projecting; antennal club with the segments thick and not closely fitted to each other (fig. 3), length of the club (along the antennal axis) greater than the length of the segments (across the antennal axis); length 10-75 mm.....LUCANIDAE p. 6
- Empodium absent or small; mandibles small, rarely projecting, usually hidden from above; antennal club with segments which fit closely together (fig. 4), length of the club along the antennal axis less than the greatest length of the segments measured across the antennal axis.....3
- 3 (1) Posterior coxae narrow (length near the outer edge less than one quarter of the width of the coxa (fig. 6)), and not overlying the abdominal ventrites; elytral epipleurae broad and continuous to the apical angle (fig. 6); colour black.....TROGIDAE p. 6
- Posterior coxae long (length near the outer edge more than one half of the width of the coxa), overlying the basal abdominal ventrites so that the basal ventrite and most of the second ventrite are not visible; elytral epipleurae not continued to the apical angle; colour usually reddish-brown (SCARABAEIDAE : MELOLONTHINAE : SERICINI) p. 9.....4



FIGS. 3-6.—(3) *Dorcus parallelipedus* (Linnaeus), antenna; (4) *Geotrupes spiniger* Marsham, antenna; (5) *Lucanus cervus* (Linnaeus), apex of tarsus, to show the empodium; (6) *Trox scaber* (Linnaeus), ventral surface of mesothorax, metathorax and abdomen showing wide elytral epipleurae.



FIGS. 7-8.—Lateral view of abdomen, with elytron raised in: (7) *Onthophagus vacca* (Linnaeus) (arrow indicates the hidden spiracle of the penultimate segment); (8) *Serica brunnea* (Linnaeus) (to show the position of the spiracle of the penultimate abdominal segment).

- 4 (1, 3) Antennae 11-segmented (e.g. fig. 4); each eye completely divided into an upper and a lower part (figs. 9, 10); anterior tibia each with at least six teeth on the outer edge (figs. 9, 10); mandibles clearly visible from above (figs. 9, 10)..... GEOTRUPIDAE p. 8
- Antennae less than 11-segmented; eyes not completely divided (e.g. figs. 1, 2); anterior tibiae each with three to five teeth on the outer edge; mandibles not visible from above (e.g. figs. 1, 12)..... SCARABAEIDAE p. 9

Family LUCANIDAE.

KEY TO SPECIES.

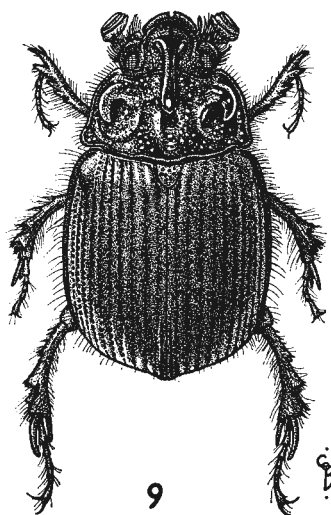
- 1 Length 10–18 mm.; elytra with irregular longitudinal striae; head with a single median horn (in ♂), or tubercle (in ♀)..... **Sinodendron** Schneider
One species only, *Sinodendron cylindricum* (Linnaeus). Black, shining, cylindric. In fallen tree trunks, especially beech. S. England, common; Scotland, rare; nocturnal.
- Length 20–75 mm.; elytra without longitudinal striae; ♂ head without horn or tubercle; ♀ head at most with two small tubercles in the middle..... 2
- 2 (1) Length 20–32 mm.; upper side of front tibiae with longitudinal grooves; mandibles in ♂ at most as long as the head..... **Doreus** Macleay
One species only, *Doreus parallelopipedus* (Linnaeus). ♂ entirely dull black, ♀ similar but middle of pronotum shining and with two small tubercles on middle of head. Larvae in rotten stumps and trunks of ash, elm, etc.; adults appear June to August and fly in the evenings and at night. Fairly common in S. England; absent from N. England and Scotland.
- Length 25–75 mm.; upperside of front tibiae without grooves; mandibles in ♂ at least one and a half times as long as the head..... **Lucanus** Scopoli
One species only, *Lucanus cervus* (Linnaeus). Head and pronotum black, mandibles of ♂ and the elytra reddish-brown. Adults appear in June, July, August and fly in the evening; larvae in rotting tree stumps and roots; males use their large jaws to wrestle with each other. Surrey, Kent, common; S.W. England and Midlands, rare; apparently absent from N. England and Scotland.

Family TROGIDAE.

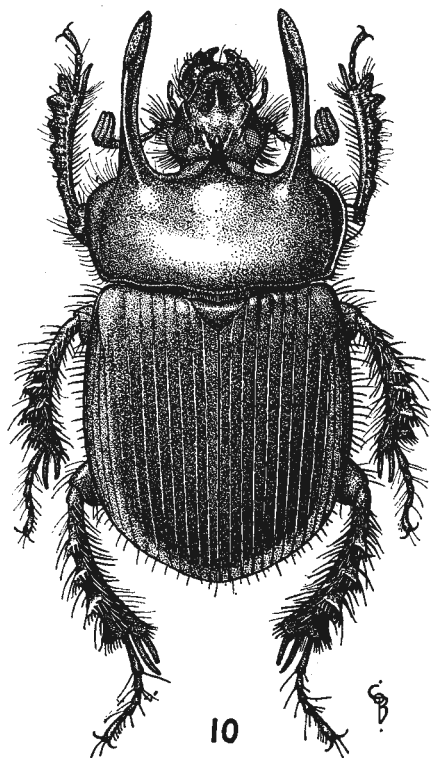
The family is represented in Britain by four species of the genus *Trox*.

Genus *Trox* Fabricius.

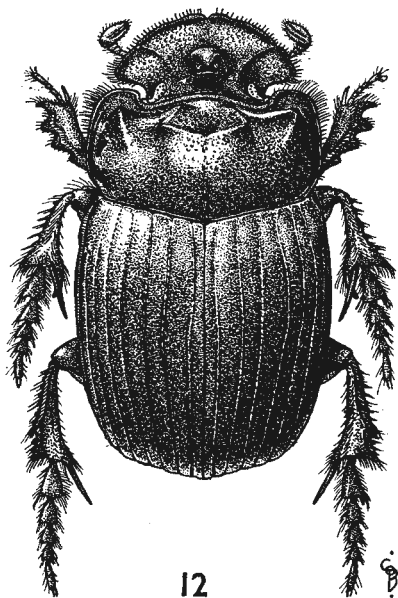
- 1 Elytral intervals 1, 3, 5, 7 and 9 with large low tubercles, each tubercle bearing a tuft of bristles towards its posterior end (fig. 13)..... 2
- Elytral intervals 1, 3, 5, 7 and 9 without obvious tubercles but bearing tufts of yellow or brown bristles (figs. 14, 15)..... 3
- 2 (1) Bristles on the body and legs black; length 8–12 mm. Very rare; Devon, Dorset; in animal debris. (On the Continent it is found in debris under nests of birds of prey on cliffs of the Atlantic coast)..... **perlatius** Goeze
- Bristles on the body and legs pale yellowish-white; length 9–11 mm. Very rare, in dried animal matter. (On the Continent it is found in nests of birds of prey)..... **hispidus** (Pontoppidan)
- 3 (1) Length 8–10 mm.; sutural stria (fig. 14s) almost as wide as intervals 1 and 2; elytral hairs pale yellow. Sandy places, in dried carcasses, horns, etc. Local in south, rare in north..... **sabulosus** (Linnaeus)
- Length 5–8 mm.; sutural stria less than half as wide as intervals 1 and 2 (fig. 15); elytral hairs brown. In dry animal remains, wood mould in oaks and elms, and birds' nests. Local in south, rare in north; adults i, ii, vi, vii..... **seaber** (Linnaeus)



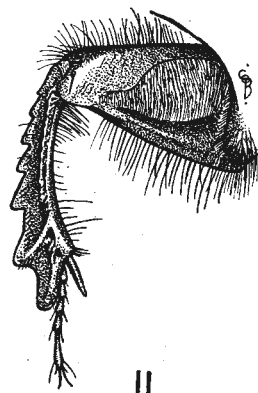
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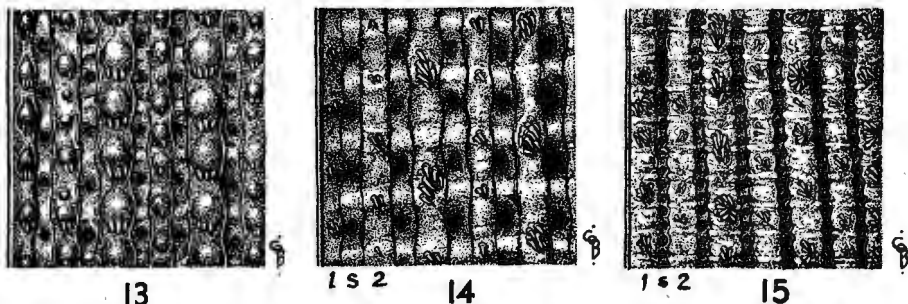
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FIGS. 9-12.—(9) *Odontaeus armiger* (Scopoli), ♂; (10) *Typhaeus typhoeus* (Linnaeus), ♂; (11) *Geotrupes spiniger* Marsham, anterior view of front leg showing patch of hairs on femur; (12) *Copris lunaris* (Linnaeus), ♂.

Family GEOTRUPIDAE.

KEY TO GENERA.

- 1 Elytra finely bordered along the suture; front femora without a large dense patch of yellow hairs on the front face; both head and prothorax of ♂ with horns (fig. 9) **Odontaeus** Klug
One species only, *Odontaeus armiger* (Scopoli) (= *Odontaeus mobilicornis* Fabricius) (fig. 9); length 7–10 mm. Shiny black. Very rare, S.E. England, flies in daylight and at dusk.
- Elytra not bordered along the suture; front femora with a large dense patch of yellow hairs on the front face (fig. 11); head and pronotum of ♂ not both with horns. 2
- 2 (1) Pronotum with horns in ♂ (fig. 10) and at least with a sharp tubercle at each anterior angle in ♀ **Typhaeus** Leach
One species only, *Typhaeus typhoeus* (Linnaeus); length 10–20 mm. Shining black. Local in S.E. England on dry sandy soil; rare in Midlands; absent from N. England and Scotland; adults ii, iii, v, viii, ix, x.
- Pronotum smooth, without horns or tubercles.... **Geotrupes** Latreille p. 8



FIGS. 13–15.—Portions of right elytron in: (13) *Trox hispidus* (Pontoppidan) (showing intervals 1–6 and striae 1–5); (14) *T. sabulosus* (Linnaeus) (showing intervals 1–6 and striae 1–5); (15) *T. scaber* (Linnaeus) (showing intervals 1–7 and striae 1–6). (s = sutural stria).

Genus **Geotrupes** Latreille.

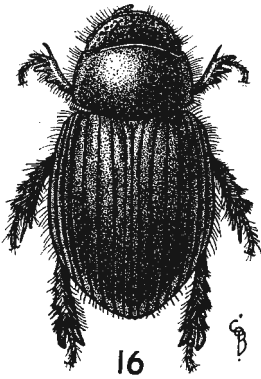
- 1 Elytral striae faint, not visible to the naked eye; the basal margin of the pronotum obliterated on each side of the middle. 2
- Elytral striae impressed and obvious to the naked eye; the basal margin of the pronotum well defined and continuous from side to side. 3
- 2 (1) Abdominal ventrites not, or only very sparsely punctured and setose in the middle; pronotum with punctures of two distinct sizes, the larger punctures very sparse and irregularly placed; elytra with microsculpture very faint or absent, surface shining; length 12–20 mm. Shining dark metallic green or blue. Local in S. England; sandy places **pyrenaeus** Charpentier
- Abdominal ventrites uniformly punctured and setose; pronotum with punctures of two distinct sizes, both kinds of punctures very numerous and fairly regularly placed on the disc; elytra with strong reticulate microsculpture (clearly visible at $\times 60$); surface rather dull; length 12–20 mm. Blue-black or dark metallic green. Local..... **vernalis** Linnaeus
- 3 (1) Elytra with nine striae between the suture and the inner side of the shoulder prominence; length 15–24 mm. Dorsal surface metallic greenish, purple, or coppery; ♂ with and ♀ without a hook-like tooth on the posterior trochanter. Common, S. England..... **mutator** Marsham
- Elytra with seven striae between the suture and the shoulder prominence. 4
- 4 (3) Posterior tibiae each with three complete, sharp-edged, transverse ridges on the outer side (including the apical edge of the tibia), or with the third (nearest middle of tibia) ridge only half complete. 5
- Posterior tibiae each with only two complete transverse ridges (including the apical edge of the tibia) and no trace of third ridge; abdominal ventrites

- fairly uniformly punctured and setose; length 12–19 mm. Black, or slightly metallic green, blue or purple above; bright metallic blue or purple beneath; anterior tibia of ♂ with a serrated ridge beneath. *Common; adults, v-x* **stercorosus** (Scriba) (= *sylvaticus* Panzer)
- 5 4) Punctures and setae almost absent from about the mid-line of the abdominal ventrites; posterior tibia with three complete, sharp-edged, transverse ridges; length 16–26 mm. Bluish-black above; metallic blue or green beneath; ♂ with a strong tooth on the posterior side of the posterior femur. *Common* **spiniger** Marsham
- Abdominal ventrites uniformly punctured and setose; posterior tibia with third ridge (nearest middle of tibia) incomplete on the inner side; length 16–25 mm. Black above, slightly metallic; bright metallic blue or green beneath; ♂ with a small blunt tooth on the posterior side of the posterior femur. *Common; adults w-x; the "Dor Beetle"* **stercorarius** (Linnaeus)

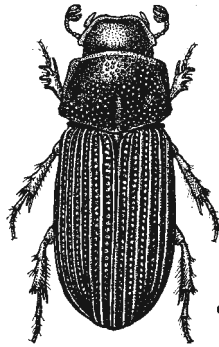
Family SCARABAEIDAE.

KEY TO SUBFAMILIES AND GENERA.

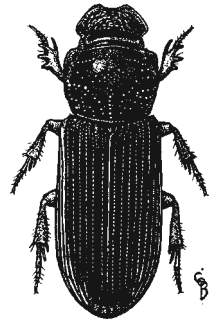
- 1 The spiracles of the penultimate segment of the abdomen not visible, well covered beneath the elytra (fig. 7); antennal club dull, uniformly clothed with minute hairs; length more than 11 mm., only in *Copris*, often less than 7 mm. ("Dung Beetles.") 2
- The spiracles of the penultimate segment of the abdomen visible or only just covered by the edges of the elytra (fig. 8); antennal club moderately shining, not uniformly clothed with minute hairs, sometimes with some irregularly arranged bristles; length often more than 11 mm., always more than 7 mm. ("Chafers") 13
- 2 (1) Posterior tibiae each with one terminal spur; scutellum not visible (e.g. fig. 12). SCARABAEINAE 3
- Posterior tibiae each with two terminal spurs; scutellum visible (e.g. figs. 1, 16, 20) 4
- 3 (2) Each elytron with nine longitudinal striae (including the marginal groove) (fig. 12); length 14–20 mm. **Copris** Müller
- One species only, **Copris lunaris** (Linnaeus). Shining black or dark reddish-brown; ♂ head with a long horn; ♀ head with a short horn which is emarginate at its apex. *Local, south east England; sandy places, in dung; adults appear in September.*
- Each elytron with eight longitudinal striae (including the marginal groove); length 7–10 mm. **Onthophagus** Latreille
- (7 species; key on p. 13.)
- 4 (2) The mandibles visible (fig. 16) when the head is viewed vertically from above the clypeus; eyes not visible from above; lateral angles of head not projecting laterally in front of the eyes **AEGIALIINAE** 5
- The mandibles completely covered (e.g., figs. 1, 16–19) from above by the clypeus; eyes usually partly visible from above; lateral angles of head often projecting laterally in front of the eyes **APHODIINAE** 7
- 5 (4) Base of pronotum without a defined margin; surface of pronotum smooth and unpunctured; wings reduced (fig. 16) **Aegialia** Latreille
- One species only, **Aegialia arenaria** (Fabricius). Length 4–5 mm.; mature colour shining black. *Local, on sand dunes.*
- Base of the pronotum with a defined margin; surface of the pronotum irregular or punctured, wings not reduced. 6
- 6 (5) Terminal spurs of the posterior tibiae tapered to their apices and pointed; mature colour black; surface of pronotum with coarse, sharply defined punctures; elytral striae strongly and regularly punctured
- **Psammoporus** Thomson
- One species only, **Psammoporus sabuleti** (Panzer) (= *Aegialia sabuleti* (Panzer)). *Local, on sandy coasts and sandy river banks.*
- Terminal spurs of the posterior tibiae expanded into flattened rounded blades; mature colour reddish-brown; pronotum rugose and obscurely punctured; elytral striae unpunctured. **Rhysothorax** Bedel
- One species only, **Rhysothorax rufus** (Fabricius) (= *Aegialia rufa* (Fabricius)). *Very rare, on sandy coasts near Liverpool.*



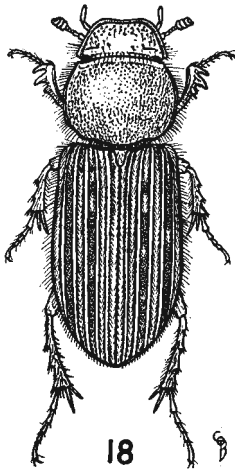
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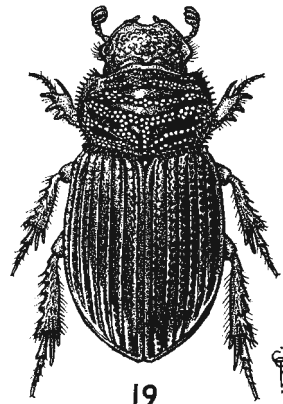
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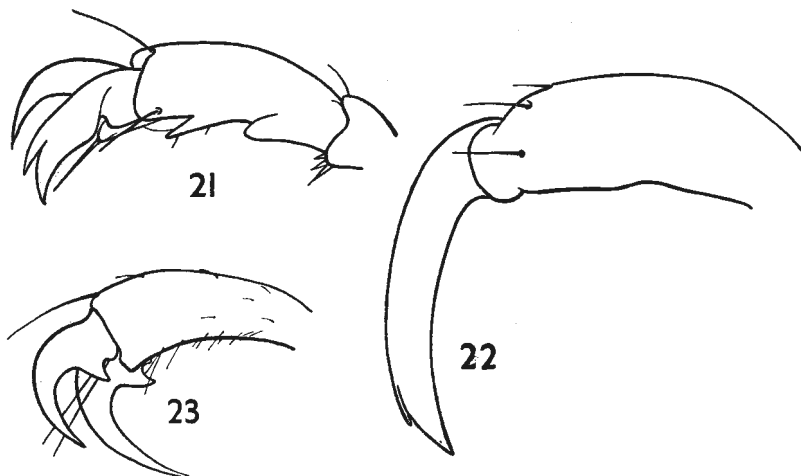


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FIGS. 16-20.—(16) *Aegialia arenaria* (Fabricius); (17) *Oxyomus sylvestris* (Scopoli); (18) *Heptaulacus sus* (Herbst); (19) *Psammobius porcicollis* (Illiger); (20) *Pleurophorus caesus* (Creutzer).

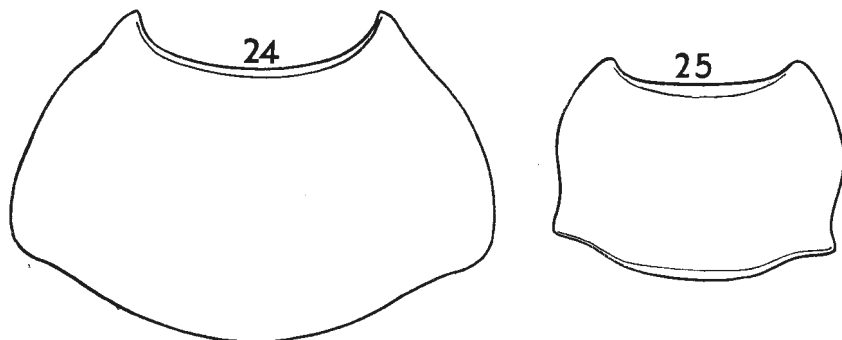
- 7 (4) Posterior tibiae each with two transverse ridges on the outer side (figs. 17, 18); pronotum usually without transverse or longitudinal depressions, apical spurs of posterior tibia inserted close together on the inner side of the articulation of the tarsus 8
- Posterior tibiae without transverse ridges (figs. 19, 20); pronotum always with transverse ridges and depressions, or lateral depressions; apical spurs of the posterior tibia separated so that the basal segment of the tarsus can pass between them 10
- 8 (7) Pronotum with a median longitudinal groove in the posterior half and slight oblique lateral depressions; elytral intervals in the form of strong longitudinal ridges (fig. 17)..... **Oxyomus** Stephens
- One species only, **Oxyomus sylvestris** (Scopoli) (= *O. porcatus* Fabricius). Length 2.5-3.7 mm. In rotting vegetation and dungheaps; adults fly at the end of July, in the evening. Local, S.E. England.
- Pronotum without a median longitudinal groove or lateral depressions; elytral intervals not raised to form strong ridges..... 9

- 9 (8) Elytra each with seven raised intervals, alternating with seven very broad "striae"; the outer striae wider than the intervals; each interval with a double longitudinal row of short yellowish hairs; surface of the pronotum bearing numerous hairs (fig. 18).....**Heptaaulacus** Mulsant
(3 species; key on p. 14.)
Elytra with ten intervals alternating with 9 relatively narrow striae; striae never wider than the intervals; intervals and pronotum usually without hairs (e.g. figs. 31-38).....**Aphodius** Illiger
(41 species, key on p. 15.)
- 10 (7) Pronotum with strong transverse ridges and depressions which are continuous across the middle; the lateral and basal edges of the pronotum fringed with yellow bristles (e.g. fig. 19).....11
Pronotum with one or two transverse depressions on each side, not continuous across the middle; the lateral and basal edges of the pronotum without setae (e.g. fig. 20).....12
- 11 (10) Posterior tarsi slender; the longer apical spur of the posterior tibia slender and slightly longer than the basal segment of the tarsus... **Rhyssemus** Mulsant
One species only, **Rhyssemus germanus** (Linnaeus). Length 2·7-3·5 mm.; black, with anterior angles of clypeus and pronotum reddish; head finely granulate; pronotum convex with five distinct transverse ridges separated by granulate depressions. *Very rare, in rotting vegetation.*
Posterior tarsi thick at the base (fig. 19); the longer apical spur of the posterior tibia broader, slightly longer than the two basal segments of the tarsus
Psammobius Heer
(2 species; key on p. 23.)
- 12 (10) The longer apical spur of the posterior tibia slender and not as long as the basal segment of the tarsus; the posterior tarsus equal in length to the posterior tibia (fig. 20).....**Pleurophorus** Mulsant
One species only, **Pleurophorus caesus** (Creutzer). Length 2·5-3·25 mm.; shining brownish-black, legs reddish; head coarsely granulate, punctured across the vertex; pronotum with irregularly spaced coarse punctures and regularly spaced fine punctures. *Very rare, S.W. England, under stones.*
The longer apical spur of the posterior tibia stout and longer than the two basal segments of the tarsus together; the posterior tarsus only three-fifths of the length of the posterior tibia.....**Diastictus** Mulsant
One species only, **Diastictus vulneratus** (Sturm). Length 3·0-3·5 mm.; black or brownish-black, the surface rather dull, with strong reticulate microsculpture; head granulate in front, coarsely punctured behind; pronotum very coarsely punctured and with a slight median longitudinal depression near the base. *Very rare; Suffolk.*
- 13 (1) Each tarsus with two unequal, assymmetric claws, or with only one large claw (figs. 21, 22).....14
Each tarsus with two equal symmetric claws (e.g. fig. 23).....16
- 14 (13) Each posterior tarsus with two unequal claws (fig. 21).....(RUTELINAE)...15
Each posterior tarsus with one large claw only (fig. 22) (HOPLINAE) **Hoplia** Illiger
One species only, **Hoplia philanthus** (Füessly). Length 7-11 mm.; head, pronotum and scutellum black, elytra reddish-brown, whole body sparsely clothed with whitish scales; antennae and legs black in ♂, red in ♀. *Local in S. England, absent from Scotland. Adults vi, vii.*
- 15 (14) Dorsal surface bare, without long setae; pronotum widest in the basal half (fig. 24).....**Anomala** Samouelle
One species only, **Anomala dubia** (Scopoli, 1763) (= *A. aenea* Degeer, 1774 = *A. frischei* Fabricius 1775). Length 11-15 mm.; metallic green, blue, reddish or purple; elytra sometimes yellowish. (About 12 colour varieties have been named but these merge.) Figs. 24-25. *Fairly common on sandy coasts in south; rare in Scotland. Adults, v.*
Dorsal surface with rather sparse long setae; pronotum widest in the anterior half (fig. 25).....**Phyllopertha** Kirby
One species only, **Phyllopertha horticola** (Linnaeus). Length 7-12 mm.; head, pronotum and scutellum metallic greenish-blue; elytra reddish-brown, rarely black, ♂ anterior tarsi thick. *Fairly common, sometimes a pest as larva and adult; larvae in turf. Common names, "fieldchafer," "bracken clock," "fernweb," "June-bug." Adults v, vi.*



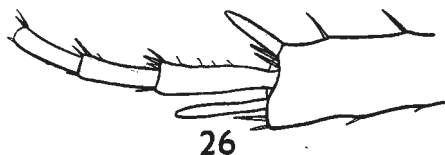
FIGS. 21-23.—Posterior tarsal claws of: (21) *Anomala dubia* (Scopoli); (22) *Hoplia philanthus* (Füessly); (23) *Melolontha melolontha* (Linnaeus).

- 16 (13) The two apical spurs of the posterior tibia placed close together on the inner side; the posterior coxae narrow (short), leaving six ventrites visible from below (laterally)..... 17
- The two apical spurs of the posterior tibia separated (fig. 26); posterior coxae expanded into large plates which cover the basal ventrites leaving only five ventrites visible from below (fig. 8) (MELOLONTHINAE: SERICINI)..... 19
- 17 (16) Claws each with a tooth beneath (fig. 23); sutures between ventrites 2, 3, 4 and 5 obliterated or faint in the mid-line (MELOLONTHINAE: MELOLONTHINI)..... 18
- Claws without teeth; sutures between ventrites not fainter in the mid-line.. 20
- 18 (17) Antennal club with three segments; ventrites not white at the sides
Amphimallon Berthold
 (2 species; key on p. 25.)
- Antennal club with four to seven segments; ventrites with obvious white patches at the sides..... **Melolontha** Fabricius
 (2 species; key on p. 25.)

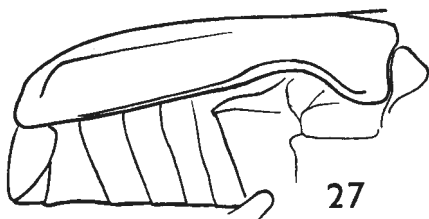


FIGS. 24-25.—Pronotum of: (24) *Anomala dubia* (Linnaeus); (25) *Phyllopertha horticola* (Linnaeus).

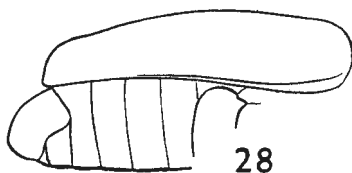
- 19 (16) Base of the pronotum with a very fine, defined border. **Homaloplia** Stephens
 One species only, **Homaloplia ruricola** (Fabricius). Length 6-7 mm.; head and pronotum black, elytra yellowish or reddish-brown with black borders, rarely all black. Rare, south of England, on chalky soil. Adults vi-vii, nocturnal.
 Base of the pronotum without a defined border. **Serica** Macleay
 One species only, **Serica brunnea** (Linnaeus). Length 8-10 mm.; entirely pale reddish-brown. Local; sandy places; adults vii, viii.
- 20 (17) Lateral edges of the elytra with a shallow emargination in the anterior half (fig. 27); pronotum closely fitted to the base of the elytra (CETONINAE)
Cetonia Fabricius
 (2 species, key on p. 26.)
 Lateral edges of the elytra without an emargination in the anterior half (fig. 28); pronotum not fitting closely to the base of the elytra (TRICHIINAE). 21



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FIG. 26.—Inner side of apex of posterior tibia and base of tarsus of *Serica brunnea* (Linnaeus).

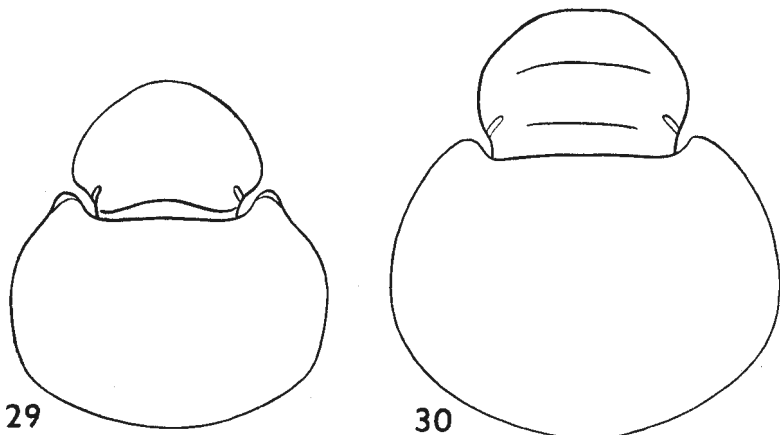
FIGS. 27-28.—Lateral view of hind body of: (27) *Cetonia aurata* (Linnaeus); (28) *Gnorumus variabilis* (Linnaeus).

- 21 (20) Dorsal surface of the head, pronotum and pygidium with long yellow hairs; elytra having black and yellow markings. **Trichius** Fabricius
 (2 species; key on p. 27.)
 Dorsal surface bare, without hairs; colour black or metallic green, elytra with small white spots. **Gnorumus** Lepeletier and Serville
 (2 species; key on p. 27.)

Genus **Onthophagus** Latreille.

- 1 Elytra uniform black or dark brown; pronotum black or with a very slight greenish reflection 2
 Elytra yellowish-brown, unicolorous or with darker markings; pronotum black, copper-coloured or metallic green. 4
- 2 (1) Pronotum with lateral edges distinctly sinuate just behind the anterior angles (fig. 29); length 6-11 mm. ♂ head elongate, produced behind into a long vertical horn; ♀ head transverse with a strong transverse ridge behind and a weaker transverse ridge in front. Local. South of England, in dung
nutans (Fabricius, 1787)
 (= *Scarabaeus verticicornis* Laicharting, 1781, not *Scarabaeus verticicornis* Fabricius, 1775 (unidentifiable)).
 Pronotum with the lateral edges rounded behind the anterior angles (e.g., fig. 30) 3

- 3 (2) Length 5.5–11.5 mm.; disc of the pronotum and at least the middle of the basal half of the elytra without hairs. ♂ head produced behind into a long curved horn on each side; ♀ with a transverse ridge between the eyes and a less prominent transverse ridge at the base of the clypeus. *Very rare. South of England, in dung*.....**taurus** (von Schreber)
 Length 4–6 mm.; pronotum and elytra uniformly clothed with erect pale hairs. ♂ head with a transverse ridge between the eyes; ♀ head with a similar ridge and a curved transverse ridge at the base of the clypeus in addition. *Common in the south of England; local in Scotland; in dung.*
**ovatus** (Linnaeus)
- 4 (1) Pronotum with the lateral edges slightly sinuate (as in fig. 29) behind the anterior angles..... 5
 Pronotum with the lateral edges uniformly rounded out (as in fig. 30) behind the anterior angles..... 6



FIGS. 29–30.—Outline of head and pronotum of: (29) *Onthophagus taurus* (von Schreber); (30) *O. nutans* (Fabricius).

- 5 (4) Elytral epipleurae entirely yellow; length 6–10 mm. ♂ head produced backwards into a horn; ♀ head with a transverse ridge. *Common in the south of England; absent from the north and Scotland; in dung*.....**coenobita** (Herbst)
 Elytral epipleurae black, or at least bordered on the inside with black; length 4.5–9.0 mm. ♂ head produced backwards into a horn; ♀ head with a transverse ridge between the eyes and a lower, curved transverse ridge at the base of the clypeus. *S. England, locally; absent from N. England and Scotland; in dung*.....**fracticornis** (Preyssler)
- 6 (4) Length 7–13 mm.; head and pronotum metallic green or bronze; elytra without a black spot at the base of the fifth interval. ♂ head produced backwards into a horn; ♀ head with two transverse ridges. *S. England, local; absent from N. England and Scotland; in dung*.....**vacca** (Linnaeus)
 Length 6–9 mm.; head and pronotum black; elytra with a black spot at the base of the fifth interval. ♂ head produced backwards into a horn; ♀ head with two transverse ridges. *S. England, local; very rare in N. England and Scotland; in dung*.....**nuchicornis** (Linnaeus)

Genus *Heptaulacus* Mulsant.

- 1 Elytra with both striae and intervals shining; elytra of a uniform reddish-brown colour; length 3.5–4.5 mm. Elytral intervals without microsculpture; striae with faint microsculpture. *Very rare; sand and chalk country in the south of England*.....**villosus** (Gyllenhal)
 Elytral striae dull, with strong reticulate microsculpture; intervals dull or shining; elytra dark brown with yellowish spots or yellow with dark brown spots..... 2

- 2 (1) Head and pronotum dark brown or black; elytra dark brown with yellowish spots; elytral intervals shining; pronotum coarsely punctured, the punctures separated by less than their own width; length 3.0-3.5 mm. *Local; in dung; sandy places in the south of England*. **testudinarius** (Fabricius)
 Head and pronotum dark brown in the middle, paler towards the edges, elytra yellow with dark brown spots on the intervals; intervals with strong reticulate microsculpture; pronotum finely and more sparsely punctured, the punctures often separated by at least twice their own width (fig. 18); length 4.5-5.0 mm. *Local, in dung; sandy places in the south of England*
sus (Herbst)

Genus *Aphodius* Illiger.

(Adults and larvae almost always in dung.)

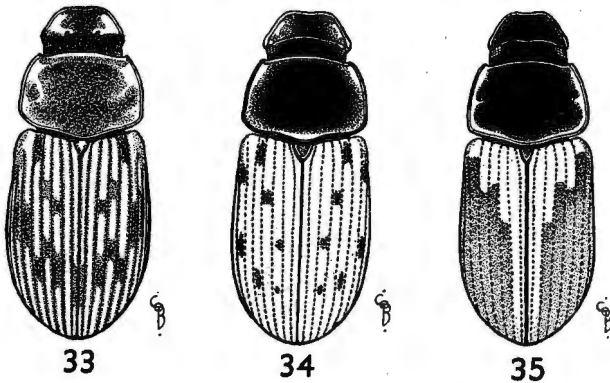
- 1 Surface of the pronotum and elytra uniformly clothed with short, backwardly directed whitish, or pale golden setae; length 3-4 mm. *Very rare, Pentire Point, Cornwall, and Southport, Lancs.; in dung*. **serofa** (Fabricius)
 Surface of the pronotum without hairs. 2
 2 (1) Base of the pronotum without a defined border in the middle. 3
 Base of the pronotum with a very narrow continuous border, defined by a fine groove (e.g., figs. 33, 34, 35). 10
 3 (2) Scutellum parallel sided or constricted in the basal half. 4
 Scutellum triangular. 5



FIGS. 31-32.—Outline of head of: (31) *Aphodius putridus* (Fourcroy); (32) *A. zenkeri* Germar.

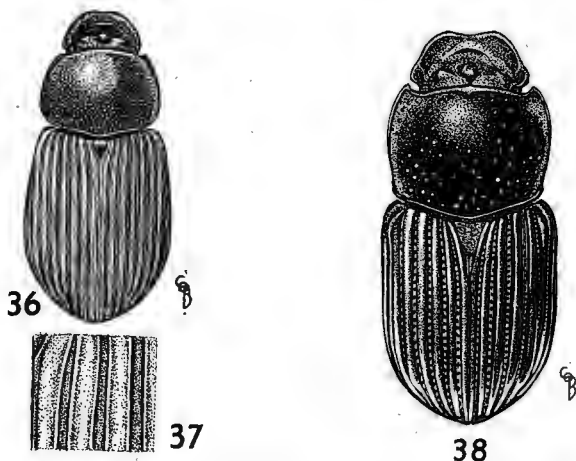
- 4 (3) Elytra yellowish-brown with the sutural intervals darker; disc of pronotum black or brown, the sides and base yellowish; the frontoclypeal suture distinct; length 3-6 mm. ♂ with tubercle in the middle of the base of the clypeus larger, metasternum concave. *Local. This species is widely distributed throughout the world; in dung*. **lividus** (Olivier)
 Elytra black, or black with a reddish spot; pronotum black; fronto-clypeal suture obliterated. 44
 5 (3) Clypeus with obvious obtuse anterior angles, the anterior edge between the angles concave (figs. 31, 32); length 5.5 mm. or less. 6
 Clypeus smoothly rounded, without anterior angles, the anterior edge straight or slightly convex (fig. 1); length rarely less than 6 mm. 7
 6 (5) Length 2.5-3.5 mm.; head and pronotum black, elytra brownish-black; intervals 7 and 9 of the elytra united at their apices and raised into a prominent fold; head without a tubercle in the middle of the fronto-clypeal suture; head as viewed obliquely from behind, fig. 31. *In dry, chalky and sandy regions, in dung, south of England, local; adults v, viii, ix*
putridus (Fourcroy, 1785)
 (= *arenarius* Olivier, 1789 = *rhododactylus* Marsham, 1802)
 Length 4.5-5.5 mm.; head and pronotum dark brown with margins reddish; elytra reddish-brown with rather indefinite oblique dark brown marks in the apical half; intervals 7 and 9 not united at their apices, and flat; head with a tubercle in the middle of the fronto-clypeal suture; head as viewed obliquely from behind, fig. 32. *South of England; in deer droppings; local; adults vii, viii, x*. **zenkeri** Germar
 7 (5) Outer-apical third of the surface of the elytra with sparse, pale pubescence; disc of pronotum with both coarse and fine punctures. 8
 Outer-apical region of the elytra without pubescence; middle of the disc of the pronotum finely and evenly punctured, the punctures of uniform size; sides of pronotum with both coarse and fine punctures. 9

- 8 (7) Basal edge of the pronotum with a fine raised margin on each side of the middle, the margin being a continuation of a similar margin on the lateral edges; elytra with the outer posterior half pale brown and the inner anterior half pale yellow; striae not darker than the intervals; ventral surface of the prothorax yellow; length 4-7 mm. ♂ with elytral pubescence longer and the angle of the outline of the head, in front of the eye, more prominent than in ♀. *Common; in dung; adults, ii, iii, iv, ix, x, ... prodromus* (Brahm)
- Pronotum without a trace of a defined basal margin; elytra usually yellow, with dark brown spots (colour is variable from all yellow to all black); striae brown (on yellow parts of elytra); ventral surface of prothorax black; length 6-9 mm. Spur of anterior tibia curved and truncate in ♂, straight and pointed in ♀. *Common; in dung, ... luridus* (Fabricius)
- 9 (7) Length 6-9 mm.; ratio of length of elytra (measured from apex of scutellum) to the middle length of the pronotum 1.7-1.8/1.0; ratio length/width of elytra 1.20-1.25/1.0. Head, pronotum and scutellum black, elytra all bright reddish-brown, or black at the base, or all black. *Red form rare, black form local; in dung, ... depressus* (Kugelann)
- Length 11-13 mm.; ratio of length of elytra (measured from apex of scutellum) to the middle length of the pronotum 1.2-2.4/1.0; ratio length/width of elytra 1.40-1.47/1.0 (figs. 1, 2). All dark reddish-brown. *Common; in dung, ... rufipes* (Linnaeus)
- 10 (2) Pronotum with a distinct red or yellow patch in the anterior angles, including the lateral edge, the red or yellow colour often extending towards the posterior angles. Elytra always paler than disc of pronotum, yellow, reddish-yellow or reddish-brown. 11
- Pronotum black or dark brown; if slightly reddish at the sides then with the lateral edge darker; elytra usually black or dark brown, sometimes reddish 35
- 11 (10) Elytra yellow, with a dark spot, or spots or lines on intervals 2-8 (e.g. figs. 33, 34) 12
- Elytra yellow, reddish-brown or black; if yellow, then uniform in colour except for the dark suture, or with the disc vaguely darkened, and sometimes with a large brownish patch extending over intervals 3-9 (e.g. fig. 35) 18
- 12 (11) Clypeus bearing setae; elytra clothed with short setae 13
- Clypeus without setae; elytra not clothed with setae 14
- 13 (12) Pronotum with pale yellowish setae on the lateral margins and edges; elytra pubescent to the base; length 5-7 mm. Elytra yellow with ill-defined brown spots on intervals 2, 3 and 4, and a brown stripe extending backwards from the shoulder on the sixth and seventh intervals. *Common, often very abundant; in dung, ... contaminatus* (Herbst)
- Pronotum without setae on the lateral margins and edges; elytra not pubescent to the base; length 4.5-7 mm. Elytra yellow with vague brownish spots distributed as in *A. contaminatus*. *Mainly in sandy places; local; in dung, ... obliteratus* Panzer
- 14 (13) Lateral angles of head projecting in front of the eyes (e.g. fig. 34); puncturation of the clypeus often rather coarse, the surface roughened; clypeus black, with or without reddish patches. 15
- Lateral angles of head scarcely projecting in front of the eyes (fig. 33); puncturation of the clypeus fine, the surface smooth; clypeus black in the middle, with a large red patch at each side; length 4-5.5 mm. Elytra yellow with brown marks as in fig. 33; ♂ with 3 tubercles on the posterior edge of the clypeus, ♀ without tubercles; puncturation of the disc of the pronotum finer in ♂ than in ♀. *Southern England, in sandy places, in dung; local, ... equestris* (Panzer)
- (= *sticticus* Panzer, 1798, not *sticticus* Linnaeus, 1767.)
- 15 (14) Clypeus all black, or at most with a narrow dark reddish margin of uniform width; the black colour of the disc of the pronotum extending to the base 17
- Clypeus black on the disc, with reddish-yellow margins, the yellowish area very much wider at the sides than in front, extending inwards along the frontoclypeal suture; clypeus sometimes all reddish-yellow; black colour of the disc of the pronotum not extending to the base, the basal margin being reddish-yellow. 16



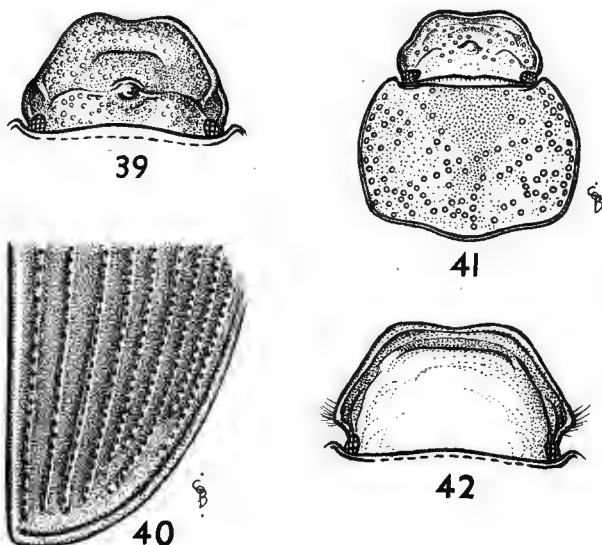
FIGS. 33-35.—Colour pattern of: (33) *Aphodius equestris* Panzer; (34) *A. conspurcatus* (Linnaeus); (35) *A. sphacelatus* Panzer.

- 16 (15) Elytra with a vague darker spot about one quarter from the apex of the fifth interval and a similar spot just behind the shoulder on the seventh interval; apices of the elytra dull, with strong reticulate microsculpture, in contrast to the shining striae; clypeus largely reddish-yellow; palpi pale yellowish-brown; length 5.5-8 mm. Median tubercle at the base of the clypeus, prominent in ♂, almost absent in ♀. *Local*; *in dung*; *rare in Scotland*
sordidus (Fabricius)
 Elytra with obvious dark brown spots on intervals 3, 4, 5 and 7; apices of the elytra shining, with very faint reticulate microsculpture; clypeus mainly black, with reddish-yellow anterior and lateral margins; palpi dark brown; length 4-5 mm. Elytral pattern as fig. 34; ♂ with three tubercles on the posterior edge of the clypeus; ♀ without tubercles. *Local*; *rare in Scotland*.....**conspurcatus** (Linnaeus)
- 17 (15) Basal segment of the middle tarsus not longer than the next two segments together; elytra yellow with a pattern of partly connected spots in dark brown, including a dark brown spot covering the bases of intervals 4 and 5; length 3-4.5 mm. Posterior edge of the clypeus more strongly 3-tuberculate in ♂ than in ♀. *Local*.....**paykulli** Bedel, 1908
 (= *tessulatus* Paykull, 1798, not *tessulatus* Laicharting, 1781.)
 Basal segment of the middle tarsus as long as the next three segments together; elytra yellow with a few dark brown, unconnected spots, the dark spot at the base on interval 5 only; length 3.5-5.5 mm. Elytra with a dark spot on intervals 3 and 4 about one quarter length from the base; interval 7 largely dark in the basal half; an irregular dark spot on intervals 3, 4 and 5 about one-third from the apex; posterior edge of the clypeus more strongly 3-tuberculate in ♂ than in ♀. *Local*
distinctus (Müller) (= *inquinatus* Fabricius)
- 18 (11) Elytra yellow, or yellowish-brown, sometimes darker on the disc; the sutural margin always dark brown.....19
 Elytra reddish-brown or black; yellow only in immature examples where the sutural edge is not dark.....24
- 19 (18) Elytra uniform yellow except for the dark suture; interval 2 and the base of the elytra not paler than the remainder; without pubescence on the apical half of the elytra.....20
 Elytra with base and greater part of interval 2 yellow, paler than the remainder of the elytra; sometimes with the disc of the elytra only vaguely darkened, but in all cases the base is paler than the disc (fig. 35); ♂ and sometimes ♀ with obvious pale pubescence on the apical half of the elytra.....22
- 20 (19) Clypeus reddish or reddish-yellow at the sides, the frons darker; frontoclypeal suture distinct, tuberculate; palpi pale yellowish-brown.....21
 Clypeus black, frons black; frontoclypeal suture indistinct and not tuberculate; palpi dark brown; length 3.5-5.5 mm. ♂ with spur of the anterior tibia stronger and more curved, and the disc of the pronotum more densely punctured than in ♀. *Common*.....**merdarius** (Fabricius)



FIGS. 36-37.—*A. porcus* (Fabricius): (36) head, pronotum and elytra; (37) enlarged section of elytral intervals 1-4 to show sculpture.

FIG. 38.—*A. subterraneus* (Linnaeus). Head, pronotum and elytra to show sculpture.



FIGS. 39-40.—*A. granarius* (Linnaeus): (39) head; (40) apex of right elytron.

FIG. 41.—*A. fimetarius* (Linnaeus). Head and pronotum.

FIG. 42.—*A. brevis* Erichson. Head.

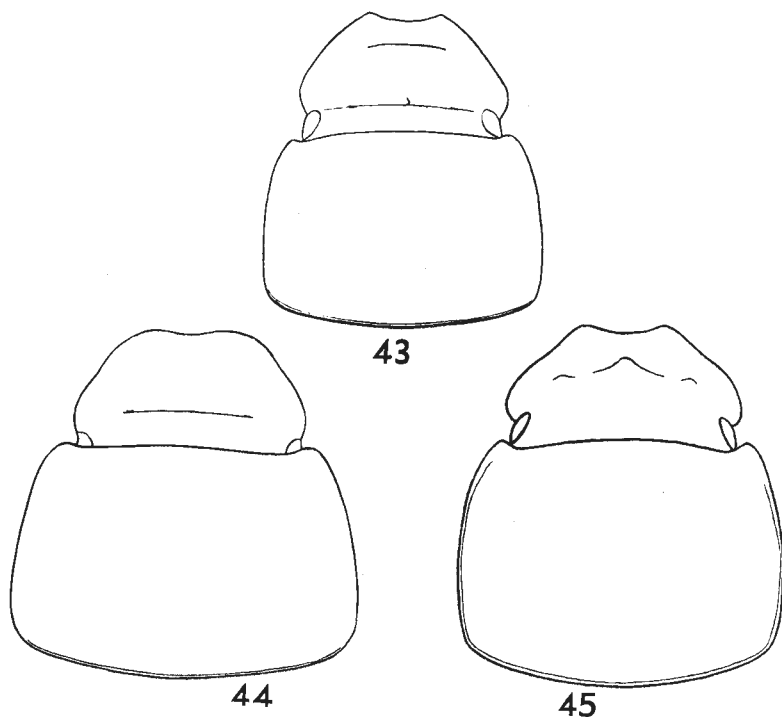
- 21 (20) Length 5.5-8 mm.; apices of the elytra dull, with strong reticulate microsculpture, faintly punctured. Median tubercle of head prominent in ♂, almost absent in ♀. *Local, rare in Scotland*.....*sordidus* (Fabricius)
Length 3.5-5.5 mm.; apices of elytra shining, without microsculpture but distinctly punctured. Median tubercle of head more prominent in ♂.
Local in southern England, absent from the north.

* *ictericus* (Laicharting), 1781
(= *nitidulus* Fabricius, 1792)

- 22 (19) Clypeus yellow at the sides; length 3·5–5·5 mm. ♂ with frontoclypeal suture indistinct but with 3 distinct tubercles on the posterior edge of the clypeus, the middle tubercle more obvious than the others; ♀ with frontoclypeal suture distinct, the tubercles almost completely obliterated. *South-east England. Rare*..... **consputus** Creutzer
Clypeus unicolorous, dark brown or black, or at most with the narrow reflexed margins dark red..... 23
- 23 (22) Posterior margin of pronotum dark brown or black; frontoclypeal suture absent; spur of anterior tibia in ♂ truncate at its apex; ♂ elytra hairy almost to the base; length 4–7 mm. ♂ with elytral pubescence longer than in the ♀. *Common*..... **prodromus** (Brahm)
Posterior margin of pronotum reddish-yellow; frontoclypeal suture distinct; spur of anterior tibia in ♂ tapered to a point; ♂ elytra not hairy on basal third; length 4–6 mm. ♂ with elytral pubescence longer than in ♀. *Common*
sphacelatus (Panzer), 1798 (= *punctatosulcatus* Sturm, 1805)
- 24 (18) Pronotum with punctures all similar in size and fairly uniformly distributed, each puncture separated from its nearest neighbour by its own width or less; elytral striae at least half as wide as the adjacent intervals; elytral intervals concave, each sharply defined by a fine ridge on each side (fig. 36, 37); intervals obscurely punctured and dull; length 4–6 mm. ♂ with middle tubercle on the head more prominent than the lateral tubercles; tubercles equal in ♀. *Local*..... **porcus** (Fabricius)
Pronotum with punctures of two distinct sizes and often sparse or irregularly distributed (e.g. fig. 41); elytral striae normal, much less than half as wide as the adjacent intervals; intervals flat or convex and not defined by ridges; intervals smooth and shining, at least near the base..... 25
- 25 (24) Pronotum, especially towards the lateral edges, with punctures of two distinct sizes, the larger punctures being five to ten times as broad as the smaller punctures which are very fine (e.g. fig. 41); the larger punctures very sparse or absent from the anterior part of the pronotum..... 26
Pronotum, especially towards the lateral edges, with punctures of two distinct sizes, the larger punctures being two to three times as broad as the smaller punctures; the large punctures fairly uniformly distributed, not more sparse in front than behind..... 28
- 26 (25) Length 3–5 mm.; elytra not more than 2·5 mm. wide; posterior edge of the pronotum smooth; the raised margin of the apex of the elytra wider than the second stria near its apex (fig. 40); shining black, elytra sometimes reddish-brown. ♂ with 3 tubercles on the head, the median tubercle most prominent (fig. 39). *In decaying vegetable matter and dung of all kinds; a cosmopolitan species. Common*..... **granarius** (Linnaeus)
Length 5–9 mm.; elytra more than 2·7 mm. wide; posterior edge of the pronotum slightly crenulate near the posterior angles; the raised margin of the apex of the elytra narrower than the second stria near its apex; head and pronotum black, elytra reddish-brown..... 27
- 27 (26) Abdomen black or brown; pronotum more transverse (fig. 41); raised lateral borders of the pronotum not continued around the anterior angles; ♂ pronotum with an anterior median depression; length 5–8 mm. ♂ with 3 prominent tubercles at the base of the clypeus; ♀ with median tubercles less prominent and lateral tubercles obliterated. *Common*
fimetarius (Linnaeus), 1758
(= *vaccinarius* (Herbst), 1789. = *foetens* (Fabricius), 1787)
Abdomen pale reddish-yellow; pronotum less transverse; raised lateral borders of the pronotum continued around the anterior angles on to the anterior margin; ♂ pronotum without an anterior median depression; length 6–9 mm. (Sex differentiation as in *A. fimetarius*.) *Local*
aestivalis Stephens, 1839
(= *foetens* Stephens, 1830 not *foetens* Fabricius, 1787)
- 28 (25) Basal segment of the posterior tarsus equal in length to the next three segments together 29
Basal segment of the posterior tarsus shorter than the next three segments together (ratio less than 4 : 5)..... 32

- 29 (28) Surface of the elytra close to the apex (in the inner apical angle) dull, with very strong reticulate microsculpture; the elytral striae near their apices shining in contrast to the dull intervals.....30
 Surface of the elytra close to the apex (in the inner apical angle) shining, without microsculpture; the elytral striae not more obviously shining than the intervals.....31
- 30 (29) Mesosternum between the middle coxae with a fine, sharp, median longitudinal carina; shoulders of elytra with very strong reticulate microsculpture similar to that elsewhere on the elytra; elytra not paler at shoulders and with no trace of a paler spot on the apical half; length 4-6 mm. ♂ with middle tubercle of head more prominent than the lateral tubercles; clypeus with a transverse curved ridge near the middle, fig. 44. *Common*
ater Degeer
 Mesosternum between the middle coxae without a median carina, but with a smooth shining convex continuation of the borders of the coxal cavities; elytra paler at the shoulders and with a vague paler spot on intervals 2-4 in the apical half; length 3.5-5.0 mm. ♂ with middle tubercle of head more prominent. *Local*..... *borealis* Gyllenhal
 (= *putridus* Sturm, 1805, not *putridus* Fourcay, 1785 nor *putridus* Herbst, 1789.)
- 31 (29) Elytra bright reddish-brown, often with a vaguely defined darker patch on each; clypeus without a transverse ridge and with anterior angles broadly rounded; length 3.5-4.5 mm. *Local*..... *tenellus* Say, 1823
 (= *putridus* Herbst, 1789 not *putridus* Fourcay, 1785; = *foetidus* Fabricius, 1792, not *foetidus* Herbst, 1783.)
 Elytra black or very dark brown; clypeus with a transverse ridge near the middle; anterior angles usually obtusely pointed (fig. 43); length 4-5.5 mm. ♂ with tubercles at the base of the clypeus. *Rare; in deer droppings; Scotland*..... *nemoralis* Erichson
- 32 (28) Elytra dark brown or black, with a faint reddish spot on the apical half of the fourth interval; scutellum parallel sided towards the base (fig. 45); elytral striae usually separate at their apical ends; length 3.5-4.5 mm. ♂ with posterior tibiae expanded in the apical half into a curved blade, fringed on the lower edge with long hairs; ♀ posterior tibia normal. *Local; sandy places in the south of England*..... *coenosus* Panzer (= *tristis* Zenker)
 Elytra reddish-brown to black, without a reddish spot on the apical half of the fourth interval; scutellum triangular (e.g. fig. 47); at least one pair of the elytral striae 3-8 fused at their apices.....33
- 33 (32) Length 3.0-4.5 mm. Head and pronotum black, elytra dark reddish-brown becoming paler towards the apex; ♂ with metasternum depressed. *Local*
pusillus Herbst
 Length 5.0-7.0 mm.....34
- 34 (33) Ventral surface of thorax and abdomen light reddish-brown in colour; antenna all pale yellowish-brown, maxillary palpi also pale yellowish-brown. Head and margins of the pronotum reddish-brown; disc of pronotum dark brown; elytra yellowish-brown sometimes with middle of each elytron vaguely darkened. *Local*..... *rufescens* Fabricius, 1801
 (= *rufus* Moll, 1782, not *rufus* Degeer, 1778.)
 Ventral surface of the thorax and abdomen dark brown or black; club of antenna blackish, darker in colour than the basal segments; maxillary palpi dark brown. Head black with only the extreme margins slightly reddish; pronotum black with anterior margins slightly reddish; elytra dark reddish-brown; median tubercle of head more prominent in ♂. *A northern and mountain species; rare except in the Scottish Highlands; occurs in N. Europe but not in France; in sheep droppings*..... *lapponeus* Gyllenhal
- 35 (10) Scutellum long (e.g. fig. 38), more than one fifth as long as the elytra.....36
 Scutellum short (e.g. fig. 36), about one-tenth as long as the elytra.....39
- 36 (35) Elytra yellowish-brown, with suture and base dark brown; scutellum, pronotum and head black; head and pronotum fairly uniformly punctured; length 6-9 mm. Clypeus with a tubercle, more obvious and sometimes bifid in ♂, in middle of the posterior edge. *Common*..... *erraticus* (Linnaeus)
 Elytra all black, or black with shoulders and apices red; scutellum, pronotum and head black; puncturation of head and pronotum irregular and usually sparse.....37

- 37 (36) Elytra black with the apical third and the shoulders light reddish-brown ; posterior edge of clypeus with a slight indication of three tubercles ; length 3-5.5 mm. ♂ head with lateral angles more obvious. *Common in the south ; absent from Scotland ; in sheep droppings in dry pastures*
haemorrhoidalis (Linnaeus)
- Elytra all black ; posterior edge of clypeus bearing three strong tubercles ; length 6-12 mm. 38



FIGS. 43-45.—Outline of head and pronotum : (43) *Aphodius nemoralis* Erichson ; (44) *A. ater* Degeer ; (45) *A. lapponum* Gyllenhal.

- 38 (37) Length 9-12 mm. ; elytral intervals without defined borders ; striae narrow, only about one fourteenth of the width of the intervals ; pronotum with very sparse, coarse punctures towards the sides and anterior edge. ♂ head with median tubercle more prominent. *Common in the south*

fossor (Linnaeus)

Length 6-7.5 mm. (fig. 38) ; elytral intervals with narrow borders marked off from the middle part of the interval by fine grooves running parallel to the stria ; striae deep and broad, about one third as wide as the intervals ; striae dull in contrast to the shining intervals. ♂ pronotum with a small depression in the middle near the anterior edge ; ♂ head with three tubercles more prominent than in ♀. *Less common in the north and absent from Scotland* **subterraneus** (Linnaeus)

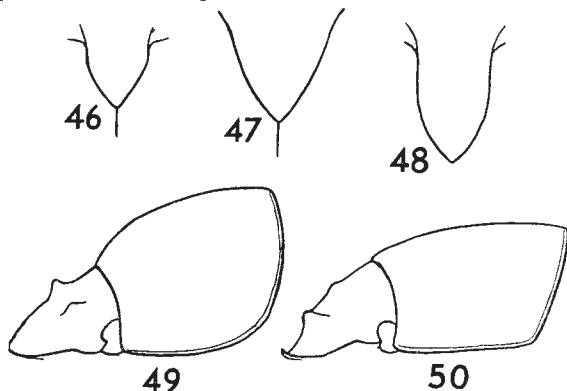
- 39 (35) Elytra black or dark brown with a reddish spot on the apical half of each elytron ; and usually with another near each shoulder ; scutellum parallel sided towards the base (e.g. fig. 46) 40
- Elytra black, reddish or yellow ; if dark, without reddish spots. 41

- 40 (39) Length 3·3–5 mm.; spots on shoulders and apical halves of elytra bright reddish-yellow, the apical spot spreading on to three or more intervals. ♂ with a distinct swelling in the middle of the clypeus. *Rare, in dry places*

quadrimaculatus (Linnaeus)

Length 3·5–4·5 mm.; spots on shoulders and apical halves of elytra dark red and obscure, the apical spot limited to the fourth interval. ♂ with posterior tibiae expanded in the apical half into a curved blade, fringed on the lower edge with long hairs, ♀ posterior tibiae normal. *Local, sandy places in the south of England*.....

- 41 (39) The raised margin of the apex of the elytra about twice as wide as the second elytral *stria* near its apex (fig. 40).....**coenosus** Panzer (= *tristis* Zenker) 42
The raised margin of the apex of the elytra very fine, narrower than the second elytral *stria* near its apex.....43



FIGS. 46–48.—Scutellum: (46) *A. coenosus* Panzer; (47) *A. rufescens* Fabricius; (48) *A. plagiatus* (Linnaeus).

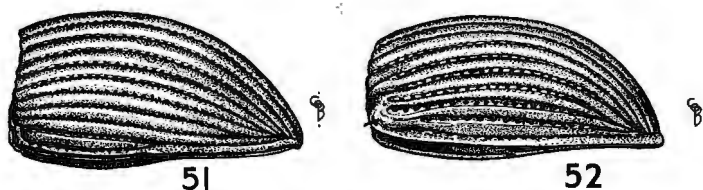
FIGS. 49–50.—Lateral view of head and pronotum: (49) *A. constans* Duftschmid; (50) *A. nemoralis* Erichson.

- 42 (41) Clypeus unpunctured, or at most with a few very fine punctures close to the frontoclypeal suture; antennal club yellow; all tibiae dark brown; edge of head in front of the eye more angulate (fig. 42); clypeus with a strong transverse ridge; length 3·5–4·5 mm. Black, shining. *Very local; abundant on sand dunes at Southport, Lancashire*.....**brevis** Erichson
Clypeus obviously punctured (fig. 39); antennal club dark brown; all tibiae reddish-brown; edge of head in front of the eye more rounded (fig. 39); clypeus in ♂ with a trace of a transverse ridge; length 3–5 mm. Black, shining; elytra sometimes reddish brown. *Common in the south, rarer in the north; in dung and decaying vegetable matter. This species is very widely distributed throughout the world*.....**granarius** (Linnaeus)
43 (41) Scutellum parallel sided or slightly constricted at the base (e.g. fig. 48); length always less than 5·5 mm.; head without tubercles.....44
Scutellum approximately triangular, not constricted at the base; length often more than 5·5 mm.; head usually with three tubercles on the frontoclypeal suture.....45
44 (4, 43) Black, with a slight metallic (brassy) reflection, sometimes with an obvious bright red patch on each elytron; elytral striae 3 and 4, or 4 and 5 united at their apices; posterior tarsus with basal segment equal in length to the next two segments together; length 3–4 mm. ♂ with metasternum depressed, more densely punctured and pubescent. *Local, damp sandy soil near the coast*.....**plagiatus** (Linnaeus)
Black, without metallic reflection and never with a red patch on the elytra; elytral striae 3, 4 and 5 free at their apices; posterior tarsus with basal segment equal in length to the next three segments together; length 4–5 mm. ♂ characters as in *A. plagiatus*. *Very local; New Forest and Herefordshire, in mud at edge of ponds frequented by cattle and horses*
niger (Panzer)

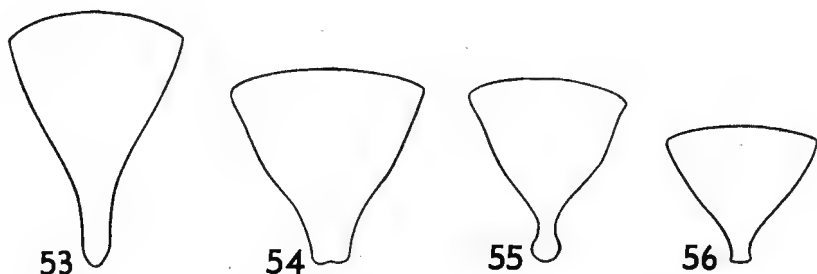
- 45 (43) Elytra with the anterior inner halves yellow and the outer, posterior halves brownish, or all yellow; sutural edges of the elytra dark brown, head black, with reflexed anterior margin of pronotum dark reddish; pronotum and scutellum black; length 5-8 mm. ♂ pronotum with a slight depression in the middle near the anterior edge; middle tubercle of head more prominent in ♂. *Common*.....**scybalarius** (Fabricius)
Elytra black, dark brown or reddish-brown, sometimes with reddish spots..46
- 46 (45) Clypeus with three tubercles on the fronto-clypeal suture, or with a transverse ridge near the middle, or with both tubercles and ridge.....47
Clypeus without tubercles or transverse ridge; length 3.5-4.5 mm. ♂ with posterior tibiae expanded in the apical half into a curved blade, fringed on the lower side with long hairs; ♀ posterior tibiae normal. *Local; sandy places in the south of England*.....**coenosus** Panzer (= *tristis* Zenker)
- 47 (46) Elytral striae almost as wide as the adjacent intervals (fig. 36); each interval bordered on each side by a ridge (fig. 37); the surface of the intervals between the ridges depressed, vaguely punctured and dull, with strong microsculpture; elytral intervals bearing minute setae on the apical third; length 5-6 mm.; head, pronotum and scutellum black, elytra reddish-brown. ♂ with the median tubercle of the clypeus more prominent than the lateral tubercles, and the puncturation of the disc of the pronotum less dense than in the ♀. *Local*.....**poreus** (Fabricius)
Elytral striae only one-seventh as wide as the adjacent intervals; intervals not limited by ridges and with surfaces very finely and sparsely punctured but with or without microsculpture; elytral intervals without setae on the apical third48
- 48 (47) Mesosternum with a fine median longitudinal ridge between the middle coxae; elytral intervals with strong reticulate microsculpture, making the intervals rather dull in contrast to the shining striae; length 4-6 mm. Head and pronotum black; elytra dark reddish-brown to black; outline of head and thorax fig. 44; ♂ with median tubercle at the base of the clypeus stronger than in ♀, and with a short transversal ridge on middle of the clypeus. *Common*.....**ater** Degeer
Mesosternum without a median longitudinal ridge between the middle coxae; elytral intervals with faint microsculpture, shining like the striae.....49
- 49 (48) Clypeus with a short transverse ridge near the middle.....50
Clypeus without a transverse ridge; outline of head and pronotum fig. 45; length 4-6 mm. Colour as in *A. ater*; median tubercle at base of clypeus more prominent in ♂. *A northern and mountain species; rare except in the Scottish Highlands; occurs in N. Europe; not in France*
lapponum Gyllenhal
- 50 (49) Posterior angles of the pronotum (viewed from the side) broadly rounded (fig. 49); anterior angles of the clypeus broadly rounded; length 5-6 mm. Head, pronotum and scutellum black; elytra dark reddish-brown; tubercles on head stronger in ♂ than in ♀. *Local*.....**constans** Duftschmid
Posterior angles of the pronotum (viewed from the side) sharply rounded (fig. 50); anterior angles of the pronotum usually obtusely pointed; length 4-5.5 mm. ♂ with tubercles at the base of the clypeus. *Rare; in deer droppings; Scotland*.....**nemoralis** Erichson

Genus *Psammobius* Heer.

- Elytra with the tenth interval short, not extending into the apical half of the elytra (fig. 51). Outer face of the posterior tibia with five teeth; length 3.3-4.3 mm. Very convex, brownish-black, head coarsely granulate. *Very rare; in dry sandy places on the coast, under stones and in vegetable debris; Whitesand Bay, Cornwall; Devonport; Pyle, Glamorganshire; biology unknown*.....**porceicollis** (Illiger)
Elytra with the tenth interval extending almost to the apex (fig. 52); outer face of the posterior tibia with six to eight teeth; length 2.6-4.0 mm. Very convex; brownish-black; head coarsely granulate. *Local; sandy places on the coast; biology unknown*.....**sulcicollis** (Illiger)

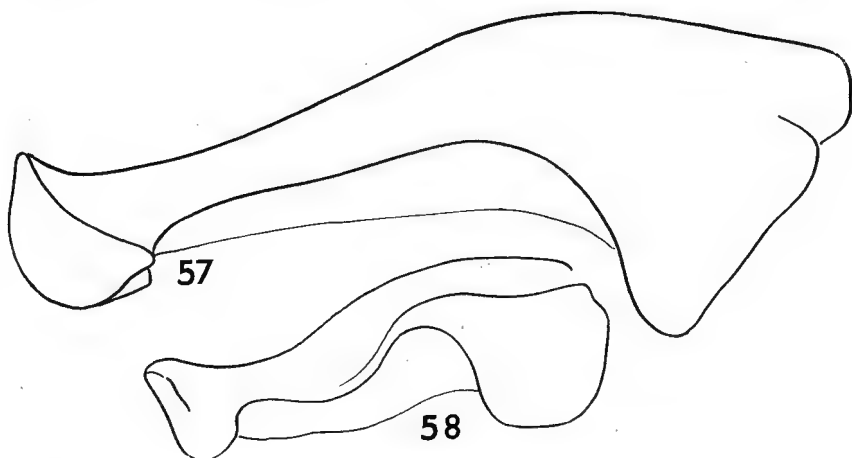


FIGS. 51-52.—Lateral view of elytra: (51) *Psammobius porcicollis* (Illiger); (52) *P. sulcicollis* (Illiger).



FIGS. 53-56.—Outline of pygidium: (53) *Melolontha melolontha* (Linnaeus), ♂; (54) the same, ♀; (55) *M. hippocastani* Fabricius, ♂; (56), the same, ♀.

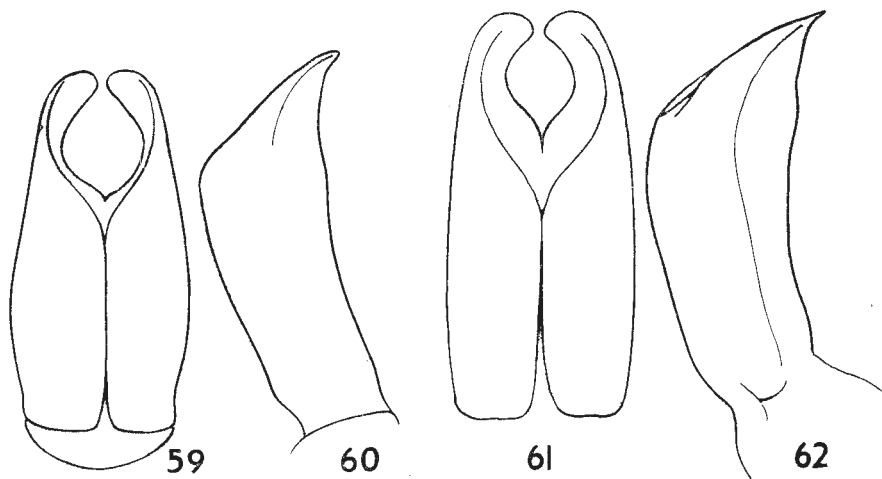
FIGS. 57-58.—Aedeagus, lateral view: (57) *M. melolontha*; (58) *M. hippocastani*.



Genus *Melolontha* Fabricius.

Pygidium (figs. 53, 54) elongate in both sexes, narrowest at the apex ; aedeagus fig. 57 ; antenna in ♂ without an anteriorly directed angle at the apex of the third segment ; setae on the elytra narrower ; setae on pygidium less dense ; length 20–30 mm. ; lamellae of ♂ antenna ca. 3·5 mm. long ; of ♀, ca. 1·5 mm. long. *Occasionally very abundant ; Midlands and South of England ; less common in Scotland ; adults lie in pupal cells over winter and appear in May and June ; ♂ flies to light ; larvae feed on roots of grass and trees. "The Cockchafer"..... melolontha* (Linnaeus)

Pygidium (figs. 55, 56) shorter in both sexes and constricted (narrowest before the apex) ; aedeagus fig. 58 ; antenna in ♂ with an anteriorly directed angle at the apex of the third segment ; setae on the elytra broader ; setae on pygidium more dense. Length 22–27 mm. Lamellae of ♂ antenna ca. 4 mm. long ; of ♀, ca 1·5 mm. long. *Local in Scotland, rare in North of England ; absent from south of England.....hippocastani* (Fabricius)



FIGS. 59–62.—Aedeagus : (59) *Amphimallon ochraceus* (Knoch), dorsal view ; (60) the same, lateral view ; (61) *A. solstitialis* (Linnaeus), dorsal view ; (62) the same, lateral view.

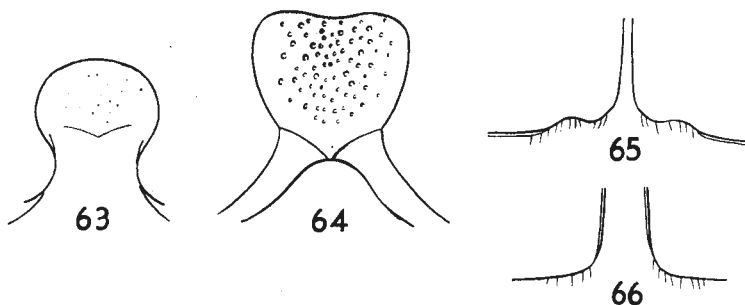
Genus *Amphimallon* Berthold, 1827.

(*Amphimallus* Mulsant, 1840 ; *Rhizotrogus* of British authors.)

Apical half of elytra, and the pygidium bearing hairs which are considerably shorter than those on the pronotum ; aedeagus as in figs. 59, 60 ; elytra reddish-brown ; length 14–17 mm. ♂ lamellae of antennal club ca. 1·5 mm. long, segments 2, 3, 4 of antenna each longer than wide ; ♀ antennal club ca 1·2 mm. long, segments 2, 3, 4 of antenna at least as wide as long. *Very rare ; England (Berkshire, N. Cornwall), Wales (Holyhead, Tenby)*

ochraceus (Knoch)

Apical half of elytra, and the pygidium bearing hairs as long as those on the pronotum ; aedeagus as in figs. 61, 62 ; elytra usually pale yellowish-brown ; length 15–20 mm. ♂ antennal club ca 2 mm. long ; ♀ antennal club ca. 1 mm. long. *Local, but often very numerous. Wales and southern half of England. Adults fly at dusk ; larvae feed on roots. Adults vi, vii "The Summer Chafer".....solstitialis* (Linnaeus)



FIGS. 63-64.—Mesosternal process: (63) *Cetonia aurata* (Linnaeus); (64) *C. cuprea* Fabricius.

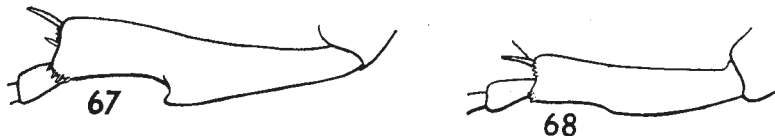
FIGS. 65-66.—Inner apical angles of the elytra: (65) *C. aurata*; (66) *C. cuprea*.

Genus *Cetonia* Fabricius.

The forwardly-projecting process of the mesosternum globular at the apex, very faintly punctured and with a very faint transverse suture (fig. 63); apical edges of the elytra obviously sinuate close to the inner angle (fig. 65); posterior tibia with a strong tooth near the middle of the outer side; body surface bright metallic green with a few transverse white marks; surface sometimes reddish; length 14-21 mm. ♂ terminal ventrite of abdomen with an area of transverse strigae on each side and the abdomen depressed along the mid-longitudinal line; ♀ terminal segment with the area of transverse strigae continuous across the middle and abdomen not depressed in the middle. *Locally common in the south of England, rare in the north. Adults v. vi. Larvae in rotting vegetation, e.g. compost heaps. "The Rose Chafer" aurata* (Linnaeus)

The forwardly-projecting process of the mesosternum broader and truncate at the apex; with obvious punctures and transverse suture (fig. 64); apical edges of the elytra scarcely sinuate near the inner angles (fig. 66); posterior tibia with a step-like ridge near the middle of the outer side; body surface dull golden-green, with a few transverse white marks; length 16-22 mm. Terminal ventrite of abdomen with puncturation sparse in the middle in ♂, continuous across middle in ♀. *Local in Scotland and the north of England; absent from south of England. Larvae in lower parts of nests of the Wood Ant (Formica rufa), sometimes in deserted nests. .cuprea* Fabricius

Note.—A very variable species, of which many aberrations, variations and subspecies have been described. The form which occurs in Britain has white marks on the elytra and has been separated as subspecies *metallica* Herbst (= *floricola* Herbst), but it occurs throughout Europe, as does the typical form. It has not yet been demonstrated that this form is in fact a subspecies.



FIGS. 67-68.—Anterior face of the middle tibia: (67) *Trichius fasciatus* (Linnaeus); (68) *T. zonatus* Germar.

Genus *Trichius* Fabricius.

Tibiae of middle legs with a strong tooth on the outer edge, the tooth forming the termination of an oblique setose ridge (fig. 67); length 12-16 mm.

♂ with basal segment of the anterior tarsi expanded on the outer side, and the apical spur only half as long as the basal segment of the tarsus; basal segment of the anterior tarsus slender in ♀ and the spur as long or longer than this segment. *Local in Scotland, rare in Wales (Glam., Mon., Brecon., Merioneth.—Llanbedr Valley), apparently absent from England; adults found on flowers, vi-vii; larvae in rotting wood. . . . fasciatus (Linnaeus)*

Tibiae of middle legs without a tooth or at most with a low obtuse and rounded angle on the outer edge (fig. 68); length 12-15 mm. ♂ and ♀ characters as in *fasciatus*; ♂ also with a white patch on each side of middle of the penultimate ventrite. *Very rare and doubtfully British; specimens have been taken at Tisbury and Reading. zonatus Germar, 1794 (= abdominalis Ménétériés, 1832)*

Genus *Gnorimus* Serville.

Lateral edges of the pronotum very slightly sinuate just behind the middle; body black, elytra with small white spots; length 17-22 mm. ♂ with four basal segments of the anterior tarsi each with a brush of yellow hairs beneath; middle tibiae in ♂ strongly curved in the basal half. *Rare; Windsor Forest; adults at flowers, larvae in wood mould in the forks of old oaks variabilis (Linnaeus, 1758) (= octopunctatus Fabricius, 1775)*

Lateral edges of the pronotum not sinuate; body metallic green or coppery, elytra with small white spots; length 15-20 mm. Sexual characters as in *variabilis*. *Rare; south of England; adults at flowers, larvae in wood mould in hollow trunks of decayed fruit trees. nobilis (Linnaeus)*

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