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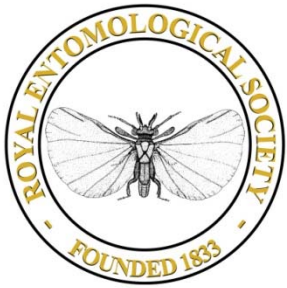

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Handbooks for the Identification of British Insects
Vol. VI, Part 3(b)

SCOLIOIDEA, VESPOIDEA AND SPHECOIDEA

HYMENOPTERA, ACULEATA

O. W. Richards

ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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Identification of British Insects

Vol. VI, Part 3(b)

Editor: M. G. Fitton

SCOLIOIDEA, VESPOIDEA AND SPHECOIDEA

HYMENOPTERA, ACULEATA

By

O. W. Richards

89 St Stephens Road
London W13 8JA

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ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

The aim of the *Handbooks* is to provide illustrated identification keys to the insects of Britain, together with concise morphological, biological and distributional information. The series also includes a *Check list of British insects.*

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Introduction

The following account deals with three superfamilies, Scolioidea, Vespoidea and Sphecoidea, of the British Hymenoptera, Aculeata. There has been no complete work on these groups since Saunders (1896). It will be found that the *Handbook* introducing the Hymenoptera (Richards, 1956; revised edition 1977) defines most of the terms used; any others are illustrated or defined in the present work. The distribution of the species is given only in broad outline since our knowledge is certainly incomplete. Subspecies are not mentioned when (as in all but one relevant example) only the nominotypical subspecies occurs in Britain. Similarly, subgenera are not indicated when only the typical one is British. In most aculeates, the male has 13 antennal segments and the female 12 (many exceptions in the Formicidae and in the Sphecidae: Crabroninae); the male normally has 7 visible gastral tergites and the female 6.

The illustrations of whole insects were drawn by Mr A. J. Hopkins, the remainder by myself. Reference is also made to a few figures of whole insects in Richards (1977).

General biology

The aculeate Hymenoptera have a special interest because of their often elaborate nesting behaviour and the stages which exist between the simplest type and the most elaborate, culminating in full sociality. Even where these stages are not the actual steps which were followed in evolution they at least show the sort of changes which must have occurred in that process.

The simplest type of behaviour is probably seen in *Tiphia* which hunts scarabaeoid larvae (Coleoptera) in their subterranean burrows. When found the grub is stung and an egg (or in some species more than one) is laid on it but no nest is made. The female also often kneads ("malaxates") the ventral surface of the prey's abdomen with her mandibles. In the next stage, in the non-British Scoliidae, the parasitised larva is dragged deeper into the soil and placed in a cell excavated by the wasp. Another simple type of behaviour is seen in some Pompilidae. A spider is caught and stung to paralysis, then carried to a suitable spot and hung on a grass stem while the wasp makes a small burrow enlarged at one end into a cell. The spider is taken in and an egg laid on it and the nest closed. This behaviour may be repeated so that each nest has only one cell, but in Sphecidae the first cell is made before the first prey is caught. Also the original burrow may lead to more than one cell. The first cell is closed when prey and egg are ready and a new cell then receives the same treatment. In these conditions not only the cell entrance but the entrance to the burrow may be closed either on every occasion when the wasp leaves or only when all the cells are complete. With this type of behaviour the egg is normally laid on the last prey brought in and this is "mass provisioning". But if the egg is laid on the first prey brought in it may hatch before the wasp has completed the next cell. This gives the wasp the opportunity to make contact with its own larva and this, in turn, may lead to "progressive provisioning" where the wasp brings its larva food as it is required. In the extreme development, as shown by Baerends (1941) in *Ammophila pubescens* (cited as *campestris),* the wasp may tend three nests at different stages simultaneously. She enters each nest every day to see what its needs are. Some species of *Ammophila* are also exceptional in being "tool-users"; they hold a small stone in their mouth and use it to tamp down the soil when closing the nest. In some species of *Bembix* (non-British, but the genus occurs in Jersey), the egg is laid in an empty cell and prey is not brought until it hatches. Many sphecoids are gregarious, building their nests near to one another. Some, such as our *Ectemnius cephalotes,* sometimes share a common burrow in rotten wood though presumably each female has her own nest-burrow out of the communal burrow. Finally, at least one South American wasp of the genus *Microstigmus* has become social. The nests are made of plant wool and hang from leaves or rocks. There may be up to 18 wasps of both sexes in one nest. Though there are no visible castes, dissection showed that one female had much better developed ovaries than the others and probably did all or most of the egg-laying. Other species of the same genus may practice either mass or progressive provisioning.

Some of the steps in the elaboration of nesting behaviour which have been described in the scolioids, pompiloids and sphecoids may also be found in the Eumenidae.

Prey-specificity in such groups as the Eumenidae and Sphecidae is of great interest. On the whole the type of prey is characteristic of each genus though the larger and more diverse genera may show more variation. We find that all the many species of *Trypoxylon* all over the world seem to prey on spiders; all *Ammophila* take caterpillars or rarely sawfly larvae; all *Pemphredon* and *Passaloecus* take aphids. On the other hand species of *Tachysphex* take a variety of orthopteroids—acridids, blattids or mantids. *Bembix* is unusual in generally taking flies but in

Australia (according to Evans and Matthews) taking also Zygoptera (damsel-flies) and Hymenoptera; one species sometimes takes more than one kind of prey. One British species, *Lindenius albilabris* takes both mirid bugs and chloropid flies, sometimes both in one nest. It has always puzzled entomologists how the wasps recognise their specific prey which, as Fabre pointed out in the case of *Cerceris buprestícida* which stings Buprestidae of several genera which may often look superficially very different.

Social life demands that the female lives long enough to make substantial contact with her offspring. Doubtless once there were a few workers to feed the queen she could easily live longer and even overlap several generations. A much more difficult step in the evolution of social life is the demand that some females should become sterile and only one or a few females lay eggs. On the face of it there would be a strong selection in favour of each female laying eggs since the genes of those that did not might not be represented in later generations. However, the haploid-diploid process of sex-determination in the Hymenoptera with the absence of a reduction division in the male spermatogenesis means that all males derived from one queen are genetically identical. Thus the female offspring of a queen which has only mated once will tend to resemble one another in three-quarters of their genes while if workers laid eggs their offspring would resemble them in only half their genes. On the assumption made by W. D. Hamilton that the interest of the females would be most strongly directed to those offspring which were genetically most similar to them, a possible way can be seen for the evolution of social behaviour. The workers would be more interested in rearing their mothers offspring than their own and selection could favour self-sterilization. There are still difficulties in explaining the evolution of the many queened colonies of tropical wasps but these might be partly overcome if, as seems to be the case, there is often much brother-sister mating within the colony. It may perhaps also be noted that what is called a "solitary" wasp differs only from a "social" bird in that the female wasp does not normally put the food directly into the mouth of her offspring.

Larvae

The larvae of the Vespoidea (principally the American ones) were given a preliminary review in Richards (1978a) and a more detailed account is in preparation. The larvae of the Sphecidae have been reviewed by Evans (1956-59; 1964) and many have been figured by Lomholdt (1975-6). There seems to be no general review of the larvae of the Scolioidea.

The larvae of the Vespoidea have a slit-like opening to the spinneret, the maxilla has two papillae and the mandibles are tridentate in lower forms but bi- or unidentate in higher ones. There is normally a more or less distinct antennal papilla (as in the Chrysididae and Pompilidae). The larvae of the Apoidea also have a slit-like opening to the spinneret but the maxilla has only one papilla and the mandibles are bi- or unidentate.

The larvae of the Sphecoidea are more diverse. The mandibles usually have more than two teeth and the maxilla has two papillae. The Sphecinae have a slit-like opening but all the others have two separate openings to the spinneret. An antennal papilla is found in the Astatinae, Nyssoninae, Pemphredoninae and Philanthinae but not in the other subfamilies. While maintaining the Mellininae, Evans, on larval characters, would unite the Crabroninae, Larrinae, Oxybelinae and Trypoxylinae. Under this arrangement it would be difficult to define the adults of an enlarged

Larrinae and as usual when the evidence is conflicting, a compromise will be necessary and incline myself on grounds of convenience to give greater weight to the adult characters.

Phylogeny

While one can see the sort of changes which must have occurred in the evolution of behaviour (Evans, 1966; Iwata, 1976), it is much harder to give a realistic account of how the various groups of Hymenoptera are related to one another (see fig. 14 in Evans & Eberhard, 1973). The Chrysidoidea (including the bethylids) are probably the most primitive stock of the aculeates though they also show many specialisations. The Tiphiidae in the scolioids are a diverse stock which seems at an earlier stage to have given rise to the higher groups. Primitive ants are very like scolioids and might well form part of that superfamily instead of a separate one. Somewhere about this level the Vespoidea must also have arisen. The Sphecoidea and the Apoidea are clearly allied, the Sphecoidea being somewhat less specialised, with the pompiloids probably springing from the bottom of the stock.

A somewhat different account of the phylogeny of these groups is given by Brothers (1975). In view of the structure of the thorax and propodeum, he would put the scolioids, pompiloids and vespoids into one superfamily and the sphecoids and apoids into another. In a sense, however, this proposal leaves one much as before because one still has to discuss the evolution which occurred within the greatly enlarged Vespoidea.

Check list and nomenclatural notes

The following check list corrects and updates that in the revised *Kloet & Hincks* (Richards, 1978b). A total of 153 species in 47 genera are included here.

SCOLIOIDEA

SAPYGIDAE

SAPYGA Latreille, 1796
clavicornis (Linnaeus, 1758)
quinquepunctata (Fabricius, 1781)

TIPHIIDAE

TIPHIINAE
TIPHIA Fabricius, 1775
femorata Fabricius, 1775
minuta Vander Linden, 1827

METHOCHINAE
METHOCHA Latreille, 1804
ichneumonides Latreille, 1804

MYRMOSINAE
MYRMOSA Latreille, 1796
atra Panzer, 1801
melanocephala (Fabricius, 1793) preocc
s. *atra* s. str.
s. *erythrocephala* Yarrow, 1954

MUTILLIDAE

MUTILLINAE
MUTILLA Linnaeus, 1758
europaea Linnaeus, 1758

SMICROMYRME Thomson, 1870
rufipes (Fabricius, 1787)

VESPOIDEA

EUMENIDAE
EUMENES Latreille, 1802
coarctatus (Linnaeus, 1758)

EUODYNERUS Dalla Torre, 1904
S: PAREUODYNERUS Blüthgen, 1938
quadrifasciatus (Fabricius, 1793)
tomentosus (Thomson, 1870)

PSEUDEPIPONA Saussure, 1856
herrichii (Saussure, 1856)
variegata misident.
basalis (Smith, F., 1857)

ODYNERUS Latreille, 1802
S. ODYNERUS s. str.
melanocephalus (Gmelin in Linnaeus, 1790)
spinipes (Linnaeus, 1758)

S. SPINICOXA Blüthgen, 1938
reniformis (Gmelin in Linnaeus, 1790)
simillimus Morawitz, F., 1867

GYMNOMERUS Blüthgen, 1938
laevipes (Shuckard, 1837)

MICRODYNERUS Thomson, 1874
exilis (Herrich-Schäffer, 1839)

ANCISTROCERUS Wesmael, 1836
antilope (Panzer, 1798)
gazella (Panzer, 1798)
nigricornis (Curtis, 1826)
callosus (Thomson, 1870)
oviventris (Wesmael, 1836)
s. *hibernicus* Blüthgen, 1937
parietinus (Linnaeus, 1761)
parietum (Linnaeus, 1758)
quadratus (Panzer, 1799)
claripennis (Thomson, 1874)
scoticus (Curtis, 1826)
trimarginatus misident.
albotricinctus (Zetterstedt, 1838)
trifasciatus (Müller, 1776)
trimarginatus (Zetterstedt, 1838)

SYMMORPHUS Wesmael, 1836
connexus (Curtis, 1826)
bifasciatus misident.
crassicornis (Panzer, 1798)
gracilis (Brullé, 1832)
mutinensis (Baldini, 1894)
sinuatus (Fabricius, 1793) preocc.
sinuatissimus Richards, 1935

VESPIDAE

POLISTINAE
POLISTES Latreille, 1802
dominulus (Christ, 1791)
gallicus misident.

VESPINAE
VESPA Linnaeus, 1758
crabro Linnaeus, 1758
s. *gribodoi* Bequaert, 1931

DOLICHOVESPULA Rohwer, 1916
S. PSEUDOVESPULA Bischoff, 1931
BOREOVESPULA Blüthgen, 1943
METAVESPULA Blüthgen, 1943
norwegica (Fabricius, 1781)
sylvestris (Scopoli, 1763)

VESPULA Thomson, 1869
S. VESPULA s. str.
ALLOVESPULA Blüthgen, 1943
austriaca (Panzer, 1799)
rufa (Linnaeus, 1758)
S. PARAVESPULA Blüthgen, 1938
germanica (Fabricius, 1793)
vulgaris (Linnaeus, 1758)

SPHECOIDEA

SPHECIDAE

ASTATINAE
ASTATA Latreille, 1796
S. ASTATA s. str.
boops (Schrank, 1781)

S. DRYUDELLA Spinola, 1843
pinguis (Dahlbom, 1832)
stigma misident.

DINETUS Panzer, 1806
pictus (Fabricius, 1793)

LARRINAE
TACHYSPHEX Kohl, 1883
pompiliformis (Panzer, 1803)
pectinipes misident.
obscuripennis (Schenck, 1857)
lativalvis (Thomson, 1870)
unicolor (Panzer, 1809)
nitidus misident.

MISCOPHUS Jurine, 1807
ater Lepeletier, 1845
maritimus Smith, F., 1858
concolor Dahlbom, 1844
bicolor: Smith, F., 1858 misident.

TRYPOXYLINAE
TRYPOXYLON Latreille, 1796
attenuatum Smith, F., 1851
clavicerum Lepeletier & Serville, 1828
figulus (Linnaeus, 1758)

CRABRONINAE
CRABRO Fabricius, 1775
cribrarius (Linnaeus, 1758)
peltarius (Schreber, 1784)
scutellatus (Scheven, 1781)

CROSSOCERUS Lepeletier & Brullé, 1835
S. CROSSOCERUS s. str.
distinguendus (Morawitz, A., 1866)
elongatulus (Vander Linden, 1829)
s. *proximus* (Shuckard, 1837)
exiguus (Vander Linden, 1829)
ovalis Lepeletier & Brullé, 1835

anxius (Wesmael, 1852)
palmipes (Linnaeus, 1767)
palmarius (Schreber, 1784)
pusillus Lepeletier & Brullé, 1835
varus Lepeletier & Brullé, 1835 preocc.
varius misspelling
tarsatus (Shuckard, 1837)
palmipes misident.
wesmaeli (Vander Linden, 1829)

S. BLEPHARIPUS Lepeletier & Brullé, 1835
COELOCRABRO Thomson, 1874
annulipes (Lepeletier & Brullé, 1835)
ambiguus (Dahlbom, 1842)
gonager (Lepeletier & Brullé, 1835)
capitosus (Shuckard, 1837)
cetratus (Shuckard, 1837)
leucostoma (Linnaeus, 1758)
carbonarius (Dahlbom, 1838)
megacephalus (Rossius, 1790)
leucostoma misident.
leucostomoides (Richards, 1935)
nigritus Lepeletier & Brullé, 1835
pubescens (Shuckard, 1837)
inermis (Thomson, 1870)
styrius (Kohl, 1892)
walkeri (Shuckard, 1837)
aphidum misident.

S. ABLEPHARIPUS Perkins, R. C. L., 1913
podagricus (Vander Linden, 1829)

S. HOPLOCRABRO Thomson, 1874
quadrimaculatus (Fabricius, 1793)

S. ACANTHOCRABRO Perkins, R. C. L., 1913
vagabundus (Panzer, 1798)

S. CUPHOPTERUS Morawitz, A., 1866
binotatus Lepeletier & Brullé, 1835
confusus (Schulz, 1906)
signatus misident.
dimidiatus (Fabricius, 1781)
serripes (Panzer, 1797)

ECTEMNIUS Dahlbom, 1845
S. ECTEMNIUS s. str.
borealis (Zetterstedt, 1838)
nigrinus (Herrich-Schäffer, 1841)
dives (Lepeletier & Brullé, 1835)

S. CLYTOCHRYSUS Morawitz, A., 1864
cavifrons (Thomson, 1870)
cephalotes: Saunders, 1896 misident.
lapidarius (Panzer, 1804)
chrysostomus (Lepeletier & Brullé, 1835)
ruficornis (Zetterstedt, 1838)
nigrifrons (Cresson, 1865)
planifrons (Thomson, 1870)
sexcinctus (Fabricius, 1775)
zonatus (Panzer, 1797)
saundersi (Perkins, R. C. L., 1899)
quadricinctus misident.

S. HYPOCRABRO Ashmead, 1899
continuus (Fabricius, 1804)
vagus misident.
rubicola (Dufour & Perris, 1840)
microstictus (Herrich-Schäffer, 1841)
larvatus (Wesmael, 1852)

S. METACRABRO Ashmead, 1899
cephalotes (Olivier, 1792)
quadricinctus misident.
interruptus misident.
lituratus (Panzer, 1804)

LESTICA Billberg, 1820
S. CLYPEOCRABRO Richards, 1935
clypeata (Schreber, 1759)

LINDENIUS Lepeletier & Brullé, 1835
TRACHELOSIMUS Morawitz, A., 1866
albilabris (Fabricius, 1793)
panzeri (Vander Linden, 1829)
pygmaeus (Rossius, 1794)
s. *armatus* (Vander Linden, 1829)

ENTOMOGNATHUS Dahlbom, 1844
brevis (Vander Linden, 1829)

RHOPALUM Stephens, 1829
EUPLILIS Risso, 1826 suppressed
S. RHOPALUM s. str.
clavipes (Linnaeus, 1758)

S. CORYNOPUS Lepeletier & Brullé, 1835
coarctatum (Scopoli, 1763)
tibiale (Fabricius, 1798)
gracile Wesmael, 1852
nigrinum Kiesenwetter, 1849 preocc.
kiesenwetteri (Morawitz, A., 1866)

OXYBELUS Latreille, 1796
argentatus Curtis, 1833
mucronatus misident.
mandibularis Dahlbom, 1845
sericatus Gerstäcker, 1867
uniglumis (Linnaeus, 1758)

PEMPHREDONINAE
PSEN Latreille, 1796
S. PSEN s. str.
ater (Olivier, 1792)

S. MIMUMESA Malloch, 1933
atratinus (Morawitz, F., 1891)

belgicus (Bondroit, 1931)
dahlbomi (Wesmael, 1852)
littoralis (Bondroit, 1933)
celtica (Spooner, 1948)
unicolor: Vander Linden, 1829 misident.
spooneri (Richards, 1948)
unicolor: Vander Linden, 1829 misident.

S. MIMESA Shuckard, 1837
bicolor Jurine, 1807
equestris misident.
rufa: Richards, 1937 ?misident.
bruxellensis (Bondroit, 1933)
equestris (Fabricius, 1804)
bicolor misident.
lutarius (Fabricius, 1804)
shuckardi (Wesmael, 1852)

PSENULUS Kohl, 1896
DIODONTUS: American authors, misident.
concolor (Dahlbom, 1843)
pallipes (Panzer, 1798)
atratus (Fabricius, 1804)
schencki (Tournier, 1889)

SPILOMENA Shuckard, 1838
beata Blüthgen, 1953
differens Blüthgen, 1953
enslini Blüthgen, 1953
troglodytes (Vander Linden, 1829)
vagans Blüthgen, 1953

STIGMUS Panzer, 1805
solskyi Morawitz, A., 1864

PEMPHREDON Latreille, 1796
S. PEMPHREDON s. str.
lugubris (Fabricius, 1793)

S. CEMONUS Panzer, 1806
enslini (Wagner, A. C. W., 1932)
inornata Say, 1824
shuckardi (Morawitz, A., 1864)
lethifer (Shuckard, 1837)
mortifer Valkeila in Valkeila & Leclercq, 1970
wesmaeli misident.
wesmaeli (Morawitz, A., 1864)
rugifer misident.
scoticus (Perkins, R. C. L., 1929)

S. CERATOPHORUS Shuckard, 1837
clypealis Thomson, 1870
morio Vander Linden, 1829
anthracinus (Smith, F., 1851)
carinatus Thomson, 1870

DIODONTUS Curtis, 1834
XYLOCELIA Rohwer, 1915
insidiosus Spooner, 1938
friesei misident.
luperus Shuckard, 1837
minutus (Fabricius, 1793)
tristis (Vander Linden, 1829)

PASSALOECUS Shuckard, 1837
clypealis Faester, 1947
corniger Shuckard, 1837
eremita Kohl, 1893
gracilis (Curtis, 1834)
insignis misident.
turionum misident.
insignis (Vander Linden, 1829)
roettgeni Verhoeff, C., 1890
monilicornis Dahlbom, 1842
singularis Dahlbom, 1844
gracilis misident.
tenuis Morawitz, A., 1864

SPHECINAE
AMMOPHILA Kirby, 1798
SPHEX misident.
pubescens Curtis, 1836
campestris misident.
sabulosa (Linnaeus, 1758)

PODALONIA Fernald, 1927
affinis (Kirby, 1798)
?lutaria (Fabricius, 1787)
hirsuta (Scopoli, 1763)
viatica misident.

MELLININAE
MELLINUS Fabricius, 1790
arvensis (Linnaeus, 1758)
vagus (Linnaeus, 1758)
crabroneus (Thunberg, 1791)
sabulosa (Fabricius, 1787) preocc.

NYSSONINAE
NYSSON Latreille, 1796
dimidiatus Jurine, 1807
interruptus (Fabricius, 1798)
spinosus (Forster, 1771)
trimaculatus (Rossius, 1790)

ALYSSON Panzer, 1806
S. DIDINEIS Wesmael, 1856
lunicornis (Fabricius, 1798)

GORYTES Latreille, 1804
S. GORYTES s. str.
HOPLISUS Lepeletier, 1832
laticinctus (Lepeletier, 1832)
quadrifasciatus (Fabricius, 1804)

S. LESTIPHORUS Lepeletier, 1832
bicinctus (Rossius, 1794)

S. DIENOPLUS Fox, 1894
HARPACTUS misident.
tumidus (Panzer, 1801)

ARGOGORYTES Ashmead, 1899
fargeii (Shuckard, 1837)
campestris misident.
mystaceus (Linnaeus, 1761)
campestris (Linnaeus, 1761)

PHILANTHINAE
CERCERIS Latreille, 1802
arenaria (Linnaeus, 1758)
quadricincta (Panzer, 1799)
quinquefasciata (Rossius, 1792)
interrupta: Saunders, 1896, misident.
ruficornis (Fabricius, 1793)
labiata (Fabricius, 1793)
cunicularia (Schrank, 1802)
rybyensis (Linnaeus, 1771)
ornata (Fabricius, 1790)
sabulosa (Panzer, 1799)
emarginata (Panzer, 1799)

PHILANTHUS Fabricius, 1790
triangulum (Fabricius, 1775)
ruspatrix (Linnaeus, 1767)

Lepeletier & Brullé (1835: 775) described a new species of European crabronine wasp as *Crossocerus varus.* The trivial name was emended to *varius* by Lepeletier (1845: 179). Panzer (1799: plate 17) described a German wasp as *Crabro varus.* This wasp, of which Panzer's plate is the type, has not been certainly recognised but a study of the illustration shows that it is almost certainly *Crossocerus (Hoplocrabro) quadrimaculatus* (Fabricius, 1793) ♀ . This means that Lepeletier & Brullé's name is preoccupied but Leclercq (1975: 2) has shown that the name *Crossocerus pusillus* Lepeletier & Brullé, 1835: 778 is available and should therefore be used.

Notes on the keys and figures

The keys are in the usual couplet form except in a few cases, where there are three sets of contrasting characters, forming a 'triplet'. Supplementary characters, given in one half of a couplet only, follow the contrasted characters and are enclosed in round brackets.

For each species there are brief details of biology (nest sites, prey, etc), distribution in Britain, abundance and months of occurrence of adults (indicated by Roman numerals).

Unfortunately, the figures were numbered and arranged in such a way that it was impossible to include them in correct numerical order in the text. Therefore, the plates of figures illustrating key characters are gathered together following the references; whilst the habitus figures of whole insects are included at the appropriate points in the text.

Superfamily Scolioidea

This large group includes five families, though some authors now also include the Formicidae (ants). The superfamily is not well represented in Britain and the large family Scoliidae whose larvae develop on scarabaeoid or less often curculionid beetle larvae is absent though it occurs in the Channel Islands. We have only 4 Tiphiidae, 2 Sapygidae and 2 Mutillidae.

Key to families and subfamilies

1 Second gastral tergite with lateral felt-lines (fig. 3). Female apterous, her thorax without any divisions; male winged (fig. 1) and without an anal lobe. Body usually well punctured, with conspicuous patches of pubescence..... Fam. **MUTILLIDAE** (p.16)
— Second gastral tergite without lateral felt-lines. Hind wings, when present, with an anal lobe. Body often smooth, shining and nearly bare 2

2 First and second gastral tergites not separated by a constriction, first and second sternites with only a feeble constriction between them. Mesosternum simple (fig. 4). Eyes with inner side emarginate. Female winged, fore wing with three submarginal cells, hind wing with anal lobe short ..... Fam. **SAPYGIDAE** (p.12)

— First and second gastral segments separated by a deep constriction, at least ventrally and/or the mesosternum (fig. 5) with two laminae which overlie or project between the bases of the mid coxae (fig. 6). Eyes not emarginate. Female often apterous. Fam. **TIPHIIDAE** (p.12) 3

3 Males and winged females *(Tiphia)* 4

— Apterous females 6

4 Hind coxa dorsally without an erect lamella near base. Tegula elongate (fig. 2), completely covering the axillary sclerites of the fore wing. Hind wing with an anal lobe nearly as long as or longer than cell M + Cu1. (Male with a spiniform process on last visible sternite. Fore wing with two submarginal cells, marginal open in female.) *(Tiphia)* ..... Subfam. **TIPHIINAE** (p.12)

— Hind coxa (fig. 7) dorsally with an erect lamella on inner edge near base. Tegula short oval. Hind wing with anal lobe much shorter than cell M + Cu1. (Males only.) 5

5 Last visible gastral sternite with a spiniform process. Fore wing (fig. 8) with two submarginal cells; hind wing with cross-vein cu-a received by Cu1, anal lobe two-thirds as long as cell M + Cu1. *(Methocha)* ..... Subfam. **METHOCHINAE** (p.14)

— Last visible gastral sternite without a spiniform process. Fore wing (fig. 9) with three submarginal cells; hind wing with cross-vein cu-a coincident with origin of Cu1, anal lobe not one quarter as long as cell M + Cu1 *(Myrmosa)* ..... Subfam. **MYRMOSINAE** (p.15)

6 Thorax divided into three dorsal sections, pronotum, meso and metascutum, propodeum. Tibial spurs 1, 1, 1. *(Methocha)* ..... Subfam. **METHOCHINAE** (p.14)

— Thorax divided into two dorsal sections, pronotum, the remainder. Tibial spurs 1, 2, 2. *(Myrmosa)* ..... Subfam. **MYRMOSINAE** (p.15)

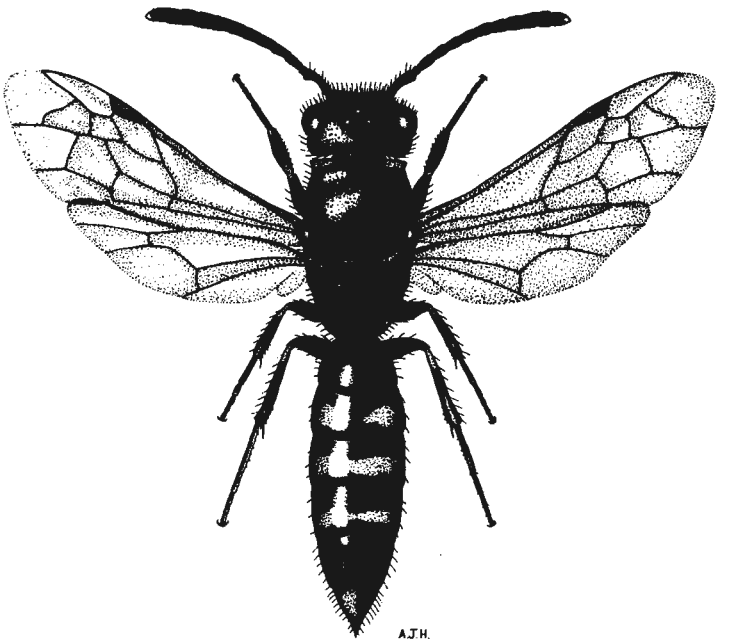

Fig. 10, *Sapyga clavicornis* ♀.

Family Sapygidae

Genus **Sapyga** Latreille

Whole insect—fig. 10. Fore wings with three submarginal cells. Antennae more or less thickened distally. Pronotum truncate in front, relatively long, latero-ventral corner not acute. Mesopleuron without any sulci. Propodeum rounded, moderately elongate, no dorsal area. Tibial spurs 1, 1, 2. Rather elongate, closely punctured, usually black and pale yellow (sometimes partly red) species.

A rather small genus, almost entirely Holarctic in distribution. The species are all parasitic on megachilid bees; the larva destroys the egg and then eats the provisions. The female introduces the egg into the nest with the aid of the ovipositor which is not exclusively a sting as in the higher aculeates.

Key to species

1 Twelve antennal segments; six visible gastral tergites. (Females).....2

— Thirteen antennal segments; seven visible gastral tergites. (Tergites black, 3-4 (rarely 2) with yellow spots.).....3

2 Gastral tergites 2-3 red, 4-5 each with two pale yellow spots, 6 with a large spot. Antennal segment 3 as long as or a little longer than 4 (fig. 11a). Length 9.0-13.0mm ..... **quinquepunctata** (Fabricius) (Female)
Parasite of Osmia *(many species) and of* Chelostoma. *England, Wales. Not very common. v-vii. (Fig. XVII, Richards, 1977.)*

— Gastral tergites black, 2-4 pale yellow marked, 3 often with a band, 6 with a large spot. Antennal segment 3 shorter than 4 (fig. 12a). Length 7.0-10.0mm ..... **clavicornis** (Linnaeus) (Female)
Parasite of Chelostoma *and* Osmia. *England to Notts and Yorks. Usually rare but sometimes localy common. v-viii.*

3 Antennal segment 13 very short, less than half as long as 12, 12 and 13 not much swollen, 3 longer than 4 (fig. 11b). Length 7.0-11.0mm ..... **quinquepunctata** (Fabricius) (Male)
See couplet 2 for notes.

— Antennal segment 13 large, nearly as long as 12, 12 and 13 swollen, 3 shorter than 4 (fig. 12b). Length 6.5-10.0mm..... **clavicornis** (Linnaeus) (Male)
See couplet 2 for notes.

Family Tiphiidae

Subfamily Tiphiinae

Genus **Tiphia** Fabricius

Whole insect—fig. 13. Fore wings (fig. 14) with two submarginal cells, marginal cell open distally in female. Antennal segments 2-4 distally shining in female, flagellar segments keeled beneath in male. Pronotum subtruncate in front, relatively long, latero-ventrally rounded. Mesopleuron with a more or less distinct epicnemial sulcus but no others. Dorsal surface of propodeum subrectangular, bounded by keels and with two longitudinal discal ones. Tibiae externally with stout spines, spurs 1, 1, 2. Gaster with a shallow constriction between tergites 1 and 2 but a deep one between the sternites. Black, rather shining, not closely punctured species, legs sometimes red.

The species are very numerous and found in all the main zoogeographical regions; they have been much studied because of their importance in the control of various scarabaeid larvae (Clausen, 1940: 290). The females burrow into the soil and find the

host larva in its own cell. It is stung to a temporary quiescence, kneaded with the mandibles and an egg is laid, usually on the side or ventral surface; the exact position depends on the species. Very little is known of the biology of the British species.

Key to species

1 Antenna with 12 segments; gaster with 6 visible tergites. Females.....2

— Antenna with 13 segments; gaster with 7 visible tergites. Males. (Last visible sternite terminating in an upturned spine. Legs blackish.).....3

2 Mid and hind femora and tibiae red. Punctures of dorsal surface obvious though not close. Sides of propodeum shining with regular striae. Length 7.0-14.0mm
..... **femorata** Fabricius (Female)
Attacks scarabaeid larvae (Aphodius, Rhizotrogus, Anisoplia, *probably* Anomala).
Kent to Cornwall, Wales, north to Oxon, Norfolk. Locally common. vii-viii.

— Mid and hind femora and tibiae black. Punctures of dorsal surface fine and sparse. Sides of propodeum dull, reticulate. Length 5.0-6.0mm. (Pterostigma longer than the part of the costa beyond it.) ..... **minuta** Vander Linden (Female)
Biology not recorded. Middx to Cornwall, north to Hereford and Norfolk, Pembroke, Ayr, Isle of Man. Local, usually not common. vi-viii.

3 Dorsal surface more distinctly punctured. Sides of propodeum shining, regularly striate. Pterostigma shorter than part of costa beyond it. Length 5.0-11.0mm
..... **femorata** Fabricius (Male)
See couplet 2 for notes.

— Dorsal surface sparsely and finely punctured. Sides of propodeum dull, reticulate. Pterostigma longer than part of costa beyond it. Length 4.0-6.0mm
..... **minuta** Vander Linden (Male)
See couplet 2 for notes.

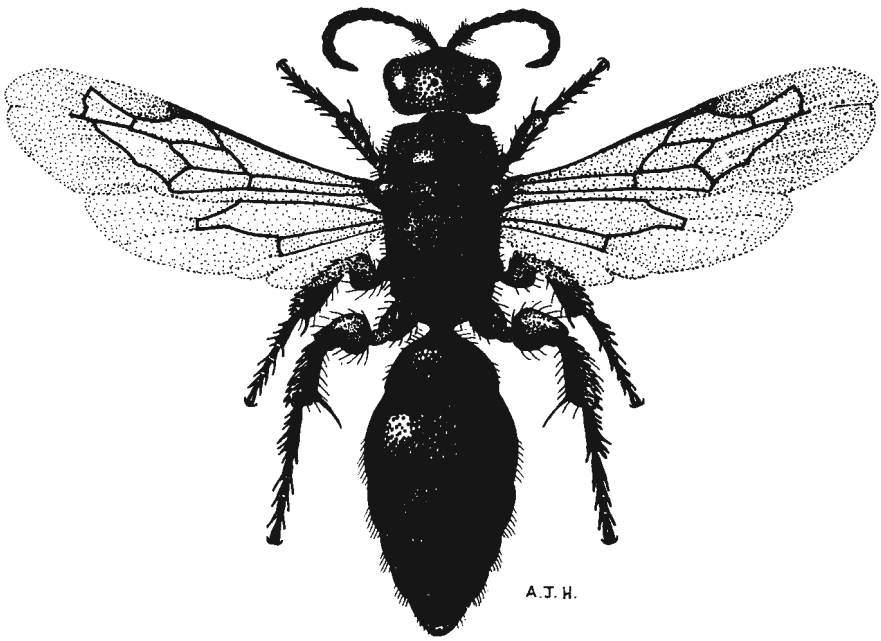

Fig. 13, *Tiphia femorata* ♀.

Subfamily Methochinae

Genus **Methocha** Latreille

Whole insect—fig. 15. Female: Apterous, glabrous. Mesoscutum much narrower than pronotum or propodeum. Gaster slightly constricted between first and second tergites, more strongly between the sternites. Male: Fore wing with two submarginal cells, first elongate; marginal cell long and pointed. Propodeum weakly truncate in front, lateroventrally obtuse. Mesopleuron with an epicnemial sulcus and a large, central, pubescent depression. Propodeum rounded clathrate. Tibial spurs 1, 2, 2. Gaster moderately constricted between first and second segments; last visible sternite produced into a strong, upwardly curved spine.

A small number of species found in all the main regions except Australia and New Zealand. The species paralyze cicindelid beetle larvae in their burrows (Champion & Champion, 1914). Males are rare and reproduction may be partly parthenogenetic (Pagden, 1925).

— Female: Very shining, head and gaster black, mandibles, antennae except tip, thorax, legs and propodeum light red; thorax, femora and propodeum largely dark in a few specimens (? usually small ones). Eyes with a few hairs. Length 3.5-8.5mm.

Male: Black, elongate, shining, finely punctured; propodeum rounded, clathrate. Antennae long, tapering. Eyes with long hairs. Length 7.0-11.0mm

..... **ichneumonides** Latreille

Hosts: Cicindela campestris, C. maritima, C. sylvatica. *Middx to Cornwall, Wales north to Cheshire and S.E. Yorks. Females locally common. v-ix.*

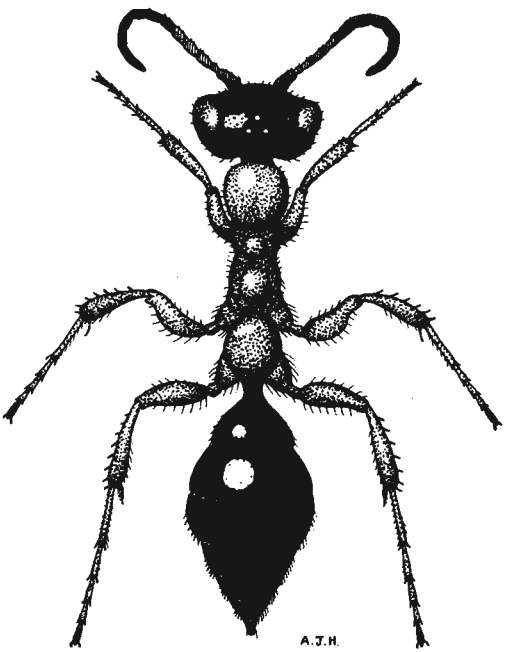

Fig. 15, *Methocha ichneumonides* ♀.

Subfamily Myrmosinae

Genus **Myrmosa** Latreille

Whole insect—fig. 16. Female: Apterous, closely and coarsely punctured; pubescent, hairs forming fringes to the gastral tergites, especially 2-5. Male: Fore wings with three submarginal cells, second almost triangular; marginal cell moderately long, pointed. Pronotum truncate in front, short, latero-ventrally obtuse. Mesopleuron subclathrate, without sulci. Propodeum short, subtruncate, more coarsely sculptured behind. Tibial spurs 1, 2, 2. Gaster quite strongly constricted between first and second segments, last sternite not spiniform.

A rather small genus of Holarctic species which parasitize bees *(Halictus), Tiphia* and some sphecoids.

Key to subspecies

1 England and Wales. Female: Gastral tergites 2-3 red with black bands. (Head globular, rounded in front. Red; head except mandibles and face black. Propodeum somewhat truncate and smoother behind. Length 4.0-7.0mm.) Male: Hairs on head and thorax less reddish. (Rather elongate, closely and coarsely punctured. Black; eyes bare. Length 5.5-11.0mm.) ..... **atra atra** Panzer

Suggested hosts: Oxybelus uniglumis, Crabro peltarius, *?* Crossocerus (ovalis, tarsatus, wesmaeli), Diodontus tristis, D. minutus, Psen equestris, Halictus *spp., ?* Panurgus. *Kent to Cornwall, north to Yorks and Cumberland. Common. v-ix.*

— Ireland. Female: Gastral tergites 2-3 red but with less strong black bands. (Otherwise similar to *atra atra.*) Male: Hairs on head and thorax more reddish. (Otherwise similar to *atra atra.*) (Yarrow, 1954b) ..... **atra erythrocephala** Yarrow

Ireland. Not very common. vii.

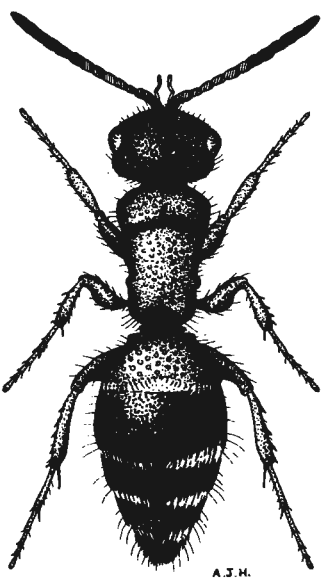

Fig. 16, *Myrmosa a. atra* ♀.

Family Mutillidae

Some thousands of species are in this family, mostly found in warmer countries. Their hosts are usually other Aculeata but one is a parasite of *Glossina* (Diptera) and another attacks *Clythra* (Chrysomelidae). The adults also sometimes attack other aculeates to obtain their juices for liquid food. Their eggs seem usually to be laid on the mature larva or the pupa of the host.

Subfamily Mutillinae

Key to genera

1 Apterous. Females 2
— Winged. Males 3
2 First gastral tergite more than half as wide as second and posteriorly level with its dorsal surface; sixth tergite without a pygidial area. Large, stout species.. **Mutilla** (p.16)
— First gastral tergite about one third as wide as second and posteriorly well below the level of its dorsal surface; sixth tergite with a finely striate pygidial area. Small, narrow species. ..... **Smicromyrme** (p.17)
3 First gastral tergite wide and little separated from second. Fore wing with parastigma shorter than the pterostigma (fig. 18) ..... **Mutilla** (p.16)
— First gastral tergite narrow, separated from the second by a depression. Fore wing with the parastigma longer than the pterostigma (fig. 20) ..... **Smicromyrme** (p.17)

Genus **Mutilla** Linnaeus

Whole insect—fig. 17. Female: Coarsely and closely punctured with conspicuous patches of silvery pubescence. Thorax and propodeum dorsally forming a

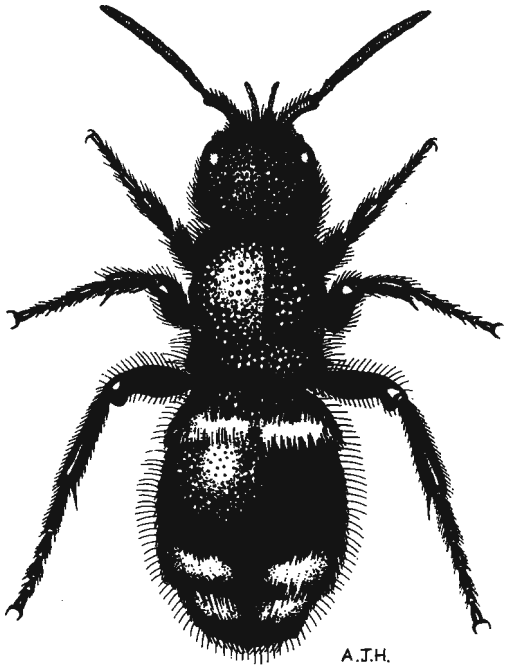

Fig. 17, ***Mutilla europaea*** ♀.

subrectangular, solid mass. Pronotum not really truncate in front, latero-ventrally obtuse. Pleuron smooth, epicnemial keel developed but not strong. Tibial spurs 1, 2, 2. Male: Rather less coarsely punctured than female, with similar patches of pubescence. Pronotum not truncate in front, latero-ventrally obtuse. Pleuron punctured, without keels or sulci. Tegula very large. Last visible gastral sternite not spiniform.

A rather large genus in all the main regions except the Americas. Two European species are known to be parasites of the larvae of *Bombus* (Apidae).

— Female: Black; thorax (except pronotum) and propodeum red. Pubescence black, rather long and coarse; dense, appressed, silvery hairs in a band at end of gastral tergite 1 and in centrally interrupted bands at ends of tergites 2-3. Length 7.5-15.0mm. Male: Black; dorsal surface of meso and metanotum, scutellum and propodeum red. Base of antenna somewhat reddish. Gaster with blue reflections. Pubescence black, coarse; tergites 1-3 with dense, silvery, pubescent bands posteriorly. Length 9.0-14.0mm ..... **europaea** Linnaeus

Parasite of Bombus *(many species) stinging the larva and its own larva spinning up in the cell. England, Scotland. Local and usually not common. vii-ix, hibernates as an adult.*

Genus **Smicromyrme** Thomson

Whole insect—fig. 19. Characters of *Mutilla* apart from the differences given in the key. Male in our species with a strong tooth beneath the base of the mandibles.

A genus of moderate size of mostly rather small species found in the Oriental, Palaearctic and Ethiopian zoogeographical regions.

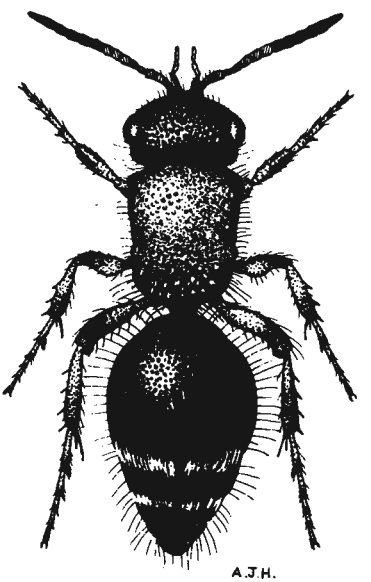

Fig. 19, *Smicromyrme rufipes* ♀.

— Female: Head black, face, mandibles and antennae red, tips of antennae darker. Thorax, legs, propodeum, most of first gastral tergite red; rest of gaster black. Pubescence long, not very dense, black and white; sides, apex and central spot of gastral tergite 2, most of tergite 3 with dense silvery hairs. Length 2.7-5.5mm. Male: Black; mesoscutum, dorsal or most of sides of pronotum, sometimes scutellum red. Pubescence long and pale. Tergites 2-4 with apical bands of not very dense, silvery pubescence. Length 4.5-7.0mm ..... **rufipes** (Fabricius)

Male considerably rarer than female. According to Borries (1897) it has two generations a year in Denmark. Hosts (Crèvecoeur, 1930) Pompilidae (Evagetes laboriosus, Plagioceps pumilus); *Sphecidae* (Miscophus spurius, Oxybelus bipunctatus, O. uniglumis, Tachysphex *sp.*, Tracheliodes quinquenotatus); *Apoidea (?* Andrena *sp.*, Halictus *spp.*, Sphecodes *spp.). Kent to Devon, north to Berks, Beds and Norfolk. Locally common. vi-viii.*

Superfamily Vespoidea

This group includes the wasps in the narrowest sense of the term with a few thousand solitary and some hundreds of social ones. A small and not very representative sample of 29 species of these constitutes the British fauna. It is now usual to treat the solitary Eumenidae as a separate family from the social Vespidae. A third family, the Masaridae, is not found in Britain. Their species usually have two submarginal cells and clubbed antennae. They make burrows in the ground or attach mud cells to rocks or plants and with one exception store their cells with pollen and nectar. Their mouthparts show some parallel adaptations to those of bees.

The British species of Vespoidea can be recognised by their emarginate eyes, their fore wings longitudinally folded when at rest with a very elongate discal cell (Rs + M), and by the sclerotised pads at the tips of the glossae and paraglossae. I have made much use of Blüthgen's monograph (1961) of the central European species. Spradbery's book (1973) deals with both the taxonomy and the biology of the British species with some information on exotic forms. The book by Evans & Eberhard (1973) is useful for their biology. The colour patterns mentioned in the account below are primarily those of British specimens.

Key to families and subfamilies

1 Mandibles more or less long and crossing when at rest. Mid tibia with one spur. Tarsal claws bifid. Solitary species. (Hind wing (fig. 22a) with an anal lobe. Hind coxa dorsally with a keel on its hind margin. Propodeal orifice about circular.) (Only the subfamily Eumeninae in Britain.) ..... Fam. **EUMENIDAE** (p.18)

— Mandibles short, when at rest lying transversely, one overlapping the other. Mid tibia with two spurs. Tarsal claws simple. Social species. Fam. **VESPIDAE** (p.29).... 2

2 Large, stout species; first gastral tergite anteriorly truncate with an anterior vertical surface at right angles to the posterior horizontal one. Hind wing with no anal lobe. Hind coxa dorsally with a keel on its hind margin. Propodeal orifice about circular. Nest enclosed in an envelope..... Subfam. **VESPINAE** (p.31)

— Smaller, more slender species; first gastral tergite with anterior curving into dorsal surface. Hind wing with an anal lobe. Hind coxa with no dorsal keel. Propodeal orifice elongate. Nest with a naked comb..... Subfam. **POLISTINAE** (p.29)

Family Eumenidae

All our British species build their nests in or with earth, often in the form of moistened clay. Our *Pseudepipona,* however, which burrows in dry sandy soil, only moistens the walls of its burrow with saliva. The species of *Odynerus* burrow in flat

or vertical earth and with pellets of wet clay construct a chimney over the entrance. The chimney may be as much as 30mm long and is more or less completely demolished and used to close the nest when all the cells are stored. Most of the other species nest in hollow stems (*Rubus,* etc) or in old beetle burrows in wood, dividing the cavity into cells with mud partitions. The larva is able to orientate its head towards the exit by the roughness of one side of the partition (Krombein, 1967). *Ancistrocerus oviventris,* however, builds in corners of rocks or walls and plasters over the completed cells with mud. *Eumenes* builds beautiful little pots of mud attached to plants. In all species the egg is laid in the empty cells from the upper wall of which it normally hangs by a short thread. The prey are then brought in and usually consist of small caterpillars though *Symmorphus* and *Odynerus* take beetle larvae. The fully fed larva spins a cocoon, usually of thin silk more or less attached to the cell walls. Probably most of these wasps, in England, have only one generation in a year but some of the *Ancistrocerus* which start work early in the season probably have two.

Subfamily Eumeninae

Key to genera

1 First gastral tergite with a distinct anterior petiole, posteriorly well set off from second tergite (fig. 22c) which is more than twice as broad and has posteriorly an apical lamella at a lower level than the rest of the tergite. Second gastral sternite (fig. 22d) with no anterior transverse furrow crossed by keels. (Tegula posteriorly rounded (fig. 22b).) ..... **Eumenes** (p.20)

— First gastral tergite without an anterior petiole, posteriorly not much narrower than second into which it passes more or less smoothly. Second tergite with no apical lamella except in *Microdynerus.* Second gastral sternite with an anterior transverse furrow crossed by keels 2

2 Tegula posteriorly rounded (fig. 23). Male: antenna with last 4-5 segments spirally rolled. (Anterior and dorsal surfaces of first gastral tergite joining in a smooth curve.) 3

— Tegula posteriorly pointed (fig. 28). Male: antenna either simple or with segment 13 bent against 11, 12 short 4

3 Male: Mid coxa and femur without teeth. Pronotum in both sexes produced into projecting angles at sides. Female: Clypeus deeply emarginate below, head considerably thickened behind, vertex with two approximate, occasionally fused pubescent pits (fig. 25). Nests in plant stems ..... **Gymnomerus** (p.21)

— Male: Mid coxa or femur with teeth. Pronotum in both sexes not produced at sides into angles. Female: Clypeus not deeply emarginate below; head not thickened behind, vertex with two pits (fig. 26), sometimes elongate but sometimes difficult to distinguish from the sculpture, behind each lateral ocellus. Nests in soil. ..... **Odynerus** (p.22)

4 First gastral tergite with its anterior surface passing smoothly into the dorsal surface. ... 5

— First gastral tergite with a transverse keel separating the anterior from the dorsal surface 7

5 Gastral tergite 2 (fig. 30) with a transparent lamella at apex beyond and at a lower level than the yellow band; tergite 1 closely and coarsely punctured (with a very narrow apical lamella). Gastral sternite 2 with anterior strip very narrow, not half as wide as length of keels which cross the basal furrow which leads up onto the general surface of the sternite in a gentle slope ..... **Microdynerus** (p.23)

— Gastral tergite 2 with no apical lamella or only a very narrow strip which is not sunk below the level of the tergite; tergite 1 closely but not coarsely punctured. Gastral sternite 2 with a wide strip in front, nearly as wide as the length of the keels across the basal furrow which rises very steeply up to the general surface of the sternite 6

6 First gastral tergite with a distinct, subtransparent, apical lamella (fig. 29), much wider

than the rudimentary ones of the posterior tergites. Female with two large, almost contiguous, triangular pubescent pits behind the ocelli. Male mandible with no deep emargination before the two apical teeth ..... **Euodynerus** (p.23)

— First gastral tergite with no real apical lamella only a very narrow strip like those of the posterior tergites. Female with a central pubescent pit behind the ocelli. Male mandible with a deep emargination before the two blunt apical teeth ..... **Pseudepipona** (p.23)

7 Disc of first gastral tergite with a longitudinal furrow (fig. 32) (very weak in *crassicornis*). Female with two circular, pubescent pits behind the ocelli. Male antenna with terminal segments much as in female, but the last 4-5 segments with longitudinal, reddish, raised welts ..... **Symmorphus** (p.24)

— Disc of first gastral tergite with no longitudinal furrow (fig. 31). Female sometimes with traces of a single, central depression behind the ocelli. Male antenna with the terminal segments narrowed, 13 bent back in a hook against 11 and 12. ..... **Ancistrocerus** (p.25)

Genus **Eumenes** Latreille

Whole insect—fig. 21. First gastral tergite narrowed anteriorly to a distinct petiole and even posteriorly relatively narrow, less than half as wide as second tergite. Mandibles very long and narrow with two blunt apical teeth in female, one in male. Eyes much closer below than on vertex. Clypeus produced and emarginate below, labrum protruding far beyond the emargination. Propodeum rounded, closely punctured, without keels. Male antennae with segment 13 hook-like, bent against 10-12. Fig. 22.

The old composite genus *Eumenes* has now been split up but even what is left is quite a large genus, found in all the main regions except Australia. The species are of

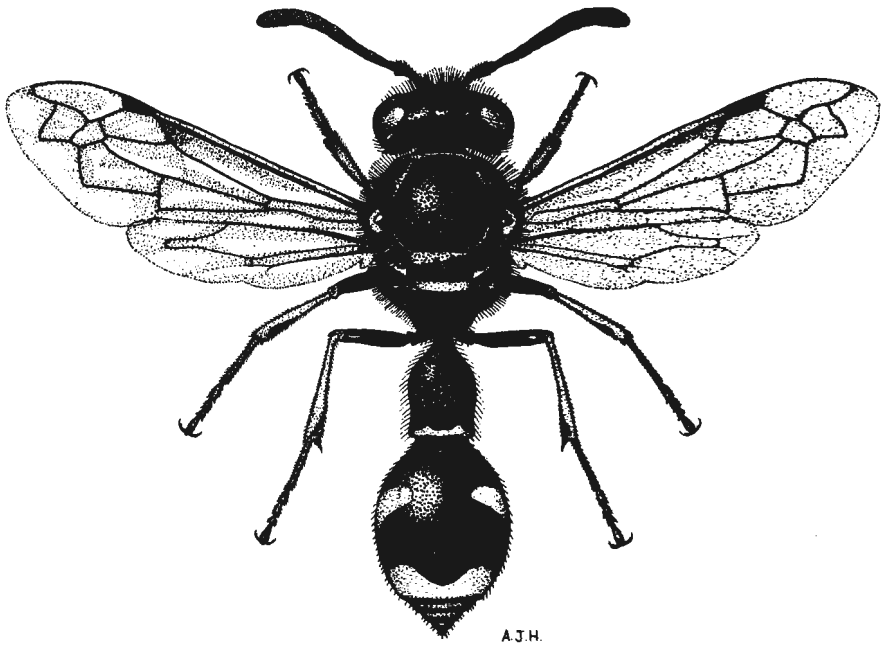

Fig. 21, *Eumenes coarctatus* ♀.

medium size, black and yellow in colour. The female builds a beautiful little pot of mud, with a short neck, usually attached in our species to heather. After an egg has been laid it is stored with paralyzed caterpillars. There may be as many as three adjacent pots but one or two is more usual.

— Black with small yellow markings on head and thorax, apices of femora, tibiae and tarsi, bands of gastral tergites 1-4 and elongate spots on tergite 2, yellow. Head and thorax with long hairs. Male with labrum, clypeus, scape beneath, pale yellow. Length, female 13.0-15.0mm, male 9.0-13.0mm ..... **coarctatus** (Linnaeus)

Prey geometrid larvae, perhaps especially Eupithecia *spp. Cornwall, Devon, Dorset, Hants, Surrey, Berks, W. Sussex, Kent, Glamorgan. Local and usually not common. vi-ix.*

(Van der Vecht (1968) showed that our species was the same as Linnaeus's *coarctatus;* Blüthgen incorrectly identified it as *pedunculatus* (Panzer).)

Genus **Gymnomerus** Blüthgen

Whole insect—fig. 24. Very close to *Odynerus* but distinguished as shown in the key to the genera. Female mandible with 4 teeth, 3 rather blunt apical ones, and, separated by a deep gap, a truncate, sub-basal one; male with only 2 apical teeth. The nest is quite different, being in hollow stems in which mud cells are built and not burrows in the ground. There is only one Palaearctic species.

— Head and thorax densely hairy. Propodeum hollowed out behind but without keels. Black; transverse line or lines at top of clypeus, transverse line above antennal sockets, dot behind eyes, two dots on pronotum, dots on tegula, bands on gastral tergites 1-4, yellow. Apices of femora, tibiae and tarsi, light red-brown. Male with spot on mandible, labrum, clypeus, scape beneath, spot on mid coxa, band on gastral tergite 5, also yellow. Length 8.0-11.0mm, male a little smaller than female.
..... **laevipes** (Shuckard)

Nests in stems of bramble (Rubus) *and elder* (Sambucus) *and also those of herbs such as* Arctium *and* Carduus. *Prey larvae of Curculionidae* (Phytonomus) *(Chambers, 1944; Bristowe, 1948). Kent to Dorset, Somerset, Hereford to Leicester and Norfolk. Local and not common. v-viii.*

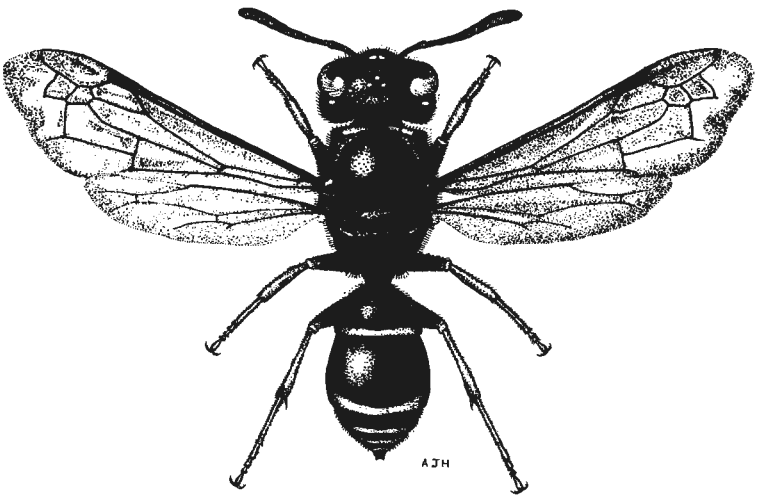

Fig. 24, *Gymnomerus laevipes* ♀.

Genus **Odynerus** Latreille

Stout species with unpetiolate gaster. Clypeus transverse, scarcely emarginate below. Mandibles in female with 4 teeth, basal one with traces of a subdivision, male with 3 teeth, basal one truncate and separated from the others by a deep emargination. Impressions behind female ocelli long, pyriform. Pronotal keel very feeble. Tegula semicircular, rounded behind. Propodeum somewhat hollowed out behind but without keels. First gastral tergite regularly rounded in profile; second sternite crossed at base by a deep furrow whose anterior side is regularly striate; no tergite with an apical lamella. Male antenna with last 5-6 segments spirally rolled; mid femur or coxae with tooth-like projections.

The old genus *Odynerus* contained several hundreds of species, found in all regions. Over the last fifty years and especially in the last thirty, it has been split up into many genera. The process is not yet complete and some species are still not definitely placed. In its modern sense, *Odynerus* is a Palaearctic genus of moderate size with medium or small sized species of black and yellow colours. They nest in the earth or in mud walls and the female builds curved chimneys over the entrance to the burrow. The chimney is taken down when the nest is complete and used, at least in part, for closing the nest. The prey are larvae of Curculionidae *(Phytonomus).*

Key to subgenera and species

1 Metanotum black, posteriorly dull, reticulate. Male with no long processes from the gena or mid coxae; mid femur with three tooth-like processes beneath; mid tibia strongly swollen beneath near apex. Pubescence long, blacker in female. (Subgen. **Odynerus**).....2

— Metanotum almost always with a pale band, posterior surface smooth and shining. Male with a long tooth-like process from the gena beneath base of mandible. Mid coxa with a long tooth-like process; mid tibia and femur simple. Pubescence shorter, paler. (Subgen. **Spinicoxa**).....3

2 Impressions behind ocelli in female separated by more than their transverse length (fig. 26). Markings of head, thorax and gaster yellow; fore and in female mid tibiae black beneath. Last five segments of male antennae thicker, segment 10 one and a half times as long as broad. Central process beneath mid femur usually more or less truncate (fig. 33). Length 8.0-12.0mm..... **spinipes** (Linnaeus)

Nests in vertical sand faces (cf. Bristowe, 1948). England, Wales, Scotland (Ayr), Ireland. Common. v-vii. (Fig. XIX, Richards, 1977.)

— Impressions behind female ocelli separated by less than their transverse length (fig. 27). Markings of head, thorax and gaster whitish; tibiae entirely yellow. Last 5 segments of male antenna thinner, segment 10 nearly twice as long as broad. Central process beneath mid femur pointed (fig. 34). Length 8.0-10.0mm (male a little smaller than female) ..... **melanocephalus** (Gmelin)

Nests in flat soil, not gregarious. Kent to Devon, north to Glamorgan, Hereford, Northants and Norfolk. Rare. v-vii.

3 Markings yellow. Female with a wide band across top of clypeus and a large spot each side top of propodeum, yellow: gastral sternite 2 finely punctured or shagreened throughout. Male with no process on hind coxa (fig. 35b); antennal segments 5-7 more thickened than adjacent ones (fig. 35a), 7 shorter than broad. length 9.0-12.0mm. ..... **reniformis** (Gmelin)

Nests, often colonially, in vertical sand faces or in flat earth. Chimney over entrance more solid, the pellets of which it is made less separate than in spinipes. *Surrey, Hants, Essex. Rare. vi-viii.*

— Markings whitish. Female with top of clypeus black or nearly so, propodeum black; gastral sternite 2 with sides densely, finely punctured, disc shining and almost unpunctured. Male hind coxa with a short angular tooth like that of mid coxa (fig. 36b) but black and much shorter. Antennal segments 5-7 less thickened than adjacent ones

(fig. 36a), segment 7 longer than broad. Length 10.0-12.0mm . . . . . **similimus** Morawitz
Essex. Rare. vii. Described from Russia (Saratov) and apart from British specimens known only from a few others in western Europe.

Genus **Microdynerus** Thomson

Like *Odynerus* but species always much smaller; distinguished as shown in the key. A small Palaearctic genus. A few species are known to nest in cavities in plants, walls or rocks and to prey on curculionid larvae.

— All pubescence very short. Mandibles with 4 teeth, only ventral one long. Clypeus shining, sparsely punctured; frons shining, closely punctured, no impressions behind ocelli. Propodeum with strong processes just above the valves. Female black; two spots on pronotum, much of tegular margin, bands on gastral tergites 1-2, sternite 2, base of fore tibia, white. Legs partly reddish. Male: Spot on mandible, labrum, clypeus, scape beneath, much of tibiae, white. Length 6.0-8.0mm, male a little smaller than female . . . . . **exilis** (Herrich-Schäffer)
Enters and probably nests in small beetle holes in wood: also one record from Rubus *stem (Danks, 1971: 365). Dorset, Hants, Isle of Wight, W. Sussex, Berks, Middx, Kent, Bucks, Wilts. Not common. vi-viii. Possibly recently introduced (first record Jones, 1937).*

Genus **Pseudepipona** Saussure

Like *Odynerus* but distinguished as shown in the key to the genera; the only British species of *Odynerus*-like wasps with red markings (on the sides of the first gastral segment). A small Palaearctic genus of moderate sized species. Our species make shallow burrows in the ground, gregariously, and preys on lepidopterous larvae (Spooner, 1934). Spooner says Tortricinae but Mortimer (1900) says ? *Depressaria.*

— Black; dots above the antennal sockets and on upper gena, two triangular pronotal spots, outer margin of tegula, sometimes small pleural spots, spots or narrow band on scutellum, bands on gastral tergites 1-5, band on sternite 1, spots on sternites 2-3, whitish-yellow. Broad sides gastral tergite 1 and legs reddish. Male with mandible, labrum, clypeus, inner orbits, scape beneath, band gastral sternite 2, also whitish-yellow. Length 9.0-11.0mm. . . . . **herrichii** (Saussure)
Dorset, on the "island" of Purbeck, on sandy heaths, sometimes locally common. vi-viii.

Genus **Euodynerus** Dalla Torre

Like *Odynerus* but distinguished as shown in the key to the genera. A large, mainly Holarctic genus but also with some African species. They are mostly of medium size and black and yellow. They nest in various cavities or, in some American species, make burrows in the ground and store caterpillars.

— Black; spots on mandible, two dorsal spots on clypeus, spot above antennal sockets, dorsal spot on gena, two transverse spots on pronotum, margin of tegula, sometimes a pleural spot, ~~band on metanotum, bands on gastral tergites 1-4~~, spots on sternite 2, yellow. Apices of femora, tibiae and tarsi, reddish-yellow. Male with most of mandible, labrum, clypeus, scape beneath, also yellow. Length 9.0-11.0mm
. . . . . **quadrifasciatus** (Fabricius)
Surrey, Dorset, S. Devon, rare. vi. Recorded by Spooner (1943) breeding in holes in pebbles on the beach at Sidmouth.

Genus **Symmorphus** Wesmael

Whole insect—fig. 37. Like *Odynerus* but distinguished as shown in the key to the genera. The male antennae are distinctive with the apical segments not spirally rolled or bent back. A moderately large, Holarctic genus with the species often rather slender, small or moderate sized. They nest in pre-existing cavities, including old burrows in walls or in the ground. They prey on the larvae of Chrysomelidae (Coleoptera) and/or sometimes larvae of Lepidoptera.

Key to species

1 Larger (length, female 10.0-15.0mm, male 8.0-12.0mm). Thorax with dense, rather long, brown pubescence, more appressed on the lower pleuron. Pronotal keel sharp but not projecting at each end (fig. 38). Notaulices weak. (Gaster with 4-5 yellow bands.) ..... **crassicornis** (Panzer)

Prey larvae of Chrysomela populi *(cf. Guichard, 1972b). Kent to Devon, north to Yorks. Local and usually rare. vi-viii.*

— Smaller. Thorax with shorter pubescence, much less conspicuous on lower pleuron. Pronotal keel sometimes not sharp but always projecting in a point at each end. Notaulices strong 2

2 Gaster with 4-5 yellow bands. Pronotum with no sharp keel (fig. 39). Gastral tergite 2 wider than long. (Part of gastral tergite 1 behind the transverse keel fully twice as wide as long. Scutellum in female with two yellow spots. Length, female 8.0-12.0mm, male 7.0-10.0mm) ..... **gracilis** (Brullé)

Common on flowers of Scrophularia. *Probably nests in holes in wood, prey larvae of* Chrysomela populi *and* Cionus hortulanus. *Kent to Cornwall, north to Yorks, Wales. Rather common. vi-viii.*

— Gaster with 2-4 yellow bands. Pronotum with a sharp keel. Gastral tergite 2 a little longer than wide 3

3 Part of gastral tergite 1 behind the transverse keel considerably longer than broad (fig. 40). Mesoscutum with some large punctures as well as small ones over most of its surface. Scutellum in female with two yellow spots. Male clypeus with at most a dorsal yellow area. Larger, length, female 7.5-9.5mm, male 6.5-9.0mm. (cf. Jørgensen, 1942) ..... **mutinensis** (Baldini)

Nests chiefly in cut plant stems (e.g. thatch), prey larvae of Phyllodecta vulgatissima. *Kent to Devon, north to Ayr and Perth, Wales, Ireland. Common. v-ix.*

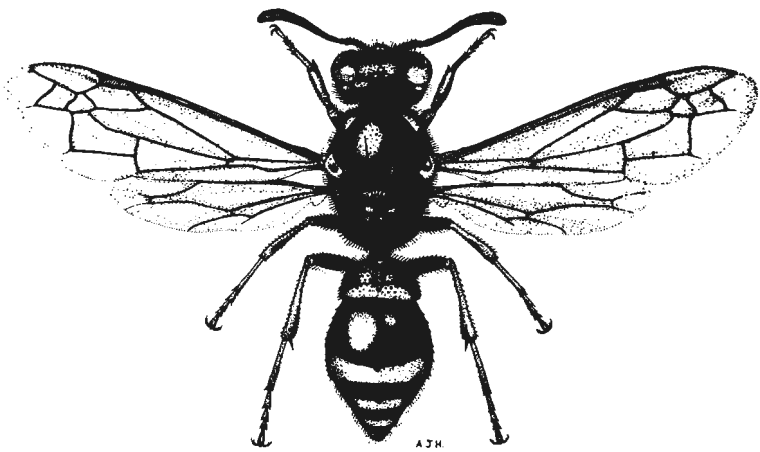

Fig. 37, *Symmorphus crassicornis* ♀.

— Part of gastral tergite 1 behind the transverse keel considerably wider than long (fig. 41). Mesoscutum with large punctures only on the anterior quarter. Scutellum of female black. Male clypeus normally yellow with a very narrow black periphery. Smaller, length, female 8.0-9.0mm, male 6.5-8.0mm ..... **connexus** (Curtis)
Nests in straws of thatch, prey larvae of Chrysomelidae (Zeugophora subspinosa) *and Gracillariidae* (Gracillaria stigmatella) *(Jørgensen, 1942). Dorset, Hants, Surrey, Berks, Kent, Herts, Essex, Suffolk. Rare. v-viii.*

Genus **Ancistrocerus** Wesmael

Whole insect—fig. 42. Like *Odynerus* but distinguished as indicated in the key to the genera. Male antennal segment 13 bent back, hook-like. A large, primarily Holarctic genus with a few species in South Africa and South America. However the generic position of some of these is probably doubtful. Many species are extremely versatile in adopting all kinds of cavities for their nests and others can build external mud structures; prey lepidopterous larvae. It is probable that at least most of our species have two generations a year. The genus includes some of the commonest British solitary wasps and the species are often difficult to distinguish. The colour patterns given below are for British specimens.

Key to species

1 Females.....2
— Males 10
2 Second gastral sternite rising abruptly after the anterior transverse furrow (the interspaces between the keels crossing the furrow about twice as long as broad (somewhat obscured by stiff hairs in *oviventris*). Sides and posterior surface of propodeum dull, granulate.) 3
— Second gastral sternite rising very gradually (rather more steeply in some specimens of *scoticus*) after the anterior transverse furrow.....4
3 Part of the first gastral tergite behind the transverse keel a little more than twice as wide

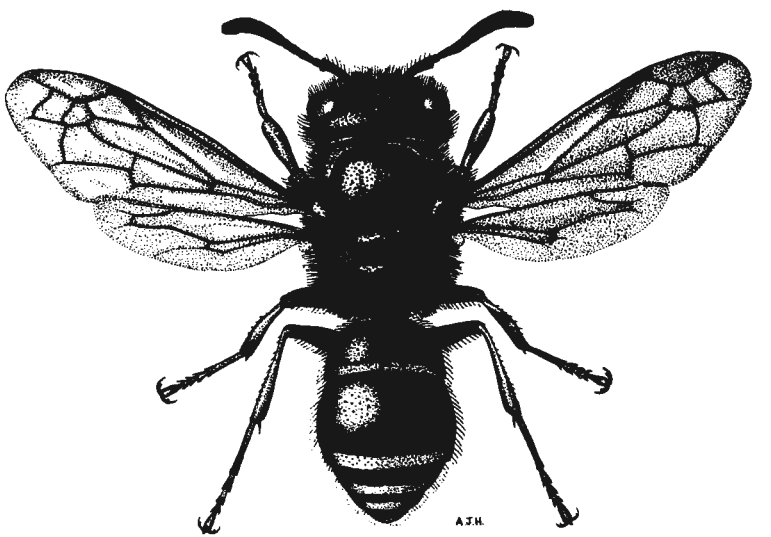

Fig. 42, *Ancistrocerus oviventris hibernicus* ♀.

as long. Clypeus with large, more striate punctures. Second gastral sternite rising absolutely perpendicularly. Black; clypeus with two dorsal and occasionally two ventral spots, spots above antennal sockets, scape beneath, dot behind the eye, pronotal band, widened at each end, outer margin of tegula, two spots on scutellum, small pleural spot, bands on gastral tergites 1-5 and sternites 2-5, apices of femora, tibiae except more or less large spot beneath, yellow. Tarsi reddish. Marginal cell hardly darkened. Length 9.0-13.0mm..... **nigricornis** (Curtis) (Female)

Nests in all sorts of cavities, prey especially tortricid larvae (cf. Perkins, V. R., 1892: 209; Latter, 1930; Móczár, 1959). Kent to Cornwall, north to Yorks, Glamorgan, Radnor, Raasay. Blüthgen says Ireland but I know of no records. Common. iv-ix.

— Part of the first gastral tergite behind the transverse keel nearly three times as wide as long. Clypeus less coarsely, not striately punctured. Second gastral sternite rising abruptly but clearly sloping a little backwards. (Hairs longer and more outstanding.) Black; spot (sometimes divided) between the antennal sockets, dot behind eyes, pronotal band usually scarcely widened at sides, at most a small spot on tegula, rarely two small round spots on scutellum, bands on gastral tergites 1-5 and often a dot on 6, bands on sternite 2 and rarely 3, usually only dots on 3 and rarely on 4, yellow. In some Scottish and Irish specimens the yellow is replaced by white or whitish. Apices of femora, tibiae and tarsi, light reddish, tibiae yellower in some specimens. Marginal cell a little darkened. Length 9.0-14.0mm

..... **oviventris hibernicus** Blüthgen (Female)

Nest like a lump of mud on walls or rocks since completed cells are plastered over; prey usually tortricid larvae (cf. Bignell, 1881-1882; Nielsen, E. T., 1932: 141). England, Wales, Scotland, Ireland, and many of the surrounding islands, commoner in north and west. v-ix.

4 Keels in the anterior transverse furrow of the second gastral sternite shorter (fig. 43), the interspaces not more than one and a half times as long as broad; sternite behind the furrow feebly concave in profile 5

— Keels in the anterior transverse furrow of the second gastral sternite longer (fig. 44a), the interspaces twice as long as broad or longer; sternite behind the furrow usually a little convex, rarely flat. (Marginal cell of fore wing partly dark shaded.) 7

5 Fore wing with the marginal cell hyaline. Fore tibia without or with a small black ventral spot. (Pronotal angles about as in *parietum*. Transverse keel of first gastral tergite as in *gazella*. Punctures of second gastral tergite about as in *parietum*. Length about 10.0mm. Black; two dorsal spots on clypeus but ventral ones small or absent, spot above antennal sockets, scape beneath, dot behind eyes, pronotum with band widened at each end, margin of tegula, pleural spot, two spots on metanotum, bands on gastral tergites 1-5 and spot on 6, bands on sternites 1-5, apices of femora, most of tibiae, yellow. Tarsi reddish-yellow.) ..... **quadratus** (Panzer) (Female)

Nests in thatch, etc. S. Devon, Herefordsh., Leicestersh. Rare. v-ix. (cf. Spooner, 1972).

— Fore wing with the marginal cell with a dark cloud covering the distal two-thirds of the cell and part of the membrane beyond it. Fore tibia usually with a black spot beneath 6

6 Smaller, length 8.0-12.0mm. Lateral angles of pronotum more narrowly acute. Propodeum coarsely rugose, more shining. Keel across the first gastral tergite without a notch in centre. Punctures of gastral tergite 2 less close. Gastral tergite 6 black. (Black; dot on mandible, usually two large dorsal and normally two small ventral spots on clypeus, spot between antennal sockets, scape beneath, dot on gena, pronotal band widened at each end, outer margin of tegula, pleural spot, usually two spots on scutellum and two on metanotum, bands on gastral tergites 1-5, that on 1 usually rectangularly emarginate in front, bands on sternites 2-3 and traces of bands on 1 and 4, apices of femora, tibiae except more or less distinct spots beneath, yellow. Tarsi reddish with some dark marks.) ..... **gazella** (Panzer) (Female)

Nests in various cavities, perhaps especially cut stems. Kent to Cornwall, north to Pembroke and Norfolk. Common. v-viii. (cf. Yarrow. 1954c.)

— Larger, length on average greater, 8.5-12.0mm. Lateral angles of pronotum less acute. Propodeum duller, more finely rugose. Keel across first gastral tergite with an angular incision in centre. Punctures of gastral tergite 2 finer and closer. Gastral tergite 6

with a yellow spot. (Pattern as in *gazella* but:—clypeus yellower, spots sometimes fused; metanotum black; band of gastral tergite 1 with an angular or rounded emargination in front; mid and hind tibiae often with no black spots beneath.)
..... **parietum** (Linnaeus) (Female)

Builds its nests in any sort of cavity. England, Wales, to south Scotland, Ireland. Common. v-viii.

7 Sides and posterior surface of propodeum shining between the ill-defined punctures and rugae. Large species, length 13.0-16.0mm. (Second gastral sternite in profile rising a little from the anterior furrow and then almost flat. Black; spot on mandible, dorsal spot on clypeus, dot between antennal sockets and eye, spot between sockets, dorsal dot on gena, pronotal band much widened at sides, sometimes spot(s) on tegula, occasionally two dots or spots on scutellum, bands on gastral tergites 1-4, spot (rarely band) on 5, spot on 6, bands on sternites 1-3, spots on 4, apices of femora, tibiae except stripes beneath fore and mid pairs, yellow. Tarsi brown.)
..... **antilope** (Panzer) (Female)

Nests in all sorts of cavities; sometimes in burrows in sandstone or walls but also in beetle burrows, old mud nests, etc. Preys on various small caterpillars such as those of Crambus; *also rarely beetle or sawfly larvae. Kent to Cornwall, north to Ayr, Wales. Local and irregular in appearance, not often common. vi-viii.*

— Sides and posterior surface of propodeum shagreened or granulate, not shining. Usually smaller species 8

8 Relatively large species, length 10.5-13.5mm, though usually smaller than *antilope*. Pubescent depressions (fig. 44b) behind the ocelli more distinct, sometimes fused. Clypeus usually with two yellow spots. Mid and hind tarsi black. (Dorsal part of first gastral segment fully twice as broad as long; second sternite rising very little from the anterior furrow. Gaster usually with 5 yellow bands and a terminal spot. All tibiae black marked beneath. Black; spot on mandible, two dorsal, rarely two ventral, spots on clypeus, spot between antennal sockets, scape beneath, dorsal dot on gena, pronotal band widened at sides, much of tegula, two spots on scutellum, pleural spot, bands on gastral tergites 1-5, spot on 6, band on 1 broad and rectangularly emarginate, bands of sternites 1-4 and marks on 5, apices of femora, tibiae except spots or stripes beneath, yellow.)..... **parietinus** (Linnaeus) (Female)

Nests in a great variety of cavities, often in houses (e.g. in cotton reels (Richardson, 1920), between books and shelf (Hobby, 1938)) but also commonly out of doors. Preys on various small caterpillars. England, Wales, Scotland, Ireland. Common. v-viii.

— Smaller species, length 8.0-12.0mm. Pubescent depressions behind ocelli very weak or absent. Clypeus nearly always dark, rarely with two small ventral spots yellow. Mid and hind tarsi reddish..... 9

9 Dorsal face of first gastral tergite fully twice as broad as long or rather broader (fig. 45). Mid and hind tibiae and tarsi reddish. Second gastral sternite often distinctly raised from the anterior furrow. Gastral tergite 2 usually more strongly punctured and in more northern specimens more shining. (Yellow markings sometimes replaced by whitish in west Scotland and Ireland.) Black; dot on mandible in half the specimens, usually dot between antennal sockets (sometimes small), nearly always dorsal dot on gena, centre of pronotum narrowly, rarely a small area on tegula, bands of gastral tergites 1-3 (that on 1 a little widened at sides), rarely spot on 4, band on sternite 2 and spots on 3 (very rarely spots on 2 and none on 3), yellow. Apices of femora, tibiae and tarsi red-brown, black spot beneath centre of mid tibia in more than half the specimens, very rarely spot beneath hind tibia..... **scoticus** (Curtis) (Female)

Often builds cells on rocks but also occasionally in cut stems (Julliard, 1950; Butterfield & Fordham, 1930: 366). Prey small caterpillars but also (Valkeila) some chrysomelid larvae. England, Wales, Scotland, Ireland, commoner in north and west and by the sea. Common. v-ix.

— Dorsal face of first gastral tergite (fig. 46) hardly as much as twice as broad as long and often somewhat less. Mid and hind tibiae yellow, usually black marked beneath at apex. Second gastral sternite scarcely raised from the anterior furrow. Gastral tergite 2 often more finely punctured. Black; almost always dot on mandible, rarely dorsal or ventral spots on clypeus, spot between antennal sockets, dot between antennal sockets and eye in about half the specimens, dorsal spot on gena, narrow band on

centre or more of pronotum, spot on tegula in half the specimens, small pleural spot in less than half the specimens, usually two spots on scutellum, bands on gastral tergites 1-3, that on 1 a little widened at sides, usually some marks on 4, band on gastral sternite 2 and usually on 1, spots on 3, yellow. Legs black, apices of femora, tibiae yellow, fore and mid tibiae with a black streak beneath, hind tibia blackish- or reddish-brown towards apex beneath ..... **trifasciatus** (Müller) (Female)

Nests in cut stems (Jørgensen, 1942) and in holes in wood (e.g. in stile at Oxford, 8.vi. O.W.R.) or galls of Andricus kollari *(Fitch, 1879). Prey small caterpillars and a few chrysomelid larvae. England, Glamorgan, north to Yorks, Skye, Isle of Man, Ireland. Not very common. v-ix.*

10 Keels in the anterior furrow of the second gastral sternite shorter, interspaces not more than one and a half times as long as broad; sternite behind the furrow slightly concave in profile. (Flagellum pale reddish-brown beneath) 11

— Keels in the anterior furrow of the second gastral sternite longer, interspaces twice or more times as long as broad; sternite behind the furrow more or less convex or at least flat in profile 12

11 Slightly larger, length 7.5-10.5mm. Antennal segment 13 longer and more narrowed (fig. 47). Ventral emargination of clypeus broader and shallower (clypeus not much swollen). Pronotal angles prominent but not acutely pointed. Gaster usually with 6 yellow bands. Mesopleuron usually with no yellow spot. Fore tibia usually with a black spot beneath. (Female: couplet 6.) (Propodeum and anterior keel of first gastral tergite as in female, but less distinctive) ..... **parietum** (Linnaeus) (Male)

See couplet 6 for notes.

— About the same size as *parietum*. Antennal segment 13 shorter and relatively less narrowed. Ventral emargination of clypeus much as in *parietum*, if anything shallower. Pronotum as in *parietum*. Gaster usually with 6 yellow bands. Mesopleuron usually with a yellow spot. Fore tibia usually without a black spot beneath. (Female: couplet 5) (Mesopleuron said to be more shining than in *parietum*.) ..... **quadratus** (Panzer) (Male)

See couplet 5 for notes.

— Rather smaller species, length 7.0-9.0mm. Antennal segment 13 (fig. 48) about as in *quadratus*. Ventral emargination of the clypeus narrower and deeper (clypeus more swollen). Pronotal angles usually more acute even if not very prominent. Gaster usually with yellow bands on tergites 1-4 and sometimes a partial one on 5. Mesopleuron usually with no yellow spot. Fore tibia usually with a black spot beneath. (Female: couplet 6) (propodeum and anterior keel of first gastral tergite as in female but less distinctive.) ..... **gazella** (Panzer) (Male)

See couplet 6 for notes.

12 Clypeus ventrally deeply, more than semicircularly emarginate. First gastral tergite three times as wide as long. Tibiae usually entirely yellow. (Antennal segment 13 (fig. 49) very long and narrow, flagellum mainly dark beneath. Gaster with bands on tergites 1-4 and more or less abbreviated bands on 5-6. Length 6.5-12.0mm. (Female: couplet 3)) ..... **oviventris hibernicus** Blüthgen (Male)

See couplet 3 for notes.

— Clypeus ventrally much less deeply emarginate. First gastral tergite not more than two and a half times as wide as long. Fore tibia with a black ventral spot 13

13 Propodeum with sides and posterior surface with considerable areas smooth and shining. Pleuron with a yellow spot. (Clypeus moderately excised below. Antennal segment 13 relatively short and broad; flagellum pale reddish-brown beneath. Gastral tergites with yellow bands on tergites 1-4 and more or less abbreviated ones on 5-6. Length 11.0-17.0mm. (Female: couplet 7)) ..... **antilope** (Panzer) (Male)

See couplet 7 for notes.

— Propodeum without smooth shining areas, rough and dull. Pleuron black 14

14 Second gastral sternite rising abruptly behind the furrow. (Antennal segment 13 (fig. 50) long and narrow; flagellum usually pale beneath. Excavation of ventral margin of clypeus usually shallow. Gaster usually with 6 yellow bands. Length 6.5-9.0mm. (Female: couplet 5)) ..... **nigricornis** (Curtis) (Male)

See couplet 3 for notes.

— Second gastral sternite rising very gradually behind the furrow 15

15 Ventral emargination of clypeus a little broader than distance between antennal sockets. Gaster with 5 dorsal yellow bands and a more or less incomplete sixth; sternites with 4-5 yellow bands. Larger species, length 8.5-12.0mm. (Female: couplet 8) (Antennal segment 13 in true dorsal view narrow, parallel sided, about two and a half times as long as broad. Dorsal surface of first gastral tergite two and a half times as wide as long.) ..... **parietinus** (Linnaeus) (Male)
See couplet 8 for notes.

— Ventral emargination of the clypeus about as broad as distance between antennal sockets. Gaster with 4 tergal yellow bands and 2 sternal bands of which the posterior one is often widely interrupted. Smaller species, length 7.0-9.0mm 16

16 Dorsal surface of first gastral tergite two and a half times as wide as long. Antennal segment 13 (fig. 51), in true dorsal view, narrowing almost from base, hardly two and a half times as long as broad at base. Thorax and propodeum about as long as broad. (Female: couplet 9.) ..... **scoticus** (Curtis) (Male)
See couplet 9 for notes.

— Dorsal surface of first gastral tergite only twice as wide as long. Antennal segment 13 (fig. 52), in true dorsal view, narrower at base, more parallel sided, about three times as long as broad. Thorax and propodeum longer than broad. (Female: couplet 9.) ..... **trifasciatus** (Müller) (Male)
See couplet 9 for notes.

Family Vespidae

These are social wasps with the eggs laid by one or a small proportion of the females (queens) and most of the foraging done by sterile females (workers). Colonies with a high proportion of queens mostly occur in tropical species. In the Polistinae the workers are scarcely distinguishable from queens except in behaviour whereas in the Vespinae the workers are nearly always separable from the queens, at least in size, and the cells which produce the queens are also larger than those which produce workers. The males may come from cells of either size.

In temperate climates only the queens hibernate and start new colonies in the spring. Males are produced in the late summer. In *Polistes,* although in the north nests are usually started by one female, others may quite soon join her. However, eventually one queen usually becomes established as the principal egg-layer. In tropical conditions colonies may be founded by swarms, sometimes of many individuals. Vespine colonies are nearly always founded by single queens but fertilized queens may exceptionally hibernate in the parental nest and then all lay in the following season but this behaviour is so far little studied or understood. In the S. American Polistinae Polybiini most colonies have several queens, up to ten per cent of the whole colony and some of these colonies are more or less perennial. However, under the same conditions, other species although having several queens have colonies which persist for less than a year. There is little doubt that these facts are partly related to the intensity of predation in the tropics. A summary of the biology and distribution of British vespid wasps is given by Archer (1978).

Subfamily Polistinae

Clypeus pointed below or, in male, more rounded. Malar space relatively long, gena broad. Pronotal keel often with a small fovea in front of it, a little above the ventral corner; area in front of reduced pronotal tubercle marked off by a raised keel. Mid tibia with two spurs. Claws simple. Propodeal orifice (fig. 54) long and narrow, more or less pointed above. First gastral segment narrowed anteriorly but not petiolate.

The very large genus *Polistes* is found in all regions but not really established in Britain. Various species, especially American ones, are occasionally introduced by commerce and one European one apparently survived for a season in Hampshire; no males, however, seem to have been recorded in any species. The classification of the genus is discussed in Richards (1973).

The species make, out of wood-pulp, small stalked combs, attached by a short peduncle, usually in more or less sheltered places. The largest colonies may have as many as 1-2,000 cells and produce twice that number of wasps but most colonies are much smaller with 1-200 cells and 10-20 wasps. The female castes are scarcely distinguishable when dead though egg-laying queens tend to be larger. Prolonged observation of a colony will usually establish that all or most of the eggs are laid by one of the females and that the others do all the work. In temperate climates, only the egg-laying queens hibernate and found new colonies in the spring. The wasps collect nectar from flowers or other sources and catch many insects, especially caterpillars. The observations on the European species are now very extensive but most of the more important papers are listed in Richards (1971). The three European species of social parasites are usually placed in the genus *Sulcopolistes*.

Genus **Polistes** Latreille

— Whole insect—fig. 53. Female: Mandibles black (rarely yellow spotted in some southern forms). Gena yellow spotted or banded. Clypeus rarely black banded. Antennae orange, only segments 1-3 more or less blackened above. Gastal sternite 6 almost entirely yellow. Pronotal band and part of hind margin, pleural spot, spots on mesoscutum, scutellum, metanotum and propodeum, yellow. Gastral tergites 1-5 with emarginate yellow bands, yellow spots on sides of tergites 2 and on tergite 6.
..... **dominulus** (Christ)

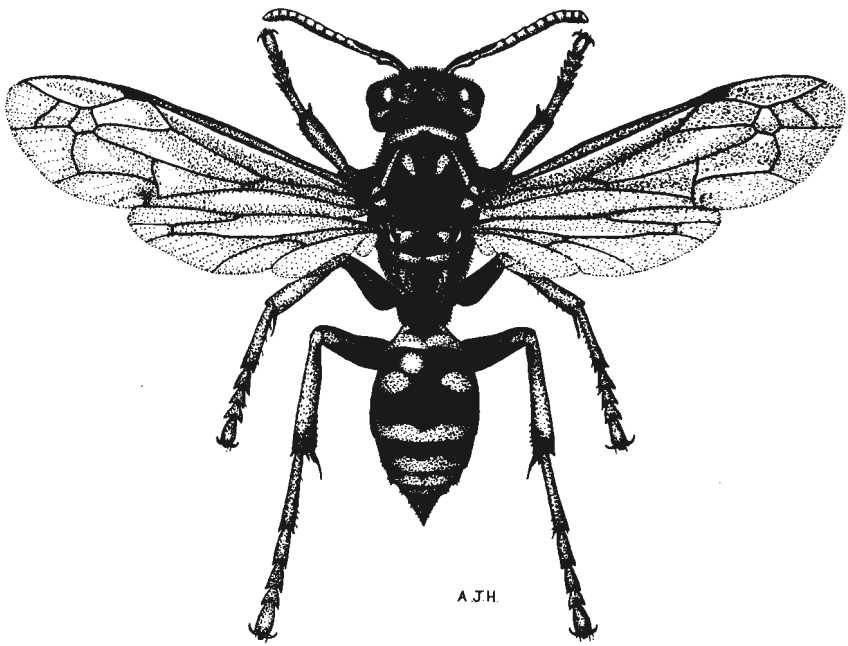

Fig. 53, *Polistes dominulus* ♀.

Nurse (1913) recorded that Major R. B. Robertson caught two female P. dominulus *(as* gallicus*) at Chandlers Ford, S. Hants in 1911 (which was the hottest summer there has been this century); Morice (1916) records the capture of a worker by J. W. H. Harrison in Durham, viii. 1915, at about 1200 feet, well away from the sea. Since these dates, the "species"* gallicus *has been split up into nine species (see Guiglia, 1972) and we cannot be sure to which the Hampshire and Durham females belonged. The British Museum has three females of certain identity: Middx, Mill Hill, 23. iii. 1937, in lettuce in shop (K. M. Guichard); W. Kent, Hither Green, 18. iii. 1975, on endive ex Spain (C. E. Bowman).*

Subfamily Vespinae

The wasps of this subfamily are easily recognised by the characters given in the key. They build, of wood-pulp, a series of combs, one below the other, surrounded by a many-layered envelope, placed normally in a hole in the ground or hollow tree, less often on a shelf in an attic or shed. *Vespula norwegica,* however, hangs its nest in trees or bushes and *Vespula austriaca* is a social parasite.

The queens and the workers are usually easily separated and the cells built at the end of the season for queen production are clearly larger than those which produce workers. Apart from rare, possibly abnormal specimens, workers differ from the queens in size and usually to some extent in colour pattern. The rare intermediates may, judging from observation of Dr. Nixon's, be perhaps the produce of abnormal nests (see *Vespula germanica* below).

The biology of our wasps is discussed in detail by Spradbery (1973) and by Kemper & Döhring (1967) and their taxonomy by de Beaumont (1944), Blüthgen (1961) and Guiglia (1972).

References below to colour patterns refer only to British specimens. Hibernating queens may be disturbed by man so that the earliest dates of capture may not be very significant. The females are made up of queens and workers. The figures in brackets after the months of occurrence show the numbers of specimens obtained in each month by general collecting.

Key to genera

1 Clypeus with short, bristle-like hairs on lower third only (fig. 55). Posterior ocelli at the level of the centre of the posterior lobe of eyes (fig. 56). Pronotal keel strong at sides, acute and bent forwards. Fore wing with a parastigma at least three times as long as pterostigma. Male with marked tyloides beneath the antennal segments. (Envelope of nest with blister-like pieces adhering to the outer surface.) ..... **Vespa** (p.32)

— Clypeus with long hairs on its whole surface (fig. 58a). Posterior ocelli at the level of the hind margin of the posterior lobe of eyes (fig. 57). Pronotum either without a keel or with a very weak one at sides. Fore wing with parastigma not more than one and a half times as long as pterostigma. Male antennae without distinct tyloides 2

2 Malar space very short, considerably shorter than the terminal diameter of the scape, even in the male. Ventral edge of mandible (fig. 58b) convex at base (least so in *austriaca)* not in a straight line with distal part. Pronotum with no keel. Envelope of nest with blister-like patches on outside or else large, overlapping sheets. ..... **Vespula** (p.33)

— Malar space considerably longer than terminal diameter of the scape. Mandible with its ventral edge near base not convex, in a straight line with distal part (fig. 59). Pronotum with a weak lateral keel. Envelope of nest with additions in large sheets which are not blister-like. (Gena not marginated.) ..... **Dolichovespula** (p.35)

Genus **Vespa** Linnaeus

Whole insect—fig. 60. Clypeus truncate below, angles of truncation slightly protruding. Malar space very short, gena broad, margined below but not on occiput. Pronotal keel with a small fovea behind its ventral corner, area in front of pronotal tubercle marked off by a raised keel. Mid tibia with two spurs. Claws simple. Propodeal orifice circular. First gastral tergite not at all petiolate, front almost at right angles to dorsal surface.

A moderate number of species of large size, mostly in the oriental tropics but extending to western Europe and Ethiopia; introduced into North America. Biology much as in *Vespula*.

— Orange with inconspicuous black markings; most of head and much of gaster after the anterior two-thirds of second segment, yellow. Queen usually with rather more black in the region of the pleural suture and metapleuron than the worker. Length, queen about 28mm, worker about 20mm, male about 22mm.

..... **crabro gribodoi** Bequaert

Nests usually in hollow trees, less often in thatch. Colonies not very large, at most a few hundred individuals. Carton yellowish, brittle. Food includes nectar, fruit, sometimes honey; various insects, including sometimes the honey-bee. England (especially S.W. Midlands), Wales, occasionally Scotland but probably carried by man (cf. Gardner, 1901: 21). Usually local but commoner in some periods (e.g. 1948-50), v-ix.

(In spite of the remark of Guiglia (1972: 86), the English form is a well-marked subspecies. It would appear that Dr Guiglia had examined only the two original females which, she says, are immature.)

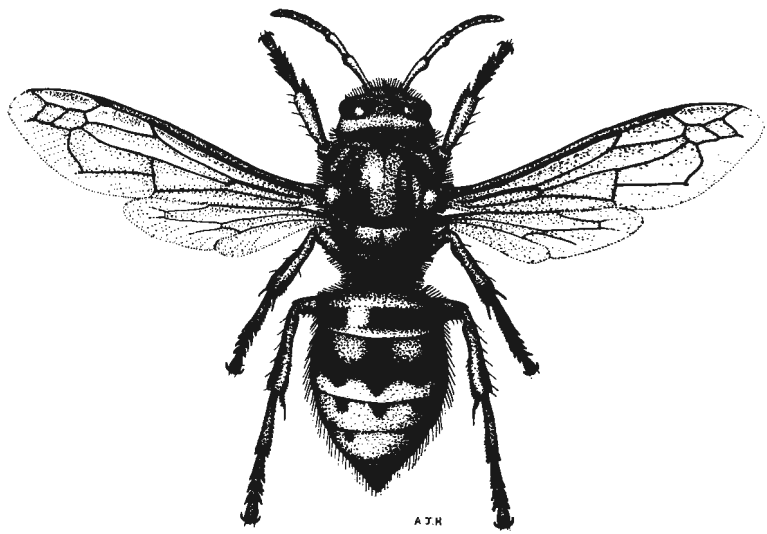

Fig. 60, *Vespa crabro gribodoi* ♀.

Genus **Vespula** Thomson

Whole insect—fig. 61. Like *Vespa* but smaller and differing as shown in the key to the genera. A moderately large Holarctic genus, introduced into Australia and New Zealand.

Colonies are founded by a single, fertilised, hibernated queen who builds a small comb with an inverted cup-shaped envelope in a hole in the ground (normally). Until her first brood of workers hatches she does all the work herself and apparently many colonies fail to reach any large size. When an appreciable number of workers has been reared, growth of the colony becomes rapid and eventually 10-14,000 cells may be constructed and 2-6,000 wasps may be active. By August combs of queen cells begin to be constructed and normally no more worker cells are built. Males may be reared in either type of cell. In September males and young queens start emerging and may be common on ivy flowers.

In warm climates (Morocco, California, Tasmania, New Zealand) fertilised queens may sometimes stay in the nest which becomes perennial and multiqueen. Such nests may become very large, up to 3m long in *V. germanica.*

A few species such as *V. austriaca* are parasitic on other species of *Vespula* and produce no worker caste.

Wasps collect a lot of sweet materials and besides nectar from flowers, fruit is destroyed and jam may be visited. They also kill many insects, including butterflies, and have been recorded attacking nestling birds. On the whole, however, their activities are beneficial to man.

Key to subgenera and species

1 Genal margin ending at a level rather below the bottom of the ocular sinus. Yellow of the inner orbit ending at the bottom of the ocular sinus. Gaster of female with long, black hairs. Male with gastral tergite 7 (fig. 62a) evenly convex, without overlapping scales. Worker propodeum black. Nest envelope with large overlapping grey sheets. (Subgen. **Vespula**).....2

— Genal margin extending to base of mandibles. Yellow of inner orbit extending to top of ocular sinus. Gaster of female with long, whitish hairs. Male with gastral tergite 7

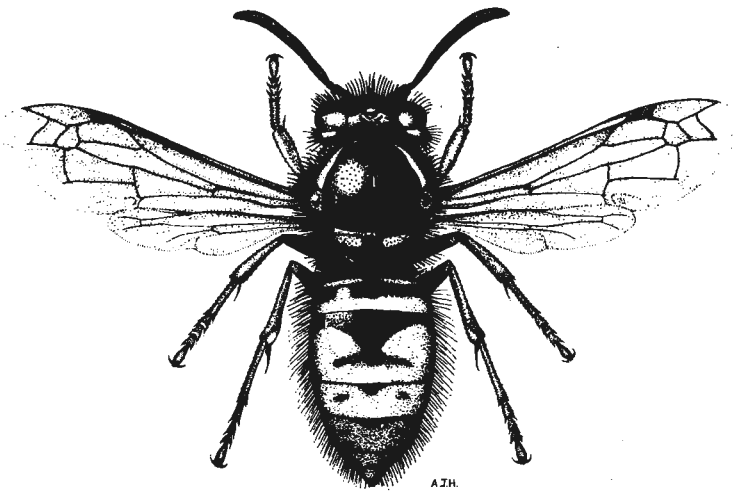

Fig. 61, *Vespula rufa* ♀.

flattened round the apex, with lateral scales. Worker propodeum with large yellow spots. (cf. Yarrow, 1955). Nest envelope with small blister-like adhesions. (Subgen. **Paravespula**) 6

2 Females 3

— Males 5

3 Tibiae with long black hairs. Angles of corners of clypeal ventral truncation more produced (fig. 63a). Clypeus usually with two or three black spots. Scape sometimes yellow beneath. Gaster without any reddish areas. (No worker caste. Length, about 17mm.) ..... **austriaca** (Panzer) (Female)

A parasite in the nests of V. rufa. *The relations between the queens are not known but the host queen is probably always killed eventually, after producing enough workers to raise the male and female parasites (references in Richards, 1971). England, Wales, Scotland, Ireland. Uncommon but less so in north and west. iv(1), vi(16), vii(13), viii(9), ix(1).*

— Tibiae without long hairs. Angles of corners of ventral clypeal truncation more rounded. Clypeus usually with a thick, central, black line. Scape black. Gaster often with reddish areas on first two tergites 4

4 Larger, length 17.0-18.0mm. Usually the yellow of the third gastral tergite is deeply anteriorly emarginate in centre and the small black side spots are widely surrounded by yellow (99% of specimens) ..... **rufa** (Linnaeus) (Queen)

ii-x (mostly iv-vi). See below and couplet 5 for further notes.

— Smaller, length 12.0-13.0mm. Often the yellow of the third gastral tergite is very shallowly emarginate and the small black spots are more or less continuous with the anterior black area (43% of specimens; 40% like the queen) ..... **rufa** (Linnaeus) (Worker)

vi(16), vii(36), viii(58), ix(6). See above and couplet 5 for notes on queen and male. Widespread in England, Wales, Scotland and Ireland but less numerous than Paravespula *species, probably because the colonies are smaller. They are subterranean but not very deep.*

5 Outer surface of mid and hind tibiae with some long black hairs. Aedeagus (fig. 63b) more contracted anteriorly, without slight lateral projections towards the apex. Gaster never with a red tinge. Length 12.0-14.0mm ..... **austriaca** (Panzer) (Male)

vi(1), vii(8), viii(31), ix(1). See couplet 3 for further notes.

— Outer surface of mid and hind tibiae without long hairs. Aedeagus (fig. 62b) less contracted anteriorly and with a slight projection towards the apex. Gaster often with traces of red on the first two segments. Length 12.0-15.0mm ..... **rufa** (Panzer) (Male)

vii(14), viii(112), ix(1). Often on flowers of Pastinaca. *See couplet 4 for further notes.*

6 Females 7

— Males 10

7 Mandibles with the cutting edge between the small sub-dorsal excision and the first large tooth absolutely straight (fig. 65b). Black separating the yellow inner orbital mark from the yellow central frontal spot not narrowing upwards (fig. 65a). Clypeus typically with a black anchor mark. Gena usually with two yellow spots, rarely joined. Humeral yellow stripe parallel-sided (fig. 65c). Yellow band of first gastral tergite in queen narrow, only feebly anteriorly emarginate but only in 17% of the workers similar, the remainder being like *germanica* 8

— Mandibles with the cutting edge between the small sub-dorsal incision and the first large tooth slightly sinuous (fig. 64b). Black separating the yellow inner orbital stripe from the yellow central spot narrowing upwards (fig. 64a). Clypeus typically with the black anchor broken into spots or reduced. Gena usually with a continuous yellow stripe. Humeral yellow mark widened to its centre in the queen (fig. 64c) but often not widened in the worker. Yellow band of first gastral tergite broad with a deep, diamond-shaped emargination (fig. 64d), usually partly enclosed in queen and worker 9

8 Larger, length 15.0-18.0mm. Propodeum black. Mid and hind coxae black. Yellow band of first gastral tergite narrow (fig. 65d), anterior angular emargination not enclosed ..... **vulgaris** (Linnaeus) (Queen)

i(2), ii(1), iii(5), iv(28), v(32), vi(18), vii(1), viii(3), ix(2), x(7), xi(4), xii(1). See below and couplet 10 for further notes.

— Smaller, length 9.0-14.0mm. Propodeum with two large yellow spots. Mid and hind coxae with yellow outer spots. Yellow band of first gastral tergite rather wider with the anterior black diamond at least half enclosed except in 17% of specimens. (Gastral sternites rather more extensively yellow.) ..... **vulgaris** (Linnaeus) (Worker)

vi(19), vii(69), viii(103), ix(29), x(48), xi(4). See above and couplet 10 for notes on queen and male.

More of a house wasp both for hibernation and nest-building than germanica *though most nests are built in holes in the ground; others in sheds, etc, or even in a dense hedge (Stelfox, 1930). Comb and envelope soft, brittle, yellowish-brown, made from rotten wood. England, Wales, Scotland, Ireland but commoner in north and west than* germanica.

[Queen-worker intercaste. Length 16.0mm. Propodeal spots small, transverse. Mid and hind coxae black. Band of gastral tergite 1 narrow with a small central emargination in front with small black spots on each side, just in front of emargination. London, Kensington, 26.ix.1966 (G. E. J. Nixon).]

9 Larger, length 16.0-20.0mm. Propodeum black. Mid and hind coxae black or with minute yellow dots. Gastral sternites 3-5 with triemarginate yellow bands. ..... **germanica** (Fabricius) (Queen)

iii(2), iv(26), v(35), vi(11), viii(1), ix(11), x(6), xi(1), xii(2). See below and couplet 10 for further notes

— Smaller, length 12.0-15.0mm. Propodeum with two large yellow spots. Mid and hind coxae with larger yellow outer spots. Gastral sternites 3-5 mainly yellow with a small black spot on each side, rarely the spot open in front as in the queen. ..... **germanica** (Fabricius) (Worker)

vi(2), vii(15), viii(62), ix(38), x(28). See above and couplet 10 for notes on queen and male.

Tends both to hibernate and build its nests more away from houses. Comb and envelope grey, tough, made from sound wood. England, Wales, Scotland, Ireland, but less comon than vulgaris *in north and west.*

[Queen-worker intercaste. Nest found Eynsham, Kent (G. E. J. Nixon), moved in vi to a summerhouse and kept until x. Produced many normal males and queens but when distrubed in x many abnormally large workers flew out. Unlike the queen, they took their bearings as a worker does. Size, length 12.0-19.0mm. Colour of propodeum black like queen (9 specimens), like worker (9), more or less intermediate, spots smaller and often divided into two on each side (18). Hind coxa black (7), with small or minute spots (21), moderate or large spots (7). Bands of gastral sternites 3-5 triemarginate (25), with enclosed lateral spots (10).]

10 Scale at sides of gastral tergite 7 (fig. 67a) extending to near apex but relatively narrow. Bowl-like apex of aedeagus entire (fig. 67b), bowl preceded on each side by a strong pointed process. Top of interantennal yellow mark flat or very little emarginate. Gaster normally with narrow yellow bands with a slight emargination, lateral enclosed spots in only about 10% of specimens ..... **vulgaris** (Linnaeus) (Male)

viii(1), ix(8), x(54), xi(3). See couplet 8 for further notes.

— Scale at sides of gastral tergite 7 (fig. 66a) relatively broad and ending where the lateral boundary of the tergite bends inwards. Bowl-like apex of aedeagus (fig. 66b) with a deep distal emargination, bowl preceded on each side by a small, rounded process. Top of inter-antennal yellow mark produced upwards into a rounded lobe on each side. Gaster normally with wider yellow bands with an angular central emargination and, on each side, an enclosed black spot, spot on tergite 3 not rarely open in front and spots on two or three others open in 25% of specimens. (Length 15.0-18.0mm.) ..... **germanica** (Fabricius) (Male)

ix(8), x(22), xi(10). See couplet 9 for further notes.

Genus **Dolichovespula** Rohwer

Like *Vespa* but smaller and differing as shown in the key to the genera. The type of the genus is the N. American species, *D. maculata* (L.), which is close to the

central European *D. media* (Degeer). Bischoff in 1941 erected a new genus *Pseudovespula* for the parasitic social wasps allied to *D. saxonica* (F.). Later, in 1943, Blüthgen made subgenera of *Dolichovespula, Boreovespula* for *D. norwegica* and *Metavespula* for *D. sylvestris* (Scopoli). I believe the best treatment is to allow only two subgenera, viz., *Dolichovespula s.s.* for *media* and its allies and *Pseudovespula* (of which *Boreovespula* and *Metavespula* are synonyms, **syn.n.**) for our two species, as well as for *D. saxonica* and the social parasites.

Dolichovespula is a moderate-sized Holarctic genus with the species showing rather more variation in general facies than is usual in *Vespula. D. media,* etc., are large wasps, half way to *V. crabro* in size. Some species have white rather than yellow markings and others have appreciable red areas on the gaster. The nests are less subterranean than those of *Vespula* and many of them are hung in the open from trees or bushes. The carton is grey and relatively tough and the envelope is in large sheets, not in small, blister-like pieces.

Key to species

1 Females.....2

— Males. (Often on flowers of *Pastinaca* or *Angelica.* Colour pattern more variable than in females.).....5

2 Clypeus with much closer large punctures, its long hairs white, its colour entirely yellow or, in 70-90% of specimens with a central black dot (fig. 68a). Pronotal keel strong right up to yellow humeral stripe. Yellow interantennal spot (fig. 68b) with a narrow ventral emargination in more than 90% of specimens. Gena in queen with a ventral spot or stripe in more than 60% of specimens. Tegula with a posterior yellow dot (fig. 68c) in most queens and some workers. Gaster with no reddish markings, tergites 3-4 with no lateral spots or emarginations in queen (fig. 68d), tergites 4-5 with none in worker (fig. 68e). Metanotum with yellow spots or dots in about 25% of specimens. Mid tibia rarely with a black or brown spot beneath.....3

— Clypeus (fig. 69a) with much sparser large punctures, its long hairs black, its colour yellow with a broad, central, longitudinal line which is widened at centre. Pronotal keel weaker as it approaches and sometimes does not reach the yellow humeral stripe. Yellow interantennal spot (fig. 69b) broadly, angularly emarginate below. Gena in queen with a ventral spot or stripe in only 4% of specimens. Tegula (fig. 69c) with a narrow anterior yellow margin in 90% of specimens, without a posterior dot. Gaster with more or less distinct traces of reddish pigment at sides of tergite 2, in front of yellow band, especially in worker, tergites 3-4 in queen (fig. 69d) and 4-5 in worker (fig. 69e) emarginate at sides or with enclosed spots. Metanotum black. Mid tibia with a black or brown spot beneath in nearly all queens and in 56% of workers.....4

3 Larger, length 16.0-18.0mm. Gena with a ventral spot or stripe in only 4% of specimens. Gastral tergite 3 with no lateral spots or emarginations. Mid tibia with black or brown ventral spot in 32% of specimens..... **sylvestris** (Scopoli) (Queen)
iii(1), iv(13), v(23), vi(18), vii(5), viii(16), ix(2). See below and couplet 5 for further notes.

— Smaller, length 12.0-15.0mm. Gena with at least a yellow dot below in 81% of specimens. Gastral tergite 3 emarginate on each side. Mid tibia with no black or brown spot beneath in 93% of specimens..... **sylvestris** (Scopoli) (Worker)
vi(13), vii(57), viii(106), ix(2). Common on flowers of Scrophularia. *See above and couplet 5 for notes on queen and male.*

Common. England, Wales, Scotland, Ireland, probably less common in the north. Nest often underground but also in ivy, hollow trees, beehives, sheds, or even in a tree or bush.

4 Larger, length 15.0-17.0mm. Gena with a ventral yellow spot or dot in only 4% of specimens. Gastral tergites 2-4 triemarginate in front, 5 with enclosed lateral spots. Mid tibia with a brown or black spot beneath in 98% of specimens.
..... **norwegica** (Fabricius) (Queen)

iii(1), iv (18), v(11), vi(10), vii(1), viii(4), ix(1). See below and couplet 5 for further notes.

— Smaller, length 10.0-14.0mm. Gena with a ventral yellow spot or dot in 90% of specimens. Gastral tergites 2-3 triemarginate, 4 in 18%, 5 in 72% with enclosed lateral spots. Mid tibia with a black or brown spot beneath in 56% of specimens.
..... **norwegica** (Fabricius) (Worker)
vi(20), vii(58), viii(10), ix(2). See above and couplet 5 for notes on queen and male. Rather common. England, Wales, Scotland, Ireland, commoner in north and west; in S.E. England local and irregular. Nests normally in trees or bushes, less commonly in haystacks, attached to a window or even, on exposed moors, underground.

5 Clypeus with a mixture of long black and white hairs. Pronotal keel strong up to yellow humeral stripe. Distal spike (fig. 68f) of parameral spine longer than width of apical expansion of aedeagus; inner margin of paramere with a row of strong bristles towards the apex, ventral projecting lamina longer and bending outwards; aedeagus parallel-sided for much of its length. Length 11.0-16.0mm. Clypeus yellow with a thick central line in only 2% of specimens, usually with a central dot or no markings. Yellow interantennal spot emarginate below, broadly (43%) or narrowly (¼-½ its width) (57%). Gena with no yellow spot below in 77% of specimens. Tegula brown (63%) or with a small posterior yellow dot (37%). No pleural spot or dot (45%). Scutellar yellow spots separated by their width or less (90%). Gastral tergites with narrow bands having a central anterior nick and sides not emarginate (26%) or one or more of tergites 2-4 emarginate on each side anteriorly. Fore tibia with a black (7%) or brown (5%) spot beneath, mid tibia yellow..... **sylvestris** (Scopoli) (Male)
vi(1), vii(54), viii(132), ix(8). See couplet 3 for further notes.

— Clypeus with long hairs all black. Pronotal keel becoming weak or evanescent as it approaches the yellow humeral stripe. Distal spike (fig. 69f) of parameral spine shorter than width of apical expansion of aedeagus; inner margin of paramere with a row of strong bristles towards apex, ventral projecting lamina not much projecting and not bent outwards; aedeagus narrowed to near apex, then expanded into a circular piece which is apically pincer-like. Length 11.0-16.0mm. Clypeus always with a broad, anchor-shaped central mark. Yellow interanntennal spot with a broad emargination below. Gena with a yellow mark below except in 28% of specimens. Tegula brown (19%) usually with a slight or broad anterior margin (81%) but a posterior dot in only 8% of these. Pleural yellow spot or dot absent in only 3%. Scutellar yellow spots separated by as little as one width in only 27% of specimens. Gastral tergites with broad yellow bands enclosing two small black spots (20%) or narrow ones, often with anterior nick and sides of bands on 2-7 emarginate (80%). Fore tibia always with a black spot beneath, mid tibia usually with a black (43%) or brown (43%) spot beneath. (The gastral colour of the male is quite sharply dimorphic but the yellower form occurs throughout its range.)
..... **norwegica** (Fabricius) (Male)
vi(3), vii(28), viii(62), ix(3). See couplet 4 for further notes.

Superfamily Sphecoidea

Family Sphecidae

The Sphecidae are a large family with more than 7,000 species in the world. After prolonged disagreements, it now seems best to place them in a single family with about 9 subfamilies. In a restricted fauna, some of these seem quite distinct but in the world fauna there are often connecting links. The sphecoids are quite close to the bees (Apoidea) and the morphological characters separating them are not large but they are clearly two different lines of specialization from a common ancestor. The sphecoids are less specialised; there is no bee with the habit of *Podalonia hirsuta* which does not make a nest until after it has captured provision for it. On the other hand, the sphecoids are very rarely social (only in the S. American *Microstigmus*)

and then not in a very high degree. But the genus *Ammophila* is remarkable in including some tool-users and *A. pubescens* is capable of looking after more than one nest at one time.

As a rule the nest (burrow in the ground or in wood or hollow stem) is built or occupied first by the fertilized female. Then prey are captured, their numbers varying with their nature (e.g., many aphids but sometimes only one caterpillar); the degree to which the prey are paralysed also varies with the species, sometimes recovering if removed from the cell but in others (e.g., *Oxybelus)* being dead. The paralysis may also vary within the species but seems usually to be more severe than in more primitive Hymenopterous families. Females probably rarely lay more than a dozen eggs which shows the value of this degree of maternal care. A few genera are parasitic (in Britain *Nysson*) on their allies. Most of our species have only one generation a year but some of the small Crabronines and Pemphredonines possibly have two.

The species are on the whole not the commonest of our insects and it may require considerable experience to find and catch them. Of our 118 supposed species, 5 have not been captured for nearly 100 years. This may be (1) because they do not now occur, (2) because they are irregular migrants, or even (3) because they were originally recorded in error. The five species with the possible reasons for their apparent disappearance are: *Tachysphex obscuripennis* (2), *Lestica clypeata* (1, 2), *Dinetus pictus* (1, 2), *Psen ater* (1, 2), *Cerceris sabulosa* (1, 2, 3). One species, *Ectemnius dives,* seems to have been introduced and spread since about 1920.

Lomholdt's recent (1975-6) account of the Danish and Scandinavian species will be found very useful; it includes an account of the early stages and also much biological information.

Key to genera

1 One submarginal cell in the fore wing 2
— Two submarginal cells in the fore wing 10
— Three submarginal cells in the fore wing 16
2 The submarginal cell not separated from the discoidal (1 M) cell. Metanotum with a small transparent projection on each side. Base of propodeum with a grooved central process (mucro) ..... **Oxybelus** (p.59)
— The submarginal and discoidal cells separated by the vein Rs + M. Neither metanotum nor propodeum with such processes 3
3 Inner margin of eye deeply emarginate. (Gaster long, gradually narrowed to base, black.) ..... **Trypoxylon** (p.44)
— Inner margin of eye not emarginate 4
4 Mandibles unidentate. Gaster bronzy-black without yellow spots. Anterior angle of ocellar triangle obtuse 5
— Mandibles normally with 2, 3 or 4 apical teeth. If with one very blunt tooth *(Crossocerus* subgen. *Hoplocrabro*), then gaster yellow-spotted and ocellar triangle equiangular 6
5 Eyes densely hairy. Mandibles (fig. 71) emarginate below near base. ..... **Entomognathus** (p.58)
— Eyes bare. Mandibles (fig. 70) not emarginate beneath ..... **Lindenius** (p.57)
6 First gastral segment narrow, elongate, gaster petiolate (not yellow marked). Mesepisternum with no raised epicnemial keel on dorsal part ..... **Rhopalum** (p.56)
— Gaster normally not petiolate or, if the first segment is somewhat narrowed *(Crossocerus* subgen. *Cuphopterus*), there is a sharp epicnemial keel 7
7 Ocelli in an equilateral triangle or almost so. Mesopleuron smooth and shining, sometimes finely punctured. Propodeum often with a dorsal area defined by a keel or furrow, whole surface more or less smooth and shining. (Gaster in many species black.) ..... **Crossocerus** (p.46)
— Ocellar triangle with anterior angle obtuse (usually, more or less, except in *Clytochrysus*). Mesopleuron striate and/or coarsely punctured (except in *Crabro* in which it is

smooth). Propodeum without a defined dorsal area, surface at least dorsally striate and often reticulate 8

8 Gaster strongly punctured. Sides of frons with deep, narrow impressions (fig. 72). Male head strongly lengthened and narrowed behind the eye. ..... **Lestica** (p.55)

— Gaster at most finely and indistinctly punctured. Frontal impressions not so strong and narrow. Male head normal 9

9 Male antennae with 13 segments, fore tibiae very strongly dilated behind. Female pygidial area broad and flat (fig. 73) ..... **Crabro** (p.45)

— Male antennae with 12 segments, fore tibiae not much dilated behind. Female pygidial area produced into a deep gutter (fig. 74) ..... **Ectemnius** (p.51)

10 Marginal cell of fore wing widely truncate at end *or* second submarginal cell petiolate. . 11

— Marginal cell gradually pointed at end. Second submarginal cell not petiolate. (Black species) 12

11 Marginal cell in fore wing truncate, second submarginal cell not petiolate. Margins of eyes divergent below. Black, red and yellow species ..... **Dinetus** (p.41)

— Marginal cell pointed, second submarginal cell petiolate. Margins of eyes parallel below. Black or black and red species ..... **Miscophus** (p.42)

12 Anterior part of first gastral segment forming a distinct, narrow petiole 13

— Anterior part of first gastral segment forming at most a very short petiole, wider than long 14

13 Fore wing with one discoidal cell (1M). Pterostigma very large. ..... **Stigmus** (p.66)

— Fore wing with two discoidal cells (1M, 2M). Pterostigma not large. ..... **Pemphredon** (p.67)

14 Fore wing with one discoidal cell (1M). Pterostigma very large. ..... **Spilomena** (p.73)

— Fore wing with two discoidal cells (1M, 2M). Pterostigma not large. 15

15 Mesopleuron smooth with two or three lines of large punctures. Hind tibia without spine-like bristles. Female without a pygidial area. ..... **Passaloecus** (p.71)

— Mesopleuron more or less coarsely reticulate. Hind tibia with spine-like bristles. Female with a pygidial area ..... **Diodontus** (p.69)

16 Gaster without yellow markings, with a petiole, generally long, formed of the first sternite alone 17

— Gaster often with yellow markings, usually not petiolate but if with a slight petiole it is formed of both tergite and sternite 20

17 Petiole cylindrical. Mid tibia with two spurs. Length 12.0-25.0mm 18

— Petiole flattened with longitudinal keels. Mid tibia with one spur. Length 5.0-12.0mm 19

18 First gastral tergite (i.e., the part immediately following the petiole) elongate, narrow, not much raised above the petiole, its spiracles lying beyond its mid point. Larger spur of hind tibia with dense, fine pectinations ..... **Ammophila** (p.75)

— First gastral tergite shorter and thicker, rising steeply from the petiole, its spiracles at its mid point. Larger spur of hind tibia with pectinations strong and well separated on distal half, especially in female. ..... **Podalonia** (p.76)

19 Hind wing with vein cu-a entering M + Cu1 before Cu1 leaves the joint vein. Face with a strong, transverse keel below the antennal sockets. ..... **Psenulus** (p.64)

— Hind wing with vein cu-a entering Cu1 after it has left M + Cu1. Face with a tubercle between the antennal sockets or a fine keel joining the lower margin of the sockets. ..... **Psen** (p.60)

20 Second submarginal cell distinctly petiolate 21

— Second submarginal cell not petiolate 23

21 First gastral segment markedly narrower than second, apex of each segment constricted. Marginal cell rounded distally. Apex of hind femur bent down and flattened into a kidney shaped plate surrounding base of tibia ..... **Cerceris** (p.83)

— First gastral segment not markedly narrower than second, other segments not constricted. Marginal cell distally pointed. Apex of hind femur unmodified 22

22 Pterostigma small, second submarginal cell receiving two recurrent veins (1 & 2 m-cu). Pronotum short. Dorsal surface of propodeum short with two, usually long, spines on each side ..... **Nysson** (p.79)

— Pterostigma elongate, second submarginal cell receiving only one recurrent vein (2 m-cu). Pronotum rather long. Dorsal surface of propodeum elongate, ending in two short

spines ..... **Alysson** (p.78)

23 Recurrent veins received in the first and third submarginal cells. First gastral segment rather elongate, swollen over apical half. Gaster black with yellow or whitish marks ..... **Mellinus** (p.77)

— Recurrent veins received in the second and third submarginal cells. First gastral segment transverse, subsemicircular. Gaster black and yellow or mainly yellow. ..... **Philanthus** (p.82)

— Recurrent veins both received in the second submarginal cell 24

24 Marginal cell pointed at end. First gastral segment subsemicircular but a little longer than or *(A. fargeii)* as long as broad, segments with yellow bands. (Inner margins of eyes parallel or convergent towards clypeus.) 25

— Marginal cell truncate with a small accessory cell beyond the truncation. First gastral segment subsemicircular, transverse, segments without yellow bands 26

25 Second gastral sternite strongly angled in profile. Epicnemial keels joining one another across the mesosternum (fig. 75) ..... **Argogorytes** (p.81)

— Second gastral sternite only gently curved in profile. Epicnemial keels curving back and joining the precoxal sulcus in front of the mid coxa (fig. 76) ..... **Gorytes** (p.80)

26 Parastigma not longer than pterostigma. Posterior ocelli normal. Eyes of male meeting on vertex ..... **Astata** (p.40)

— Parastigma much longer than pterostigma. Posterior ocelli flattened and deformed (fig. 77). Eyes of male widely separated on vertex ..... **Tachysphex** (p.43)

Subfamily Astatinae

Genus **Astata** Latreille

Whole insect—fig. 78. Mandibles not emarginate beneath. Ocelli normal, eyes of male widely touching on vertex. Pronotal tubercles nearly reaching the tegula. Anal lobe of hind wing large, especially in male. Mid tibia with two spurs. Gaster sessile. British species red and black. A widely spread genus which stores Hemiptera Heteroptera in cells in the ground.

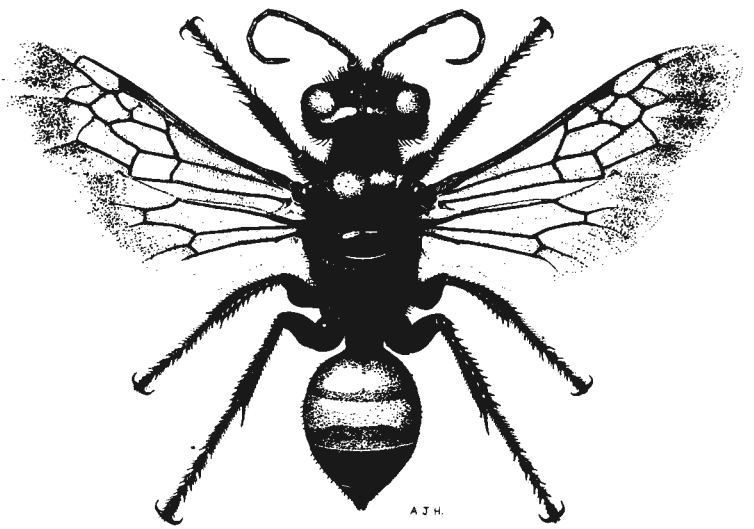

Fig. 78, *Astata boops* ♀.

Key to species

1 Female with pygidial area dull, granulate, margined with rows of strong, curved spines (fig. 79). Frons shining with close punctures. Male frons black. Last gastral sternite with outstanding hairs. Larger species, 9.0-13.0mm. (Subgen. **Astata**) ..... **boops** (Schrank)

Sometimes common on umbellifers. Prey pentatomid nymphs. Kent to Cornwall, north to Pembroke and Norfolk. Common. vi-viii.

— Female with pygidial area (fig. 80) shining, with a few punctures, no marginal bristles. Frons dull, reticulate with sparse punctures. Male with a white spot just in front of median ocellus. Last gastral sternite without outstanding hairs. Smaller species, length 6.0-8.0mm. (Subgen. **Dryudella** Spinola) ..... **pinguis** (Dahlbom)

Usually on sandy soils, prey pentatomid and lygaeid nymphs. Kent to Cornwall, north to S. Lancs and N. W. Yorks, Perth, eastern Ireland. Not common. v-viii.

Genus **Dinetus** Panzer

Whole insect—fig. 81. Mandibles emarginate beneath. Ocelli normal. Fore tarsi with a distinct pecten. Mid tibia with 2 spurs in female, none in male. Anal lobe of hind wing short. Propodeum with an elongate, cross-striate, well-defined dorsal area. One European and a few Oriental species. Nests in light soils, prey Hemiptera Heteroptera (Lygaeidae and especially Reduviidae).

— Black, gaster mostly red; spots behind eyes, part of pronotum, legs mostly and spots on gaster, pale yellow. Male with face yellow, antennae spirally coiled (fig. 83). Head and thorax closely punctured. Length 7.0-8.0mm, male smaller ..... **pictus** (Fabricius)

Berks (Windsor, Ascot). Not seen for more than 100 years.

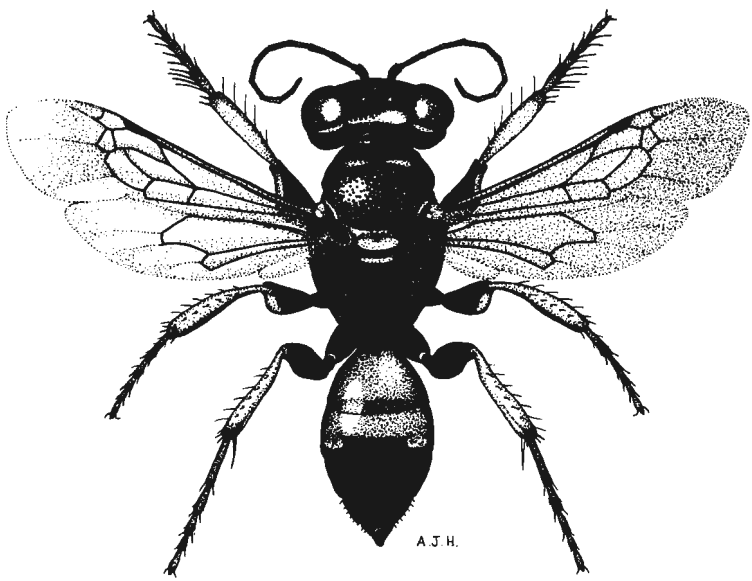

Fig. 81, *Dinetus pictus* ♀.

Subfamily Larrinae

Genus **Miscophus** Jurine

Whole insect—fig. 82. Mandibles emarginate beneath. Ocelli normal. Fore tarsi of female with a distinct pecten. Mid tibia with 1 spur. Female with no pygidial area. Species all small (British 3.5-5.5mm long), found in Europe, Africa and North America. Nest in sandy soils, preying on small spiders.

Key to species

1 Gaster basally red except in some males which may be only red-tinged. Frons shining, closely but relatively coarsely reticulate..... **concolor** Dahlbom
Hants, Dorset, Beds, Berks, Notts, Surrey, W. Kent. Not very common. vi-ix.

— Bronzy-black, no red on gaster. Frons dull, very closely and finely reticulate, especially near ocelli ..... **ater** Lepeletier
Sandhills. E. Kent (Deal), E. Sussex (Camber). Rare. vi-viii.

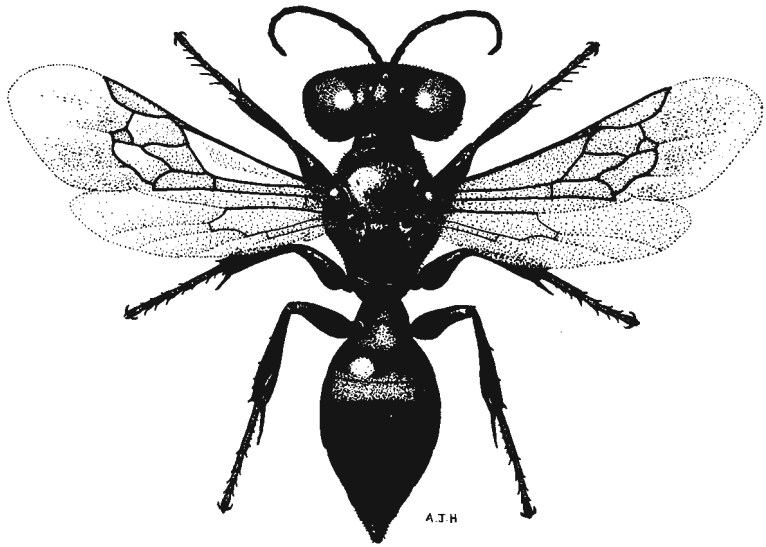

Fig. 82, *Miscophus concolor* ♀.

Genus **Tachysphex** Kohl

Whole insect—fig. 84. Mandibles emarginate beneath. Posterior ocelli flattened and elongate. Fore tarsi with a pecten in female. Mid tibia with 1 spur. Female with a pygidial area, male without. Anal lobe of hind wing large, elongate. Dorsal area of propodeum large but not defined. A great many species in all continents (except apparently New Zealand), mostly of moderate or small size. Nest in the soil, prey orthopteroids.

Key to species

1 Gaster black. Mesoscutum quite closely punctured but shining, with very distinct interstices. (Facial pubescence of male silvery. Legs black, tarsi of male reddish. Length 4.0-7.0mm.) ..... **unicolor** (Panzer)
Nests in sandy soils and preys on acridid nymphs. Kent to N. Devon, north to Caernarvon and N. Lincs, N. Lancs. Not very common. v-viii.

— Gaster with major anterior part red. Mesoscutum dull, confluently punctured..... 2

2 Females: with 12 antennal segments, a distinct pygidial area, fore femora simple 3

— Males: with 13 antennal segments, no pygidial area, fore femora excised beneath 4

3 Fourth segment of hind tarsi distinctly longer than broad (fig. 85a). Fore tibia blackish beneath. Length 5.0-7.0mm..... **pompiliformis** (Panzer) (Female)
Nests in light, usually sandy soils, prey acridid nymphs. A rare form of the female has the gastral tergites 1-3 much blackened; it differs from T. unicolor *in the much denser pleural sculpture. Kent to Cornwall, north to Anglesey, N. Lancs, N.E. Yorks, Ayr, Aberdeen, eastern Ireland. Common. v-ix.*

— Fourth segment of hind tarsi broader than long (fig. 86a). Fore tibia reddish beneath. Length 6.0-10.0mm ..... **obscuripennis** (Schenck) (Female)
Nests in light soils, prey blattoid nymphs (Ectobius). *E. Kent (Deal). 1 ♂, viii. 1882.*

4 Facial pubescence silvery. Third submarginal cell less produced. Fourth segment of hind tarsi a little longer than broad (fig. 85b). Fore tibia blackish beneath. Eyes in life dark.

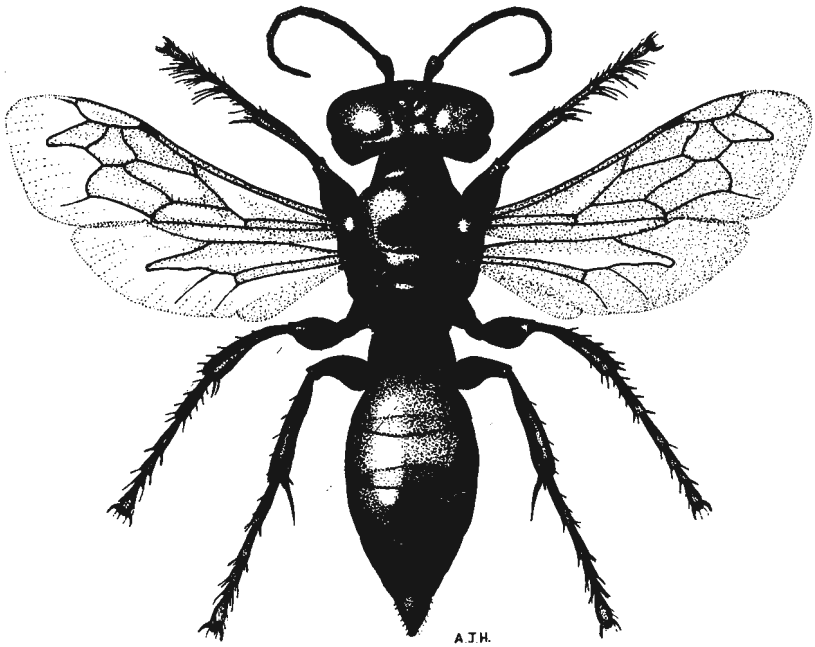

Fig. 84, *Tachysphex pompiliformis* ♀.

..... **pompiliformis** (Panzer) (Male)
See couplet 3 for notes.

— Facial pubescence golden. Third submarginal cell more produced. Fourth segment of hind tarsi not quite so long as broad (fig. 86b). Fore tibia reddish beneath. Eyes in life green ..... **obscuripennis** (Schenck) (Male)
See couplet 3 for notes.

Subfamily Trypoxylinae

Genus **Trypoxylon** Latreille

Whole insect—fig. 87. Eyes emarginate on their inner side. Mandibles not emarginate beneath. Fore wing with marginal cell pointed distally, hind wing with a small anal lobe. Mid tibia with one spur. Propodeum with a large dorsal surface, dorsal area hardly defined.

A large number of species in all regions of the world, all preying on spiders and building with mud. British species small or rather small black insects, nesting in various cavities such as *Anobium* burrows, cut stems, hollow roots, rarely in small holes in vertical earth-faces. The cavities are divided into cells by mud divisions.

Key to species

1 Anterior tibia and tarsus largely reddish. Antennae (fig. 88) thickened distally, especially in male, segment 13 in male about two and a half times as long as broad at base. (Clypeus with two small ventral teeth in female. Length 4.5-8.0mm. (cf. Richards, 1955.)) ..... **clavicerum** Lepeletier
Kent to Cornwall, Glamorgan, north to Staffs and S.E. Yorks. Common. v-ix.

— Anterior tibia and tarsus black or blackish. Antennae scarcely thickened distally, segment 13 in male more than three times as long as broad at base (fig. 89b, c) 2

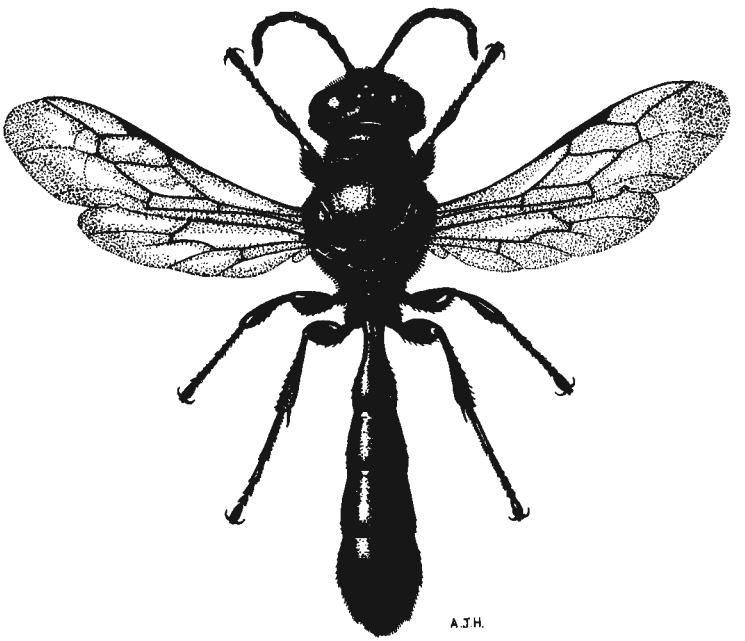

Fig. 87, *Trypoxylon figulus* ♂.

2 Separation of eyes on vertex and at clypeus about the same (fig. 89a). First segment of gaster wider and relatively shorter (fig. 89d). Female clypeus not or scarcely dentate..... **figulus** (Linnaeus)

S. England to at least S. Scotland (Dumfries). Common. v-ix.

[Three varieties have been recognised by de Beaumont (1945: 476-8): (a) *major* Kohl, 1882. Length, female 9.0-12.0mm, male 7.5-10.0mm. Pleural punctures distinct, well separated. Striae of propodeal dorsal area longitudinal. Clypeus in female projecting moderately below. (b) *media* de Beaumont, 1945. Length, female 6.5-10.0mm, male 6.0-8.5mm. Pleural punctures close, not very distinct. Propodeal striae more oblique. Clypeus of female strongly projecting. Segment 13 of male antenna shorter than in the other two forms. (c) *minor* de Beaumont, 1945. Length, female 6.0-9.0mm, male 5.0-7.5mm. Pleural punctures indistinct, not close. Propodeal striae more irregular. Clypeus of female feebly projecting. These three forms occur in Britain; *media* is the most distinct. They would have to be bred in some numbers to determine their status.]

— Separation of eyes considerably greater on vertex than at clypeus (fig. 90a). First segment of gaster normally relatively longer and narrower (fig. 90b). Female clypeus distinctly bidentate. (Length 7.0-11.0mm) ..... **attenuatum** Smith

Kent to Cornwall, Wales, Notts, Dumfries. Common. v-ix.

Subfamily Crabroninae

Genus **Crabro** Fabricius

Whole insect—fig. 91. Mandibles bidentate, not excavated beneath or feebly so in male. Antennae inserted just above the clypeus, in male more or less defomed, with 13 segments. Ocelli in anteriorly obtuse triangle. Eyes with margins strongly converging below. Second sector of lower margin of submarginal cell of fore wing not more than half as long as first, a little longer than the 'cubital' cross-vein (r-m). Male fore tibia expanded into a very large plate. Female with a flat pygidial plate.

Large or moderate sized species, nearly always with yellow spotted gaster. About 80 species, Holarctic with a few species in South America. Only the typical subgenus occurs in Britain. Species nesting in the soil and preying on Diptera.

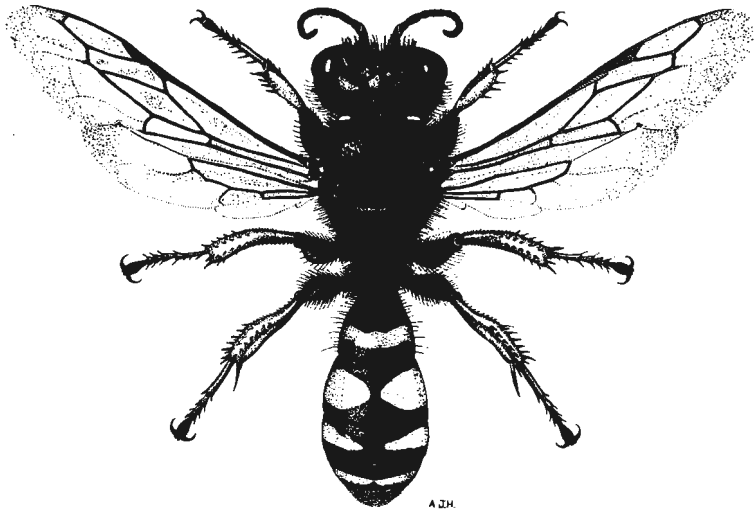

Fig. 91, *Crabro cribrarius* ♀.

Key to species

1 Mesoscutum longitudinally striate on posterior half or more. Angles of posterior face of propodeum not keeled except quite ventrally. Larger, length 10.0-15.0mm. (Male fore tibia (fig. 92) anteriorly mainly yellow, posterior expansion brownish with pale spots. The British form normally lacks the yellow pronotal and metanotal bands which are usual on the Continent.) ..... **cribrarius** (Linnaeus)
Prey Therevidae, Asilidae, Empididae, Syrphidae, Muscoidea. Kent to Cornwall, north to Nairn and mid Perthshire, Wales, Isle of Man. Common. v-ix.

— Mesoscutum nowhere longitudinally striate. Angles of posterior face of propodeum keeled for most or all of its length. Smaller, length 7.0-13.0mm 2

2 Females 3

— Males (posterior face of propodeum coarsely clathrate) 4

3 Propodeum with posterior face somewhat rugose, dorsally with a sharp-margined furrow. Thorax and first gastral tergite yellow spotted.
..... **peltarius** (Schreber) (Female)
Prey Therevidae, Stratiomyidae, Muscoidea. Kent to Cornwall, north to Sutherland, Wales, eastern Ireland. Common. v-viii.

— Propodeum with posterior face coarsely clathrate, with no marked furrow. Thorax and first gastral tergite black ..... **scutellatus** (Scheven) (Female)
Prey Dolichopodidae, nearly always female. Surrey to Dorset, E. Suffolk, S.E. Yorks. Very local. vi-viii.

4 Antenna with funicle strongly dilated, with long white hairs beneath. Expansion of fore tibia (fig. 93) half dark brown, half whitish with yellow-brown stripes. Scape beneath and spots on first gastral tergite nearly always yellow.
..... **peltarius** (Schreber) (Male)
See couplet 3 for notes.

— Antenna with funicle little dilated, without white hairs beneath. Expansion of fore tibia (fig. 94) brown with yellow lines except on distal quarter. Scape, thorax and first gastal tergite black ..... **scutellatus** (Scheven) (Male)
See couplet 3 for notes.

Genus **Crossocerus** Lepeletier & Brullé

Whole insects—figs. 95 and 103. Mandibles with 1-3 teeth, not excavated beneath. Antennae inserted just above the clypeus, in male rarely slightly modified though

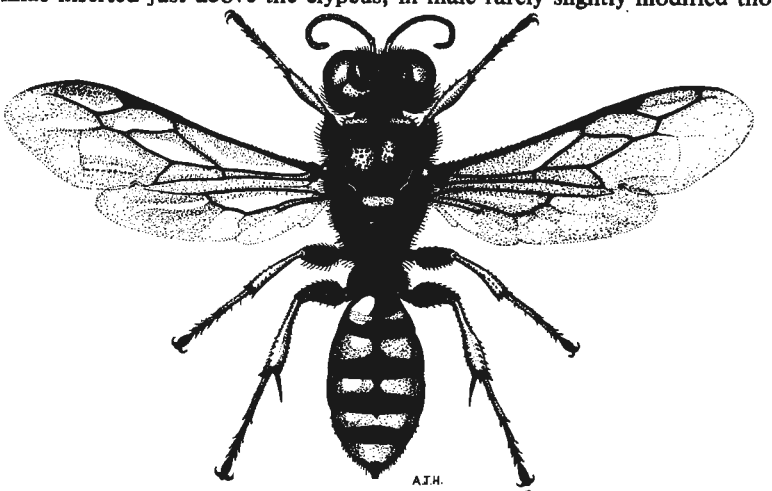

Fig. 95, *Crossocerus vagabundus* ♀.

usually with cilia beneath, with 13 segments. Ocelli in a more or less equilateral triangle. Eyes with inner margins strongly converging below. Second sector of lower margin of submarginal cell in fore wing usually about as long as first, usually much shorter than the 'cubital' cross-vein (r-m). Fore tibia of male rarely expanded, fore basitarsus more often so. Female pygidial plate of variable form.

Mostly rather small black species, only a few larger with yellow markings. About 140 species found in all regions but mainly Holarctic. Species nesting in the soil or in hollow stems or rotten wood. Prey varied but usually Diptera. The thorn-like spine in front of the mid coxa of some species is often best seen from beneath.

Key to species

1 Gaster yellow-spotted, except rarely in *quadrimaculatus* which has a small spine at the bottom of the occipital carina (fig. 96a) 2

— Gaster black; occipital carina without a spine below 5

2 Occipital carina produced into a small spine at lower end. Female with unidentate mandibles and median lobe of clypeus acute at sides (fig. 96c). Male with antennal segment 13 truncate (fig. 96b). (No frontal impressions. Dorsal area of propodeum strongly defined. Subgenus **Hoplocrabro** Thomson. Yellow markings variable, rarely absent. Length 5.0-10.0mm.) ..... **quadrimaculatus** (Fabricius)

Nests in earth, particularly amongst roots of uprooted trees. Prey mainly Diptera, of many families including some Nematocera, rarely also adult Lepidoptera (Tortricidae) and Trichoptera (Phryganeidae). Kent to Cornwall, north to Cheshire and mid-west Yorks, Wales, Ireland. Common. vi-ix.

— Occipital carina not produced into a spine at lower end. Female with tridentate mandibles and median lobe of clypeus not so acute at sides. Male antennal segment 13 not truncate 3

3 First segment of gaster a little longer than broad (fig. 97a). Dorsal area of propodeum strongly defined. Frons quite closely punctured with well-defined narrow impressions (fig. 97b). Male with a spine at basal third of fore femur, hind coxa simple. Length 7.0-11.5mm. Subgenus **Acanthocrabro** Perkins ..... **vagabundus** (Panzer)

Nests in rotten wood. Prey Tipulidae, legs often removed (or autotomized). London to S. Hants, north to N. Lincs and Cheshire. Not common. vi-vii.

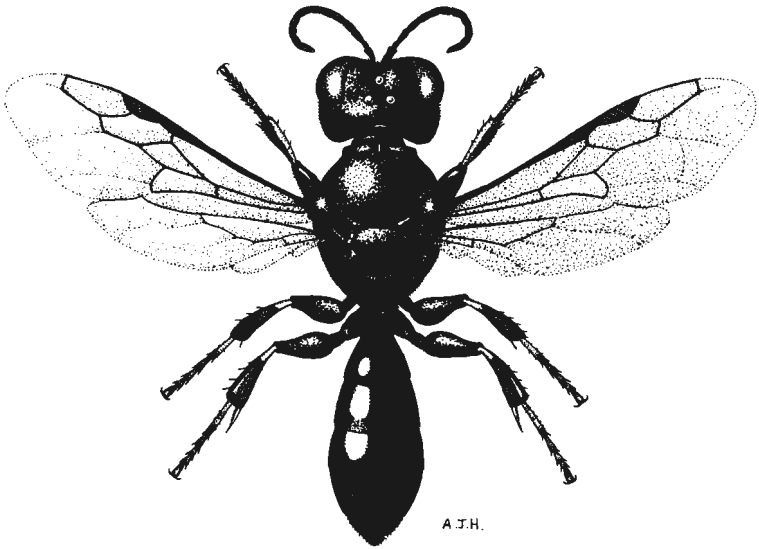

Fig. 103, *Crossocerus elongatulus* ♀.

— First segment of gaster considerably longer than broad (fig. 98a). Dorsal area of propodeum feebly defined, especially at sides. Frons largely occupied by the very wide, almost unpunctured impressions (fig. 98b). Male fore femur flattened but without a tooth beneath, hind coxa with a spine at base. Length 7.5-11.5mm. (Male with cilia beneath the long proximal flagellar segments.) Subgenus **Cuphopterus** Morawitz 4

4 Tibiae spotted with black posteriorly. Furrow at anterior margin of propodeum usually defined behind, though only weakly in male. Frons in male with long hairs anteriorly (fig. 98c). Mid tibia in male externally longitudinally excavated.
..... **dimidiatus** (Fabricius)
Nests in rotten wood. Prey various Diptera. Kent to Cornwall, north to Ross and Inverness, Inner Hebrides, Glamorgan, Ireland. Common, perhaps especially in north. v-viii.

— Tibiae entirely yellow. No real furrow at anterior margin of propodeum and certainly no posterior margin to one. Frons in male with short hairs anteriorly. Mid tibia in male externally a little flattened ..... **binotatus** Lepeletier & Brullé
Nests in hard rotten wood. Prey Diptera: Rhagio (Leptis). *Kent to Devon, north to Dumbarton. Local and not common. vi-viii.*

5 Female with a trilobed impression on the broadly triangular pygidial plate (Fig. 99a). Male with mid tibia short, apex truncate (fig. 99b), without spurs, basitarsus slightly curved. (Mandibles distally bidentate with a central tooth on the inner margin. Dorsal area of propodeum defined all round by a crenate furrow.) (Subgenus **Ablepharipus** Perkins, R. C. L.) ..... **podagricus** (Vander Linden)
Nests in hard dead wood. Prey small Diptera, especially Nematocera. Kent to Cornwall, north to Ayr, Glamorgan, eastern Ireland. Common v-viii.

— Female pygidial plate without a trilobed impression. Male mid tibia and basitarsus not as above 6

6 Females 7

— Males. (Antennae with 13 segments. Usually without a pygidial area.) 22

7 Pygidial area regularly triangular, its surface flat, punctured. (Small black species occurring from v to ix and possibly having two generations a year.) Subgenus **Crossocerus** Lepeletier & Brullé 8

— Pygidial area with its sides curved inwards, excavated so that it is posteriorly gutter-like. Subgenus **Blepharipus** Lepeletier & Brullé 15

8 Sternopleural area in front of mid coxa with a small projecting point (fig. 100a). Pygidial plate closely punctured, with recumbent silvery hairs posteriorly 9

— Sternopleural area in front of mid coxa without a projecting point. Pygidial plate more or less sparsely punctured, with sparse bristles 12

9 Clypeus more or less yellow, median lobe broad, edge straight, well defined at sides. Mandibles largely yellow. (Length 5.0-7.0mm.) ..... **palmipes** (Linnaeus) (Female)
Nests in the ground, usually in sand. Prey small Diptera. Kent to Devon to Beds, Lincs, Dumfries, Isle of Man. Not common. vi-ix.

— Clypeus black and with a different shape. Mandibles black or ferruginous with little yellow 10

10 Dorsal area of propodeum (fig. 101) at least mainly brightly shining and defined by a deep, crenate furrow; sides of propodeum also smooth and brightly shining. Pygidial plate usually ferruginous posteriorly. (Length 4.0-6.0mm.)
..... **ovalis** Lepeletier & Brullé (Female)
Nests in sandy ground. Prey usually small Diptera (empidids) but Adlerz recorded two mirids (Hemiptera). Kent to Devon, north to Perth, Wales. Not common. vi-ix.

— Dorsal area of propodeum finely striate, defining furrow weaker, along anterior margin not defined posteriorly; side of propodeum finely striate though shining. Pygidial plate (fig. 100b) rarely ferruginous 11

11 Central furrow of dorsal area of propodeum wider, especially anteriorly (fig. 100c). Punctation of mesoscutum anteriorly sparser. Length 4.0-6.0mm.
..... **tarsatus** (Shuckard) (Female)
Nests in light soils or in mortar in walls. Prey small Diptera, especially empidids. England, Wales, Scotland, Ireland. Common. v-ix. The British (typical) form of the species has a narrower front basitarsus in the male with a smaller dark mark compared

with the continental one. A third form occurs in North Africa (see de Beaumont, 1950).

— Central furrow of dorsal area of propodeum narrower (fig. 102). Punctation of mesoscutum anteriorly closer. Length 4.5-6.5mm ..... **pusillus** Lepeletier & Brullé (Female)
Nests in soil. Prey small Diptera. England, Wales, Scotland, Ireland. Common. vi-ix.

12 Mesoscutal-scutellar boundary not, or scarcely, longitudinally striate. Furrow in front of median ocellus usually weaker. Length 3.5-5.0mm. (Fore and mid tibiae mainly yellow.) ..... **exiguus** (Vander Linden) (Female)
Nest not known. Prey said to be aphids. Kent, Surrey, W. Sussex. Rare. vi-vii.

— Mesoscutal-scutellar boundary (in front of crenate furrow of scutellum) with fine longitudinal striae (fig. 104b). Furrow in front of median ocellus stronger (fig. 104a). Rather larger species 13

13 Mid tibia dorsally largely yellow. Pronotal collar and scutellum also largely yellow. Pygidial plate usually largely ferruginous. (Length 4.0-6.0mm.)
..... **wesmaeli** (Vander Linden) (Female)
Nests in sand. Prey various small Diptera but sometimes exclusively Thereva. *England, Wales, Scotland, Ireland. Common. v-ix.*

— Mid tibia black or with a small proximal yellow ring. Pronotal collar and scutellum usually black. Pygidial plate never more than reddish near the tip 14

14 Facial fovea (dorsal on inner side of eyes) slightly convex. Interstices of frons anteriorly shining. Length 5.0-6.5mm. (The British subspecies has in the male much shorter hairs on the fore trochanter, femur and mesosternum than in the typical Channel Is. and continental subspecies. The females seem not to differ.)
..... **elongatulus proximus** (Shuckard) (Female)
Nests in soil but also in holes in old posts. Prey various small Diptera. England, Wales, Ireland. Common. v-ix.

— Facial foveae flat. Interstices of frons anteriorly with fine microsculpture under high magnification. Length 4.5-5.0mm. (Yellow markings more reduced.)
..... **distinguendus** (Morawitz, A.) (Female)
East Kent (near Canterbury, Sturry). vi-vii. (L. Packer).

15 Dorsal area of propodeum defined by a distinct, usually crenate furrow, often weaker at sides anteriorly. (Mandibles tridentate.) 16

— Dorsal area of propodeum not defined by a distinct furrow though a difference in sculpture may sometimes indicate its hind margin 18

16 Clypeus and a narrow stripe on inner orbits yellow beneath the silvery hairs. (Clypeus ventrally (fig. 105) somewhat broadly rounded or subtruncate. Mesopleuron with no sharp tubercle in front of mid coxa.) ..... **walkeri** (Shuckard) (Female)
Nests in wood. Prey Ephemeroptera, usually Baetidae, very rarely Diptera. Brecon, Monmouth, Devon, Hants, Berks, Surrey, Suffolk, Norfolk, Aberdeenshire, E. Lothian, Ireland (Carlow, Clare, Wicklow). Rare. v-viii.

— Clypeus and inner orbits black 17

17 Ventral margin of clypeus (fig. 106a) with two stout, rather closely approximated teeth. Fore basitarsus (fig. 106b) with a posterior row of 6-7 stout bristles. Mesopleuron with no sharp tubercle in front of mid coxa.
..... **annulipes** (Lepeletier & Brullé) (Female)
Nests in wood, sometimes rotten. Prey Hemiptera (Typhlocybidae with, rarely, mirids or psyllids). Kent to Dorset, Glamorgan to Inverness. Local, rather common in the south. v-ix.

— Ventral margin of clypeus (fig. 107a) rather narrowly truncate. Fore basitarsus (fig. 107b) with 2-3 short bristles posteriorly. Mesopleuron with a small tubercle in front of mid coxa ..... **leucostoma** (Linnaeus) (Female)
Nests in wood. Prey small Diptera. Isle of Man, Cumberland, Dumfries, E. Lothian, Nairn, Inverness. Rare. v-viii.

18 Mesopleuron with no small tubercle in front of mid coxa. Mandibles quadridentate (fig. 108a). Frontal impressions very weak. Hind basitarsus short and thick. (Hind tibia very strongly swollen distally) 19

— Mesopleuron with a small acute tubercle in front of mid coxa (weaker in *C. cetratus* and a form of *C. nigritus*). Mandibles tridentate (fig. 110a). Frontal impressions

well-defined (least strong in *C. cetratus)* (no traces of a furrow between posterior ocelli). Hind basitarsus relatively long and thin (shorter in *C. cetratus*). 20

19 Hind tibia (fig. 108c) externally with only fine, very short spines, hardly distinguishable from the pubescence. Fore tibia anteriorly yellow. Clypeus ventrally (fig. 108b) strongly produced and narrowly truncate. Weak traces of a furrow between the posterior ocelli. ..... **capitosus** (Shuckard) (Female)

Nest normally in pith of cut stems of living ash, more rarely elder, sumach, Viburnum lantana. *Prey various Diptera and some psyllids (cf. Danks, 1971: 362). Kent to Devon, Glamorgan, north to Dumfries, E. Lothian (Haddington), Ireland. Nests usually much commoner than adult wasps. vi-vii.*

— Hind tibia (fig. 109c) externally with strong and not very short spines. Fore tibia anteriorly reddish-brown. Clypeus ventrally widely but sometimes weakly tridentate (fig. 109a). A well-marked furrow between the posterior ocelli (fig. 109b).
..... **styrius** (Kohl) (Female)

Nesting habits and prey not known. Kent to S. Devon, Glamorgan to Dumfries, W. Ireland. Rare and local. v-ix.

20 Head and mesoscutum with very short pubescence. Occipital carina (fig. 110b) as high at the point where it ends below as it is above. (Clypeus (fig. 110c) ventrally with central lobe feebly angled.) ..... **cetratus** (Shuckard) (Female)

Nests in hollow stems or more often dead wood. Prey small Diptera and (?) Homoptera Sternorrhyncha. London to Cornwall, Wales, north to Cumberland, Ireland. Rare and local. v-viii.

— Head and mesoscutum with long pubescence. Occipital carina gradually decreasing in height to where it ends below 21

21 Frons (fig. 111a) less concave in front of median ocellus. Clypeus (fig. 111b) ventrally obtusely tridentate. (In variety *inermis* (Thomson) the mesopleural spine is effectively absent.) ..... **nigritus** (Lepeletier & Brullé) (Female)

Nests in cut stems of shrubs or in stems of Typha. *Prey small Diptera. Kent to Devon, S. Wales to Cheshire and S.E. Yorks. Not common. v-vii.*

— Frons (fig. 112a) more concave in front of median ocellus. Clypeus (fig. 112b) ventrally feebly emarginate ..... **megacephalus** (Rossius) (Female)

Nests in wood, usually rotten and previously bored (e.g. by beetles). Prey very varied Diptera. England, Wales, Scotland, Ireland. Common. v-ix.

22 Front basitarsus (sometimes also tibia) widened (black and white) 23

— Front basitarsus cylindrical or slightly flattened, edges parallel 28

23 Front tibia greatly enlarged, shield-like over almost its whole length 24

— Front tibia not enlarged or only moderately so towards its apex 25

24 Front tibia (fig. 113) yellow with a large black spot near posterodistal corner. Clypeus yellow ..... **palmipes** (Linnaeus) (Male)

See couplet 9 for notes.

— Front tibia (fig. 114) blackish with a posterior yellow margin (tibia not so broad). Clypeus black ..... **cetratus** (Shuckard) (Male)

See couplet 20 for notes.

25 Front basitarsus strongly dilated, about twice as long as broad 26

— Front basitarsus feebly dilated, about three times as long as broad 27

26 Front tibia (fig. 116) yellow, posteriorly darker shaded, basitarsus antero-distally black ..... **annulipes** (Lepeletier & Brullé) (Male)

See couplet 17 for notes.

— Front tibia (fig. 115) yellow with at least posterior half blackish, basitarsus with a postero-distal black spot ..... **tarsatus** (Shuckard) (Male)

See couplet 11 for notes.

27 Front basitarsus (fig. 118) with only a distal pale spot. Thorax black.
..... **leucostoma** (Linnaeus) (Male)

See couplet 17 for notes.

— Front basitarsus (fig. 117) with proximal and distal pale spots. Thorax nearly always yellow spotted ..... **pusillus** Lepeletier & Brullé (Male. In part)

See couplet 11 for notes.

28 Vertex and mesoscutum with long, upright pubescence. Last visible sternite with a tubercle 29

— Vertex and mesoscutum with very short pubsecence. Last visible sternite with a tubercle. 30

29 Median ventral lobe of clypeus (fig. 119) with a strong, recurved tooth on each side. . . . . **megacephalus** (Rossius) (Male)
See couplet 21 for notes.

— Median ventral lobe of clypeus (Fig. 120) feebly trilobed. . . . . **nigritus** (Lepeletier & Brullé) (Male)
See couplet 21 for notes.

30 Clypeus mainly or entirely yellow beneath the silvery hairs 31

— Clypeus black. 32

31 Antenna simple. Median ventral lobe of clypeus (fig. 121) obtusely trilobed. . . . . **walkeri** (Shuckard) (Male)
See couplet 16 for notes.

— Antenna with segment 7 produced beneath (fig. 122). Clypeus not trilobed. . . . . **exiguus** (Vander Linden) (Male)
See couplet 12 for notes.

32 Dorsal area of propodeum not defined by a crenate furrow. Punctation of mesopleuron feeble or very sparse. Gastral tergite 7 not punctured. 33

— Dorsal area of propodeum clearly defined by a crenate furrow. Punctation of mesopleuron distinct and usually moderately dense. Gastral tergite 7 distinctly punctured. 34

33 Ventral median lobe of clypeus (fig. 123) with lateral teeth almost as long as central one. Mesoscutum with distinct, strong punctures . . . . . **styrius** (Kohl) (Male)
See couplet 19 for notes.

— Ventral median lobe of clypeus (fig. 124) with lateral teeth much longer than central one. Mesoscutum with very fine punctures . . . . . **capitosus** (Shuckard) (Male)
See couplet 19 for notes.

34 Gastral tergite 7 with a punctured pygidial area (fig. 125a) defined by a keel which is low and absolutely marginal 35

— Gastral tergite 7 with no pygidial area. 36

35 Front basitarsus slightly dilated (fig. 125b), white proximally and distally. . . . . **pusillus** Lepeletier & Brullé (Male. In part)
See couplet 11 for notes.

— Front basitarsus narrow (fig. 126). cylindrical, brown. . . . . **ovalis** Lepeletier & Brullé (Male)
See couplet 10 for notes.

36 Mid femur abruptly widened at base beneath. Pronotal collar (fig. 127b) roundly truncate. Clypeus (fig. 127a) weakly quadridentate. Gastral tergite 7 truncate (fig. 127c). (Fore and mid tibiae brown. Last antennal segment rounded at tip.). . . . . **elongatulus** (Vander Linden) (Male)
See couplet 14 for notes.

— Mid femur very gradually widened from base. Pronotal collar rounded truncate (fig. 128b). Clypeus truncate (fig. 128a). Gastral tergite 7 rounded (fig. 128c). 37

37 Last antennal segment truncate. Front femur with numerous long hairs beneath. Fore and mid tibiae largely dark . . . . . **distinguendus** (Morawitz, A.) (Male)
See couplet 14 for notes.

— Last antennal segment rounded. Front femur bare beneath. Fore and mid tibiae largely yellow dorsally . . . . . **wesmaeli** (Vander Linden) (Male)
See couplet 13 for notes.

Genus **Ectemnius** Dahlbom

Whole insects—figs. 133 and 144. Mandibles tridentate, sometimes also with a tooth in centre of dorsal margin. Antennae inserted just above the clypeus, in male with 12 segments, some of the intermediate ones sometimes toothed or emarginate.

Ocellar triangle equiangular to strongly anteriorly obtuse. Eyes with inner margins strongly convergent below. Second sector of lower margin of submarginal cell in fore wing shorter than the 'intercubital cross-vein' (r-m) and one third to one quarter as long as first sector. Male fore tibia not, fore tarsi rarely, expanded. Female with pygidial area produced, narrowed, excavated into a gutter.

About 150 large or medium-sized species, usually with a yellow marked gaster, found in all regions. Species nesting in rotten wood or in plant stems. Prey Diptera. Adults often seen on flowers of umbellifers.

Key to species

1 Mesoscutum and gastral tergite 1 with short erect pubescence. Pronotal collar with lateral spines (fig. 129b) (weak in male *borealis*). Antennal scrobe limited above by a fine transverse keel. (Ocellar triangle anteriorly obtuse, especially in female. Antennal segments 3 and 6 more or less excavated beneath in male. Nest in wood. Subgenus **Ectemnius** Dahlbom.) 2

— Mesoscutum and nearly always first gastral tergite with long erect pubescence. Pronotal collar with no lateral spines. Antennal scrobe not limited above by a keel 3

2 Pronotal collar yellow marked, spines longer. Larger species. Pubescence of central lobe of clypeus (fig. 129a) in female more or less golden. Gaster with more yellow. Fore tarsal segments 1-2 (fig. 130a) in male yellow, not much flattened, mid basitarsus (fig. 130b) distinctly swollen at centre. Length 6.5-10.00mm. **dives** (Lepeletier & Brullé)
Prey almost entirely Diptera (Syrphidae and a few Tachinidae) (Richards, 1944). Kent, London, Middx, W. Sussex, Bucks, Surrey, Hants, Isle of Wight, Dorset, S. Devon, Cheshire. Probably introduced with timber in about 1926, now spreading. vi-ix.

— Pronotal collar black or little yellow, spines smaller (fig. 131). Smaller species. Pubescence of central lobe of clypeus in female silvery. Gaster with less yellow. Fore tarsal

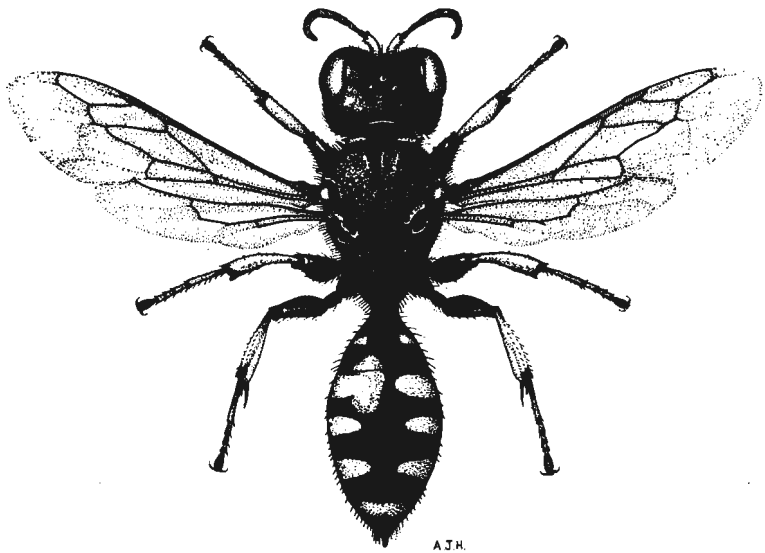

Fig. 133, *Ectemnius lapidarius* ♀.

segments 1-2 (fig. 132a) in male white, much flattened, mid basitarsus (fig. 132b) not swollen. Length 6.0-9.0mm ..... **borealis** (Zetterstedt)
Hants (Else, 1974), W. Sussex. Rare. vi-ix.

3 Clypeus in female with golden pubescence. Third antennal segment in both sexes at least three times as long as broad (in male toothed in centre beneath and segments 4 and 5 in male also often emarginate). Ocellar triangle equiangular or nearly so, except in *E. lapidarius* (especially female). (Nest in rotten wood. Subgenus **Clytochrysus** Morawitz.) 4

— Clypeus in female rarely faintly golden, normally silvery. Third antennal segment shorter. Ocellar triangle anteriorly obtuse, especially in female 11

4 Females 5

— Males 8

5 Angles of propodeum with a longitudinal keel. Ocellar triangle (fig. 134b) clearly anteriorly obtuse. (Median lobe of clypeus (fig. 134a) not wider than emarginations on each side of it. Gastral sternites black (fig. 134c). Length 9.0-12.0mm.).
..... **lapidarius** (Panzer) (Female)
Prey Diptera, chiefly Syrphidae. England, Wales, S. Scotland, Ireland. Common. v-viii.

— Angles of propodeum only with transverse keels. Ocellar triangle equiangular or very nearly so 6

6 Median lobe of clypeus (fig. 136) much narrower than the emarginations on each side of it, prominences defining these emarginations directed outwards. (Gastral sternites black. Length 10.0-16.0mm.) ..... **ruficornis** (Zetterstedt) (Female)
Prey Diptera (Syrphidae). Surrey, Hants, W. Sussex, Dorset, Northants, Glamorgan, Ireland (Antrim). Perhaps especially in woodlands, usually rare. vi-ix.

— Median lobe of clypeus at most a little narrower than the emarginations on each side of it, prominences defining these emarginations directed downwards 7

7 Median lobe of clypeus (fig. 135) a little narrower than the emarginations on each side of it, prominences blunt. Central nick in pronotal collar deeper. Gastral sternites mostly yellow spotted. Length 12.0-17.0mm. ..... **sexcinctus** (Fabricius) (Female)

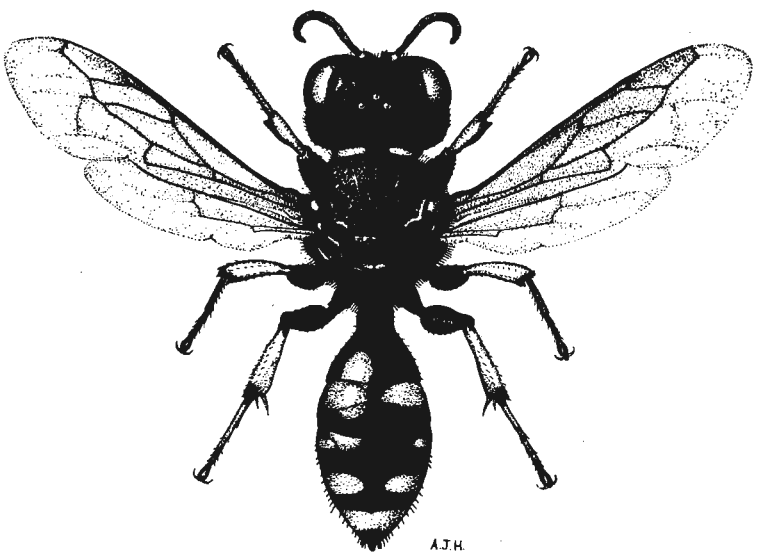

Fig. 144, *Ectemnius continuus* ♀.

Prey Diptera (Syrphidae and some Calliphoridae) (Richards, 1958). Kent to Cornwall to Somerset, Glamorgan, Norfolk. Not common. v-viii.

— Median lobe of clypeus (fig. 137) wider than the emarginations on each side of it, prominences sharp. Central nick in pronotal collar less deep. Gastral sternites black. Length 11.0-16.5mm. ..... **cavifrons** (Thomson) (Female)
Prey Diptera (chiefly Syrphidae). Kent to Cornwall, north to Lincs and Staffs, Wales, Ireland. Common. vi-x.

8 Central tooth beneath antennal segment 3 (fig. 138) with a few curled hairs. (Length 10.0-13.0mm.). ..... **sexcinctus** (Fabricius) (Male)
See couplet 7 for notes.

— Central tooth beneath antennal segment 3 without hairs 9

9 Antennal segment 3 (fig. 139) dorsally distinctly convex near centre; teeth beneath segments 4 and 5 much smaller than the two beneath 3.
..... **lapidarius** (Panzer) (Male)
See couplet 5 for notes.

— Antennal segment 3 dorsally not convex; teeth beneath segments 4 and 5 about as large as those beneath 3 10

10 Antennal segment 3 (fig. 140) beneath with a deep emargination beneath the two teeth. Central lobe of clypeus with more or less golden pubescence.
..... **cavifrons** (Thomson) (Male)
See couplet 7 for notes.

— Antennal segment 3 (fig. 141) beneath with a shallow emargination between the two teeth, much less deep than that before the first tooth. Clypeal hairs silvery.
..... **ruficornis** (Zetterstedt) (Male)
See couplet 6 for notes.

11 Mesoscutum and scutellum more or less striate, at least posteriorly. Antenna of male simple (British species). Medium to large sized species. Nests in dead wood. Subgenus **Metacrabro** Ashmead. (Gastral tergite 3 yellow marked.) 12

— Mesoscutum and scutellum reticulate or punctate. Antennal segment 6 of male excavated beneath. Small to medium sized species. Nests in dead wood or plant stems. Subgenus **Hypocrabro** Ashmead 13

12 Front half of mesoscutum not striate, posterior longitudinal striae with punctures amongst them. Gastral tergite 1 with short hairs. Male with mid basitarsus (fig. 142b) not widened, antennal segment 13 (fig. 142a) conical, gastral tergite 7 (fig. 142c) not grooved. Length 9.0-14.5mm. ..... **lituratus** (Panzer)
Prey Diptera (muscoids). Kent to Devon, north to Somerset and S.W. Yorks, perhaps especially in woods. Not common. vi-ix.

— Front half of mesoscutum transversely striate, few punctures amongst any of the striae. Gastral tergite 1 with long hairs. Male with mid basitarsus (fig. 143b) anteriorly widened, antennal segment 13 (fig. 143a) truncate, gastral tergite 7 (fig. 143c) grooved. Length 9.0-17.0mm ..... **cephalotes** (Olivier)
Prey Diptera (especially muscoids and syrphids). Burrows in soft rotten wood; several females seem sometimes to share a common entrance to their separate nests. Kent to Cornwall, north to Cheshire and Yorks, Glamorgan. Common. vii-ix.

13 Antennal segment 3 (fig. 145a) clearly more than twice as long as broad, segment 6 more deeply emarginate beneath in male (fig. 146a). Fore femur of male (fig. 146b) not angled at base, segments 1-2 of mid tarsi prolonged into two antero-ventral points. Median lobe of clypeus in female (fig. 145b) very little protruding.
..... **continuus** (Fabricius)
Prey Diptera of various families but especially muscoids and syrphids. Kent to Cornwall, north to Perth, Wales, Ireland. Common. v-ix.

— Antennal segment 3 (fig. 147a) about twice as long as broad, segment 6 shallowly emarginate beneath in male (fig. 148a). Fore femur of male (fig. 148b) angled at base, segments 1-2 of mid tarsi not prolonged into antero-ventral points. Median lobe of clypeus in female (fig. 147b) quite strongly protruding.
..... **rubicola** (Dufour & Perris)
Prey Diptera of various families but often some or many Acroceridae. Nests in dead wood or in stems (e.g. Cirsium*). Kent to Dorset, Isle of Wight, Gloucester, Hereford, Glamorgan, Oxon, Berks, Essex, Cambs. Usually not common. v-ix.*

Genus **Lestica** Billberg

Whole insect—fig. 149. Only the subgenus *Clypeocrabro* Richards has been recorded from Britain and the characters given below are those of the subgenus. Mandibles tridentate with a tooth also on the dorsal edge. Antennae inserted just above the clypeus (fig. 150a), in male with 13 segments, intermediate segments rather long with a raised line beneath on each side. Ocellar triangle just obtuse in female, equiangular in male. Eyes with inner margins convergent below. Second sector of lower margin of submarginal cell in fore wing a little shorter than the 'intercubital cross-vein' (r-m) and not more than one quarter as long as the first sector. Gaster closely punctured. Male with fore tibia little (fig. 150b), fore tarsus, especially basitarsus, greatly expanded; head greatly narrowed and prolonged behind, prothorax also relatively elongate and narrowed anteriorly. Female with a narrowly produced, gutter-like pygidial area.

A small group of medium sized, black and yellow Palaearctic species. Prey adult Lepidoptera though two old records mention Diptera. Nests in dead wood, entrance partly closed with mud.

— Length 8.0-12.0mm. Black with substantial yellow areas on legs and gaster and in female on thorax. Body coarsely punctate. Male with a strong spine at base of mid femur and on hind trochanter..... **clypeata** (Schreber)
Surrey (Weybridge, male 1848, female 1853. F. Smith).

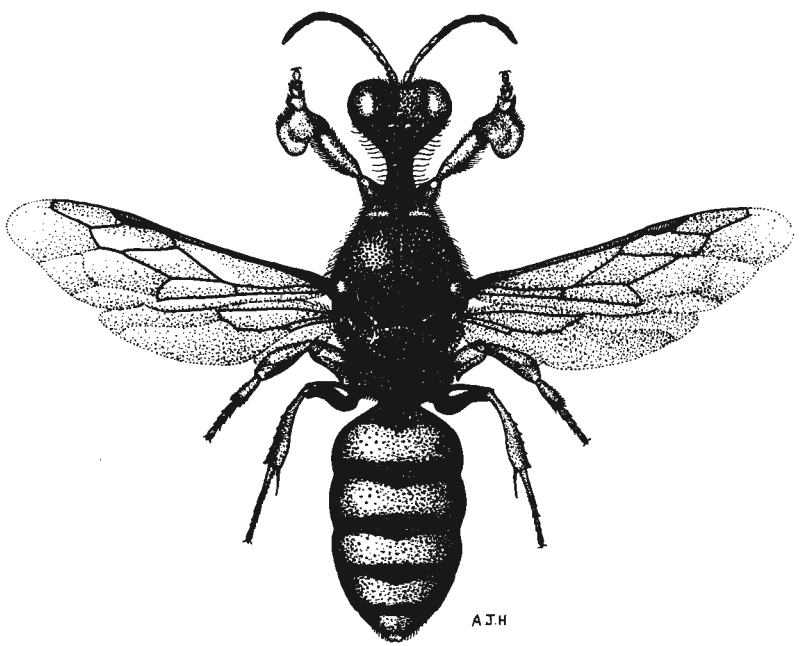

Fig. 149, *Lestica clypeata* ♂.

Genus **Rhopalum** Stephens

Whole insect—fig. 151. Mandibles bidentate. Antennae inserted just above the clypeus, in male with 13 segments, simple or with segments 2, 4 and 5 deformed, 3 very short. Ocellar triangle equiangular. Inner margins of eyes convergent downwards but becoming nearly parallel. Second sector of lower margin of submarginal cell of fore wing a little shorter than first, twice as long as the 'intercubital cross-vein' (r-m). Gaster elongate, first segment narrow and petiolate, posterior half swollen. Male fore tibia not widened, fore and hind basitarsus sometimes modified. Female with a more or less distinct, relatively wide pygidial area.

A group of about 60 small, largely dark insects found in the main regions. Prey mainly Psocoptera but also some Diptera and Hemiptera. Nests chiefly in hollow stems but sometimes in dead wood or even in sand.

Key to species

1 Hardly any prominence between the antennal sockets. First gastral segment (fig. 152b) longer than hind femur, rest of gaster largely reddish. In female, pygidial area dull, ill-defined. (Clypeus (fig. 152a) with a narrow, truncate central lobe.) In male, antenna simple, legs unmodified. Length 4.0-6.0mm. Subgenus **Rhopalum** Stephens. ..... **clavipes** (Linnaeus)

Prey chiefly Psocoptera but sometimes Diptera or Hemiptera (Aphidoidea, Psylloidea). Usually nests in stems or straws but also rarely in dead wood, old mortar or sand (cf. Freeman, 1938; Danks, 1971: 362). England, Wales, Scotland, Ireland. Common. v-ix.

— A strong prominence between the antennal sockets. First gastral segment (fig. 153b) longer than hind femur, rest of gaster mainly black. In female, pygidial area shining, well-defined. In male, antenna with segments 2, 4 and 5 deformed, legs with at least fore and mid tarsi modified. Subgenus **Corynopus** Lepeletier & Brullé 2

2 Hind tibia yellow, black and red. In female, clypeus strongly pointed (fig. 153a). In male, antenna (fig. 154b) with segments 6, 7, 9 and 11 white; clypeus (fig. 154a) with a strong, rounded central lobe; fore and hind basitarsus expanded at apex, mid

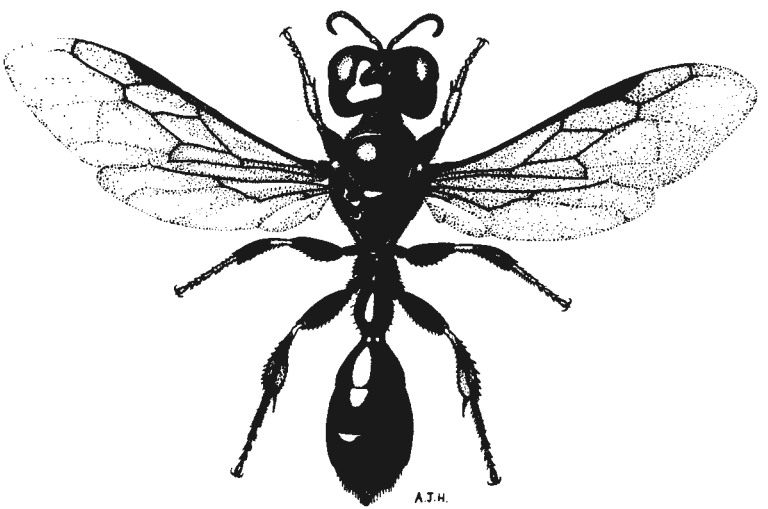

Fig. 151, *Rhopalum coarctatum* ♀.

basitarsus thickened at centre beneath. Length 5.0-7.0mm..... **coarctatum** (Scopoli)

Prey Diptera (especially Nematocera) but also isolated records of Psocoptera, Aphidoidea and Staphylinidae. Usually nests in stems but sometimes in old wood (cf. Danks, 1971: 351). Kent to S. Devon, north to Inverness, Glamorgan, Ireland (Fermanagh). Not very common. v-ix.

— Hind tibia black with a yellow base. In female, clypeus produced and relatively widely truncate (fig. 155). In male, antenna (fig. 156b) with segments 1-5 yellow or partly yellow, rest black; clypeus (fig. 156a) with a large, truncate central lobe; fore and hind basitarsus slightly widened, mid tarsi 2-4 wide and flat. Length 4.5-6.0mm. ..... **gracile** Wesmael

Prey (in Japan) Psocoptera and Diptera. Nests in stems. Suffolk, Cambs, in fens, very local, viii.

Genus **Lindenius** Lepeletier & Brullé

Whole insect—fig. 157. Mandibles unidentate, not emarginate beneath, sometimes with a sub-basal tooth on dorsal inner edge. Antennae inserted just above the clypeus, in male with 13 segments, simple. Ocellar triangle anteriorly very obtuse. Eyes bare, inner margins converging downwards. Second sector of lower margin of submarginal cell in fore wing about as long as first, about twice as long as the 'intercubital cross-vein' (r-m). Gaster relatively stout with a pygidial area in both sexes. In female, a large unpunctured frontal impression nearly reaching the lateral ocellus. Tibiae and tarsi not widened in male.

About 40 small or rather small, mostly dark species which are Palaearctic as far as the subgenus *Lindenius* is concerned, though another subgenus is found in the Americas. Prey Diptera (mainly Chloropidae), Heteroptera and various small Hymenoptera. Nests in the soil, usually in sand.

[Pate and Leclercq place *albilabris* in *Lindenius* sensu stricto and our other two species in another subgenus, *Trachelosimus* Morawitz. The characters separating these two subgenera seem to me very small.]

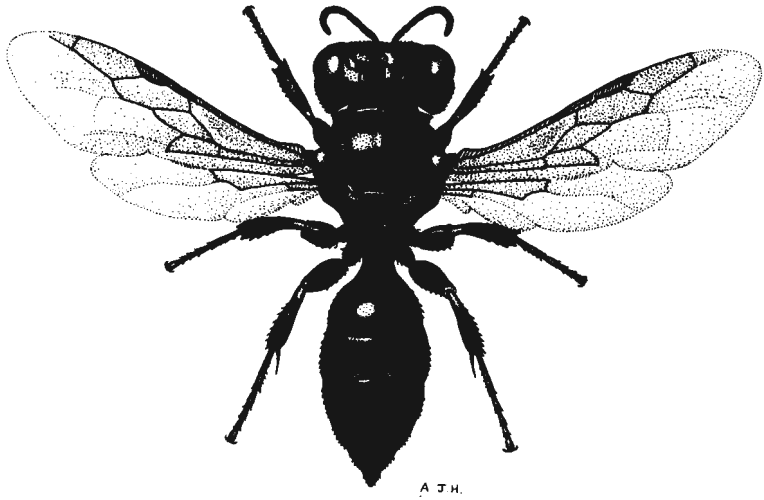

Fig. 157, *Lindenius albilabris* ♀.

Key to species

1 Pleuron with very short, sparse hairs. Frons with a prominence between the antennal sockets. Female with mandibles, scape and pronotal collar black. Male with no spine at ventral end of occipital carina; mid basitarsus (fig. 158) strongly curved, its apex and apex of tibia with long white hairs. (Length 5.0-8.0,mm.)
..... **albilabris** (Fabricius)
Prey Heteroptera (Miridae) or Diptera (Chloropidae), either mixed or one type exclusively. Recently found in abundance on flowers of Chrysanthemum leucanthemum. *Kent to Cornwall, north to N.E. Yorks and Nairn, Glamorgan. Common. vi-ix.*

— Pleuron with long, more or less dense hairs. Frons with no prominence between the antennal sockets. Female with mandibles, scape and pronotal collar yellow marked. Male with a spine at ventral end of occipital carina (reduced in small *armatus*); mid basitarsus straight, it and mid tibia without long white hairs..... 2

2 Dorsal area of propodeum strongly shining, defined, including the anterior margin, by a strong, crenate furrow. Hind basitarsus of female a little thickened (fig. 159). Mandibles in male black with a reddish apex; hind tibia and basitarsus very narrowly yellow at base. Length 3.5-5.5mm. (cf. Yarrow & Guichard, 1941; Leclercq, 1967).
..... **pygmaeus armatus** (Vander Linden)
Prey (on continent) small parasitic Hymenoptera, rarely Diptera. Dorset (Wimborne, 1♂, 23.vii.56. Harwood), London (Hampstead Heath, 1♂, 25.vii.39. Guichard). This species is not certainly British. The two supposed males (both in the BMNH) may be small panzeri *(teste Guichard and Richards).*

— Dorsal area of propodeum longitudinally striate, less strongly defined. Hind basitarsus of female not thickened (fig. 160). Mandibles in male mainly yellow; hind tibia and basitarsus broadly yellow at base. Length 4.5-7.5mm..... **panzeri** (Vander Linden)
Prey Diptera, especially male Chloropidae. Kent to Dorset, Oxon, Suffolk, Norfolk. Usually not common. vi-ix.

Genus **Entomognathus** Dahlbom

Whole insect—fig. 161. Mandibles unidentate, emarginate beneath near base, dorsal inner edge near middle with a bifid, tooth-like prominence, especially in female. Antennae inserted just above the clypeus, in male with 13 segments, simple. Ocellar triangle anteriorly very obtuse. Eyes hairy, inner margins converging

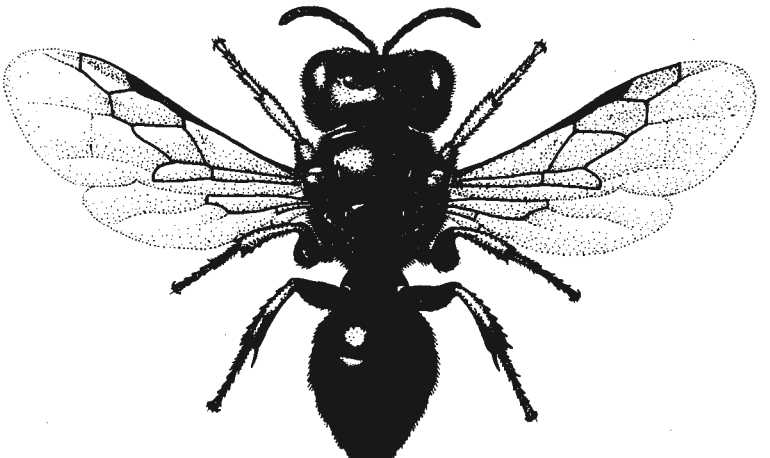

Fig. 161, *Entomognathus brevis* ♀.

downwards but nearly parallel below. Second sector of lower margin of submarginal cell in fore wing half as long as first, about as long as 'intercubital cross-vein' (r-m). Gaster relatively stout with pygidial area in both sexes. In female, a deep, rather narrow frontal impression nearly reaching the lateral ocellus. Tibiae and tarsi not widened in male.

A genus of about 30, mainly black species found in all the main regions, but the typical subgenus is purely Palaearctic with not more than ten species. Prey Coleoptera (Chrysomelidae: Halticinae, Cryptocephalinae). Nests in soil, often in sand.

— Black; scape, pronotal tubercles, most of tibiae, yellow. Dorsal area of propodeum brightly shining, completely surrounded by a crenate furrow. Length 3.5-5.5mm.
..... **brevis** (Vander Linden)
Kent to Cornwall, north to N. Lincs, Notts, Wales. Locally common. vi-viii.

Genus **Oxybelus** Latreille

Whole insect—fig. 162. Mandibles unidentate, not emarginate beneath. Antennae inserted just above the clypeus, in male with 13 segments. Ocellar triangle anteriorly slightly obtuse. Eyes with the inner margins parallel above, diverging below. Top of clypeus with a strong nose-like projection in female, in male with a narrower nose-like projection, extending below the ventral margin with a strong process on each side of it at lateral boundaries of clypeus. Venation characteristic, only one submarginal cell which is not separated from discoidal cell (1M) (i.e. Rs + M missing). Scutellum with narrow, lamellate lateral margins; metanotum with broad, leaf-like, transparent, lateral wings; propodeum with a strong central, pointed process (mucro).

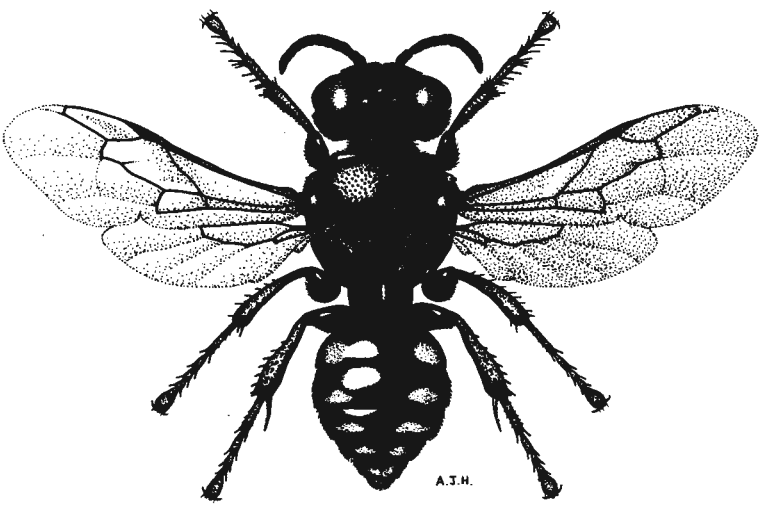

Fig. 162, *Oxybelus uniglumis* ♀.

A large (more than 200 species) genus of small or moderate sized species, found in all the main regions. They are mostly black, often with pale spots on the gaster. Prey Diptera which are carried back to the nest impaled on the sting. Nests in soil, usually in sand. All our species with tibiae and tarsi ferruginous, gaster more or less white spotted or banded.

Key to species

1 Females.....2
— Males.....4
2 Femora mainly light ferruginous. Mesoscutum and gaster with dense, recumbent silvery pubescence. Mucro (fig. 163) narrow, acutely pointed, much narrowed from base. (Length 7.0-9.0mm.)..... **argentatus** Curtis (Female)
Prey Diptera, especially Thereva annulata. *Coastal dunes from Kent to Cornwall and up through Wales to S. Lancs, on east to Norfolk, also inland in Beds (V. H. Chambers). Locally common. vi-viii.*
— Femora mainly blackish. Mesoscutum and gaster with short, relatively sparse, brownish pubescence. Mucro with tip rounded.....3
3 Mesopleuron with coarse, clathrate sculpture, interstices finely reticulate. Mandibles pitchy. Mucro (fig. 164) with sides converging to apex. Length 5.5-8.0mm.
..... **uniglumis** (Linnaeus) (Female)
Prey Diptera, mainly Cyclorrapha. England, Wales, S. Scotland (Ayr), Ireland. Common. vi-ix.
— Mesopleuron smooth, brightly shining with rather sparse punctures. Mandibles largely yellow. Mucro (fig. 165) narrow, almost parallel-sided. Length 6.0-7.5mm.
..... **mandibularis** Dahlbom (Female)
Prey Diptera, especially muscoids. W. Sussex, Surrey, Hants, Dorset, Devon, Glamorgan, Cardigan, Merioneth, Cheshire, Suffolk, Norfolk. Local, usually not common. vi-viii.
4 Gastral sternites 2-5 with dense apical rows of recumbent, silky pubescence. Mandibles yellow and light reddish, tips black. (Mucro as in female. Femora dark brown, fore pair largely white beneath. Length 5.0-7.0mm.)..... **mandibularis** Dahlbom (Male)
See couplet 3 for notes.
— Gastral sternites 2-5 without such pubescence. Mandibles pitchy or black.....5
5 Dorsal surface with short, brownish, not very dense pubescence. Mesoscutum with close, fine but not nearly confluent punctures. Mucro as in female but often narrower. Femora blackish, tips light ferruginous, fore pair with a large white spot beneath. Length 5.0-7.0mm..... **uniglumis** (Linnaeus) (Male)
See couplet 3 for notes.
— Dorsal surface with silvery pubescence as in female but less dense and conspicuous. Mesoscutum with coarse, almost subconfluent punctures. Mucro as in female. Femora creamy-white, proximal dorsal two-thirds of mid pair and most of hind pair, blackish. Length 5.0-7.0mm..... **argentatus** Curtis (Male)
See couplet 2 for notes.

Subfamily Pemphredoninae

Genus **Psen** Latreille

Whole insects—figs. 166 and 173. Gaster petiolate, petiole long, with dorsal longitudinal keels. Fore wings with pterostigma long, narrow, distally pointed, three submarginal cells; hind wing with one M + Cu1 cell which ends in Cu1 after it separates from M. Frons with a tubercle between the antennal sockets or a keel

joining the lower edge of the sockets. Female with a distinct pygidial area, male without such an area though the last gastral tergite is sometimes flattened.

A large genus found in all parts of the world except New Zealand. Usually black or with the anterior part of the gaster red. Species of moderate size, preying on Hemiptera (Homoptera). Nests in the ground, in rotten wood or in plant stems (see Spooner, 1948; Richards, 1948; van Lith, 1949).

Key to species

1 Upper part of mesepisternum smooth and shining, clearly separated by a dorsal sulcus from the lower part (fig. 167). Epicnemial keel sharp. Gaster (in British species) black 2

— Upper part of mesepisternum reticulate, more or less dull, not or weakly delimited below by a dorsal mesepisternal sulcus (fig. 176b). Epicnemial keel represented by a sulcus which meets weakly across the mesosternum. Gaster red anteriorly. (A somewhat obtuse prominence between the antennal sockets. Subgenus **Mimesa** Shuckard.) 10

2 Frons with a small but acute prominence between the antennal sockets. Epicnemial keel not passing down onto mesosternum. Subgenus **Psen** Latreille. (Petiole long, smooth and shining, slightly curved in profile. Antenna of male somewhat flattened beneath, segments 6-12 projecting at apex, segment 2 very small, hidden in the widely excavated end of scape. Mid tarsus (fig. 168) with spine-like projections beneath segment 1 (centre and apex) and segment 2 (apex). Length 10.0-12.0mm). ..... **ater** (Olivier)

Prey Homoptera (Cicadellidae, Issus coleoptratus, Iassus lanio, Thaumnotettix confinis). *Nests either in beetle holes in dead wood or in sand. Hants, Suffolk, ?Glamorgan. All records more than 100 years ago.*

— Frons with a fine keel joining edges of the antennal sockets. Epicnemial keel extending downwards to centre of mesosternum. Subgenus **Mimumesa** Malloch 3

3 Females. Length 7.0-9.0mm 4

— Males. Length 6.0-8.0mm 7

4 Pygidial plate narrow, central part convex, sides shallowly excavated and with a row of coarse punctures (fig. 169b). (Epicnemial keels (fig. 169a) deeply angled where they meet on mesosternum.) ..... **dahlbomi** (Wesmael) (Female)

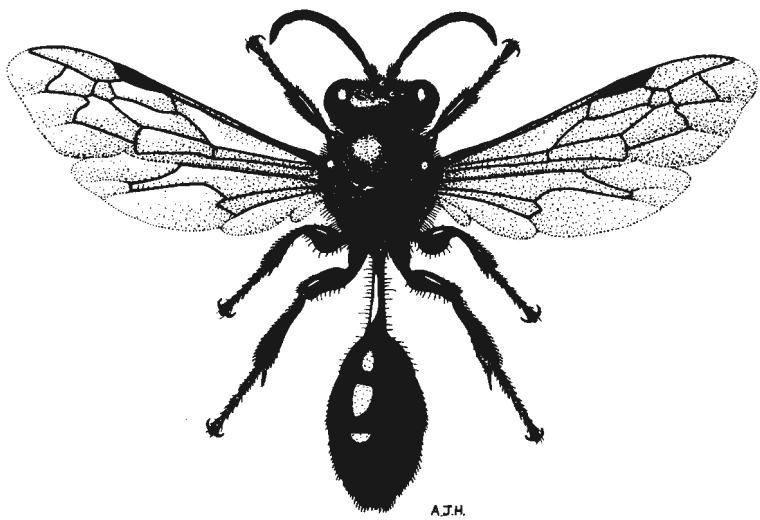

Fig. 166, *Psen ater* ♀.

Prey Homoptera (Delphacidae and Cicadellidae nymphs). Nests in beetle holes in dead wood. Kent to Devon. Glamorgan and north to Inverness. Widespread but local. Not very common. v-ix.

— Pygidial plate broader, dull, closely punctured with short pubescence (fig. 170b)..... 5

5 Epicnemial keels deeply angled where they cross the mesosternum. Petiole in dorsal view much longer than gastral tergite 1 (almost as long as hind tibia).
..... **atratinus** (Morawitz, F.) (Female)
Nests in decayed wood. Prey nymphs of Issidae. Isle of Wight (1 ♀ Ladder Chine, near Chale, 7.viii.1950. O. W. Richards; det, van Lith. ♂ ♀ in cop., Luccombe Chine. 20.vii.1977. G. R. Else).

— Epicnemial keels not angled where they cross the mesosternum. Petiole in dorsal view not or little longer than gastral tergite 1..... 6

6 Epicnemial keels roundly but quite deeply bent back where they cross the mesosternum (fig. 170a). Punctures of head closer and stronger, including on areas at sides of ocelli..... **spooneri** (Richards) (Female)
Nest and prey not known. Dorset, Hants, Isle of wight, Surrey, W. Kent, Suffolk, Norfolk. Chiefly on sandy heaths. Usually not common. vi-ix.

— Epicnemial keels scarcely at all bent back on the mesosternum. Punctures of head less close, areas at sides of ocelli unpunctured. (On the average a little smaller.)
..... **littoralis** (Bondroit) (Female)
Prey unknown. Nests possibly in stems of marram (Ammophila arenaria). *Devon, Glamorgan, Merioneth, Caerns, Anglesey, N. Lancs, E. Ireland. On marram dunes. Locally common. vii-viii.*
[Spooner (1948) separated celtica *from* littoralis *but continental authors now treat them as synonyms.]*

7 Epicnemial keels deeply angled where they cross the mesosternum. Antennae black beneath..... 8

— Epicnemial keels scarcely bent back or only roundly bent where they cross the mesosternum. Antennae often reddish beneath towards apex..... 9

8 Parameres (fig. 171) posteriorly produced into long, narrow, bare processes. Gena in profile a little wider than eye. Antennal segment 13 not quite twice as long as broad at base..... **dahlbomi** (Wesmael) (Male)
See couplet 4 for notes.

— Parameres (fig. 175) hairy, bluntly produced but without definite processes. Gena in profile not quite as wide as eye. Antennal segment 13 twice as long as broad at base.
..... **atratinus** (Morawitz, F.) (Male)
See couplet 5 for notes.

9 Parameral processes wider (fig. 172), lateral emargination much shallower. Epicnemial keels quite deeply but roundly bent back on mesosternum. Pale parts of tarsi brownish-testaceous..... **spooneri** (Richards) (Male)
See couplet 6 for notes.

— Parameral processes narrower (fig. 174), lateral emarginations much deeper. Epicnemial keels hardly bent back where they cross the mesosternum. Pale parts of fore and mid tarsi whitish..... **littoralis** (Bondroit) (Male)
See couplet 6 for notes.

10 Females. Length 8.0-9.0mm. (Gaster usually more red; transverse apical welt on clypeus stronger.)..... 11

— Males. Length 7.0-9.0mm. (No pygidial area)..... 14

11 Antennae longer (fig. 176a), segment 3 four times as long as broad, penultimate segment one and a half times. Gena clearly narrower than eye in profile. Petiole longer than tergite 1. (Tergite 1 black anteriorly, tergite 3 black.).
..... **bruxellensis** (Bondroit) (Female)
Burrows at a slight angle to 10-12cm into sand at the roots of grass. Prey Homoptera (Cicadellidae, Jassinae) (Guichard, 1972a). Dorset, Hants, Surrey, W. Sussex, Middx, Kent, S. Lancs. Usually rare. vi-viii.

— Antennae shorter (fig. 177a), segment 3 three times as long as broad, penultimate segment a little longer than broad. Gena as wide as eye in profile. Petiole not longer than gastral tergite 1. (Clypeal welt (fig. 177b) stronger and/or longer.)..... 12

12 Gastral petiole parallel-sided, a little curved in side view, as long or a little longer than

tergite 1 which is black anteriorly (tergite 2 red, 3 usually largely red). Mesopleuron smooth, not punctured, mesoscutum only very weakly so. Clypeal welt broad and strong. ..... **equestris** (Fabricius) (Female)

Nests in sandy soil, often in flat places, burrows 25-30cm deep. Prey Homoptera (Cicadellidae, occasionally including nymphs). England, Wales, Scotland but some old records need verifying. Perhaps two broods. Common. vi-ix.

— *Gastral petiole usually somewhat broadened behind, shorter than or hardly as long as* tergite 1 which is usually entirely red. Mesopleuron and mesoscutum distinctly rugose or punctured. Clypeal welt usually less developed 13

13 Gastral petiole a little shorter and broader, flat above. Tergite 3 usually entirely black. Mesopleuron less rugose, more clearly punctured ..... **lutarius** (Fabricius) (Female)

Burrows in sand. Prey Homoptera (Cicadellidae, nearly all Jassinae, one Typhlocybinae): Hants, Surrey, Middx, Kent, Bucks, Berks, Oxon, Norfolk, perhaps Notts, N. Lincs, S. W. Yorks. Common. vi-viii.

— Gastral petiole a little longer and narrower, usually convex above. Tergite 3 partly or wholly red, rarely black. Mesopleuron more rugose, less clearly punctured. ..... **bicolor** (Jurine) (Female)

Nests in sandy soils but not the driest places. Prey Homoptera (Cicadellidae). W. Kent to S. Devon, Glamorgan, north to Notts and N. Lincs. Usually not very common. vii-ix.

14 Antennae longer (fig. 178), segments 8-10 more than one and a half times as long as broad. Gastral petiole clearly longer than tergite 1. Gena not more than two-thirds as wide as eye. (Legs except tarsi entirely black. Gastral tergite 3 black.). ..... **bruxellensis** (Bondroit) (Male)

vi-vii. See couplet 11 for further notes.

— Antennae shorter, segments 8-10 less than one and a half times as long as broad. Gastral

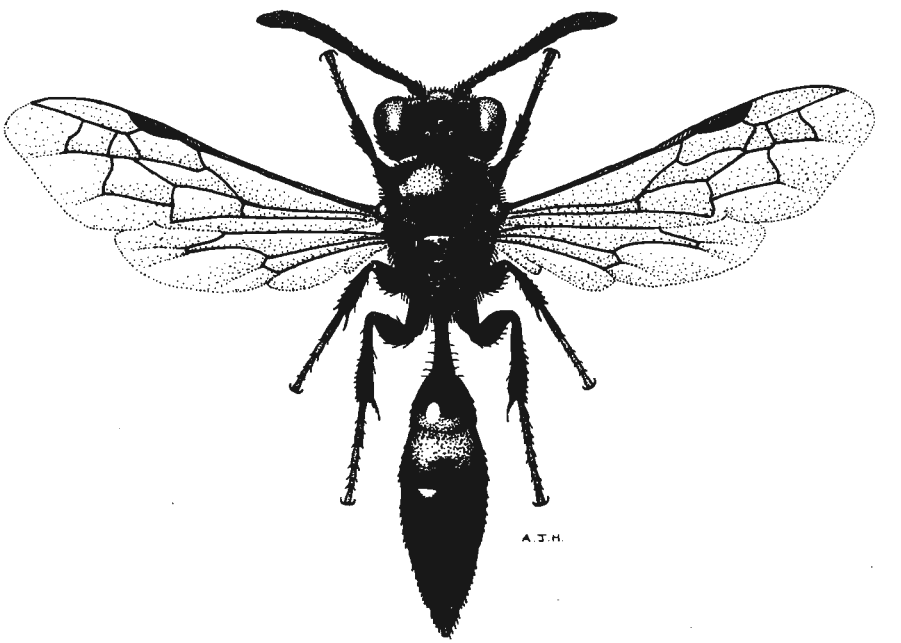

Fig. 173, *Psen lutarius* ♀.

petiole at most a little longer than tergite 1, often shorter. Gena at least three-quarters as wide as eye in profile. 15

15 Mesopleuron coarsely, rugosely, confluently punctured. Mesoscutum closely and quite strongly punctured. No flagellar segments keeled beneath. (Gastral petiole dorsally flatter and shorter than in *equestris*, slightly longer than in *lutarius*. Tibiae partly pale reddish, fore tarsi entirely so. First gastral tergite usually mainly black, second usually mainly red, at least on anterior half, third black.). . . . . **bicolor** (Jurine) (Male)
vi-vii. See couplet 13 for further notes.

— Mesopleuron less strongly and at most only rather closely punctured. Mesoscutum more shining, less closely punctured. Some flagellar segments keeled beneath 16

16 Tibiae almost entirely black. Gastral petiole shorter, broader, straight in side-view, flattened above. Gastral tergites 1-2 often largely red but sometimes much blackened, 3 black. Mesoscutum and mesopleuron more distinctly punctured.
. . . . . **lutarius** (Fabricius) (Male)
vi-vii. See couplet 13 for further notes.

— Tibiae more or less extensively reddish. Gastral petiole longer, narrower, curved in side-view, dorsally convex. Gastral tergite 1 mainly red, 2 red, 3 usually red at base. Mesoscutum finely, mesopleuron scarcely punctured. (Flagellum, fig. 177c.)
. . . . . **equestris** (Fabricius) (Male)
vi-viii. See couplet 12 for further notes.

Genus **Psenulus** Kohl

Whole insect—fig. 179. Gaster petiolate, petiole relatively long, dorsally flat or with a longitudinal furrow. Fore wing with pterostigma short, wide, distally rounded, 3 submarginal cells, the second and third normally receiving recurrent veins (1 m-cu, 2 m-cu) at their proximal ends; hind wing with one M + Cu1 cell which ends on M + Cu1 before vein Cu1 leaves it. Frons with a T- or Y-shaped prominence between the antennal sockets, the straight stem of the prominence

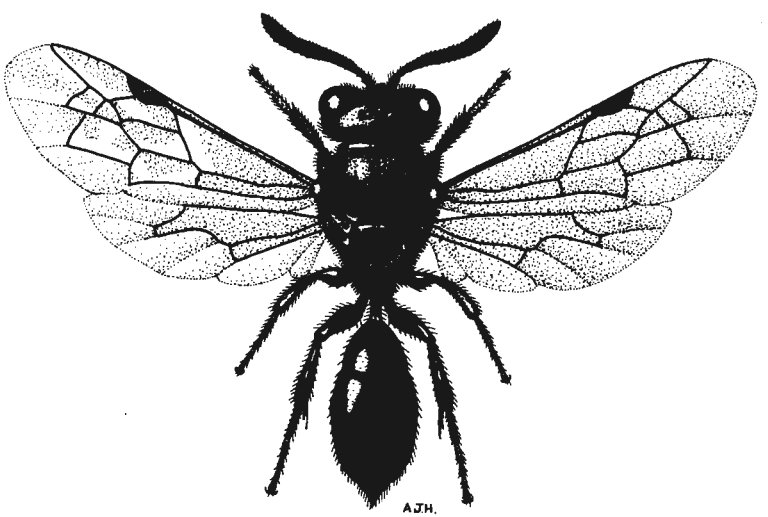

Fig. 179, *Psenulus pallipes* ♀.

enclosing a circular or oval depression. Female with an indistinct or no pygidial area, male without one. Male last visible gastral sternite ending in an upturned spine, often visible externally.

A genus of moderate size, found in all the main regions except New Zealand and S. America. The European species are all small black insects which nest in stems or rotten wood, cell divisions being made of pith or wood dust. Prey Homoptera (Sternorrhyncha). See Yarrow (1954a) for *P. schencki;* it and *P. concolor* are probably more often bred than caught.

Key to species

1 Females.....2
— Males.....4
2 Second gastral sternite (fig. 180b) with a large, well-defined, shallow depression on its basal half. Gastral sternites 4 and 5 with dense, pale fringes of hairs. Impression in the stem of the T-shaped frontal prominence wide (fig. 180a), subcircular though pointed below. Pygidial area broadly triangular (fig. 180c). (Frons punctured. Ventral margin of clypeus distinctly bidentate. Length 5.0-7.0mm.).
..... **pallipes** (Panzer) (Female)
Nests in stems, straws or in beetle holes in wood. Prey aphids (cf. Freeman, 1938). England to N.E. Yorks and N. Lancs, Glamorgan, E. Ireland. Common. v-viii.
— Second gastral sternite without a defined, parabolic impression. Sternites 4 and 5 without dense fringes. Impression in stem of frontal prominence narrow, pyriform. Pygidial area much narrowed posteriorly (fig. 181b).....3
3 Head smooth, unpunctured. Frontal prominence Y-shaped (fig. 181a). Clypeus very weakly emarginate. Mid tibia simple. Petiole dorsally with a very broad, shallow furrow. Length 6.0-8.0mm ..... **concolor** (Dahlbom) (Female)
Nests in stems, especially, perhaps, ash. Prey Homoptera (Psyllidae) (cf. Danks, 1971: 345). Kent to Devon, north to Staffs, N. Lincs. Not very common. v-viii.
— Head closely punctured. Frontal prominence T-shaped. Clypeus ventrally strongly bidentate. Mid tibia externally (fig. 182) with an elongate impression followed by a row of short spines. Petiole dorsally with a deep narrow furrow. Length 5.0-7.0mm.
..... **schencki** (Tournier) (Female)
Nests in cut stems or decayed wood. Prey Homoptera (Psyllidae) (Danks, 1971: 346). London, Surrey, W. Sussex, Kent. Rare. vi-vii.
4 Head smooth, unpunctured. Antennal segment 13 two and a half times as long as broad. (Frontal prominence almost T-shaped, impression enclosed by the stem pyriform.).
..... **concolor** (Dahlbom) (Male)
See couplet 3 for notes.
— Head punctured and finely striate. Antennal segment 13 twice as long as broad.....5
5 Mesosternal furrow with short keels perpendicular to the central, longitudinal keel. Gastral sternite 2 with no trace of a parabolic impression.
..... **schencki** (Tournier) (Male)
See couplet 3 for notes.
— Mesosternal furrow with short keels oblique to the central longitudinal keel. Gastral sternite 2 with traces of a parabolic impression..... **pallipes** (Panzer) (Male)
See couplet 2 for notes.

Genus **Stigmus** Panzer

Whole insect—fig. 183. Gaster rather short petiolate, petiole dorsally somewhat rugose. Fore wing with a large, distally rounded pterostigma, two submarginal cells, one recurrent vein (1m-cu) received by the first; hind wing with one M + Cu1 cell, ending at the point where Cu1 leaves M + Cu1. Frontal prominence between antennal sockets small. Clypeus ventrally bidentate and traces of a pygidial area in female. Male with a spiniform eighth gastral sternite.

A rather small genus of small black species, found in all regions except the Australian. Nests in holes in wood or in cut stems. Prey aphids.

— Black; mandibles, much of antennae and legs, light brown. Pronotal tubercles white. Head large, brightly shining. Mesoscutum dull, shagreened. Scutellum shining. Propodeum coarsely clathrate. Length 3.5-4.5mm ..... **solskyi** Morawitz

Nests in small beetle holes in wood and in cut stems. Kent to Cornwall, north to Staffs and N. Lincs, Glamorgan. Not very common. vi-viii.

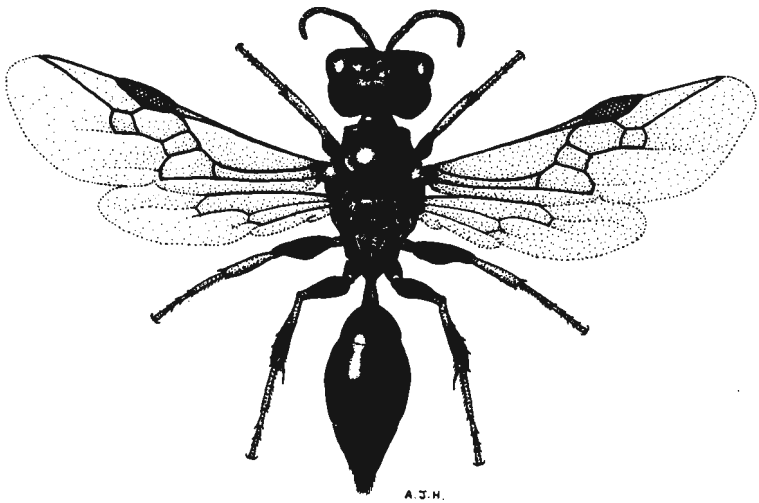

Fig. 183, *Stigmus solskyi* ♀.

Genus **Pemphredon** Latreille

Whole insect—fig. 184. Gaster with a rather short petiole with dorsal surface sculptured. Head and thorax with long, outstanding pubescence. Fore wing with a narrow, pointed pterostigma, two submarginal cells, either both or only the first receiving the two recurrent veins (1 m-cu, 2 m-cu); hind wing with one M + Cu1 cell, ending on Cu1 after it leaves M + Cu1. Frontal prominence between the antennal sockets only in the subgenus *Ceratophorus*. Clypeus ventrally with a variable emargination in the female, sometimes strong, sometimes obsolete. Female normally with a small pygidial area. Male with the end of gastral sternite 8 long and narrow, almost spiniform.

A genus of moderate size, mainly Holarctic (just reaching India) species of moderate or small size. Nests in dead wood or cut stems. Prey aphids. The species are often difficult to separate and the status of a number of them is still doubtful. The distribution of the rarer species is very uncertain. The present treatment is provisional.

Key to species

1 Clypeus ventrally with a small or no emargination, labrum short. Frons with no tubercle between the antennal sockets. Gastral petiole longer. (Mandibles 3 to 6 dentate.)..... 2

— Clypeus ventrally with a deep emargination, between the bounding teeth of which protrudes the long labrum. Frons with a marked tubercle between the antennal sockets. Gastral petiole short. (Second submarginal cell higher than wide, receiving the second recurrent vein (2 m-cu). Male clypeus without dense pubescence, gastral sternites 2-4 with long fringes. Subgenus **Ceratophorus** Shuckard.)..... 12

2 In the fore wing the second recurrent vein (2 m-cu) normally enters into the first third of the second submarginal cell which is generally wider than high, rarely square. Antennal segment 3 usually three times as long as broad in female and rarely over twice in male. Subgenus **Pemphredon** Latreille. (Black, wings slightly brownish. Mandibles

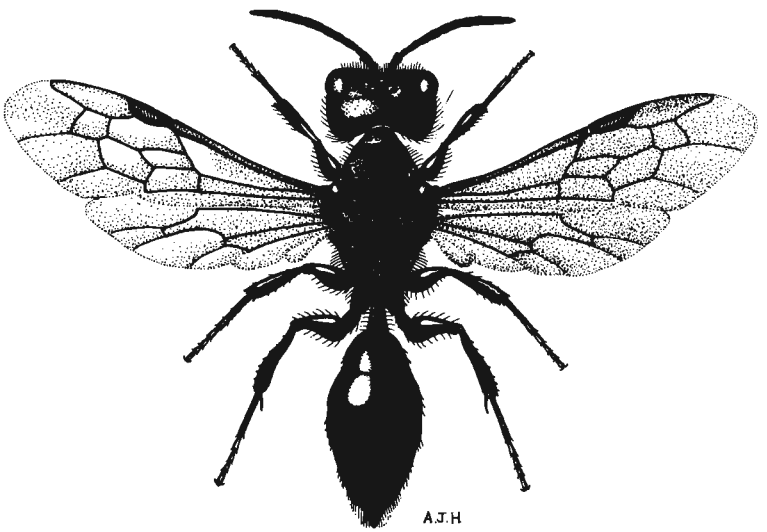

Fig. 184, *Pemphredon lugubris* ♀.

quadridentate in female (fig. 185a), tridentate in male (fig. 186a). Central lobe of clypeus ventrally truncate in female (fig. 185b), emarginate in male (fig. 186b). Propodeum, including the ill-defined dorsal area, rather finely clathrate. Pygidial area (fig. 185c) in female shining, no broader than hind basitarsus. Length 7.5-11.0mm.) ..... **lugubris** (Fabricius)

Nests in rotten wood. England, Wales, north to Dumfries and Midlothian, Isle of Man, Ireland. Common. v-ix.

— In the fore wing the second recurrent vein (2 m-cu) normally enters into the end of the first submarginal cell, rarely into the extreme base of the second, which is higher than wide. Antennal segment 3 about twice as long as broad. Subgenus **Cemonus** Panzer... 3

3 Females..... 4

— Males..... 8

4 Clypeus, seen strictly from in front, with the centre of its ventral margin with no emargination. Pygidial area with no central keel..... 5

— Clypeus, seen strictly from in front, with the centre of its ventral margin with at least a small emargination. Pygidial area often with a short keel. (Propodeum sometimes with no shining, crescentic posterior margin of dorsal area or with it partly obliterated, posterior surface with a long furrow becoming wide at the top. Length 7.5-10.5mm.)..... 7

5 Clypeus, seen from above, with its ventral margin produced into a small point (fig. 187b) (seen from below the point lies in the centre of a semicircular emargination). Mesoscutum shining, with sparse punctures which may be produced into short striae on the posterior part (scutellum and metanotum also a little punctured). Pygidial area short (fig. 187c), broad, clearly margined. (Female mandibles with 4 apical teeth (fig. 187a) and a blunt more proximal one, in male tridentate. Furrow on posterior face of propodeum short and broad. Length 6.0-8.0mm.)
..... **inornata** Say (Female)

Nests in stems (cf. Danks, 1971: 337). Kent to Cornwall, north to Ayr, Wales, Ireland. Common. v-ix.

— Clypeus never with a point at the centre of its ventral margin. Mesoscutum often closely and strongly punctured. Pygidial area longer, rather narrower..... 6

6 Centre of clypeus (fig. 188b), seen from in front, with ventral lobe truncate or very feebly emarginate. Front half of scutellum shining, finely and sparsely punctured. (Mandibles quadridentate (fig. 188a). Propodeum with the smooth area broad and not defined posteriorly, posterior face with a longer, narrower furrow. Length 5.0-7.0mm.)
..... **lethifer** (Shuckard) (Female)

Nests in cut stems, usually Rubus *(cf. Danks, 1971: 324). Kent to Cornwall, north to Dunbarton, Wales, Ireland. Very common. v-x.*

— Centre of clypeus seen from in front with central lobe feebly tridentate. Scutellum relatively closely and strongly punctured throughout. (Mesoscutum not very densely punctured.) ..... **enslini** (Wagner) (Female)

Nests in cut stems of brambles. N.W. Yorks (Richmond, 1903, 6♂ 2♀, A. J. Chitty (det. Valkeila)), S. Devon (Whitchurch Down, 28.viii.1972, 1♀. G. M. Spooner).

7 Ventral emargination of median lobe of clypeus (fig. 189) wider than antennal sockets and deep, almost semicircular, occasionally with a small tooth at bottom of emargination. Mesoscutum more discretely punctured and never with wrinkles. (Head posteriorly not bulging out more than eyes.).
..... **mortifer** Valkeila & Leclercq (Female)

Nests in rotten wood. W. Gloucester, Dorset, Hants, Surrey, Kent, Essex, Beds, Cambs, Suffolk, Notts, N. Lincs, Scotland (Perthshire). Rare. vii-viii.

— Ventral emargination of clypeus less wide than base of antennal scapes and shallow. If, rarely, the emargination is very shallow it may be slightly wider than the antennal sockets. Mesoscutum with relatively dense punctures, often in longitudinal rows and often with folds or wrinkles as well..... **wesmaeli** (Morawitz, A.) (Female)

Nests in hard wood or bark. Scotland (Inverness, Moray). Locally common. vi-viii.

8 Antennal segments 6-9 posteriorly convex. Gastral tergite 7 not distinctly punctured. (Gastral sternites 2-5 with a shining apical depression. Length 5.0-6.0mm.)
..... **lethifer** (Shuckard) (Male)

See couplet 6 for notes.

— Antennal segments 6-9 not posteriorly convex. Gastral tergite 7 with sparse, fine but moderately distinct punctures 9

9 Mesoscutum with fine, sparse punctures, Gastral sternites 2-5 without apical impressions. (Anterior part of scutellum with sparse punctures. Length 5.0-6.5mm.) ..... **inornata** Say (Male)
See couplet 5 for notes.

— Mesoscutum with closer punctures. Gastral sternites 2-5 with apical impressions..... 10

10 Length 5.5-6.0mm. Gastral sternites 3-6 striolate, 2-5 with narrow, shining apical impressions, well-defined at base; punctures of tergite 7 less distinct. ..... **enslini** (Wagner) (Male)
See couplet 6 for notes.

— Length 8.0-9.5mm. Gastral sternites 3-6 indistinctly striolate, 2-5 with wide, shining apical impressions, not clearly defined at base; punctures of tergite 7 fine and sparse but distinct..... 11

11 Wrinkled part of dorsal area of propodeum about level with the fold which surrounds it. (Petiole dorsally usually weakly convex.)..... **wesmaeli** (Morawitz, A.) (Male)
See couplet 7 for notes.

— Wrinkled part of dorsal area of propodeum depressed below the marginal fold (details very variable)..... **mortifer** Valkeila & Leclercq (Male)
See couplet 7 for notes.

12 Size larger 6.0-8.0mm. Clypeus little punctured in female with no tooth at centre of emargination (fig. 190b). Gastral sternites 3-6 closely punctured and with more large ones. Process between the antennal sockets large. Pygidial area more excavated (fig. 190a)..... **morio** (Vander Linden)
Nests in rotten wood. Hants, Surrey, Middx, Kent, Oxon, Cambs, N. Essex, W. Suffolk. A number of other records belong to this subgenus but the species is uncertain. Rare. vi-viii.

— Size smaller, 4.5-6.0mm. Clypeus (fig. 191) with closer punctures, ventral emargination with a more or less distinct tooth at its centre. Gastral sternites 3-6 with closer and finer and fewer large punctures. Process between the antennal sockets smaller. Pygidial area less excavated..... **clypealis** (Thomson)
Nests in rotten wood. E. Cornwall, Hants, Surrey, Middx, Kent, Bucks, Beds, S. Essex, Glamorgan. Rare. vi-viii.

Genus **Diodontus** Curtis

Whole insect—fig. 192. Gaster not petiolate. Head and thorax with short pubescence. Fore wing with a pointed, relatively narrow pterostigma, two submarginal cells, each receiving a recurrent vein (1 m-cu, 2 m-cu); hind wing with one M + Cu1 cell, ending on Cu1 after it leaves M + Cu1. Antennal sockets somewhat widely separated, no prominence between them. Upper frons with an elongate welt or shallow sulcus along inner margin of eye. Clypeus in female usually protruding, with an angular notch. Mandibles bidentate. Mesopleuron clathrate, coarsely so above. Mid and hind tibiae dorsally with short spines. Female with a flat, triangular pygidial area.

About 50 species of small, black insects found mostly in the Holarctic but also in the Oriental and Ethiopian regions. Nests in the soil. Prey aphids.

Key to species

1 Mandibles yellow. Fore and mid basitarsi of male more or less deformed. Length, ♀4.0-5.0mm, ♂3.0-4.0mm (see Spooner, 1938) 2

— Mandibles blackish. Basitarsi of male simple. Length, ♀ 5.0-6.5mm, ♂ 4.0-5.5mm..... 3

2 Separation of lateral clypeal teeth in female (fig. 193a) greater than distance from one of them to nearest point of eye. Mid basitarsus of male (fig. 193b) curved and distally thickened..... **minutus** (Fabricius)

Nests in sand. Kent to Devon, north to Ayr, Wales. Common. vi-viii.

— Separation of lateral clypeal teeth in female (fig. 194a) less than the distance from one of them to nearest point of eye. Mid basitarsus of male (fig. 194b) only slightly curved and little distally thickened..... **insidiosus** Spooner

Nests in sandy places, often in flat surfaces. Kent, Surrey, Berks, Sussex, Middx, Hants, Dorset. Local but occasionally common. vi-viii.

3 Female with a welt along the internal margin of eye (fig. 195); fore tibia more or less yellow beneath. Male with frons dull, closely and finely punctured; pronotal tubercles black..... **luperus** Shuckard

Kent to Devon, north to S.E. Yorks. Rather common. vi, ix.

— Female with a narrow furrow along internal margin of eye (fig. 196); fore tibia black. Male with frons more shining, less clearly sculptured; pronotal tubercles usually white..... **tristis** (Vander Linden)

Sometimes nests in mortar of walls. Kent to Devon, north to N.E. Yorks, Wales. Not very common. vi-ix.

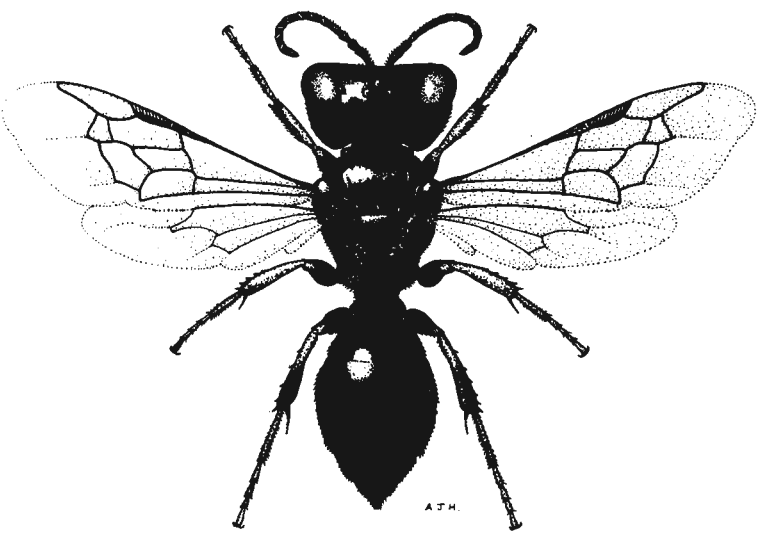

Fig. 192, *Diodontus minutus* ♀.

Genus **Passaloecus** Shuckard

Whole insect—fig. 197. Gaster not petiolate. Head and thorax with very short pubescence. Fore wing with pterostigma pointed, moderately broad, two submarginal cells, each receiving a recurrent vein (1 m-cu, 2 m-cu); hind wing with one M + Cu1 cell, ending on Cu1 after it leaves M + Cu1. Antennal sockets rather widely separated with a small prominence between them, rarely more enlarged. Clypeus usually with the ventral margin medially somewhat projecting but sometimes biemarginate; labrum pointed or very narrowly rounded, often projecting over the mandibles. Mandibles bidentate. Mesopleuron smooth or nearly so with two or three strong, crenulate furrows, one of which is vertical. Tibiae without any spines. Female without a pygidial area; male with last visible sternite spiniform (rather like a sting), but clypeus with close silvery hairs.

About 30 small, black, Holarctic species with forms which are perhaps generically distinct in the Ethiopian and Oriental regions. Nests in hollow stems and beetle burrows, with partitions of resin or rarely mud. Prey aphids. For the British species see Yarrow (1970); for their biology see Danks (1971) and Corbet & Backhouse (1975).

Key to species

1 Mesopleuron with one vertical and one horizontal crenate furrow (fig. 198b), the upper horizontal furrow being not or scarcely indicated. (Clypeus truncate. Eyes not at all convergent below. Fore tibia mainly, mid tibia beneath, reddish-yellow. At least four front tarsi largely pale brown. Mandibles white marked.) 2

— Mesopleuron with one vertical and two horizontal crenate furrows (fig. 203c) the upper one sometimes rather weak or hardly crenate. (Second gastral tergite impressed at base.) 9

2 Females 3

— Males. (Mesoscutum and impressions of gaster as in female.) 6

3 Second and third gastral tergites impressed at base (fig. 198c) (well seen in profile). Mesoscutum without rugae posteriorly, generally very shining and regularly punctate with a small central area of dense punctures. Ventral margin of clypeus clearly upturned. (Labrum black. Length 5.0-6.0mm.) 4

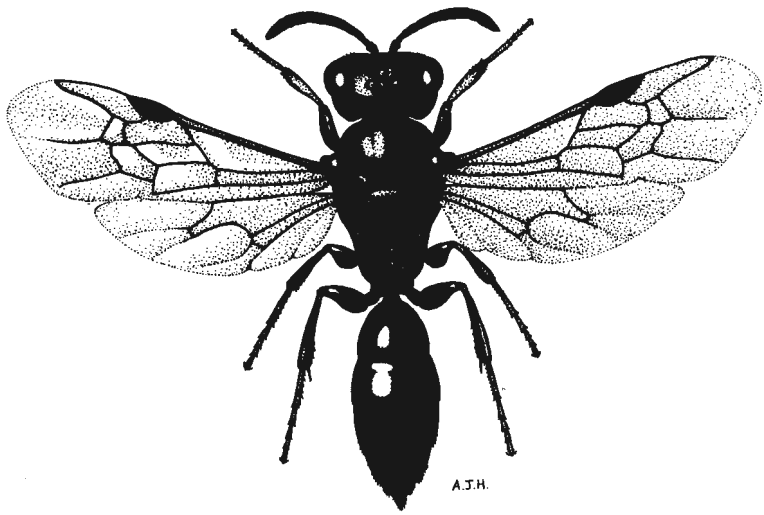

Fig. 197, *Passaloecus corniger* ♀.

— Second and third gastral tergites not impressed at base (fig. 199). Mesoscutum with short rugae at posterior margin, surface otherwise finely and regularly punctate. Ventral margin of clypeus in the same plane as the rest of it. (Pronotal tubercles black.)..... 5

4 Clypeus with ventral with margin roundly produced. Head clearly narrowed behind. Pronotal tubercles yellow. (Dorsal horizontal furrow of pleuron strong but not crenate.)..... **clypealis** Faester (Female)

Cambridge (Wicken Fen), amongst reeds in which it probably breeds, Essex (Benfleet). vi. Kent (Higham), reared 1978 from galls of Lipara lucens *(G. H. L. Dicker). There are many records on the continent (e.g. Müller, 1911) of* Passaloecus *nesting in* Lipara *galls on reeds and some of these may have been this species.*

— Clypeus with ventral margin truncate or feebly concave (fig. 198a). Head little narrowed behind. Pronotal tubercles usually black, occasionally pale posteriorly.
..... **singularis** Dahlbom (Female)

Nests in cut stems; the only species building cell partitions of resin, mud and small stones. Kent to Cornwall, north to Dumfries, Glamorgan. Common iv-vi, less commonly vii-ix.

5 Labrum brownish. Length 5.0-6.0mm. Punctation of gaster rather finer and sparser. Frons not sloping down towards the edge of lateral ocelli.
..... **monilicornis** Dahlbom (Female)

Nests in dead wood. England from Cheshire northwards, Scotland, Ireland. v-ix. Not rare.

— Labrum usually white, rarely yellowish or brownish. Length 4.5-6.0mm. Punctation of gaster rather stronger and closer. Frons sloping down to a shallow depression at outer edge of lateral ocellus..... **insignis** (Vander Linden) (Female)

Nests in cut stems or dead wood. Kent to Devon, north to mid west Yorks. Not common. vi-ix.

6 Mandibles narrow (fig. 200) distinctly bidentate, teeth prolonging long axis of mandible. Antenna longer and thinner, segments 5-8 or 9 with a narrow, reddish, shining prominence beneath. Length 4.0-5.0mm..... 7

— Mandibles somewhat distally widened (fig. 201b), ventral tooth short and wide, projecting more ventrally. Antenna thicker, moniliform, segments 5-10 or 11 with narrow, black keels beneath. Length 4.5-6.0mm..... 8

7 Antenna thinner, areas beneath segments 5-8 narrower. Labrum dark brown, palps pale yellow, mid and fore tarsi and base of hind tibia whitish. (Pronotal tubercle whitish.)..... **clypealis** Faester (Male)

See couplet 4 for notes.

— Antenna thicker, areas beneath segments 5-9 wider. Labrum blackish-brown, palps pale, mid and fore tarsi and base of hind tibia yellowish.... **singularis** Dahlbom (Male)

See couplet 4 for notes.

8 Labrum blackish-brown. Pronotal tubercles brown. Antennal segments more globular (fig. 201a), carinate beneath segments 4 or 5-11. Length 5.5-6.0mm.
..... **monilicornis** Dahlbom (Male)

See couplet 5 for notes.

— Labrum brown. Pronotal tubercles usually brown but sometimes white. Antennal segments less globular (fig. 202) with shorter carinae beneath segments 4 or 5-10. Length 4.5-5.5mm..... **insignis** (Vander Linden) (Male)

See couplet 5 for notes.

9 Mesopleuron with vertical crenate furrow preceded by a contiguous row of large punctures (fig. 205c). Eyes with inner margins converging downwards (fig. 205b), especially in female. Notaulices strong and wide. Mandibles (fig. 205a) with a broad rounded tooth in female, with two rather wide teeth in male. Female clypeus truncate. Labrum black, palps brownish-yellow. Length 4.5-5.5mm. (Female pronotal tubercles usually white. Male antennae (Fig. 206) rather short and thick, with conspicuous keels beneath segments 4-11; pronotal tubercles black.)..... **gracilis** (Curtis)

Nests in burrows of the tortricid Rhyacionia *or in beetle burrows (cf. Danks, 1971: 339). Kent to Devon, north to Lancs and mid Yorks, Wales. Common. vi-viii.*

— Mesopleuron with only the usual vertical crenate furrow. Eyes with inner margins parallel below (fig. 203b). Notaulices narrow and short. Mandibles with the broad

ventral tooth concave, so that they are effectively tridentate (fig. 203a). Clypeus ventrally biemarginate, so that it appears weakly tridentate. Labrum and palps brown or brownish-yellow. Length 5.0-7.0mm..... 10

10 Antennae short; in female the third segment little longer than wide at apex; in male relatively short, dark beneath, segments 8-12 ventrally with an inner distal tooth (fig. 204). Prominence between antennal sockets a distinct pointed projection, in female nearly as long as width of extremity of third antennal segment. Face narrower. Clypeus in female with dense appressed silvery pubescence. Pronotal tubercles white. Mandibles brown. Hind tibia ferruginous at base. (Length 5.0-7.0mm).
..... **corniger** Shuckard

Kennedy (1838) first recorded that this species steals aphids from other Passaloecus. *Chevalier (1923) and Corbet & Blackhouse (1975) have described this behaviour in more detail. Chevalier also records that most prey is stolen from* Psenulus pallipes *and that resin may also be taken. Nests in* Lipara *galls and also dead wood. Kent to Devon, north to N. Lincs and Warwick, Glamorgan. Common. v-viii.*

— Antennae longer, more slender; in female segment three nearly twice as long as broad; in male relatively long, segments simple, pale beneath. Prominence between antennal sockets rudimentary. Face wider. Clypeus in female nearly bare. Pronotal tubercles white posteriorly. Mandibles with a white spot or streak. Hind tibia white at base.
..... **eremita** Kohl

E. Sussex (Crowborough, edge of Ashdown Forest, 6.viii. 1979. ♀ . G. H. L. Dicker), W. Sussex (Midhurst Common, 19.viii. 1978. ♀ . M. Edwards). In Europe widespread, usually rare. Breeds in thatch. Prey Lachnidae (Lomholdt).

Genus **Spilomena** Shuckard

Whole insect—fig. 207. Very small, black insects. Gaster sessile. Head and thorax with very short pubescence. Fore wing with pterostigma wide, bluntly pointed, two submarginal cells, one interstitial recurrent vein (1 m-cu); hind wing with one M + Cu1 cell, ending before the origin of Cu1. Antennal sockets placed low down, widely separated, whole area between them slightly convex. Clypeus truncate or occasionally weakly emarginate, labrum hidden, mandibles bidentate. Tibiae without small spines. Dorsal area of propodeum finely coriaceous. Female with

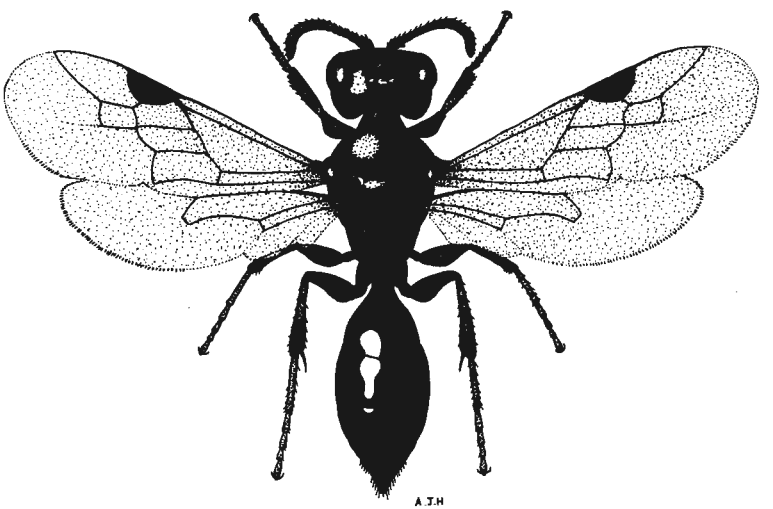

Fig. 207, *Spilomena troglodytes* ♀.

pygidial area very narrow and indistinct. Male face and clypeus with yellow markings. Length about 2.5-3.5mm.

About 30 species found in all regions except, apparently, South America and New Zealand. Nests in hollow stems or in holes in wood. Prey thrips and perhaps aphids. Yarrow (1969) deals with the British species and explains the very considerable difficulty of identifying them. Danks (1971: 341) gives some notes on their biology.

Key to species

1 Furrow between scutellum and mesoscutum crenate (fig. 208). OOL = 2.5 POL and POL slightly longer than diameter of anterior ocellus. Female with clypeus longitudinally furrowed. Male with ventral margin of clypeus yellowish-white; inner orbits shortly (one fifth of their length) and narrowly ivory-white. (Dorsal surface of propodeum more or less enclosed by a half oval carina and divided by longitudinal carinae into central and dorso-lateral areas, former with a few transverse, latter with some oblique rugae. Head behind eyes short, strongly narrowed and posteriorly concave. Female antennal segments 1-2 brownish-yellow, pronotal tubercles almost entirely reddish-brown. Male antennal segments 1-2 and legs pale yellow; pronotal tubercles reddish-brown.) ..... **differens** Blüthgen

Nests in holes in wood. Prey thrips. Kent to Devon, north to Lancs and Warwick, Dublin. Not common. vi-ix.

— Furrow between scutellum and mesoscutum not crenate. If OOL is more than 2 POL, then POL is not longer than diameter of anterior ocellus. Female clypeus without or with a very slight longitudinal furrow. Male clypeus entirely yellow or yellowish-white, facial pale markings more extensive 2

2 OOL = 2.5-3.0 POL. Head long behind eyes (fig. 209a) (not much narrowed nor concave posteriorly, very shining but finely reticulate). Male with facial markings pale yellowish-white. (Propodeum with dorsal area rather more truncate behind than in the other species, enclosed by longitudinal welts rather than by a carina, transverse rugae conspicuous. Female with two approximated keels on posterior half of gastral tergite 6 (fig. 209b); mandibles and antennal segments 1-2 yellowish-brown; pronotal tubercles reddish-brown. Male facial markings extending one third of the way up the inner orbits and usually across the malar area to form small genal spots; flagellum yellowish-brown, individual segments a little convex with very short outstanding hairs; pronotal tubercles pale reddish; legs yellowish-brown, mid and hind femora darker.) ..... **enslini** Blüthgen

Nests in hollow stems, perhaps especially Rubus. *Prey thrips. S.E. England, Ireland (Queens County). Locally common. vi.*

— OOL = 2 POL or less (POL clearly longer than diameter of anterior ocellus). Head shorter behind the eyes. Pale marks of male face deeper yellow 3

3 Head rather large, hardly narrowed and not very concave behind. OOL = about 1.5 (♀) or 2.0 (♂) POL. Dorsal area of propodeum enclosed by a strong, half-oval carina (transverse rugae moderately strong but irregular, surface shining). Female with two approximated rows of short, dense, pale hairs on gastral tergite 6 (fig. 210a). Male with flagellar segments not convex and without outstanding hairs; last visible gastral sternite constricted apically into an upwardly directed hook (fig. 210b). (Frons rather strongly reticulate in front of ocelli and on vertex. Pronotal tubercles brownish-black. Female with flagellum dark brown or almost black; legs brownish-orange, all femora and mid and hind tibiae darker brown. Male with pale markings extending up one third of inner orbit; flagellum dark brown; legs with fore tibiae yellowish, femora and mid and hind tibiae darker brown.) ..... **beata** Blüthgen

Nests in stems or in holes in wood. Kent to Devon, north to Leics and Staffs. Moderately common. vi-viii.

— Head less large, distinctly narrowed and concave posteriorly. OOL = 2 POL. Dorsal area of propodeum rather more elongate-oval. Female with two approximated keels on posterior two-thirds of gastral tergite 6. Male with flagellar segments individually convex and conspicuously hairy; last visible gastral sternite less prominent, less compressed and hooked 4

4 Dorsal area of propodeum defined more by a smooth, shining band than by a carina, mostly strongly shagreened but little trace of transverse rugae. Head short, strongly narrowed and considerably concave behind; gena clearly narrower than eye in profile. Female with pronotal tubercles reddish-brown or black; legs brownish, femora and tibiae sometimes almost black. Male with pale facial markings extending one third up the inner orbit and sometimes downwards across the maler space onto the gena; colour of antennae rather variable, but flagellum usually somewhat dark or even brown; legs usually pale with femora darker. (Mesoscutum shallowly punctate, posteriorly more finely punctate-striate. Female with flagellum brownish.)

..... **troglodytes** (Vander Linden)

Apparently nests chiefly in wood in beetle holes. Prey nymphal thrips. Kent to Devon, north to Glamorgan, Dumfries. Rather common. v-ix.

— Dorsal area of propodeum with distinct transverse rugae, little shagreened, carina bounding it distinct, half oval. Female with head a little longer behind the eyes; gena slightly narrower than eye in profile; pronotal tubercles reddish-brown; legs orange, hind femora brown or brownish above. Male with pale facial markings extending halfway up the orbits, genal spots large; antennae and legs honey coloured, antennal segment 13 and hind femur a little darker..... **vagans** Blüthgen

Nests in holes in wood. S. Devon, Beds, Warwick. Rare. vii.

Subfamily Sphecinae

Genus **Ammophila** Kirby

Whole insect—fig. 211. Gaster with a long petiole formed of the first sternite, tergite also narrow and adding to the length of the petiole, spiracle situated behind its middle. Fore wing with three submarginal cells, the second receiving both recurrent veins (1 m-cu, 2 m-cu); hind wing with cell M + Cu1 ending before the separation of the veins. Mid tibia with two spurs, larger spur of hind tibia with an even comb of fine bristles. Species rather large, elongate (13.0-24.0mm), black with part of gaster red. Female with a tarsal pecten on fore leg, no pygidial area.

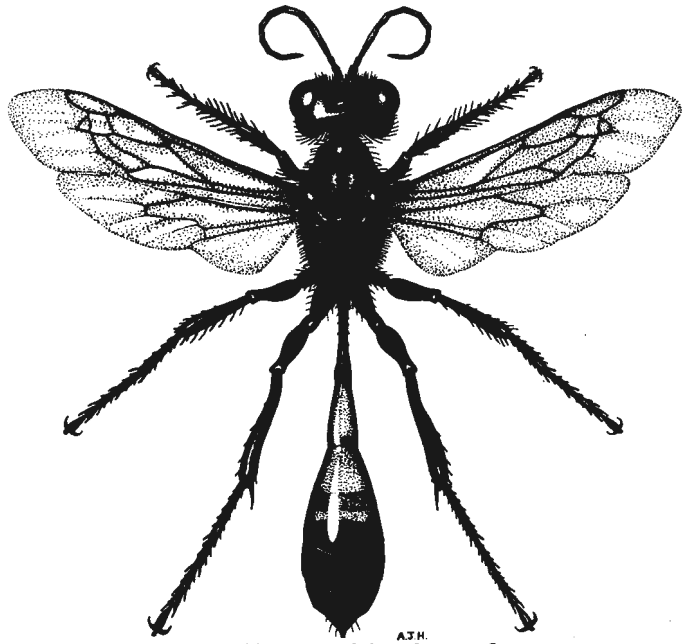

Fig. 211, *Ammophila pubescens* ♀.

Numerous species in all regions except New Zealand. Make short burrows, ending in one cell, in sandy soils. Prey caterpillars or, rarely, sawfly larvae which they catch after making the burrow.

The biology is remarkable in two respects. Some females in North America are tool-users, holding a small stone in the mouth to tamp down the sand when closing the nest. Secondly, *A. pubescens* feeds its larva with additional prey as required, and, as shown by Baerends (1941; cited as *A. campestris)*, one female may sometimes tend three different nests in different stages of development.

At Surrey (Oxshott, 26.viii.1936), I saw a female *A. sabulosa* put a large noctuid larva into a nest and close it. It was found that the nest already contained a caterpillar with a 4.0mm long larva feeding on it. This is certainly very unusual for this species.

Key to species

1 Larger species, length, ♀ 16.0-24.0mm, ♂ 14.0-19.0mm. Dorsal area of propodeum reticulate. Third submarginal cell (fig. 212) not petiolate. Gaster posteriorly blue-black. . . . . **sabulosa** (Linnaeus)
Kent to Cornwall, north to Yorks and Cheshire, Wales. Common. vi-ix.

— Smaller species, length, ♀ 18.0-19.0mm, ♂ 13.0-17.0mm. Dorsal area of propodeum transversely striate. Third submarginal cell petiolate. Gaster posteriorly black. . . . . **pubescens** Curtis
Surrey, W. Sussex, Berks, Hants, Dorset, Suffolk, Isle of Man. Locally common. vi-viii.

Genus **Podalonia** Spinola

Whole insect—fig. 213. Very like *Ammophila* and in the fauna of the whole world only distinguished from it with difficulty. First gastral tergite wide, not forming a prolongation of the petiole but making an angle with it in profile, its spiracles at or

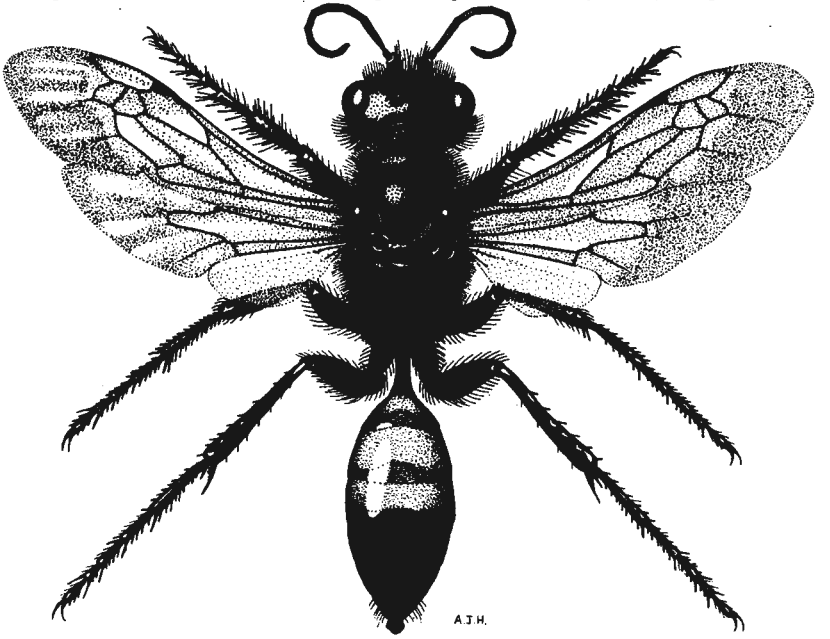

Fig. 213, *Podalonia hirsuta* ♀.

before its middle. Larger spur of hind tibia with the distal spines of its pecten stouter and less close together than the proximal ones.

Mainly Holarctic but widely spread except in New Zealand and South America. British species black and red with long black pubescence. The wasps (at least the females) pass the winter as adults and may emerge early in the year. They nest in sandy soil and store caterpillars, which they catch before making a burrow.

Key to species

1 Dorsal area of propodeum reticulate. Pubescence very conspicuous. Tarsal claws with rudimentary pulvilli (fig. 214)..... **hirsuta** (Scopoli)
Surrey to Cornwall, north to Lancs and Norfolk, Wales. Common. iii-viii.

— Dorsal area of propodeum transversely striate (fig. 215b). Pubescence less conspicuous. Tarsal claws with normal pulvilli (fig. 215a)..... **affinis** (Kirby)
Kent to Hants, north to Lancs and N. Lincs, Ireland (Wicklow). Not common, v-ix.

Subfamily Mellininae

Genus **Mellinus** Fabricius

Gaster black and yellow or whitish, rather shortly petiolate, first segment about 2.5 times as long as posteriorly broad. Fore wing with pterostigma well-developed, three submarginal cells, the first and third receiving recurrent veins (1 m-cu, 2 m-cu); hind wing with cell M + Cu1 ending after the separation of the veins. Clypeus ventrally tridentate. Mesopleuron without raised keels. Female with a well-defined pygidial area. Male with shining areas beneath antennal segments (7) 8-11.

Species of moderate size, found in the Holarctic and Neotropic regions. They nest in moderately deep burrows with more than one cell, in light soils. Prey Diptera, especially Cylorrhapha (see Hamm & Richards, 1930: 96).

Key to species

1 Females.....2
— Males 3
2 Larger, length 11.0-14.0mm. Gastral tergites 2-3 with yellow bands, 2 with more numerous, rather stronger fine punctures and basal part finely shagreened. Antennal segments 5-7 (fig. 216a) nearly three times as long as broad. Depression where the convex part of gastral tergite 1 (fig. 216b) meets the flattened petiole shallow, more or less the shape of an inverted V. Scutellum with a large yellow spot.
..... **arvensis** (Linnaeus) (Female)
England, Wales, Scotland, Ireland. Common. vi-ix.
— Smaller, length 8.0-11.0mm. Gastral tergites 2-3 with two paler yellow spots, 2 with less numerous, finer fine punctures and not shagreened. Antennal segments 5-7 (fig. 217a) hardly more than two and a half times as long as broad. Depression where the convex part of gastral tergite 1 (fig. 217b) meets the flattened petiole deep, more or less oval. Scutellum with a small yellow spot.
..... **crabroneus** (Thunberg) (Female)
England to Cumberland, Wales. Local, usually rare. vii-ix.
3 Larger, length 7.0-11.0mm. Last four antennal segments not swollen beneath. Sculpture of gastral tergite 2 and depression at end of petiole much as in female. Tergite 3 with a band, often narrowly interrupted. Femora black, apical quarter and underside yellow..... **arvensis** (Linnaeus) (Male)
See couplet 2 for notes.
— Smaller, length 6.0-8.0mm. Last four antennal segments swollen beneath at base. Sculpture of gastral tergite 2 and depression at end of petiole much as in female

but not so distinctive. Tergite 3 with two whitish-yellow spots. Femora black, apical quarter and underside brownish..... **crabroneus** (Thunberg) (Male)
See couplet 2 for notes.

Subfamily Nyssoninae

Genus **Alysson** Panzer

Whole insect—fig. 218. The only British species of the genus belongs to the subgenus *Didineis* Wesmael and the characters given are of the subgenus. Fore wing with three submarginal cells, the second petiolate, recurrent veins (1 m-cu, 2 m-cu) received by the first and second submarginals, pterostigma elongate but narrow in female, cross vein cu-a (nervulus) received by Cu1 well after the fork of M + Cu1; hind wing with cell M + Cu1 ending on Cu1 after the fork. Mesopleuron without keels. Propodeum with a defined dorsal area, top of sides with small spinose processes. Gaster not petiolate, partly red. Female with a defined pygidial area. Male with antennal segment 12 (fig. 219) spinosely produced beneath, 13 strongly curved.

A small Holarctic genus with one or two species in Jamaica and U.S.A. The nest (not known in England) is a moderately deep burrow in clayey soils. Prey Cicadellidae and Delphacidae.

— Black, first three segments of gaster red, legs and female clypeus largely pale brown. Pronotum somewhat elongate. Length, ♀ 7.0-8.0mm, ♂ 5.5-7.0mm.
..... **lunicornis** (Fabricius)
W. Gloucester, Dorset, S. Hants, Isle of Wight, E. Sussex, E. Kent, N. Essex, E. Suffolk, Cambs, Oxon. Rare. viii-ix.

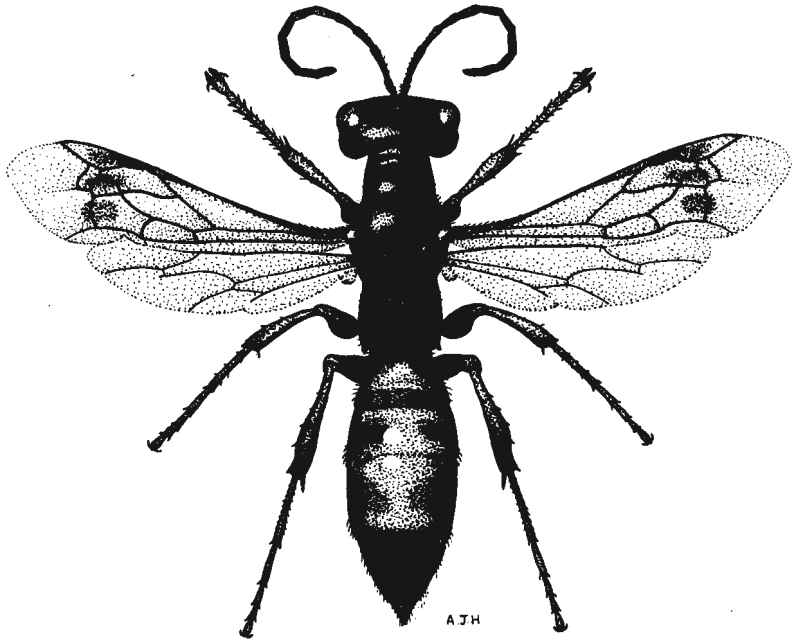

Fig. 218, *Alysson lunicornis* ♀.

Genus **Nysson** Latreille

Whole insect—fig. 220. Fore wing with three submarginal cells, second petiolate and receiving both recurrent veins (1 m-cu, 2 m-cu), pterostigma very small, cross vein cu-a (nervulus) received by Cu1 after fork of M + Cu1; hind wing with cell M + Cu1 ending on either M + Cu1 before the fork or on Cu1 after the fork. Mesopleuron without keels. Both meso and metasterna produced posteriorly to overlie the bases of their coxae. Hind tibia with small dorsal spines. Propodeum with dorsal area more or less defined, top of angles between lateral and posterior surfaces with spinose processes, sometimes short. Body stout, gaster not petiolate. Female with a pygidial area.

A moderately large genus, mainly Holarctic but with a few Oriental and Ethiopian species. They are cleptoparasitic, laying their eggs on the prey of other sphecoids (usually Gorytini, but sometimes Larrinae). The hard, strongly punctured cuticle and the way the sterna overlap the bases of the coxae are characteristic of wasps with such behaviour; so also is the strongly prominent second gastral sternite of three of our four species. These characters tend to divert the sting of the host from the vulnerable joints in the armour. For information on the probable hosts of our species see Hamm & Richards (1930: 103).

Key to species

1 Base of gaster not red, tergites 1-3 with yellow bands, sometimes interrupted. Second gastral sternite strongly raised, then angled, just after its base. Genal margin running down to near mandibles. 2

— Base of gaster red, tergite 2 or 2-3 with two white spots. Second gastral sternite little raised or angled near its base. Genal margins effaced long before reaching mandibles. (Hind wing with cell M + Cu1 ending in Cu1 after the fork (fig. 221). Male antennal segment 13 longer than 11 and 12 together, emarginate beneath; fore basitarsus (fig. 222) somewhat truncate at apex with a group of antero-ventral black spines.) . . . . . **dimidiatus** Jurine

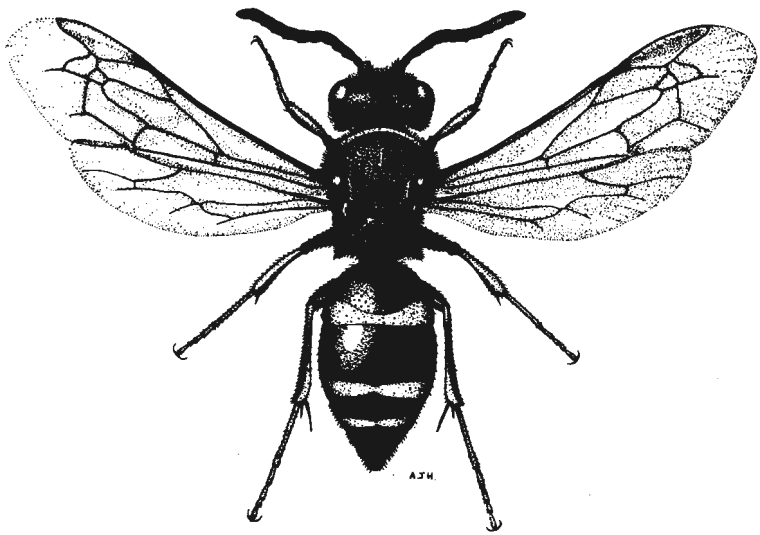

Fig. 220, *Nysson spinosus* ♀.

Usually associates with Gorytes tumidus *but when that species is absent it apprently associates with* Lindenius albilabris. *Kent to Cornwall, north to Northumberland, Wales. Not very common. vi-ix.*

2 Clypeus with small, approximated keels which protrude from ventral margin as a slight tubercle. Hind wing with cell M + Cu1 (fig. 223) ending on M + Cu1 before the fork. Gaster with tergite 1 much more coarsely and more closely punctured than tergite 2; yellow tergal bands continuous..... 3

— Clypeus without such keels. Hind wing with cell M + Cu1 ending on Cu1 after the fork. Gaster with punctures of tergites 1 and 2 very similar; yellow tergal bands interrupted..... **trimaculatus** (Rossius)

Associates with Gorytes quadrifasciatus. *Kent to Devon, north to Warwick and Norfolk. Not common. vi-viii.*

3 Pronotal tubercles black. Clypeus quite shining. Gaster with tergite 2 indistinctly punctured in female..... **spinosus** (Forster)

Associates with Argogorytes mystaceus *and* A. fargeii. *Kent to Devon, north to mid Perth, Wales, Ireland. Common. v-vii.*

— Pronotal tubercles yellow. Clypeus dull. Gaster with tergite 2 clearly punctured in female..... **interruptus** (Fabricius)

Associates with Argogorytes fargeii *and also species of* Gorytes. *London to Cornwall, Oxon, Essex. Not common. v-vii.*

Genus **Gorytes** Latreille

Whole insect—fig. 224. Fore wing with three submarginal cells, second not petiolate and receiving both recurrent veins (1 m-cu, 2 m-cu), pterostigma large, cross-vein cu-a (nervulus) received by Cu1 after fork, or (subgenus *Lestiphorus*), at fork, or (subgenus *Dienoplus*) before the fork. Epicnemial keel strong to mesosternal region, then bending back and running more weakly to top of insertion of mid coxae; dorsal furrow of mesepisternum developed only in *Dienoplus;* a strong horizontal furrow from the centre of the pleural suture to epicnemial keel except in *Lestiphorus.* Hind tibia with dorsal area well or quite well defined, no spinose

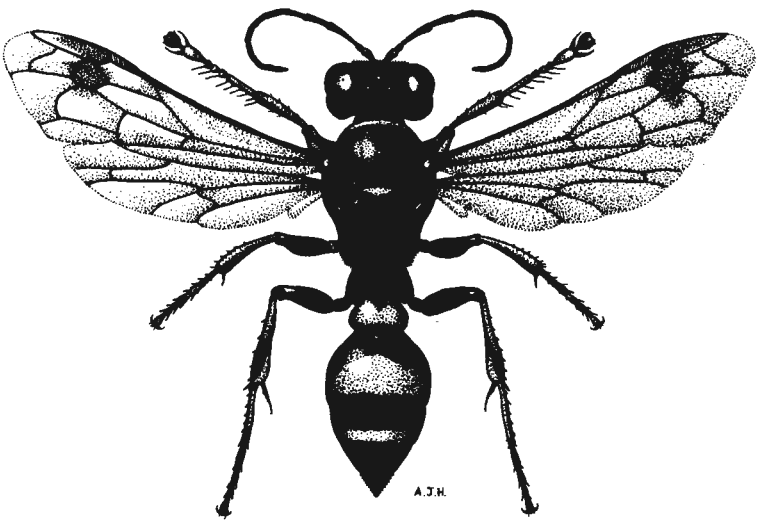

Fig. 224, *Gorytes bicinctus* ♀.

processes. Gaster at most subpetiolate, with pygidial area in female; second gastral sternite with a shallow transverse furrow at base but very little raised behind it.

Black and yellow banded species or with gaster anteriorly red with white markings behind. Species of medium or small size. A moderately large genus and though mainly Holarctic is found in all regions except Australia and New Zealand. The nest is a rather short burrow ending in several cells, stored with various Auchenorrhyncha.

Key to species

1 First gastral tergite posteriorly strongly convex but much constricted before it joins the second. Hind wing with cell M + Cu1 ending at or scarcely after the fork. Mesopleuron closely and finely punctured with no furrows, only the epicnemial keel (fig. 225). (Subgenus **Lestiphorus** Lepeletier.) (Black; clypeus and area above it, scape beneath, pronotal collar but not tubercles in female, spot on scutellum in female, wide bands on tergites 1-3 (interrupted on 1), legs beneath in female, yellow.) ..... **bicinctus** (Rossius)

Nests in light soils. Prey cicadellids and cercopids (at Slough), Bucks, 21.viii.1936 with Philaenus leucophthalmus *adult* ♀ *. O.W.R.). Middx to Cornwall, Bucks, Essex. Rare. vi-ix.*

— First gastral tergite not strongly convex, not constricted before it joins the second. Hind wing (fig. 228b) with cell M + Cu1 ending well before or well after the fork. Mesopleuron with a strong horizontal furrow from centre of pleural suture to epicnemial keel (fig. 228a) 2

2 Hind wing with cross-vein cu-a straight (fig. 226b), meeting M + Cu1 before the fork. Mesepisternum as well as the horizontal furrow with a strong dorsal furrow (fig. 226a) from just beneath the hind margin of fore wing to epicnemial keel. Subgenus **Dienoplus** Fox. Black; gastral segments 1-2 red; spots on clypeus, inner orbits, scape beneath, spot on scutellum, spots on gastral tergites 2 and 5, and at base of fore tibia in male, white ..... **tumidus** (Panzer)

Nests in sand. Prey cicadellids and cercopids. Kent to Cornwall, north to N. Lancs and Yorks, Wales, Scotland (Moray), E. Ireland. Not common. vi-ix.

— Hind wing with cross-vein cu-a strongly bisinuate, meeting Cu1 after the fork. Mesepisternum with only the horizontal furrow from the centre of the pleural suture to the epicnemial keel. Subgenus **Gorytes** Latreille. Black and yellow species..... 3

3 Band of second gastral tergite wide, occupying about one third of its length (fig. 227). Clypeus mainly or entirely, wide inner orbits and spot between antennal sockets, yellow..... **laticinctus** (Lepeletier)

Nests in soil. An old record is of Philaenus *as prey but the determination of the wasp is doubtful. Devon, Dorset, Wilts, Hants, Cambs, Suffolk. Rare. vii-viii.*

— Band of second gastral tergite narrow, not occupying more than one quarter of its length (fig. 228c). Clypeus extensively black marked, spots on inner orbits small and narrow, spot between antennal sockets absent or very small..... **quadrifasciatus** (Fabricius)

Nests in soil, sometimes quite heavy. Prey Philaenus. *Kent to Dorset, Somerset, W. Gloucester, to Warwick and N. Lincs. Locally common. vi-ix.*

Genus **Argogorytes** Ashmead

Like *Gorytes* but hind wing with cell M + Cu1 ending before the fork (fig. 229b). Epicnemial keel not bent back but running across the mesosternum to meet its fellow from the other side (fig. 229a); dorsal furrow of mesepisternum and furrow from centre of pleural suture both strong. Hind tibia with no spiniform bristles, female fore tarsus with a very short pecten. Male antennae long.

Species of moderate size, found in all regions except the Ethiopian. Nests in soil. Prey nymphs of *Philaenus* (Cercopidae) which the wasp extracts from the cuckoo-spit.

Key to species

1 Female with second gastral sternite perpendicularly raised beyond the basal furrow and with some very large punctures anteriorly. Fourth gastral tergite black or with a small median yellow spot. Male tibiae substantially brown marked. Antennae longer (fig. 229c), segment 12 three times as long as broad. (Whole insect—fig. XXXI, Richards, 1977.) ..... **mystaceus** (Linnaeus)
England, Wales, S. Scotland, Ireland. Common. v-vii, ix.

— Female with second gastral sternite only gradually raised beyond the basal furrow and anterior punctures smaller and closer. Fourth gastral tergite with a yellow band. Male tibiae almost entirely yellow. Antennae shorter (fig. 230), segment 12 hardly more than two and a half times as long as broad..... **fargeii** (Shuckard)
London to S. Devon, to Glamorgan, W. Gloucester and N. Lincs. Rare. vi-viii.

Subfamily Philanthinae

The two British genera are rather widely separated members of a large group.

Genus **Philanthus** Latreille

Whole insect—fig. 231. Fore wing with three submarginal cells, the second not petiolate, recurrent veins (1 m-cu, 2 m-cu) received by the second and third, pterostigma long and narrow, cross-vein cu-a (nervulus) meeting M + Cu1 a little before the fork; hind wing with cell M + Cu1 ending shortly before the fork. Eyes internally emarginate, inner margins converging towards vertex. Mesepisternum with a dorsal and a less distinct horizontal furrow. Mid and hind tibiae with distinct dorsal spines, mid tibia with one spur. Hind femur without flat plates surrounding articulation of tibia. Propodeum with no defined dorsal area. Gaster sessile, segments not constricted where they join (though the first may be so in some non-British species), punctures not very strong or close, particularly in female. Female with no pygidial area, fore tarsal pecten strong. Male with a group of dense, shining,

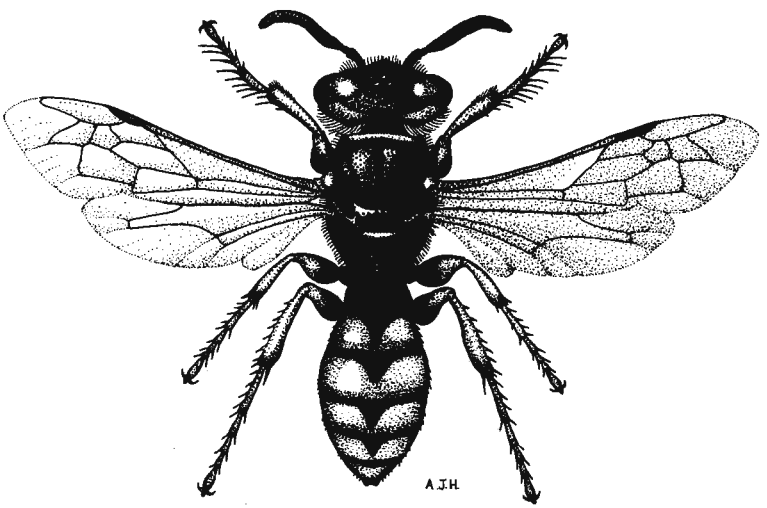

Fig. 231, *Philanthus triangulum* ♀.

brown curved bristles (moustache), directed inwards from lateral clypeal lobe below.

Large or moderate-sized black and yellow or reddish species. Genus rather large with Holarctic, Ethiopian and a few Oriental species. Nest in deep burrow in the soil. Prey bees.

— Black; (fig. 232) clypeus, wide inner orbits, characteristic mark, sometimes trident-like, between and above antennal sockets, pronotal collar, spots on scutellum and metanotum, bands on gaster which are usually very broad in female, most of legs, yellow. Head large in female. Length, ♀ 13.0-17.0mm, ♂ 8.0-10.0mm.
..... **triangulum** (Fabricius)

Makes a deep burrow, usually in flat ground and stores honey bees. It has been much studied on the continent because of its attacks on bees and a famous biological study was made by Tinbergen and his associates (references in Tinbergen, 1951). The northern limits of its range fluctuate with the climate (Leclercq, 1944); in good years a few specimens seem to reach England though there seems to be a permanent small colony in the Isle of Wight. Hants, Surrey, Kent, Essex, Suffolk (near Ipswich, vii.1976. 6♂♂. M. E. Archer). Most records are from more than 70 years ago. Usually viii.

Genus **Cerceris** Latreille

Whole insect—fig. 233. Fore wings with three submarginal cells, second petiolate, recurrent veins (1 m-cu, 2 m-cu) received by the second and third, pterostigma long, not very broad, cross vein cu-a (nervulus) meeting M + Cu1 just before the fork; hind wing with cell M + Cu1 ending far before the fork. Eyes not internally emarginate, inner margin slightly converging towards vertex. Mesepisternum with no dorsal but with an ill-defined horizontal furrow. Mid and hind tibiae with dorsal

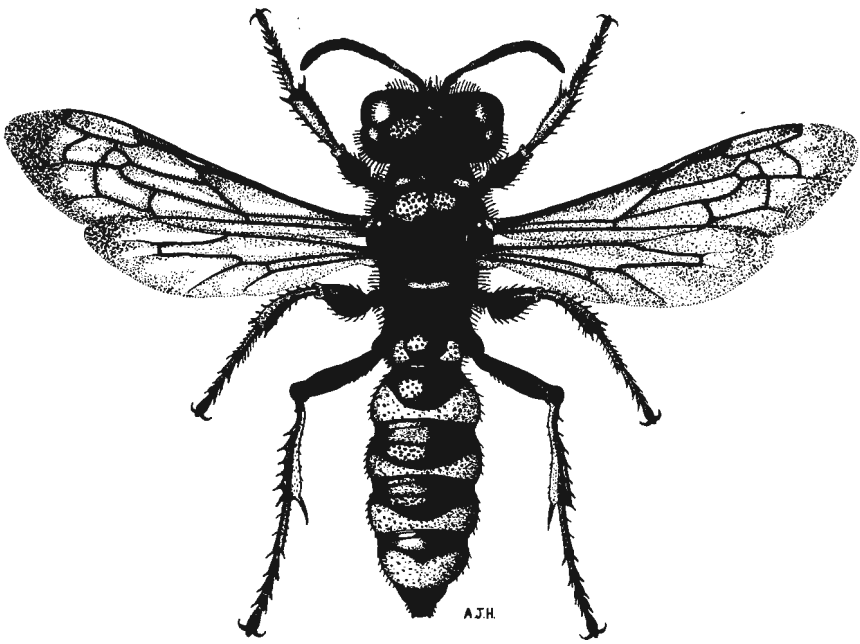

Fig. 233, *Cerceris arenaria* ♀.

spines, hind tibia also serrate, mid tibia with one spur. Hind femur with two plates enclosing articulation of tibia. Propodeum with a well-defined dorsal area. Gaster subpetiolate, first segment nodiform and though narrower than second, quadrate or broader than long, segments constricted where they join, punctures close and strong. Both sexes with a very strongly defined pygidial area. Female with fore tarsal pecten not long. Male with a dense, pale, shining, brown fringe on ventral margin of each lateral clypeal lobe.

Large to rather small, black and yellow species. The largest genus in the Sphecidae with several hundred species found in all regions except New Zealand. Nest a more or less deep burrow in soil. Prey bees or Coleoptera.

Key to species

1 Second gastral sternite with a basal raised area (fig. 234) whose hind margin is a little curved. Second tergite yellow marked at base, rarely entirely black in male..... 2

— Second gastral sternite without a basal raised area. Second tergite yellow banded posteriorly 5

2 Females; gaster with 4 to 5 yellow bands 3

— Males; gaster with tergite 1 black or scarcely yellow marked, 2-6 with yellow bands..... 4

3 Gastral tergite 4 with less yellow than 5, either black or with two yellow spots. Median lobe of clypeus depressed on its lower two-thirds. Length 8.0-12.0mm.
..... **rybyensis** (Linnaeus) (Female)
Burrows in flat soil, sometimes very hard. Prey includes Hylaeus, Halictus *(mainly), Devon, north to Norfolk and Oxon, Scotland (Ayr). Common. v-ix.*

— Gastral tergites 4 and 5 with almost similar yellow bands. Median lobe of clypeus depressed over its lower half. Length 6.0-10.0mm..... **sabulosa** (Panzer) (Female)
Burrows in flat soil, sometimes very hard. Prey includes Hylaeus, Halictus *(Mainly),* Andrena, Panurgus, Epeolus. *E. Kent (Deal, 1♀. viii. 1861. F. Smith), perhaps a migrant.*

4 Gastral tergite 4 usually black, 5 also often black; if these segments are yellow marked, there is more yellow on 5 than 4. Flagellum largely black. Length 6.0-10.0mm.
..... **rybyensis** (Linnaeus) (Male)
See couplet 3 for notes.

— Gastral tergites 4 and 5 with almost similar yellow bands. Flagellum paler.
..... **sabulosa** (Panzer) (Male)
See couplet 3 for notes.

5 Females..... 6

— Males..... 8

6 Clypeus (fig. 235) with its ventral margin somewhat upturned, forming a shining, black, crescentic plate about as wide as distance between outer edges of antennal sockets. Pygidial area little more than twice as long as broad at base, wrinkled, mainly transversely, apex truncate with rounded corners. First gastral tergite with two large, almost joined yellow spots. Length 8.0-12.0mm..... **arenaria** (Linnaeus) (Female)
Nests nearly always in sandy places. Prey various curculionids (abroad rarely also eumolpids). Kent to Cornwall, north to Norfolk and Staffs, Wales. Common. vi-ix.

— Clypeus (fig. 236) with a large, strongly raised lamella, springing from its upper third, overhanging its smooth, shining lower surface which is produced into two blunt teeth. Pygidial area two and a half times as long as broad at base, nearly parallel-sided, surface wrinkled with some punctures at base. First gastral tergite with two spots which nearly meet but are not very broad in the anteroposterior direction. Length 10.0-13.0mm..... **ruficornis** (Fabricius) (Female)
Nests in sand. Prey curculionids, eumolpids, halticids. Kent to Cornwall, north to Lincs and Berks. Locally common. vi-ix.

— Clypeus at its ventral margin perpendicularly raised, forming a gently concave surface about two and a half times as wide as high, somewhat angulated at each side. Pygidial area fully two and a half times as long as wide at base, narrowed to the rounded apex, surface finely wrinkled. First gastral tergite black or with a very narrow posterior band..... 7

7 Clypeus (fig. 237) less strongly raised. Gastral sternites 2-4 with large yellow spots, second tergite with a band which is little emarginate and much wider than that of the third. Length 8.0-10.0mm..... **quadricincta** (Panzer) (Female)
Abroad nests in clay or sand. Prey curculionids. N. Essex (apparently locally common), E. Kent. Generally rare. vii-viii.

— Clypeus (fig. 238) more strongly raised. Sternites 2-4 not yellow marked, tergite 2 with a band which is narrow or wide but deeply emarginate, usually not very different from that of the third. Length 7.0-10.0mm..... **quinquefasciata** (Rossius) (Female)
Nests in sand. Prey curculionids, rarely chrysomelids, in Berks nitidulid (Meligethes). *Kent to S. Devon, north to Suffolk, Cambs, Oxon. Locally common. vii-viii.*

8 Sixth gastral sternite with lateral tufts of dense, shining, red-brown hairs (fig. 241b). Antennal segments 10-12 without a prominence beneath, 12-13 slightly concave beneath, with some short, outstanding bristles at least beneath 13 9

— Sixth gastral sternite with no lateral tufts of hairs, but with a dense central fringe (fig. 239c). Antennal segments 12-13 if concave beneath with outstanding bristles and segments 10-12 with an elongate prominence.....10

9 Clypeus slightly convex in profile, ventral margin hardly tridentate. Some bristles beneath antennal segment 12 (fig. 241). Length 6.0-8.0mm.
..... **quinquefasciata** (Rossius) (Male)
See couplet 7 for notes.

— Clypeus flat in profile, ventral margin more distinctly tridentate (i.e. central tooth developed). No bristles beneath antennal segment 12 (fig. 242). Length 8.0-10.0mm.
..... **ruficornis** (Fabricius) (Male)
See 'triplet' 6 for notes.

10 Antennal segments 10-12 (fig. 239b) with an elongate prominence beneath, 13 concave with 2-3 curved bristles beneath. Ventral margin of clypeus tridentate (fig. 239a). Length 8.0-12.0mm..... **arenaria** (Linnaeus) (Male)
See 'triplet' 6 for notes.

— Antennal segments 10-13 (fig. 240) entirely unmodified. Ventral margin of clypeus not tridentate. Length 6.0-9.0mm..... **quadricincta** (Panzer) (Male)
See couplet 7 for notes.

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These are not intended to be complete. They are either to document specific facts or to give some idea of the literature on the biology of wasps, especially the British species.

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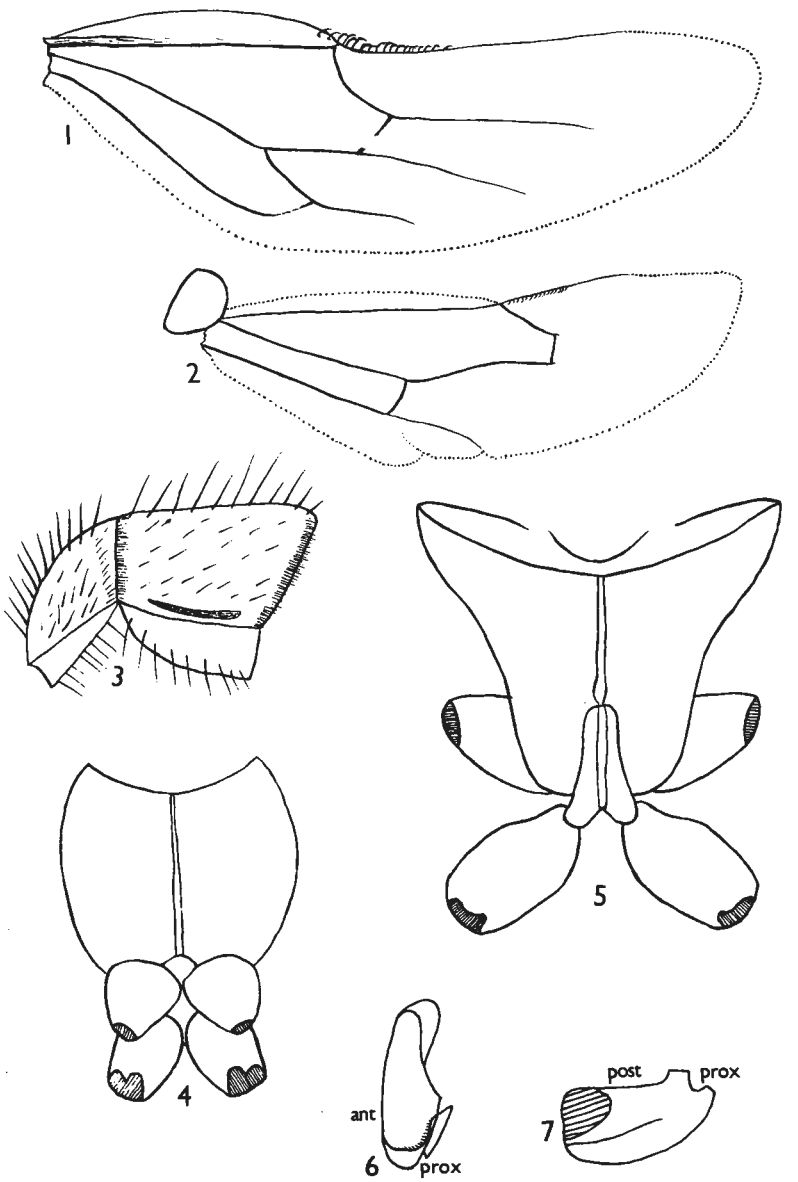
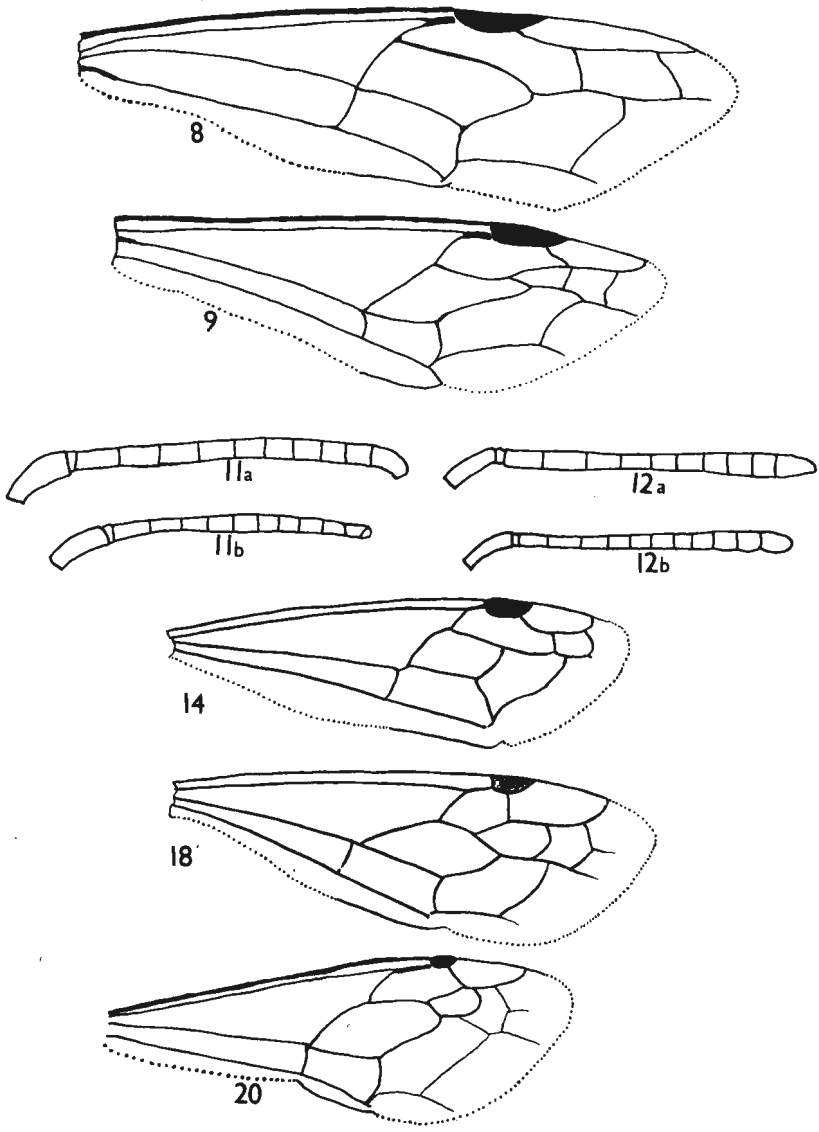
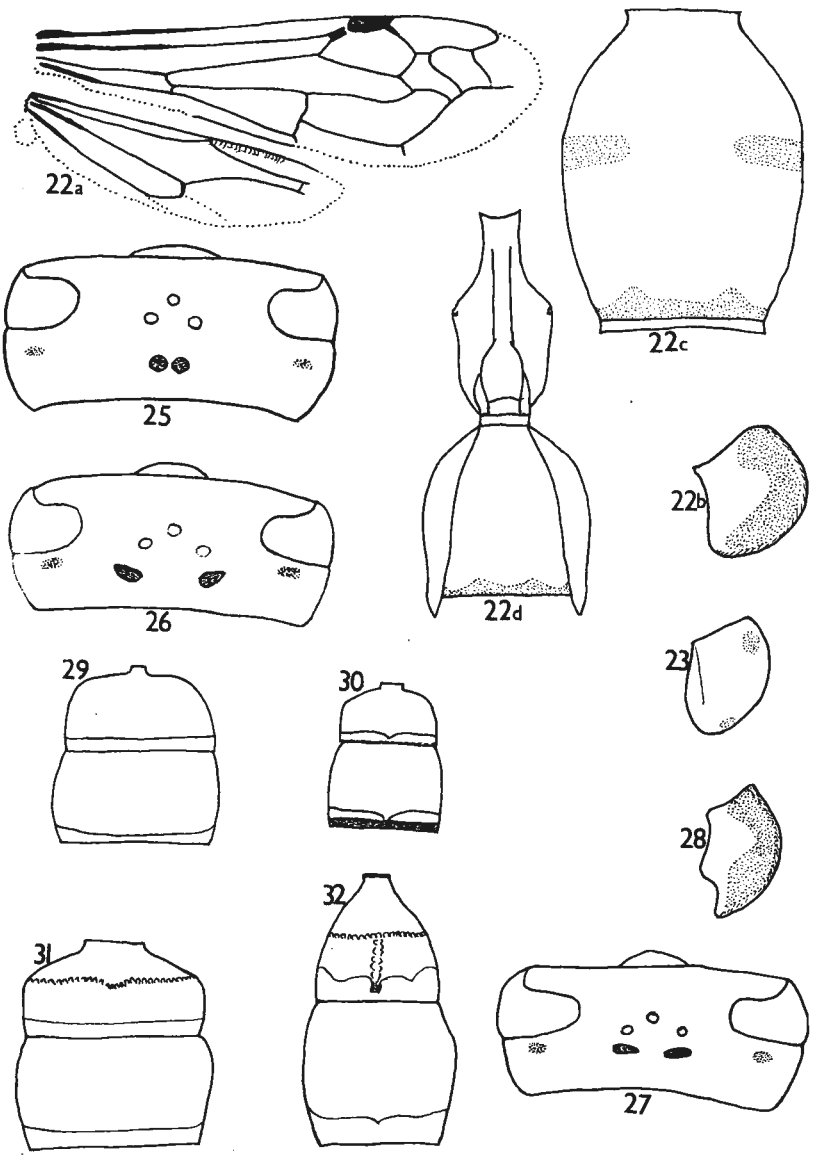


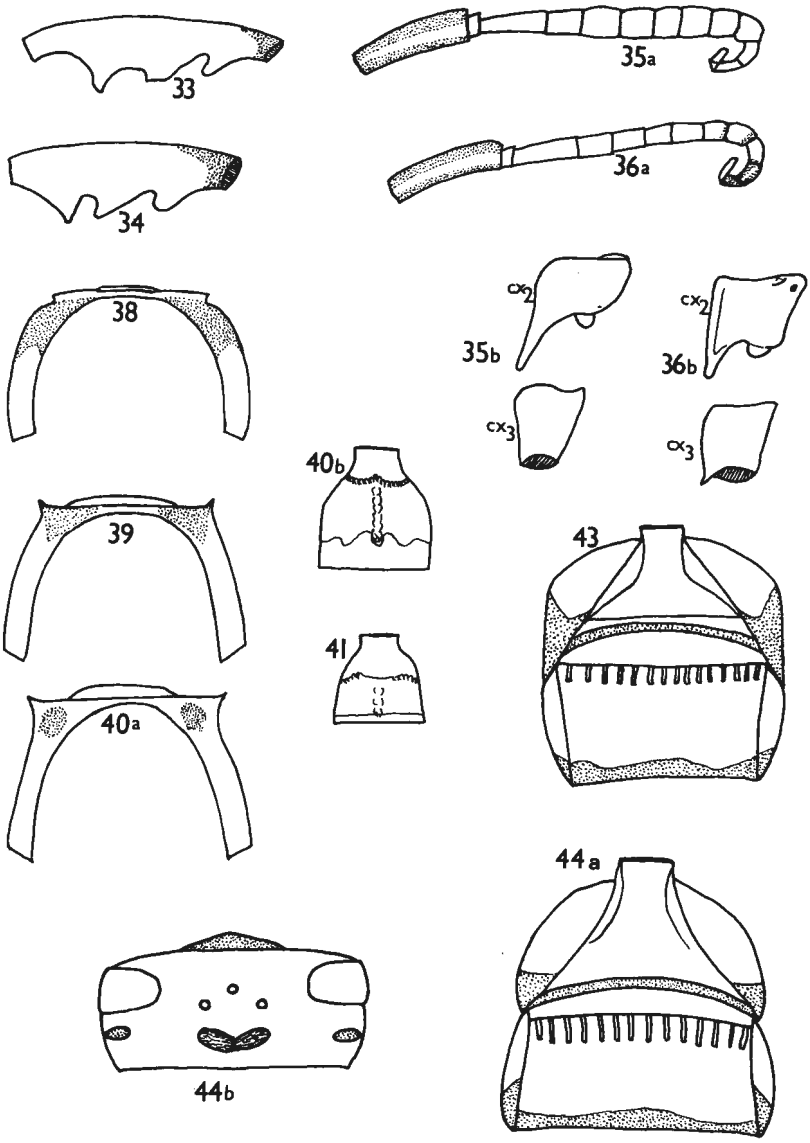
Figs. 1-7. 1, Right hind wing of *Mutilla.* 2, Right hind wing and tegula of *Tiphia.* 3, Left side of gastral tergites in *Mutilla,* showing the felt line. 4, Mesosternum of *Sapyga.* 5, Mesosternum of *Tiphia.* 6, Right hind coxa of *Tiphia;* ant = anterior, prox = proximal. 7, Right hind coxa of *Methocha;* post = posterior, prox = proximal.



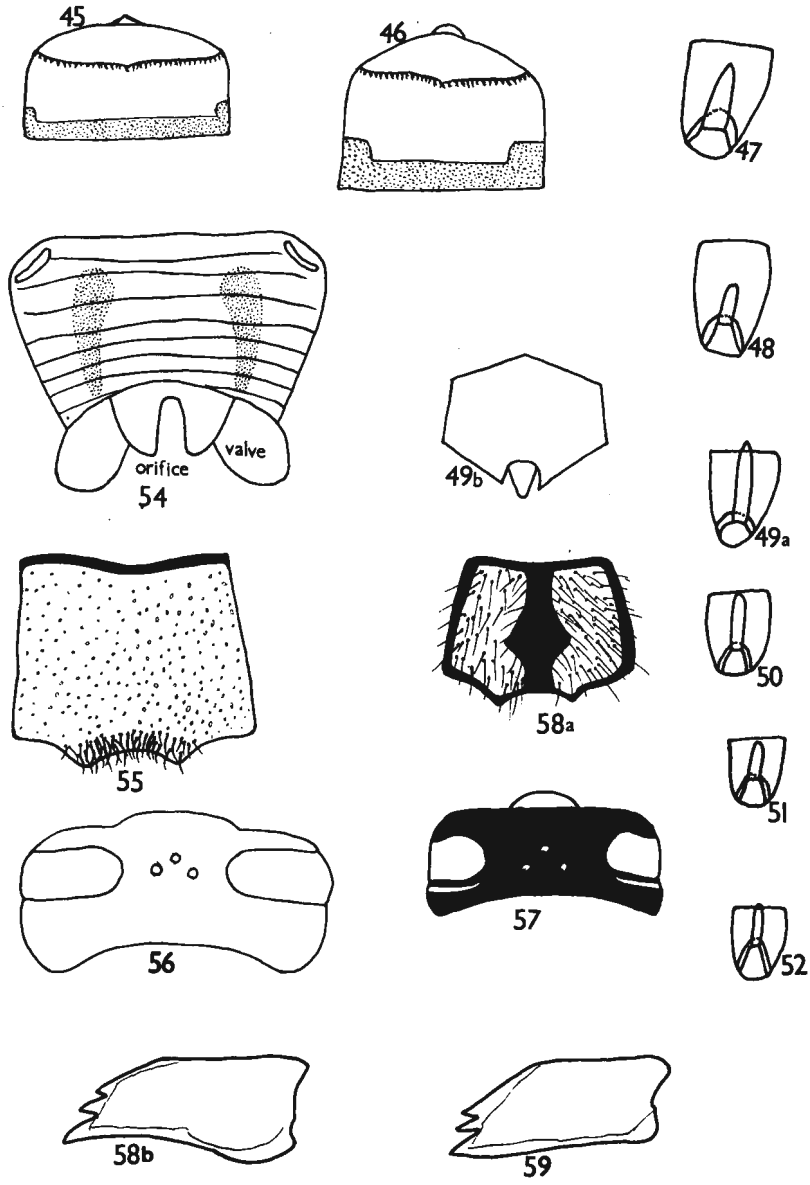
Figs. 8-9, 11-12, 14, 18, 20. 8, Right fore wing of *Methocha* ♂. 9, Right fore wing of *Myrmosa* ♂. 11, Antenna of *Sapyga quinquepunctata;* a, ♀ ; b, ♂. 12, Antenna of *clavicornis;* a, ♀ ; b, ♂. 14, Right fore wing of *Tiphia femorata* ♂. 18, Right fore wing of *Mutilla europaea* ♂. 20, Right fore wing of *Smicromyrme rufipes* ♂.



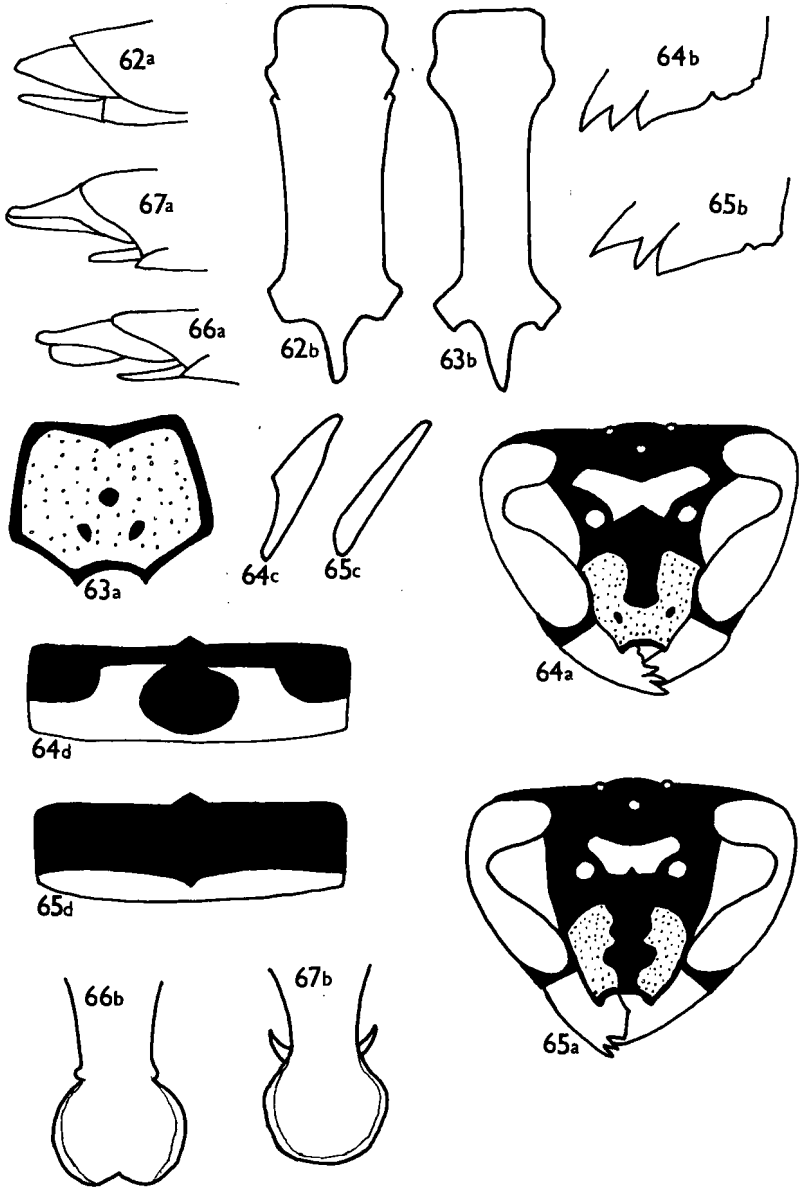
Figs. 22-23, 25-32. 22, *Eumenes coarctatus* ♀; a, right wings; b, tegula; c, gastral tergite 2; d, gastral sternites 1-2. 23, *Gymnomerus laevipes* ♀, right tegula. 25, *G. laevipes* ♀, head with vertical pits. 26, *Odynerus spinipes* ♀, head with vertical pits. 27, *O. melanocephalus* ♀, head with vertical pits. 28, *Pseudepipona herrichii* ♀, tegula. 29, *Euodynerus quadrifasciatus* ♀, gastral tergites 1-2. 30, *Microdynerus exilis* ♀, gastral tergites 1-2. 31, *Ancistrocerus oviventris hibernicus* ♀, gastral tergites 1-2. 32, *Symmorphus gracilis* ♀, gastral tergites 1-2.



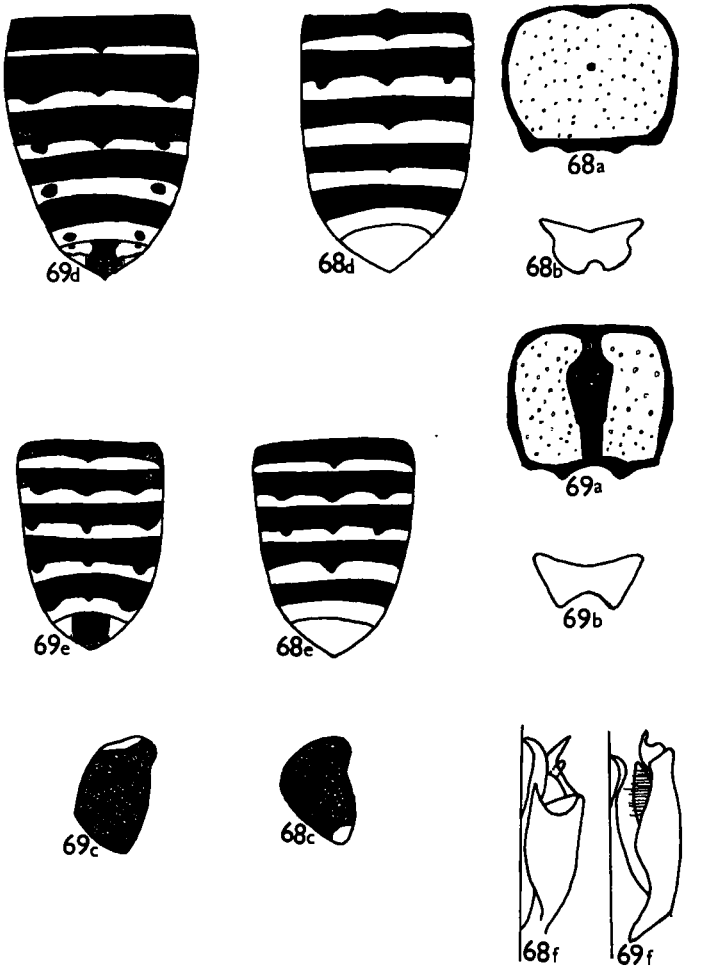
Figs. 33-36, 38-41, 43-44. 33, *Odynerus spinipes* ♂, right mid femur. 34, *O. melanocephalus* ♂, right mid femur. 35, *O. reniformis* ♂; a, antenna; b, mid and hind coxae. 36, *O. simillimus* ♂; a, antenna; b, mid and hind coxae. 38, *Symmorphus crassicornis* ♀, pronotum. 39, *S. gracilis* ♀, pronotum. 40, *S. mutinensis* ♀; a, pronotum; b, gastral tergite 1. 41, *S. connexus* ♀, gastral tergite 1. 43, *Ancistrocerus parietum* ♀, furrow and keels at base of second gastral sternite. 44, *A. parietinus* ♀; a, furrow and keels; b, vertical pits.



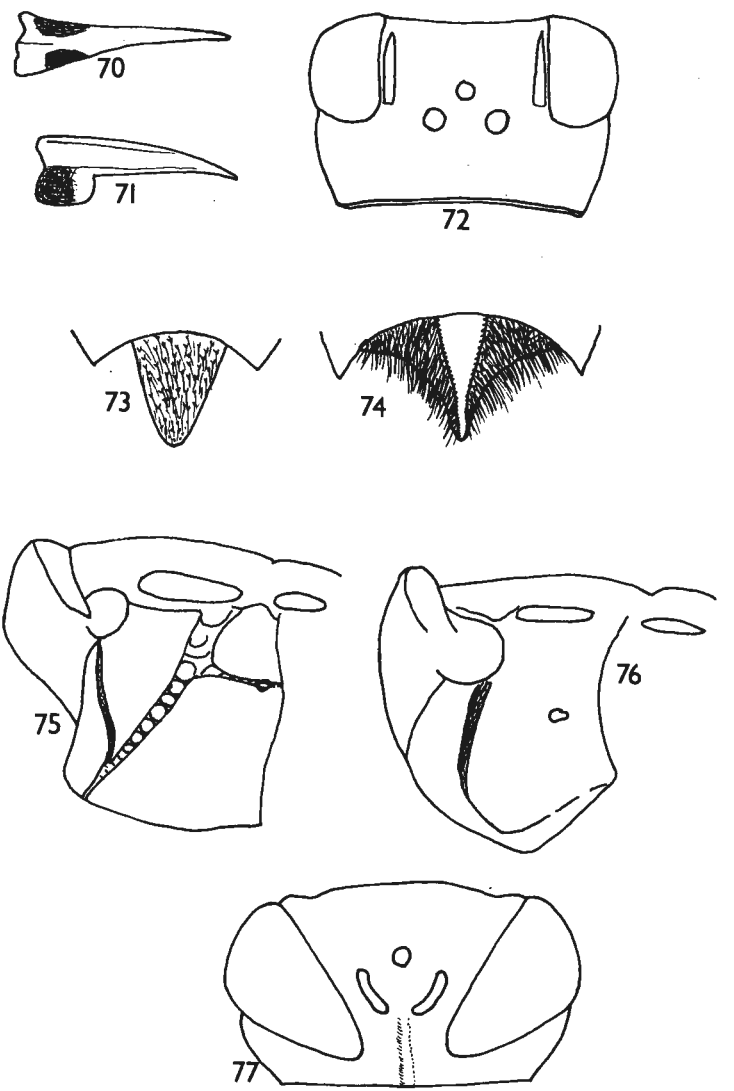
Figs. 45-52, 54-59. 45, *Ancistrocerus scoticus* ♀, gastral tergite 1. 46, *A. trifasciatus* ♀, gastral tergite 1. 47, *A. parietum* ♂, antennal segments 10-13. 48, *A. gazella* ♂, antennal segments 10-13. 49, *A. oviventris hibernicus* ♂; a, antennal segments 10-13; b, clypeus. 50, *A. nigricornis* ♂, antennal segments 10-13. 51, *A. scoticus* ♂, antennal segments 10-13. 52, *A. trifasciatus* ♂, antennal segments 10-13. 54, *Polistes dominulus* ♀, propodeal orifice. 55, *Vespa crabro* ♀, clypeus. 56, *V. crabro* ♀, head dorsal. 57, *Vespula rufa* ♀, head dorsal. 58, *V. rufa* ♀; a, clypeus; b, mandible, anterior view. 59, *Dolichovespula sylvestris* ♀, mandible, anterior view.



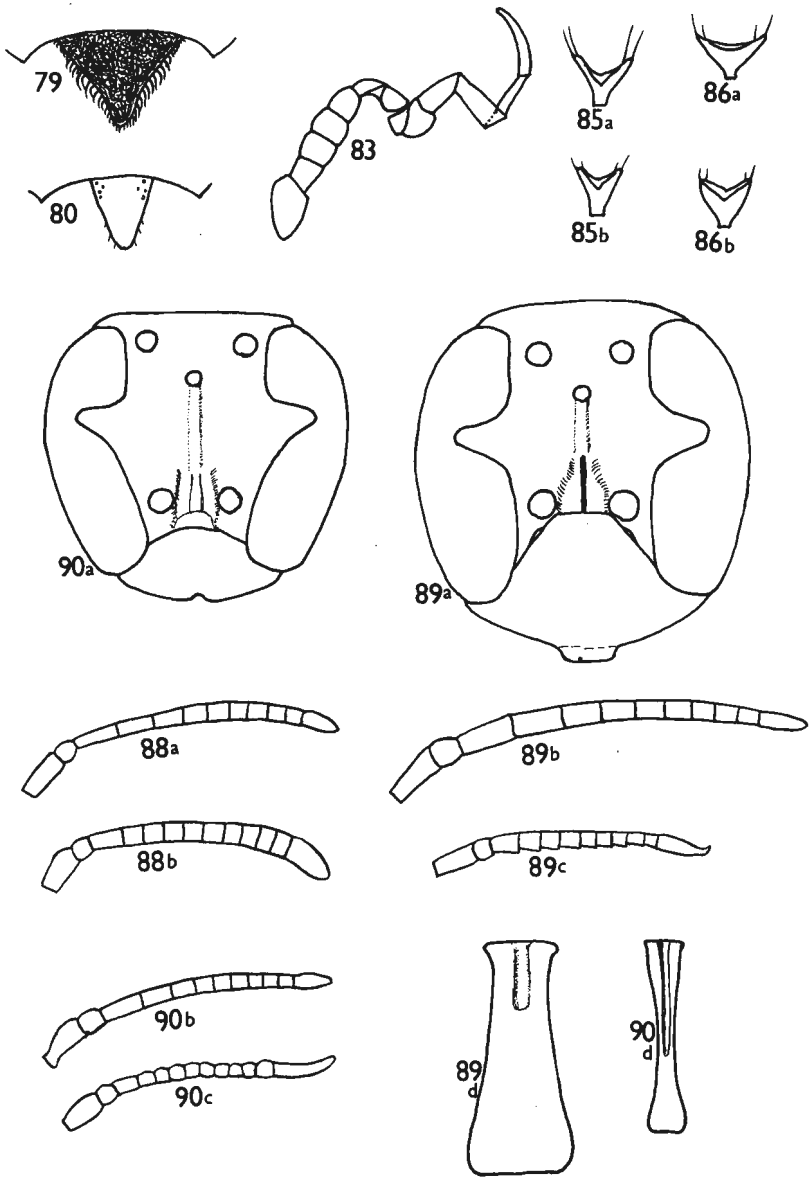
Figs. 62-67. 62, *Vespula rufa* ♂; a, gastral tergite 7; b, aedeagus. 63, *V. austriaca;* a, ♀ clypeus; b, ♂ aedeagus. 64, *V. germanica* ♀; a, face; b, right mandible, dorsal view of cutting edge; c. left humeral stripe; d, queen gastral tergite 1. 65, *V. vulgaris* ♀ ; a, face; b, right mandible, dorsal view of cutting edge; c, left humeral strips; d, queen gastral tergite 1. 66, *V. germanica* ♂; a, scale of gastral tergite 7; b, apex of aedeagus. 67, *V. vulgaris* ♂ ; a, scale of gastral tergite 7; b, apex of aedeagus.



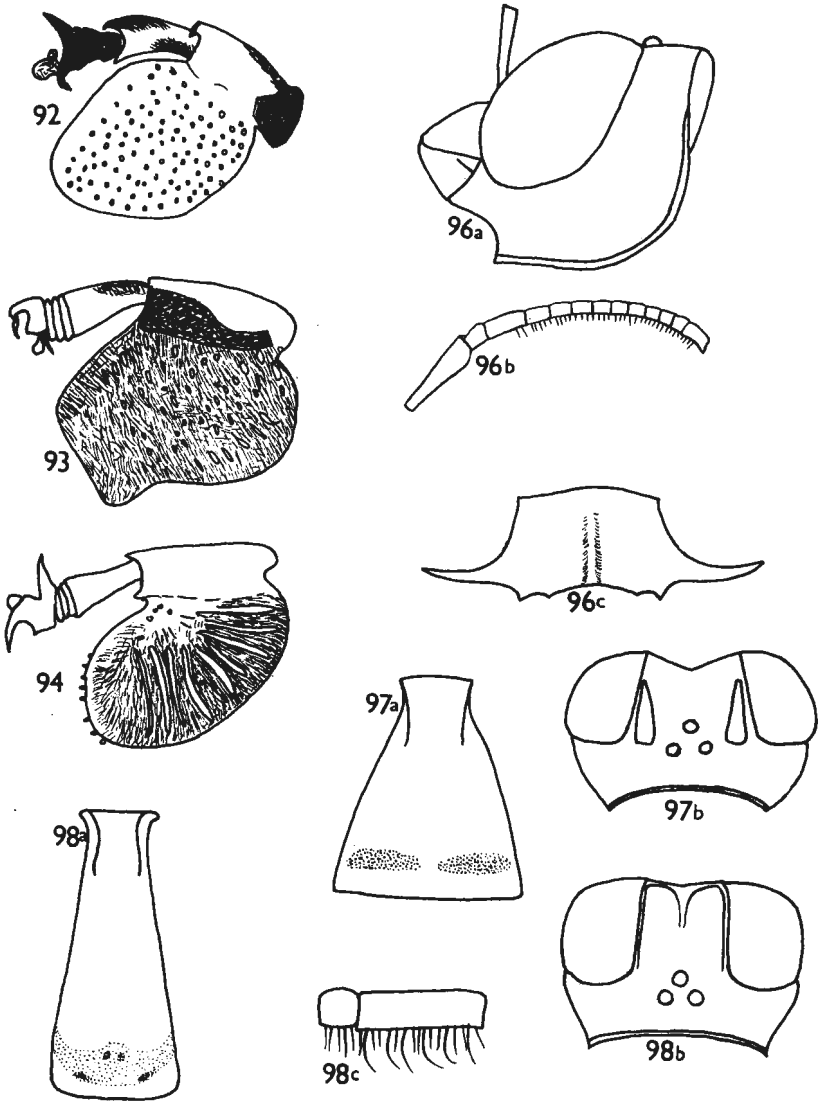
Figs. 68-69. 68, *Dolichovespula sylvestris;* a, ♀ clypeus; b, ♀ interantennal spot; c, ♀ tegula; d, queen gaster; e, worker gaster; f, ♂ left half of genitalia. 69, *D. norwegica;* a, ♀ clypeus; b, ♀ interantennal spot; c, tegula; d, queen gaster; e, worker gaster; f, ♂ left half of genitalia.



Figs. 70-77. 70, Mandible of *Lindenius* ♀. 71, Mandible of *Entomognathus* ♀. 72, Frontal impressions of *Lestica* ♀. 73, Pygidial area of *Crabro* ♀. 74, Pygidial area of *Ectemnius* ♀. 75, Mesopleural keels of *Argogorytes*. 76, Mesopleural keels of *Gorytes*. 77, Ocelli of *Tachysphex*



Figs. 79-80, 83, 85-86, 88-90. 79, *Astata boops* ♀, pygidial area. 80, *A. pinguis* ♀, pygidial area. 83, *Dinetus pictus* ♂, antenna. 85, *Tachysphex pompiliformis,* fifth segment of hind tarsus; a, ♀ ; b, ♂ . 86, *T. obscuripennis,* fifth segment of hind tarsus; a, ♀ ; b, ♂ . 88, *Trypoxylon clavicerum;* a, ♀ antenna; b, ♂ antenna. 89, *T. figulus;* a, ♀ face; b, ♀ antenna; c, ♂ antenna; d, ♀ gastral tergite 1. 90, *T. attenuatum* ♀; a, face; b, ♀ antenna; c, ♂ antenna; d, gastral tergite 1.



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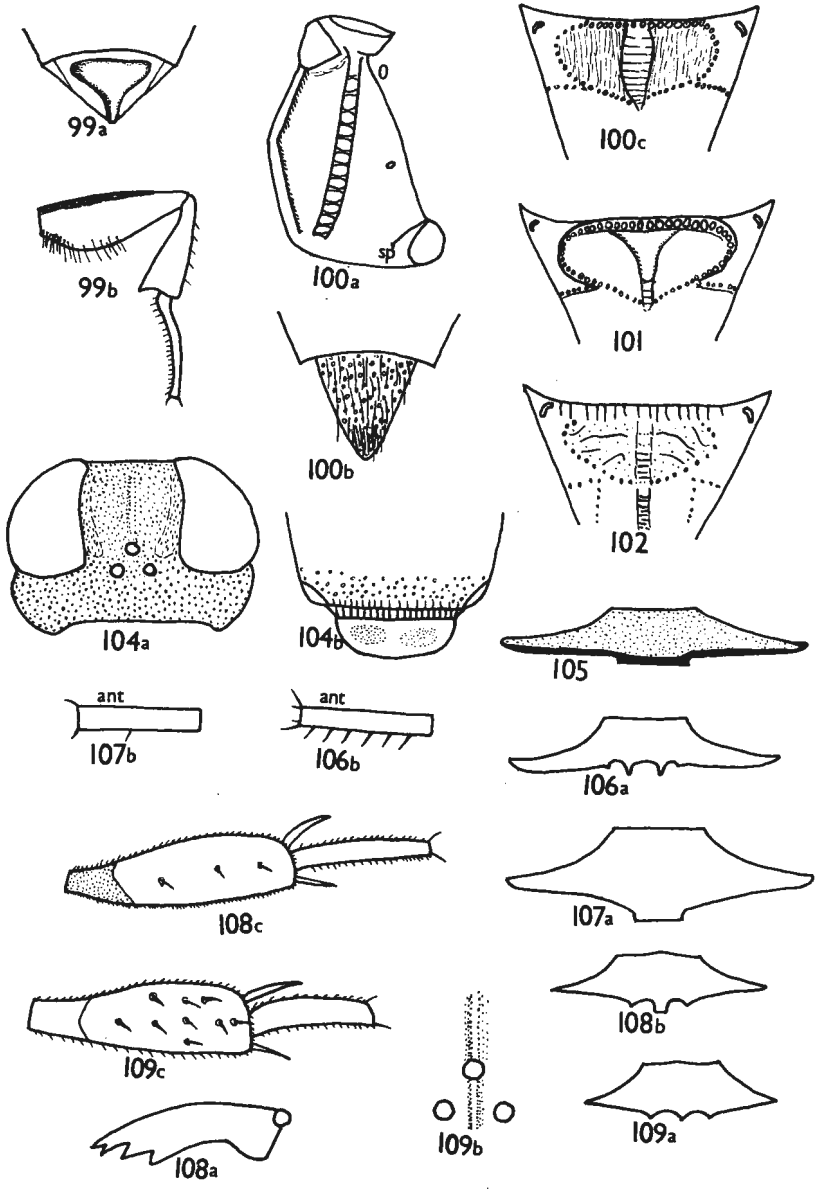
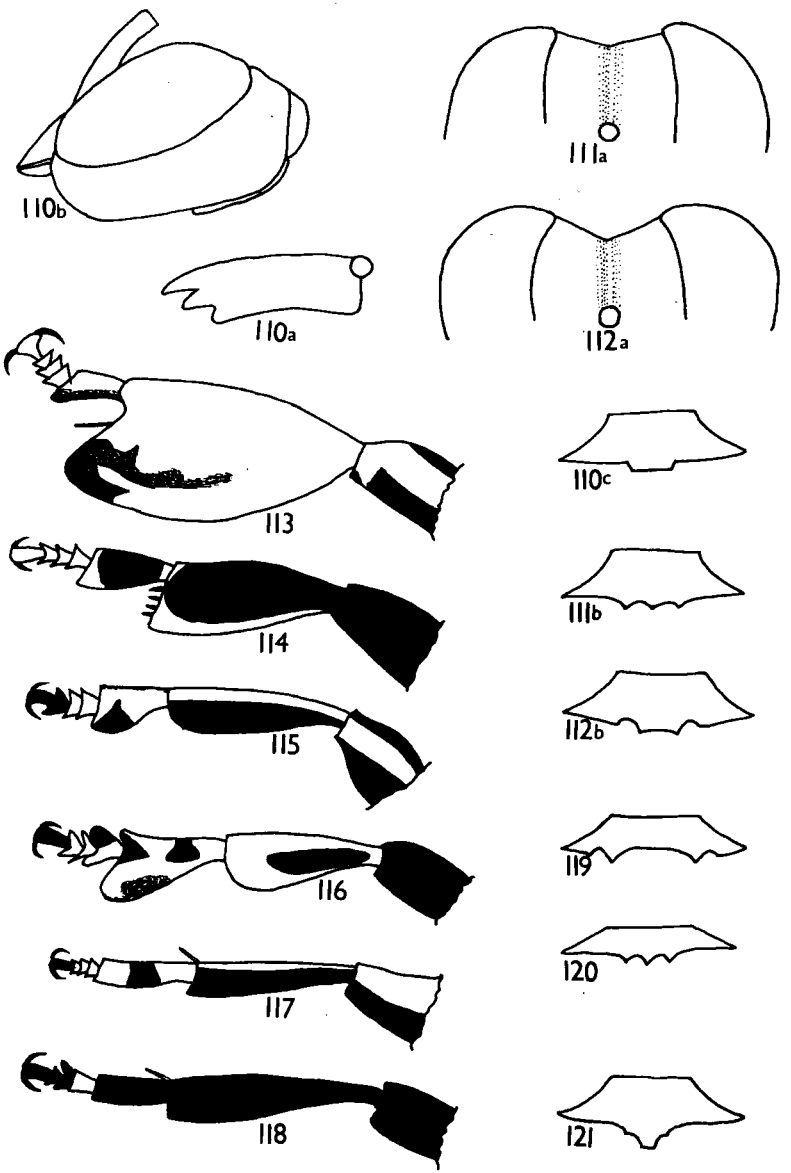
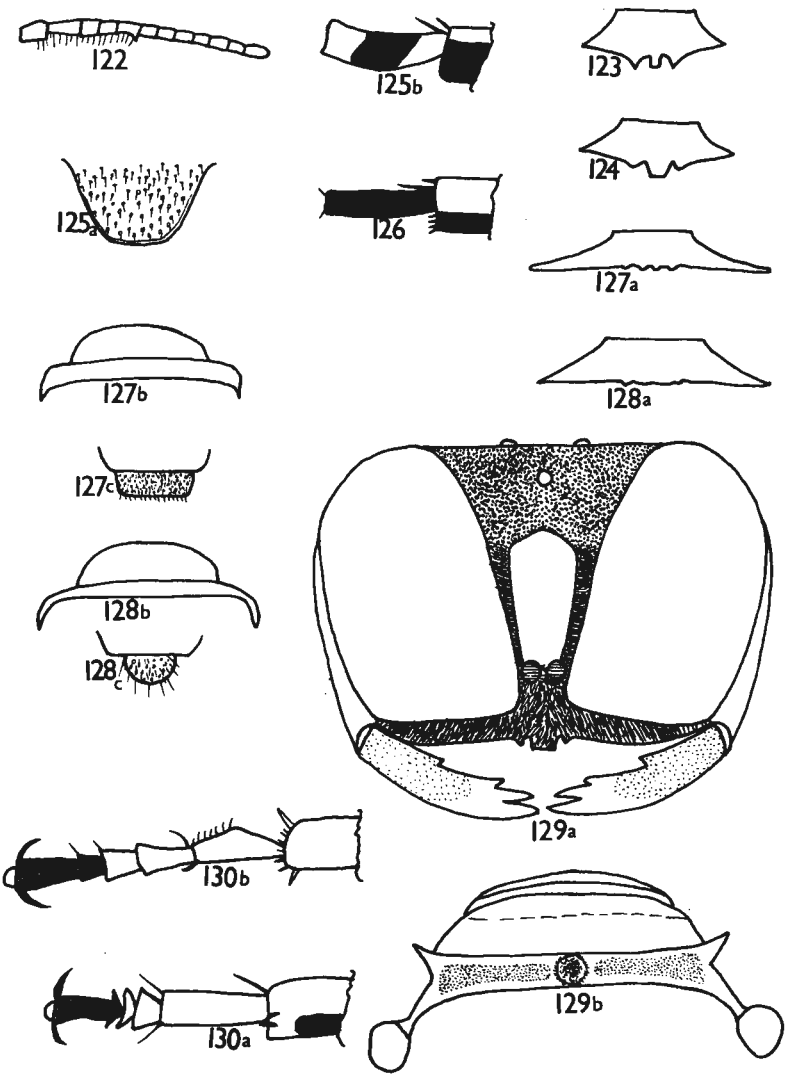


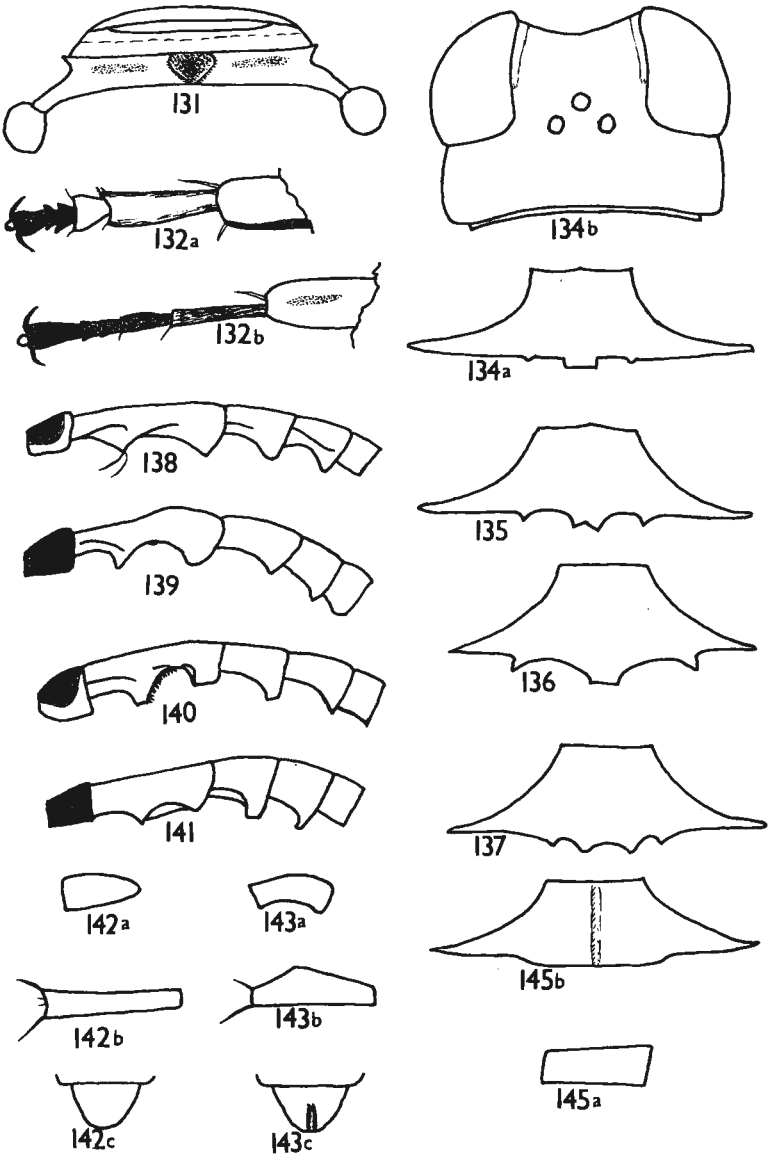
Figs. 99-102, 104-109. 99, *Crossocerus podagricus;* a, ♀ pygidial area; ♂ left mid femur, tibia and basitarsus, anterior view. 100, *C. tarsatus* ♀ a, left mesosternal spine (sp); b, pygidial area; c, dorsal area of propodeum. 101, *C. ovalis* ♀, dorsal area of propodeum. 102, *C. pusillus* ♀, dorsal area of propodeum. 104, *C. wesmaeli* ♀; a, furrow in front of medial ocellus; b, mesoscuto-scutellar boundary. 105, *C. walkeri* ♀, clypeus. 106, *C. annulipes* ♀; a, clypeus; b, left fore basitarsus, ant = anterior. 107, *C. leucostoma* ♀; a, clypeus; b, left fore basitarsus. 108, *C. capitosus* ♀; a, left mandible; b, clypeus; c, left hind tibia and basitarsus. 109. *C. styrius* ♀; a, clypeus; b, ocelli; c, left hind tibia.



Figs. 110-121. 110, *Crossocerus cetratus* ♀; a, left mandible; b, occipital carina; c, clypeus 111, *C. nigritus* ♀; a, anterior concavity of frons; b, clypeus. 112, *C. megacephalus* ♀; a, anterior concavity of frons; b, clypeus. 113, *C. palmipes* ♂, left fore leg. 114, *C. cetratus* ♂, left fore leg. 115, *C. tarsatus* ♂, left fore leg. 116, *C. annulipes* ♂, left fore leg. 117, *C. pusillus* ♂, left fore leg. 118, *C. leucostoma* ♂, left fore leg. 119, *C. megacephalus* ♂, clypeus. 120, *C. nigritus* ♂, clypeus. 121, *C. walkeri* ♂, clypeus.



Figs. 122-130. 122, *Crossocerus exiguus* ♂, flagellum. 123, *C. styrius* ♂, clypeus. 124 *C. capitosus* ♂, clypeus. 125, *C. pusillus* ♂, a, pygidial area; b, left fore basitarsus. 126, *C. ovalis* ♂, left fore basitarsus. 127, *C. elongatulus* ♂; a, clypeus; b, pronotal collar; c, pygidial area. 128, *C. wesmaeli* ♂; a, clypeus; b, pronotal collar; c, pygidial area. 129, *Ectemnius dives* ♀; a, face; b, pronotal collar. 130, *E. dives* ♂; a, left fore tarsus; b, left mid tarsus.



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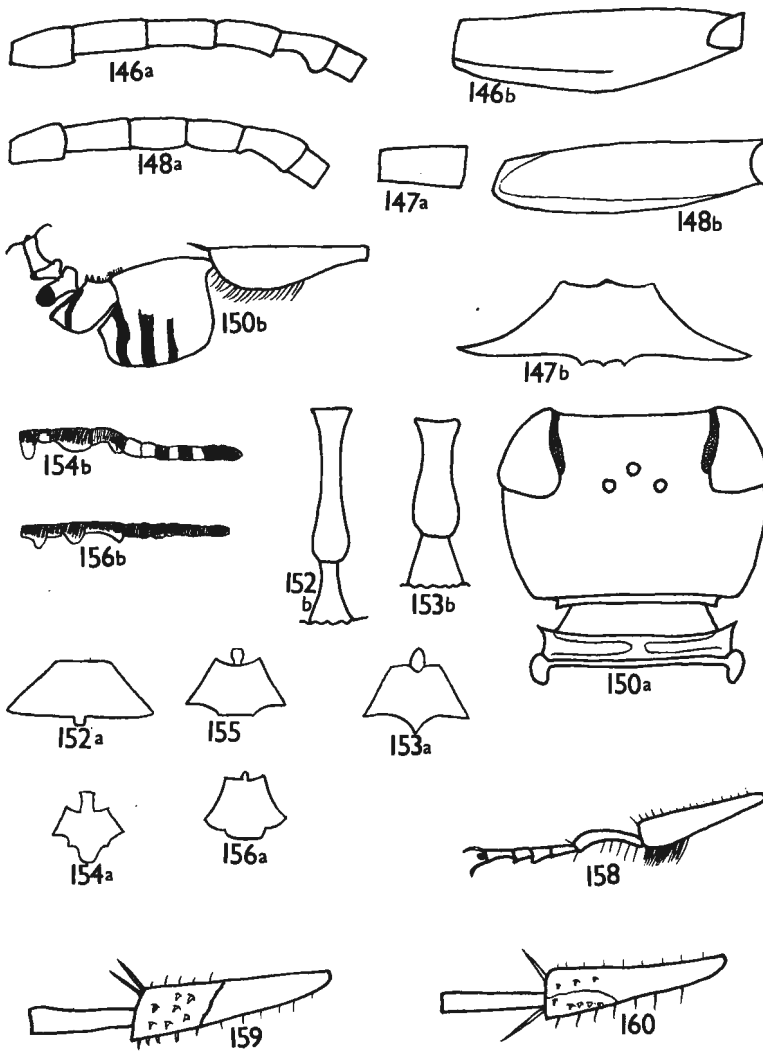

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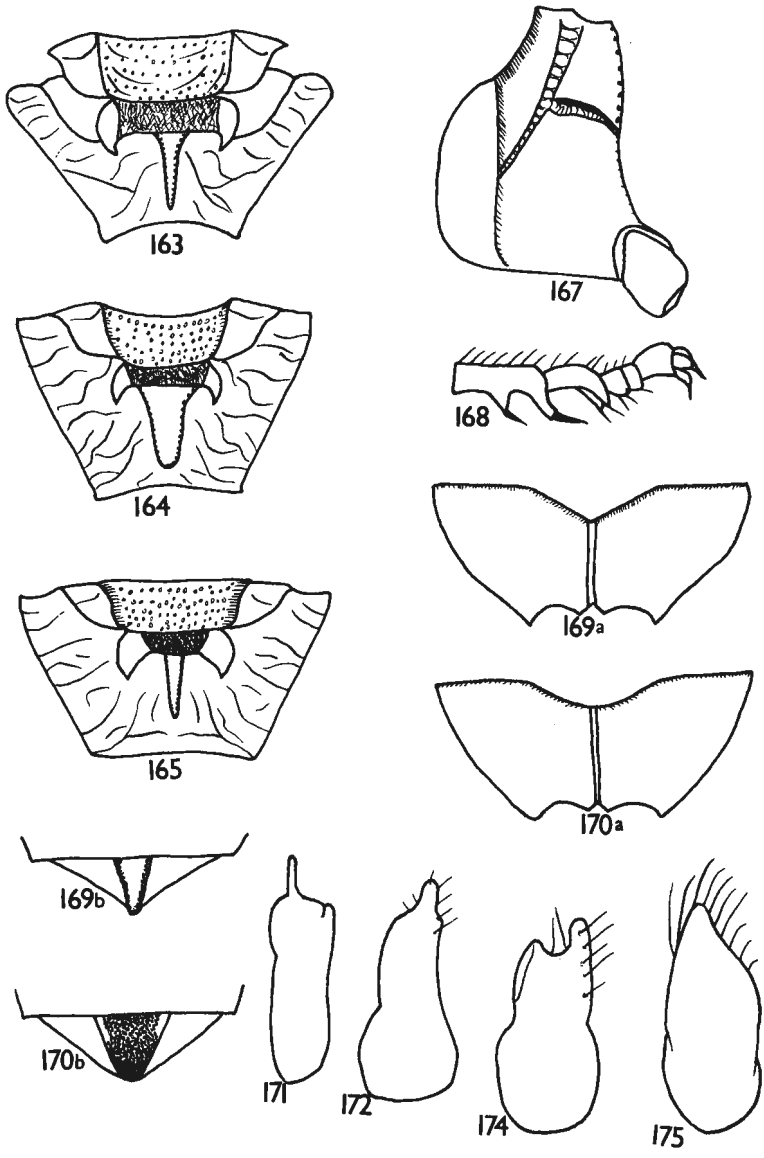

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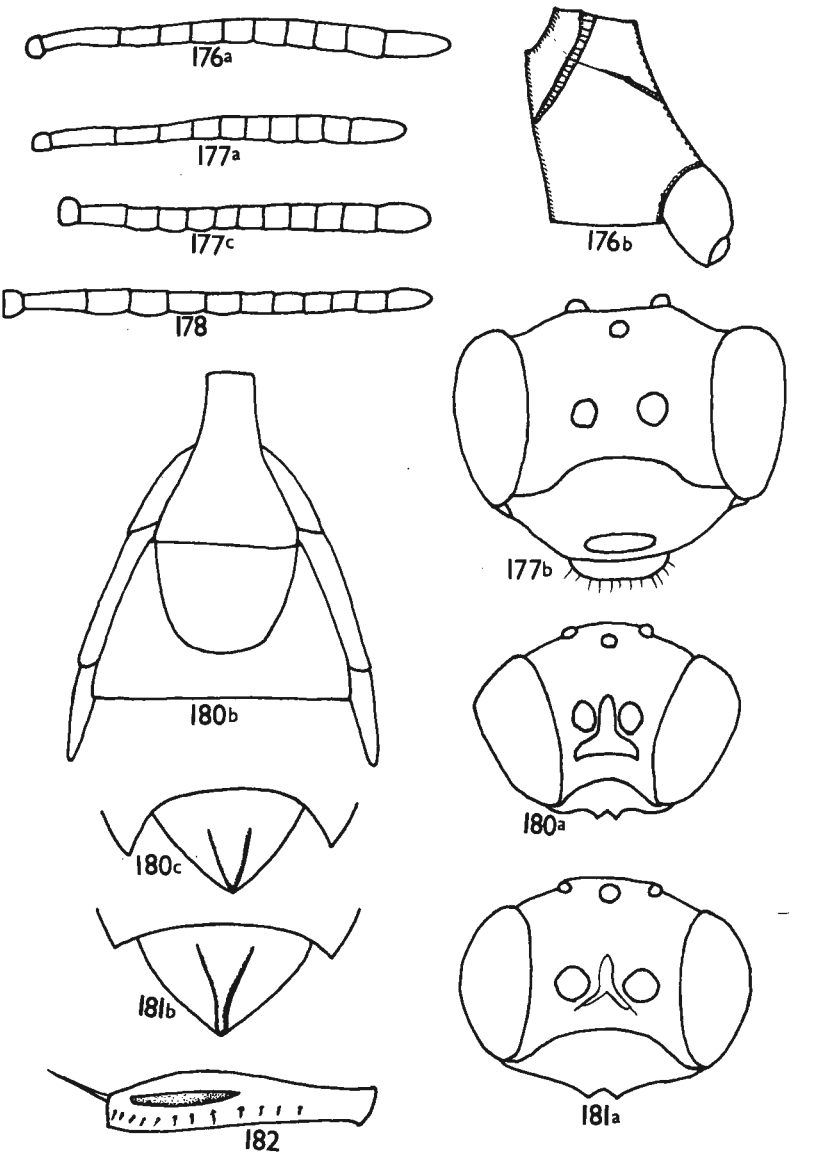

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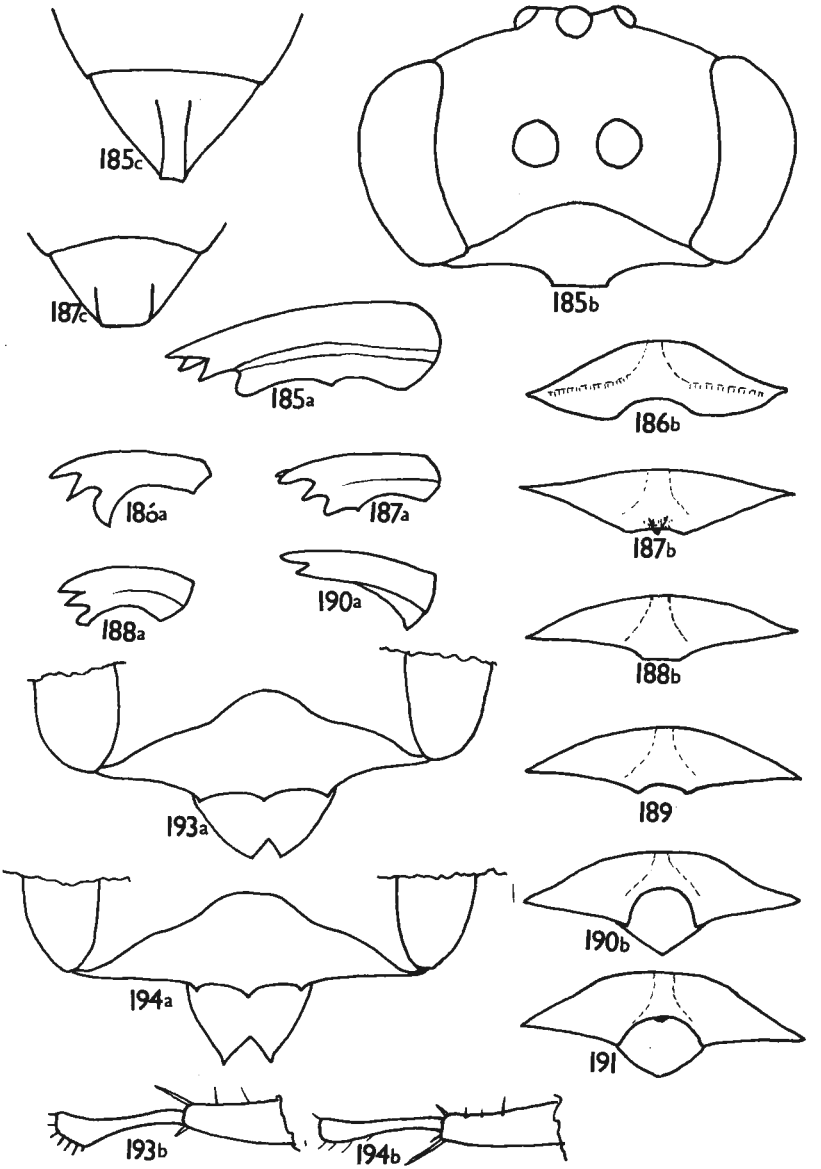

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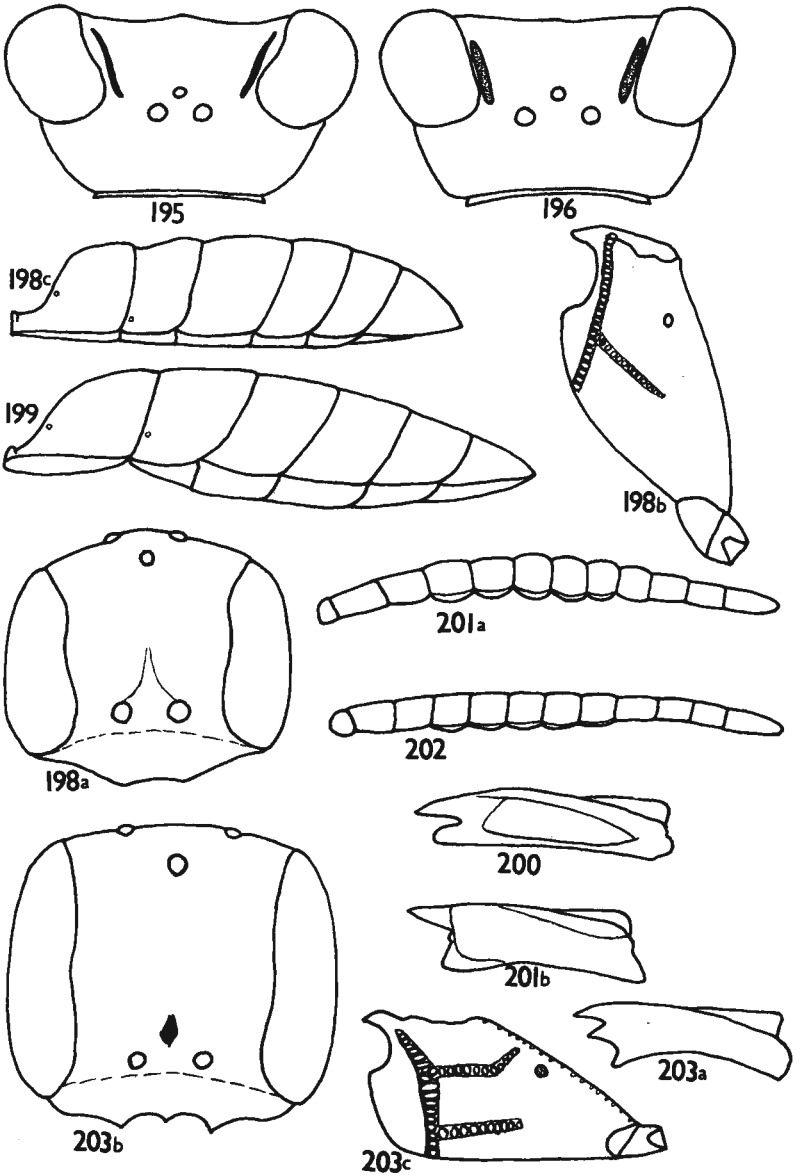

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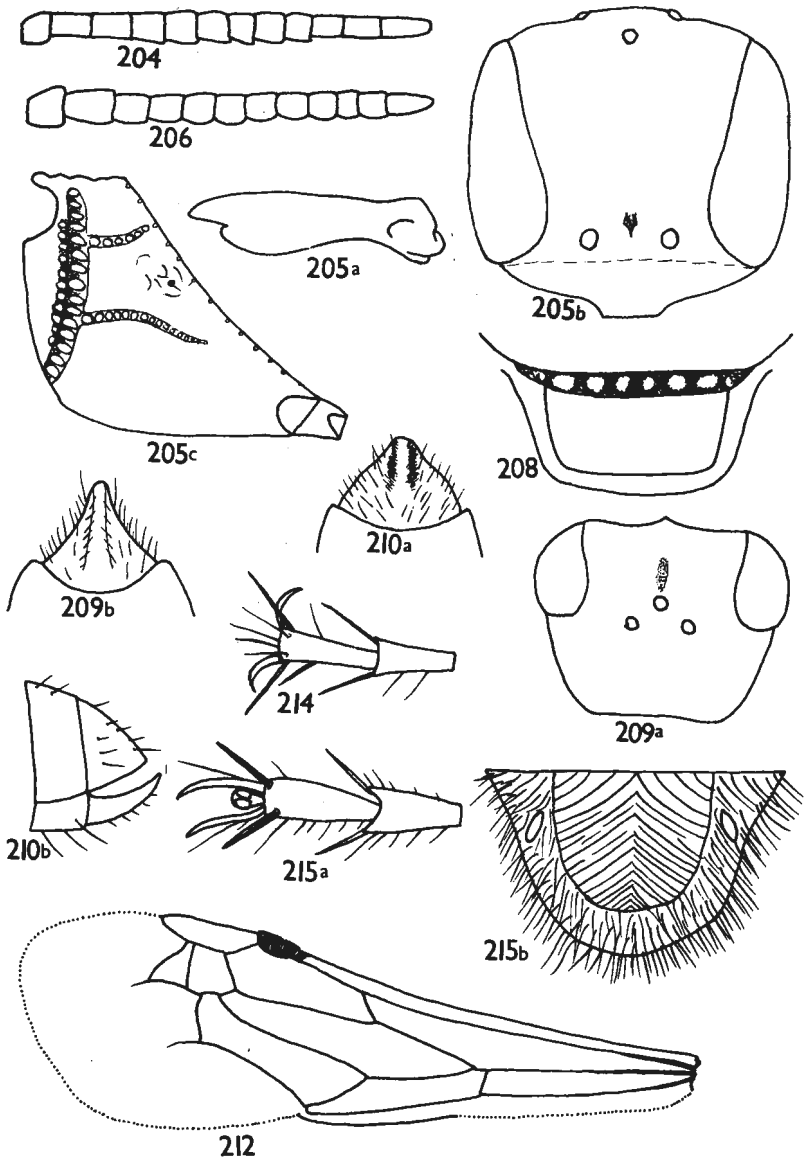

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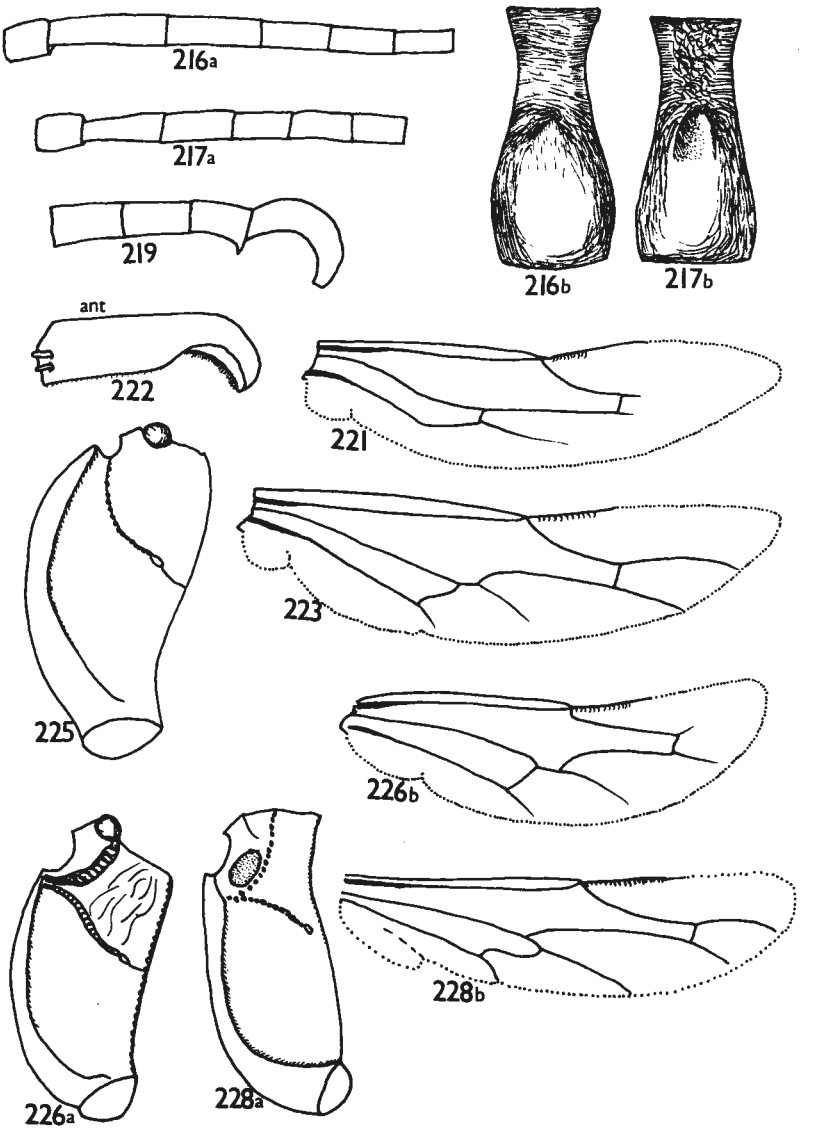

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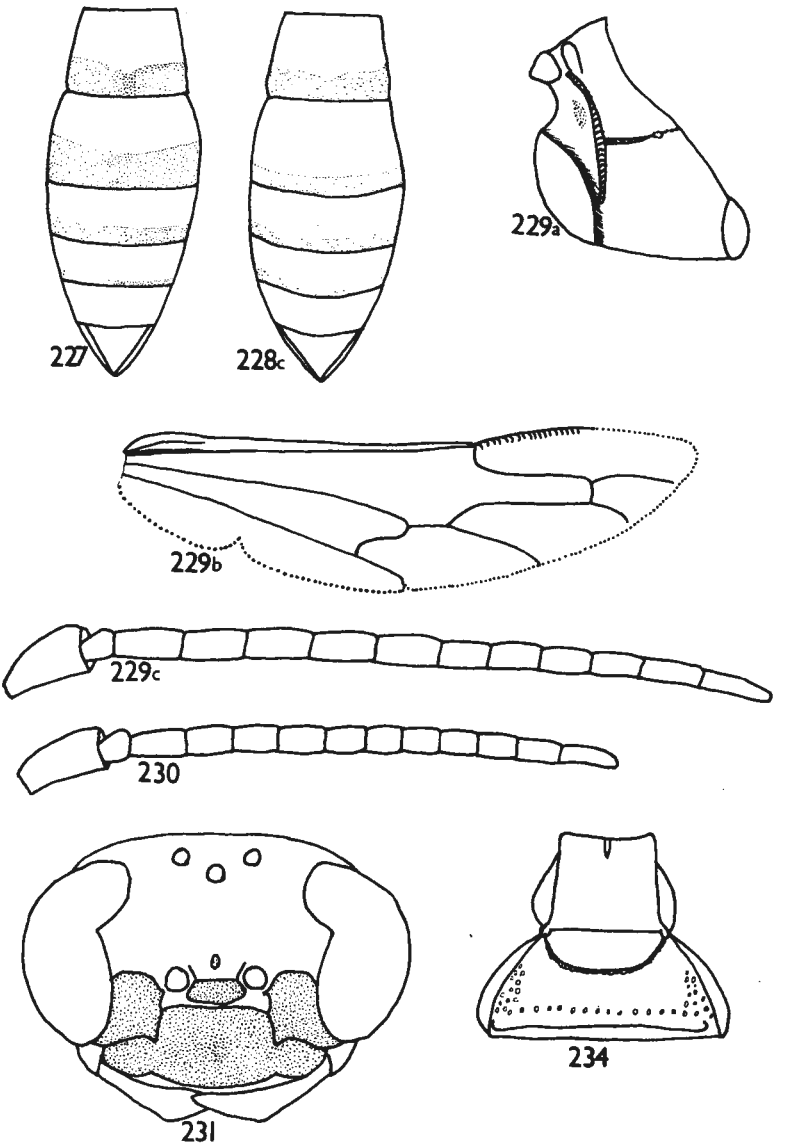

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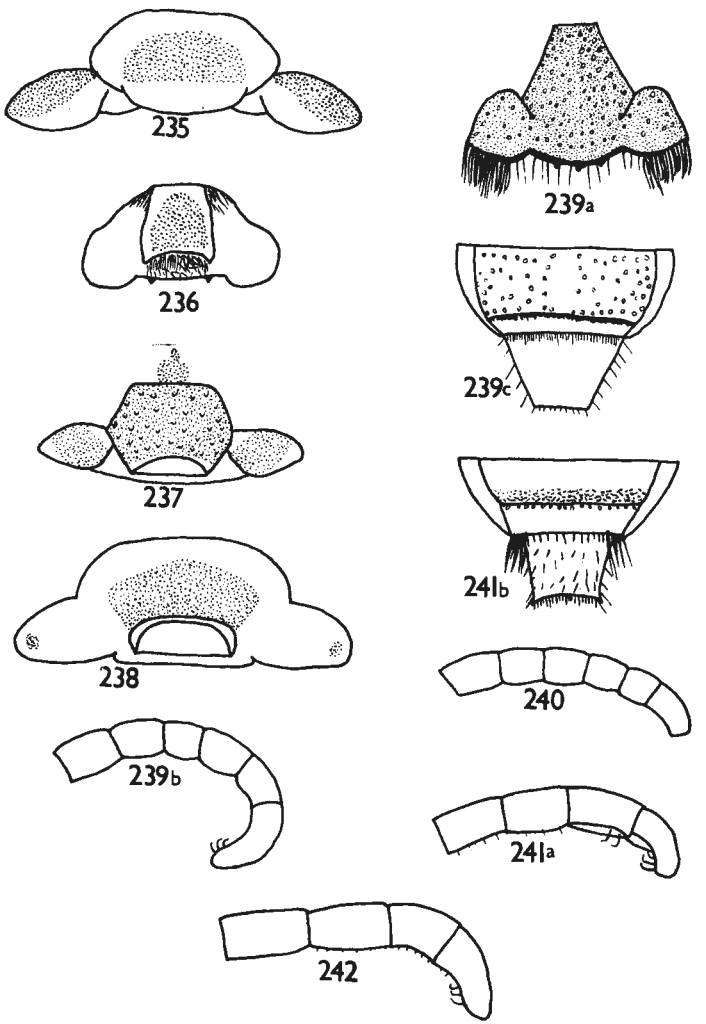

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