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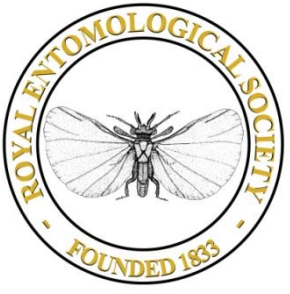

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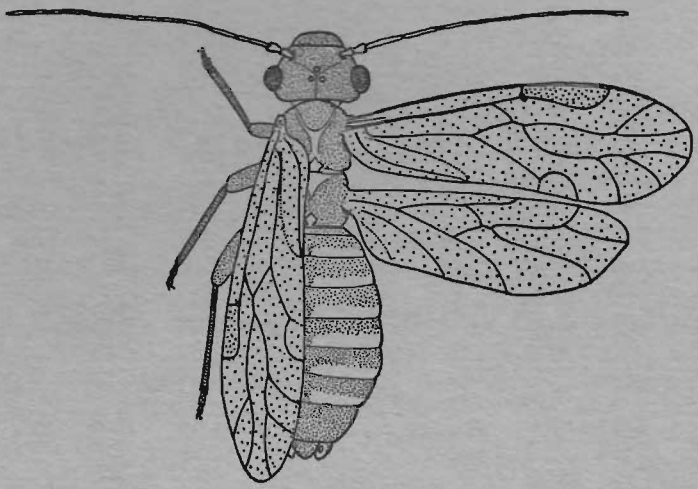

PSOCOPTERA

By

T. R. NEW

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HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS

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

I. Part 1. General Introduction.
" 2. Thysanura.
" 3. Protura.
" 4. Collembola.
" 5. Dermaptera and Orthoptera.
" 6. Plecoptera.
" 7. Psocoptera.
" 8. Anoplura.
" 9. Ephemeroptera.
" 10. Odonata.
" 11. Thysanoptera.
" 12. Neuroptera.
" 13. Mecoptera.
" 14. Trichoptera.
" 15. Strepsiptera.
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II. Hemiptera.
III. Lepidoptera.
IV. and V. Coleoptera.
VI. Hymenoptera: Symphyta and Aculeata.
VII. Hymenoptera: Ichneumonoidea.
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Volumes II to X will be divided into parts of convenient size, but it is not possible to specify in advance the taxonomic content of each part.

Conciseness and cheapness are main objectives in this series, and each part is the work of a specialist, or of a group of specialists. Although much of the work is based on existing published keys, suitably adapted, much new and original matter is also included.

Parts are issued, separately paged and priced, as they become available.

A second (revised) edition of *A Check List of British Insects*, by G. S. Kloet and W. D. Hincks, is being issued as an extra, eleventh, volume in this series.

The Society is indebted to the Royal Society for a grant towards the cost of initiating this series of *Handbooks*.

A list of parts so far published appears on the inside and outside back covers.

PSOCOPTERA

By T. R. New

Foreword

This Handbook is designed to give a general account of the external morphology of the Psocoptera, emphasizing those characters used in classification, and to enable adults of species found in Britain to be identified. The project was started some twenty five years ago by the late Mr. J. V. Pearman who, unfortunately, was unable to complete the work. I have had the benefit of examining a considerable quantity of his accumulated notes and sketches, and some of these have been incorporated into the present account.

The figures have been drawn especially for the Handbook. Many are original and are based on specimens in my collection but, for a number of species, I have had to rely on copying figures from original descriptions and other sources. These are acknowledged individually in the legends. I have received advice and specimens from several colleagues whilst working on this account, and it is a pleasure to acknowledge their ready co-operation. Errors of fact or interpretation are, of course, my own responsibility.

It will become obvious to the reader that much remains to be done on the British Psocoptera, and some of the keys provided (notably those to *Liposcelis*, *Caecilius* and *Ectopsocus*) may need considerable emendation in due course. They serve to indicate weakness in our present knowledge and, hopefully, will enable progress towards completing documentation on British species to be made more rapidly than has hitherto been possible.

Introduction

The Psocoptera are one of the least-known orders of small insects. Nearly 2000 recent species have been described, in some 226 genera, but the very high proportion of new species found in almost all collections from the tropics suggests that there may be several thousand undescribed species. Some 90 species have been recorded from Britain, but only about 50 of these are known to occur naturally. The others are mostly casual imports, often in stored products, and some are recorded only from single specimens found in warehouses or ships holds. Such species have attracted attention as minor stored products pests, and members of the large genus *Liposcelis* Motschulsky (the "booklice") are frequently found indoors and associated with human habitations. Most of the species occurring out-of-doors (sometimes termed "barklice") have no economic importance and, although they may be present in very large numbers, have attracted little attention from entomologists. Frequently at least some dissection and measurement is necessary for specific identification, and microscopical examination is needed for accurate determination of many forms. The only generally applicable common name for these insects is "psocids", derived from "*Psocus*".

Many of the British species are arboreal, but a few are more usually found on grasses, on low vegetation, or in litter: in all these habitats they feed on

microflora (such as fungal spores and unicellular algae) and organic debris. The stored product species feed on yeasts, flour, fragmented grain and similar materials. Several species of Psocoptera show marked habitat and food preferences, and much of the scattered literature on the ecology and life histories of the British species was mentioned by New (1971). This account deals only with identification of their adult forms.

Brief taxonomic accounts of the British psocids were written by Stephens (1836), Hagen (1861), McLachlan (1867) and Pearman (1927). The three first-mentioned authors included the psocids in the "Pseudoneuroptera" and during the nineteenth century they were generally included in the heterogeneous mass of insects then loosely termed "Neuroptera"—which also included such orders as Plecoptera, Ephemeroptera, Odonata, Isoptera and Trichoptera. Shipley (1904) and most later authors treated psocids as a distinct order, and several schemes of classification were advanced in the early part of this century. Alternative ordinal names still widely used are "Corrodentia" and "Copeognatha". Pearman's (1936) tabular arrangement of the Psocoptera forms the basis for all later classifications. Roesler's (1944) arrangement of genera (which was followed in the recent Kloet and Hincks list—Broadhead, 1964) contains groupings not now widely accepted, although invaluable as a first attempt to indicate natural relationships within the order. In particular his groupings of "Mesopsocidae", "Polypsocidae" and "Pseudocaeciliidae" can lead to confusion. The classification used in this account is basically that of Badonnel (1951) (which incorporates features of both Pearman's (1936) account and that of Roesler (1944)), as slightly modified by Smithers in his (1967) *Catalogue of the Psocoptera of the World*. Two features which differ from Smithers' account are the separation of Stenopsocidae from Caeciliidae, and the division of the Peripsocidae into two families: Peripsocidae and Ectopsocidae. Further, *Kolbea* Bertkau is retained in the Caeciliidae for convenience, although its true position is in the Amphipsocidae, a family not otherwise represented in Britain. Structurally this genus is very similar to *Caecilius*, and its separation here could cause confusion.

No recent keys adequately cover the British species. Badonnel's (1943) *Faune de France* volume includes most of the out-door species but the reprint edition (1970) has not been revised to incorporate more recent work. Vishniakova's (1967) keys to the European U.S.S.R. and von Kéler's (1963) *Die Tierwelt Mitteleuropas* account are also useful, but again provide ambiguities when applied to the British fauna. The present keys are designed for the British psocids, including casual introductions, and are not fully applicable to other regions. However, European species which have not yet been found in Britain and which could cause confusion are briefly noted, and their separation from British species outlined. Many areas of Britain have not been adequately searched for psocids, and it is possible that several continental species await discovery in Britain: indeed Fahy (1968) has recently discovered the genus *Atlantopsocus* in Eire. Thus, detailed records of British distribution have little real meaning, and even such general comments as "most common in southern England" may prove grossly misleading. Distribution notes given in the keys should be treated with some caution. Even widely distributed and common genera in Britain (such as *Caecilius*, *Ectopsocus*, *Peripsocus*) are not fully known, and unrecorded

species may occur. It is emphasized that determination of psocids must include examination of genitalia (or details of setal pattern and sculpturing in Liposcelidae) in all dubious cases. Most other useful characters are incorporated in the following keys but the genitalia figures provided should be regarded as an integral part of the specific diagnoses.

Definition

Psocoptera may be defined as follows:

Freeliving exopterygote insects, usually small (body length c. 1–10 mm.); head mobile, *large bulbous postclypeus*, eyes usually large, antennae long and filiform; biting mouthparts with mandibles asymmetrical, *lacinia specialized to form rod-like pick*, maxillary palp of 4 segments; hypopharynx highly modified, with ovoid lingual plates connected by filament(s) to sitophore sclerite; prothorax reduced, laterocervical sclerite present but dorsal and ventral cervical sclerites apparently absent; wings membranous or scaled, sometimes reduced or absent; venation simple, wings in some forms held horizontally over the abdomen when at rest but more usually in a more vertical "tent" over the animal—in which cases a projection near the base of the pterostigma and a hook at the apex of Cu_2 are present on the underside of the forewing. *Tarsi 2 or 3-segmented in adults, 2-segmented in nymphs;* a ventral articulation between prosternum and fore coxae. Gonapophyses complete. *Cerci absent.*

The terms in italics together comprise the most obvious characters that can be observed without dissection and these, together with comparison of wing venation with figures in this account should enable separation of winged psocids from all other insects. However, many are apterous, and the unique lacinial structure (figs. 21–25) is the most reliable "spot" character. On superficial appearance, some Psyllidae (Homoptera) which often occur in similar habitats to outdoor Psocoptera, can be confused with psocids but are easily separated by having sucking mouthparts.

Apterous or brachypterous adults having reduced venation may be confused with the immature stages (nymphs). Distinction can be made as follows:

(1) All nymphs have 2-segmented tarsi, although an incipient division into three segments may be visible through the cuticle of last instar nymphs of adults with 3-segmented tarsi.

(2) Most macropterous species undergo six nymphal instars, and the wing pads become progressively larger from instars III to VI. However, they remain fleshy, and no traces of venation are visible until just before the adult moult.

Aptery or brachyptery is sometimes considered a neotenic (juvenile) character in psocids, and many such adults pass through a smaller number of instars than their macropterous counterparts. In Britain, adults of four species which have 2-segmented tarsi could be confused with nymphs. These are the females of *Epipsocus lucifugus* (Rambur) (p. 46), *Reuterella helvimacula* (Enderlein) (p. 68) (both of which are apterous), *Lachesilla greeni* (Pearman) (p. 56) and *Kolbea quisquiliarum* Bertkau (p. 50), which have very small vestiges of wings. They are separable by having well defined and clearly visible genitalia. In nymphs, female genitalia are not distinct except for outlines of the gonapophyses visible through the last instar cuticle towards the time of the final moult. The cuticle will usually

be partially detached from the body at this time, and the whole insect appear soft.

(3) The apical abdominal terga of nymphs are not fused together, and any visible rudiments of the gonapophyses are separate from the terga.

(4) Younger nymphs of many species are very pale in colour, and have fewer antennal segments than adults.

It is generally believed that Psocoptera diverged from some basal Hemipteroid stock. They appear to be most closely related to the Mallophaga, with which they share the highly specialized hypopharynx and (with some) the unusual articulation of the fore coxae. The mouthparts of some Mallophaga include a pair of small rod-like sclerites which appear to be homologous with the Psocopteran lacinia. However, further direct evidence to link the two groups is lacking, although Clay (1971) has suggested that the mode of spermatophore formation may also be common to some members of both orders.

Fossils of Psocopteran-like insects are known from as far back as the lower Permian. Some of these are only dubiously psocids, but some very well-preserved specimens have been found in Baltic, Canadian and Mexican amber. Many of these comparatively recent fossils are closely allied to living species, but the older fossils are, for the most part, of families not known alive: some of these have rather more complex wing venation than living forms, and it is clear that there has been a tendency towards reduction of crossveins to give the relatively simple series of venational patterns found in recent species. Much of the fragmentary fossil evidence for psocid relationships is discussed by Enderlein (1911), Tillyard (1926) and Becker-Migdisova and Vishniakova (1962), amongst others. Smithers (1972) has recently summarized much of this information, and has discussed the phylogeny of the order in detail.

External Morphology

A brief account of external morphology is essential for maximum utility of the following keys. In particular, characters of mouthparts, antennae, wings, hind legs and genitalia are used for identification at all levels, and knowledge of the main types of structure found will greatly facilitate rapid determination. Figures 1–62 should be used in conjunction with these notes, and later figures are referred to wherever relevant. Badonnel (1934, 1943, 1951) and Smithers (1972) have given good accounts of the structure of Psocoptera and have referred to important earlier accounts; other authors have treated particular facets in more detail. The recent accounts of the insect head and thorax by Matsuda (1966, 1970) provide an excellent comparative treatment, and general accounts of morphology are found in many entomological textbooks—such as Imms (1964). In common with most other orders a rather specialized terminology has grown up around psocid morphology, and such general accounts are invaluable for comparative work and added clarification. Only external structures are considered here, but for internal anatomy and detailed functional accounts, note should be made of papers by Badonnel (1934, general anatomy—good bibliography), Klier (1956, male reproductive system), von Kéler (1966, feeding mechanisms) as well as the earlier-noted papers.

Head

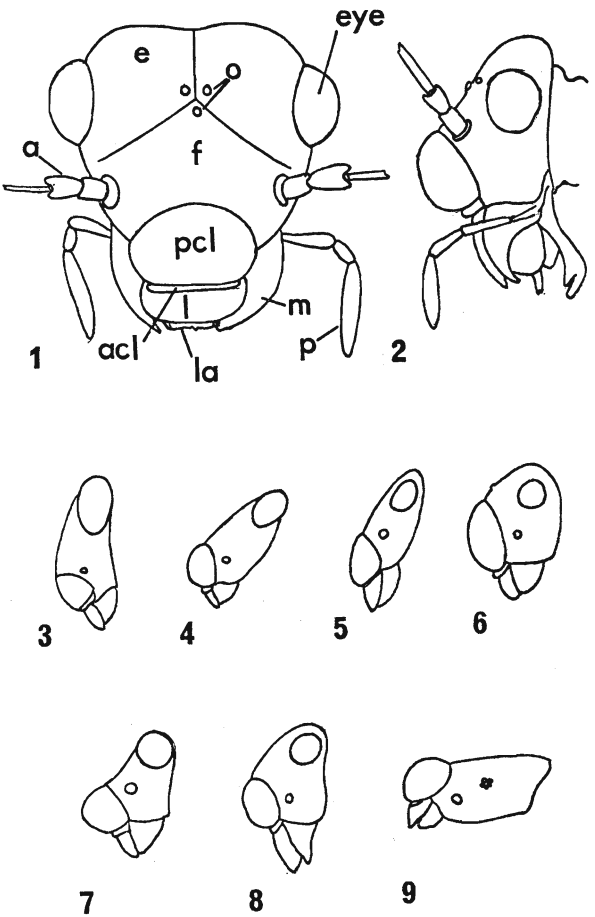
The Psocopteran head is usually large and mobile, and is characterized mainly by having an enlarged, often bulbous, postclypeus. The epicranium (fig. 1) is most commonly smoothly rounded but may form a sharply angled posterior edge. The median epicranial suture is usually present but is sometimes reduced to a small notch at the vertex (some Pachytroctidae) or indicated by an insignificant break in the sculpturing (Liposcelidae). The frons is not always clearly delimited and the fronto-clypeal sutures are sometimes obliterated. When present, these sutures diverge widely and may become obsolete between the orbit and the antenna (fig. 1), run into the eye margin or to the antennal socket. In many species a small, sometimes reticulate triangular area, which marks the site of one of the ecdysial lines involved in hatching, is present near the frontoclypeal suture: this may be mistaken for a contracted frons. Laterally, the epicranium and frons come together to form the genae ("cheeks") which are rounded in most groups but in some bear an oblique furrow or are elongated.

The clypeus is divided into a large postclypeus (morphologically, part of the frons) and a smaller anteclypeus. The postclypeus is often greatly enlarged and gives the head a characteristic profile (figs. 2–9): in many groups it is marked with longitudinal striae which converge towards the midline, and the extent of its enlargement provides a useful taxonomic character.

The eyes vary considerably in different groups, but in most are large and prominent. In some apterous or brachypterous psocids (Liposcelidae, Sphaeropsocidae) they may be reduced to a few ommatidia, the number and arrangement of which has taxonomic significance. This reduction in eye size appears to be correlated with loss of flight—macropterous *Embidopsocus* (Liposcelidae), for example, have large compound eyes and apterous individuals of the same species only a few ommatidia. In the most usual form, the compound eye has the longer axis (as seen from the front of the head) running down the genae; others are globular and protruding, having a relatively small area of attachment to the head and culminating in the eyes being stalked (*Labocoria* (Africa), *Steleops* (S. America), for examples) (fig. 19). They may enclose, project above, or leave bare the side regions of the vertex (temples). Considerable differences in eye size may occur between closely related species, and there are sometimes pronounced sexual differences—the male eyes being the larger (some Caeciliidae, Peripsocidae, Psocidae, for examples—see fig. 17). Short hairs may be present between some or all of the ommatidia, and the interommatidial areas may be sclerotized to form a fine reticulation.

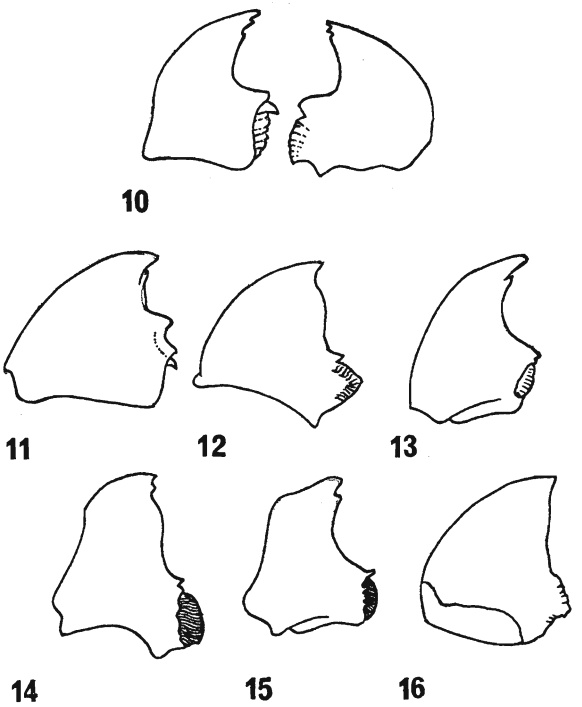
Ocelli, if present, are usually three in number and placed one in each of the angles formed at the junction of the epicranial and frontoclypeal sutures. They may be widely spaced or aggregated closely on a small prominent tubercle. In some species the epicranial (lateral) ocelli are near the eye margin and the frontal one lacking (some Amphientomidae—not British). Again, in polymorphic species apterous or brachypterous individuals frequently lack the ocelli present in macropterous specimens. The ratio of interocular distance to eye diameter is sometimes of specific value in descriptions (p. 24).

The cylindrical scape and pedicel of the slender filiform antennae are of basically similar form throughout the order, but the apical end of the pedicel



FIGS. 1–9.—Heads of Psocoptera. (1) Anterior aspect and (2) profile of generalized psocid to show main regions. *pcl*, Postclypeus; *acl*, anteclypeus; *l*, labrum; *f*, frons; *m*, mandible; *a*, antenna; *e*, epicranium; *la*, labium; *p*, maxillary palp; *o*, ocelli. (3)–(9) Profiles to show examples of different head shapes: (3) *Soa*, (4) *Trogium*, (5) *Psyllipsocus*, (6) *Peripsocus*, (7) *Mesopsocus*, (8) *Epipsocus*, (9) *Liposcelis*.

is sometimes excavated and may have the external margins elongated. Both these segments are short. In contrast, the flagellum varies considerably between different groups in the number of segments, and their size, surface structures and ciliation. The number of flagellar segments is consistent within a group, and there appears to have been a progressive reduction in their number (from 20 or more in the Trogiomorpha, to 13–15 in most Troctomorpha and 11 in most Psocomorpha—see p. 25). Many Trogiomorpha have the flagellar segments short, reaching at most about four

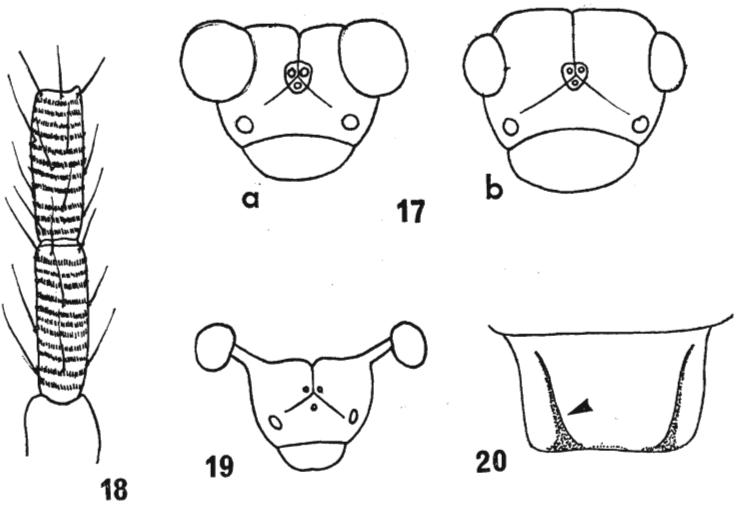


FIGS. 10–16.—Mandibles to show variations in form. (10) *Trogium*, (11–16) (left only) of (11) *Liposcelis*, (12) *Amphigerontia*, (13) *Psyllipsocus*, (14) *Caecilius*, (15) *Epipsocus*, (16) *Peripsocus*.

times as long as wide, but in other groups they are much longer (f1 often being several times as long as the combined lengths of scape and pedicel) and sometimes thickened. Such thickening, especially of the basal flagellar segments is usually a secondary sexual character. In some families the shape of the apical flagellar segment is characteristic—some Philotarsidae, for example, have this drawn out to a narrow point.

The type of flagellar ornamentation may also have taxonomic significance. In particular, the annulations (rings of minute hairs, or microtrichia) of the lower suborders (fig. 18) are useful, as they may be confined to certain segments. Some families possess prominent discoidal sensilla on particular flagellar segments and in the (tropical) Archipsocidae, for example, their form and position provide useful generic and specific characters. Sensilla of different kinds are present on most psocid antennae but they are often obscured by the long or dense generally-distributed ciliation, and are visible only by careful searching under high magnification.

At the specific level, the relative lengths of the basal flagellar segments can be useful for separation. In particular the ratio "f1/f2" is a standard descriptive measurement in the Psocomorpha (p. 24).

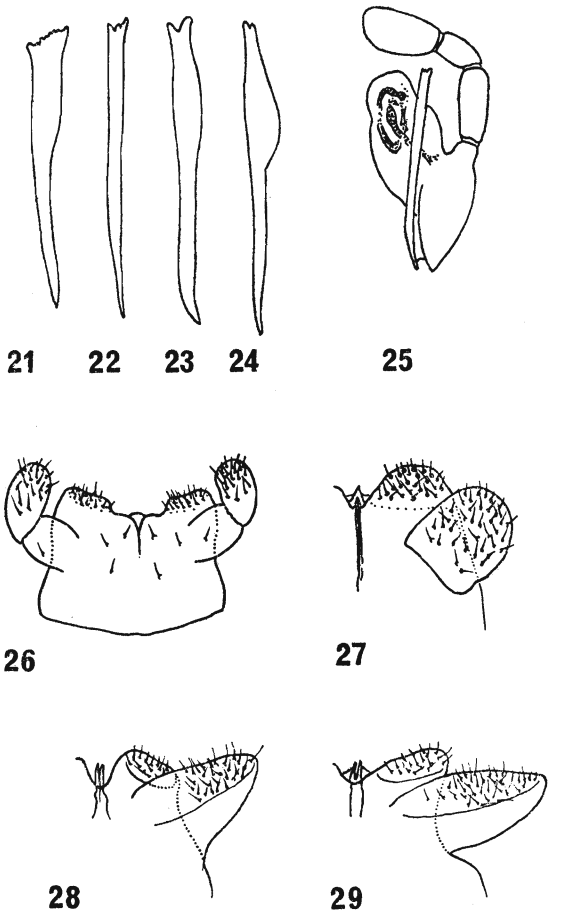


FIGS. 17–20.—Head structures. (17) Anterior aspect of (*a*) male and (*b*) female heads of *Stenopsocus* to show sexual dimorphism. (18) Basal flagellar segments of *Liposcelis*, to show secondary annulations. (19) Anterior aspect of head of *Steleops* to show extreme form of stalked eyes. (S. America). (20) Labrum of *Epipsocus* to show position of sclerotized ridges.

Except in one aberrant species (*Prionoglaris stygia* Enderlein from Europe—not yet found in Britain) the biting mouthparts comprise the labrum, epipharynx, mandibles, maxillae with four-segmented palpi and highly modified lacinia (the "rod" or "pick"), labium, and peculiar hypopharynx. Each of these occurs in a number of basic forms, and some are of considerable taxonomic value (figs. 10–16, 20–32).

The labrum is simple, slightly convex, and is usually semi-circular or roughly trapezoidal in outline. In Epipsocidae and related families it bears two thickened longitudinal ridges (fig. 20), but is otherwise unthickened over most of its surface. The centre of the anterior margin bears a small groove, at each end of which a small pointed process projects from the inner surface of the labrum. Behind this there is often a small hyaline area and within the groove usually a series of short setae arranged in one, two or three rows. Similar setae occur on the outer surface of the labrum, and the number and arrangement of internal and external setae has some taxonomic value. The epipharynx forms the palatal lining of the labrum and anteclypeus, is membranous and, although it usually bears numerous small hairs, has not been investigated in detail for any taxonomic significance.

The basally broad mandibles narrow apically to an inwardly curved point which is sometimes divided (fig. 10). The basal area is strongly differentiated to form an ovoid grinding or molar surface crossed by finely denticulate ridges and with more prominent teeth at its anterior edge. The mandibles are usually asymmetrical: commonly the left mandible has two anterior teeth to the molar area (which is itself concave), and the right mandible has one anterior tooth and the molar area is convex. The outline shapes of the



FIGS. 21–29.—Mouthparts. (21–24) Examples of main types of lacinial rod. (21) *Epipsocus*, (22) *Liposcelis*, (23) *Philotarsus*, (24) *Caecilius*. (25) Maxilla, to show relationship of lacinia to other structures. (26–29) Examples of main types of labium. (26) *Trogium* (palpi 2-segmented), (27) Psocidae, (28) Epipsocidae, (29) Stenopsocidae.

mandibles as viewed from the dorsal surface are sometimes of taxonomic use (figs. 11–16), but the left mandible is generally more variable than the right.

Each maxilla appears superficially to consist only of a bulbous galea with its associated palp (fig. 25): the cardo is not differentiated and the lacinia extensively modified to form a rod-like structure. The galeae, which are ovoid or pyriform, are supported internally by a system of rod- and ribbon-like sclerotizations. They bear a few small setae externally. In their natural position the galeae lie within the mandibular arch (formed

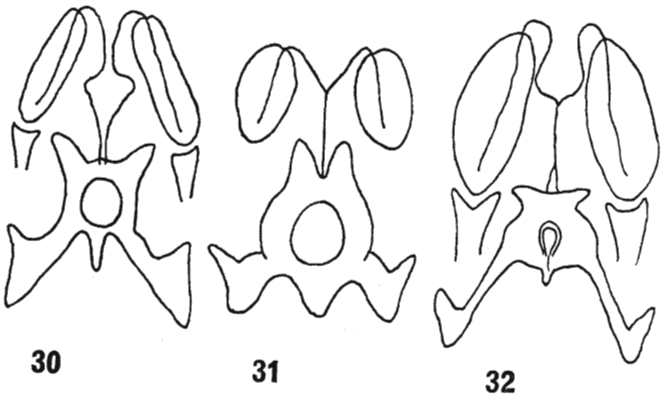
by dorsal flexure of the mandibular apices) with their apices in close contact. The relationships of the basal ("stipital") area are not clear, as part of it may represent the undifferentiated cardo.

The maxillary palpi are four-segmented throughout the order: the few references to a fifth segment have almost certainly resulted from inclusion of the palpifer. There is some variation in the relative lengths of the segments but, with very few exceptions, the basal and third segments are each noticeably shorter than either the second or the fourth. Two features of the palpi are of taxonomic significance. Firstly, the shape of the apical segment (figs. 93, 94, 102, 255, 256) which may be ovoid, strongly clavate (Trogiidae, Psyllipsocidae), more weakly clavate (Elipsocidae—*Cuneopalpus*), or strongly globular (some non-British Liposcelidae), with many minor variations. Secondly, a number of lower Psocoptera (many Trogiomorpha) have a prominent spine-like sensillum on the inner edge of the second segment: in some cases this is a short stout spine (fig. 94), in others a long fine hair. Further, in some Liposcelidae the grouping of setae on the ventral surface of the apical segment of the palp provides specific characters: these have not been investigated in comparative detail for British species.

The laciniae are perhaps the most specialized and characteristic psocid structure, but their function is not wholly clear. It has been assumed that they are used as gouges or scrapers, but such has not been directly observed: von Kéler (1966) inferred that they may be used as "picks", and I have seen psocids moving laciniae vertically in a manner which suggests this may be so. Further, they appear to be used to support the head whilst feeding and may act as "props" to regulate the depth of feeding on the substrate. Further experimental work is needed to clarify their function. The lacinia occurs in a variety of forms. Essentially it is a tubular styliform sclerite, divisible into two definite regions (figs. 21–24): a basal tapering root to which muscles are attached, and a distal stem with a more or less denticulate apex. Although the apex wears somewhat during the life of the insect its gross form (and sometimes smaller details) are of considerable use in separating taxa at different levels. Until recently, its main use was in specific description, but the overall form is valuable in separating many higher taxa as well. Thus many Epipsocidae are characterized in part by having the lacinial apex broadened and divided into a row of teeth (figs. 21, 134). Differences in the form of the apical teeth (tines) tend to obscure the underlying similarities in the structure, and there are rather few basic types of lacinia (figs. 21–24). It is emphasized that for examination of laciniae very careful orientation of the specimen is needed, especially in comparative work.

The labium (figs. 26–29) has reduced one- or two-segmented palpi. The chitinous mentum is joined to the head capsule by a membranous fold, and is divided apically into lateral halves by a small protuberance or furrow representing the opening of the labial (silk) glands to the exterior. The borders of this opening, if protuberant, are formed of the greatly reduced glossae. The external paraglossae are usually rounded and often strongly setose. All these structures may be thickened marginally. The number of segments to the palpi is used in subordinal separation, but other labial characters have not been fully appraised for their taxonomic potential.

The hypopharynx (figs. 30–32) is highly modified. It comprises a posterior, usually quadrate plate (the sitophore sclerite), bearing a central



FIGS. 30–32.—Examples of basic forms of hypopharynx. (30) *Lepinotus*, filaments divided for whole length; (31) *Liposcelis*, filaments joined; (32) *Mesopsocus*, filaments joined for intermediate part of their length.

orifice. From this sclerite, sclerotized filament(s) lead anteriorly to the oval sclerotized portion of the lingua ("lingual plates"). Most authors have agreed that these filaments are merely cuticular fibres, without any continuous lumen, but in the basically similar hypopharynx of some Mallophaga it has been claimed that a duct exists. The function of this structure is discussed in detail by von Kéler (1966) and its homologies by Haub (1972): the main interest here is that in some psocids these filaments remain separate for the whole of their length and in others the filaments from each lingual plate join in the midline for part of their length. The former condition separates the order Trogiomorpha from other Psocoptera (p. 25). The lingual plates themselves are linked with a funnel-shaped apodeme which is sometimes greatly reduced.

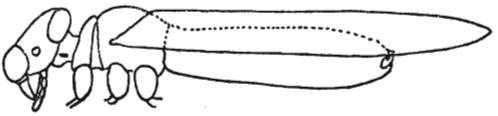
Thorax

The membranous neck region of psocids is greatly reduced, and the head may abut closely on the thorax. The neck contains small latero-cervical sclerites, which have been used for taxonomic purposes in the homogeneous family Archipsocidae (non-British), but dorsal and ventral cervical sclerites have not been found in the order.

With very few exceptions (some neotenic apterous species), the prothorax of both winged and apterous psocids is clearly separated from the other thoracic segments. The meso- and metathorax, usually closely applied to form a compact pterothorax, are distinct and usually separable in dissections. Only in Liposcelidae are they fused to form one structure. As a whole, the thorax adopts one of two basic patterns (figs. 33, 34):

(a) Pronotum visible from dorsal surface. Pterothoracic terga not enlarged and raised above the level of the vertex. Wings carried flat over abdomen.

(b) Pronotum reduced, not clearly visible from dorsal surface. Pterothoracic terga enlarged and raised above the level of the vertex. Wings carried in more vertical position.



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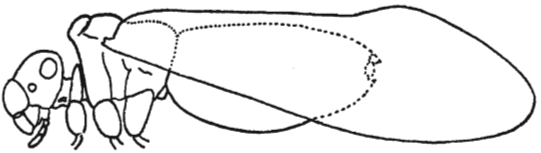

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FIGS. 33–34.—Schematic profiles, to indicate two main types of thorax and of wing position at rest. (33) Lepidopsocidae, prothorax exposed, wings held at slight angle to horizontal. (34) Psocidae, prothorax covered by pterothorax in dorsal view, wings held in steep "tent" over body.

The prothorax of most winged forms is strongly reduced anteroposteriorly and the simple notum almost linear; in apterous and some brachypterous forms the pronotum is usually more extensive. It is prominent and flattened only in Liposcelidae and in *Liposcelis* is clearly divided into a central region and a lateral lobe on each side: the arrangement and number of setae on these lobes provides important taxonomic characters in this genus (p. 39).

The meso- and metanota are separated by furrows into distinct regions (fig. 45), and these divisions are often less defined in the metathorax. In both segments the scutellum is usually well-defined, and the two segments are separated by a large phragma. The scutum is divided into an anterior lobe and lateral lobes. The pleura have been little used in taxonomic work. In most species the thoracic sternites are greatly reduced and narrow and those of the pterothorax are partially amalgamated. They have relatively large, usually branched furcae. However the Liposcelidae have the sternites greatly developed to form broad plates, with simple furcae. The arrangement of furcae and setation of the sternites is of considerable taxonomic use in this family.

For taxonomic purposes, more attention has been paid to the hind legs than to the anterior pairs, although characters of the fore femora and tibiae are used in characterizing some Amphientomidae and Thyrsophoridae (both non-British), and these legs may often yield useful additional metric data in other families. Measurements of the hind legs are particularly useful in specific description, and the following remarks apply particularly to these (figs. 46–49).

The coxae vary considerably in size, and those of the hindlegs are modified in many species by having cuticular projections of various kinds. The most usual of these are a small blister-like projection on the inner surface, an ovoid "rasp" bearing rows of small denticles, or the rasp and a nearby rounded area of similar size. The function of these "Pearman's organs"

on the inner coxal surface is unknown: it has been suggested that they are stridulatory (Pearman, 1928a) and in some forms they may be involved in coxal articulation. The coxae of the middle legs of a few species have similar but reduced structures, and in a few Lepidopsocidae the inner surface of one mid coxa bears a prominent peg which fits into a notch on the other coxa.

The small trochanters are articulated with the coxae, but their junction with the femora is usually immovable. The femora are usually simple, but sometimes markedly convex on their outer surface ("expanded"). Similarly, the tibiae are usually narrow and cylindrical, but have broad laminate expansions in one species from Singapore (*Eremopsocus* (*Podopterocus*) *longicornis* (Banks) : Psocidae). They usually have apical spurs, the arrangement of which can be useful in a few cases—as for separation of *Liposcelis* and *Embidopsocus* (p. 37). These almost always number from one to four, but more are found in some Amphientomidae. Tibiae and tarsi may have a row of characteristic "ctenidiobothria" along the ventral surface: these are elaborated setal sockets, having four to ten or more conspicuous "teeth", and each bearing a single spine (fig. 47). Their number on the hind tibia and tarsal segments is a useful specific character in some groups of psocids.

The tarsi are of either two or three segments, the basal one usually being the longest, and in almost all psocids the tarsi are distinctly shorter than the tibiae. All except the apical segment have apical spines, and ctenidiobothria may be present on the basal or all segments. Spines without ctenidiobothria ("plantar spines") are sometimes present on the basal and median segments, but never on the apical one. These may be restricted to the hindleg or occur also on the more anterior tarsi.

The tarsus terminates in a serrated unguitractor plate and a pair of claws. These (figs. 48, 49) may be slender, more or less hooked and with or without subapical teeth and other processes, and are of considerable taxonomic value—especially in conjunction with the pulvillus. The base of each claw usually has two ventral projections; the proximal one is always setiform and the distal (the pulvillus) is of various forms. It may be a slender bristle, be expanded at the apex to form a capitate knob, or become a broad laminate appendage, with many intermediate gradations between these three types. The greatly expanded pulvillus usually accompanies claws without subapical teeth (fig. 49), and this combination has apparently evolved several times in the order. It appears that the expanded pulvillus acts as a "sucker" and enables the insect to walk on smooth surfaces—most foliage-frequenting psocids have a pulvillus of this type, whereas most bark-frequenters have a narrow pulvillus.

Two pairs of wings are found in many psocids, although one or both pairs may be reduced in size. Venation is extremely important taxonomically and, indeed, many early specific descriptions contain little else but details of colour and venation. However, much trivial variation in venational patterns occurs, and individuals with an extra branch to the radius or media (for examples) have sometimes been described as new species on no other basis. The forewing is larger, and has more complex venation than the hindwing but, although some one hundred venational patterns have been described, these are reducible to a few basic types, examples of which are shown in figs. 36–41. Most living psocids have relatively simple venation,

and ramifying or numerous crossveins are present in very few genera (none British).

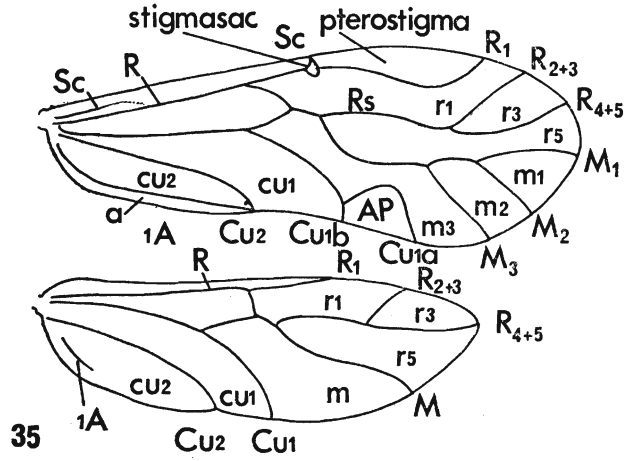
In the forewing the subcosta (Sc) is often greatly reduced to a small vein at the base of the wing, but is large in Lepidopsocidae. Most higher psocids have this vein ending free in the membrane but in some genera of Psocidae it either reaches the costa or joins the radius (figs. 287–294) and is of use in generic definition. The radius (R or R1) runs more or less parallel to the costa and forms the posterior border of the pterostigma in higher psocids. The shape of the pterostigma varies in different groups and in a few families is joined by a crossvein to the radial sector. The radial sector (Rs) terminates in an apical fork (radial fork, composed of R_{2+3} and R_{4+5}) and contacts the media (M) in the middle of the wing. At this junction the two veins may meet in a point, be linked by a short crossvein or be fused for a short length. M typically has three branches (M1, M2, M3). The first cubital vein (Cu1) reaches the posterior border of the wing, sometimes simply (Peripsocidae, Ectopsocidae) but in many psocids forked to form a cell generally known as the "areola postica" (AP), bordered by Cu1A and Cu1B. The presence and shape of the AP vary considerably in different groups of psocids, and it may be variously joined to the media (for examples, by a crossvein in Stenopsocidae (fig. 40) or fused with it in Psocidae (fig. 41) or completely free (fig. 39). The second cubital vein (Cu2) is often partially evanescent and morphologically distinct from the more anterior veins. It is simple and unbranched. Behind this is one anal vein (1A) which reaches the wing margin at or near the same point as Cu2. In a few groups a small second anal vein (2A) is present.

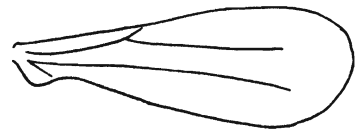
Numerous minor variations on this pattern occur. This venation pattern is most reduced in Liposcelidae (fig. 36) in which only R and M are conspicuous in the forewing and both become evanescent before reaching the wing margin.

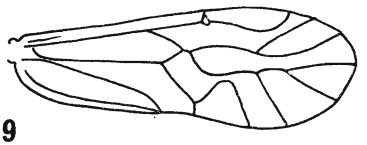
The cells take the name of the vein immediately anterior to them, and are sometimes labelled in the lower case to enable separation from veins (fig. 35). Some workers label veins in the lower case and cells in capitals: others use capitals throughout and differentiate by using "vein" or "cell" before each. The one exception to this nomenclature is the large "discoidal cell" bordered by M and Cu1 in the forewing of Psocidae and other forms in which AP is joined to M.

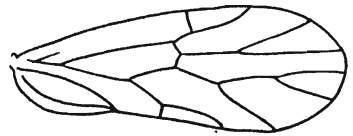
Similar nomenclature is applied to the hindwing, but the venation is more reduced (fig. 35). Sc is often vestigal, R1 reduced and simple, Rs forked as in the forewing, M often simple but sometimes having two branches, both cubital veins are simple and one small anal vein is usually present. As in the forewing, the form of the R-M junction can be of taxonomic value.

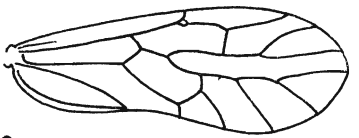
The overall shape of the wings is often characteristic of a genus or family: thus Pachytroctidae have the forewing broadly rounded at the apex and many Lepidopsocidae have the apex acuminate. Both brachyptery and microptery occur in psocids and are sometimes hard to separate: such modifications are correlated with reduction in thoracic size, reduction of ocelli, decrease in number of paraproct trichobothria, and other characters. A "working definition" for distinguishing these two states is as follows. Brachyptery implies relative shortening of the apical half of the wing (fig. 43), the basal region being normal or nearly normal, whereas in microptery the whole wing is reduced in size but of even proportions (fig. 44).

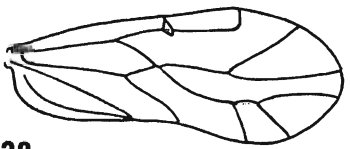


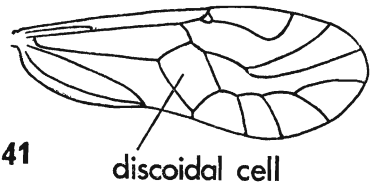






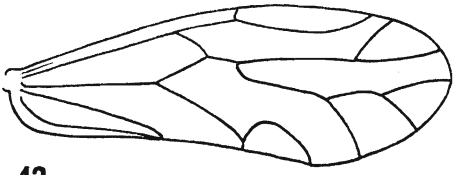






FIGS. 35–41.—Wings. (35) Forewing and hindwing with venation and cells labelled (see text). (36–41) Examples of variations of forewing venation. (36) *Embidopsocus*, (37) *Psyllipsocus*, (38) *Ectopsocus*, (39) *Mesopsocus*, (40) *Stenopsocus*, (41) Psocidae.

Some other wing features are notable or of some taxonomic use. In Lepidopsocidae and Amphientomidae the forewings are typically scaled and give the insect the appearance of a small moth: some tropical members of these families are extremely brightly coloured and the shapes of scales are sometimes of specific value.



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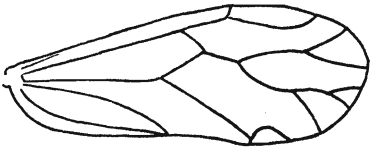

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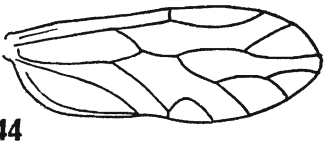

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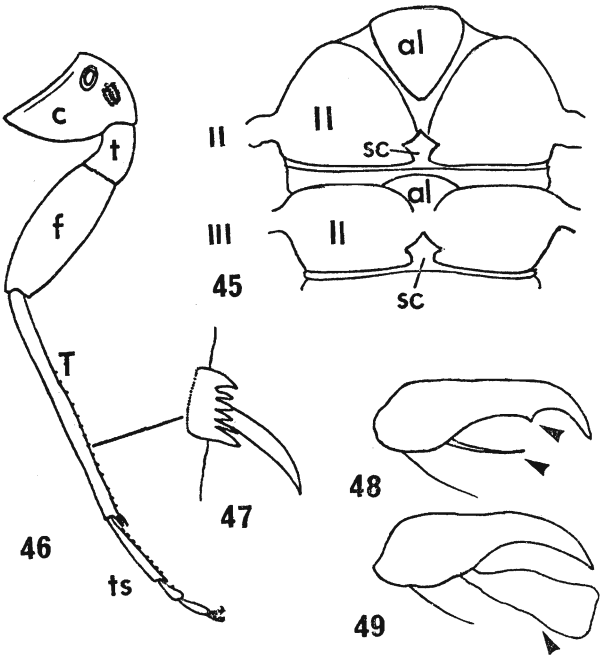
FIGS. 42–44.—Wings. (42) Macropterous form. (43) Brachypterous form, showing relative shortening of apical region of wing. (44) Micropterous form, in which all regions are uniformly reduced in size.

The veins and margin of the wing may bear macro- or microtrichia, and the extent and position of these may in part delimit genera or families. For examples, Lachesillidae have the wings entirely glabrous, Caeciliidae are distinguished from Amphipsocidae by having one row of macrotrichia (setae) on the forewing veins rather than two, and most Elipsocidae have marginal setae on the hindwing limited to the radial fork.

Psocoptera are unusual in that many species possess two independent sets of wing coupling apparatus. At rest the wings are held horizontally over the abdomen (many lower forms) or in an almost vertical "tent" over the body (Psocomorpha). These latter forms have a protrusion at the base of the pterostigma on the underside of the forewing, formed from modified trichia and tracheolar rings of R1. This projection ("stigmasac" or "stigmapophysis") engages the costa of the hindwing in repose. A similar "repose-coupling" structure is present in the Lepidopsocidae, where it is composed of a row of comb-like teeth on Sc or R1, and Amphientomidae in which the vein is merely thickened and elaborated to hold the more nearly horizontal wing. On the hindborder of the forewing, at the marginal junction of Cu2, Psocomorpha possess a hook which engages the hind costa in flight. This is less well-defined in Lepidopsocidae and Amphientomidae, where it is represented by a fold or slight comb. Details of these wing-coupling mechanisms are of taxonomic value, but they have not been fully explored. In most psocids the wing membrane is hyaline or faintly coloured, but in some groups very characteristic markings are present. These are better defined during revisionary work on particular species-groups or families than in a general



FIGS. 45–49.—(45) Dorsal aspect of pterothorax of Caeciliidae, to show main areas. *sc*, scutellum; *al*, anterior lobe of scutum; *ll*, lateral lobe of scutum; II, III, segments (meso- and metathorax). (46) Leg, to show different regions. *c*, coxa, with Pearman's organ; *t*, trochanter; *f*, femur; *T*, tibia; *ts*, tarsus (3-segmented). Tibia and tarsus with ctenidiobothria. (47) Single ctenidiobothrium. (48–49) Basic claw types, (48) Typical bark frequenting psocid, pulvillus narrow, subapical tooth present, (49) typical foliage-frequenting psocid, pulvillus broad, no subapical tooth.

discussion, but examples are the maculation of the "*Peripsocus alboguttatus* group" (p. 61, Mockford 1971) and some Psocidae.

Abdomen

Characters of the apical abdominal region, mainly of genitalia, epiproct and paraprocts, are extremely important in identification of psocids and provide essential reference points for definition of many species and higher taxa.

In general, nine abdominal tergites are recognisable, and some Liposcelidae appear to possess an additional tergite: in these the "basal" tergite has apparently been demarcated from the first true tergite. The anterior tergites of most psocids are not heavily sclerotized but the last two (VIII and IX) are amalgamated, often more heavily sclerotized and darkened, and laterally prolonged towards the ventral surface. The epiproct is attached to the dorsal apical point of these fused tergites and is flanked by the paraprocts (figs. 50, 51): the collective term "telson" has sometimes been applied

to these. The female external genitalia comprise the ventral subgenital plate (sternite VII), a pair of anterior gonapophyses from the eighth segment (ventral valves), and a pair of posterior gonapophyses from the ninth segment: these are usually divided into two lobes joined basally (dorsal and external valves) and aid the appearance of three distinct pairs of ovipositor valves. Between the gonapophyses, the orifice or duct of the spermatheca may open on a ventral membranous area, which is sometimes strongly convoluted or pigmented. The male genitalia comprise a (ventral) hypandrium and a complex copulatory apparatus (phallosome) hidden dorsal to this. Secondary, accessory structures may also be developed on tergites VIII and IX and/or the epiproct and paraprocts.

These structures are considered in more detail below: they are extremely diverse and the figures given in this account exemplify many types.

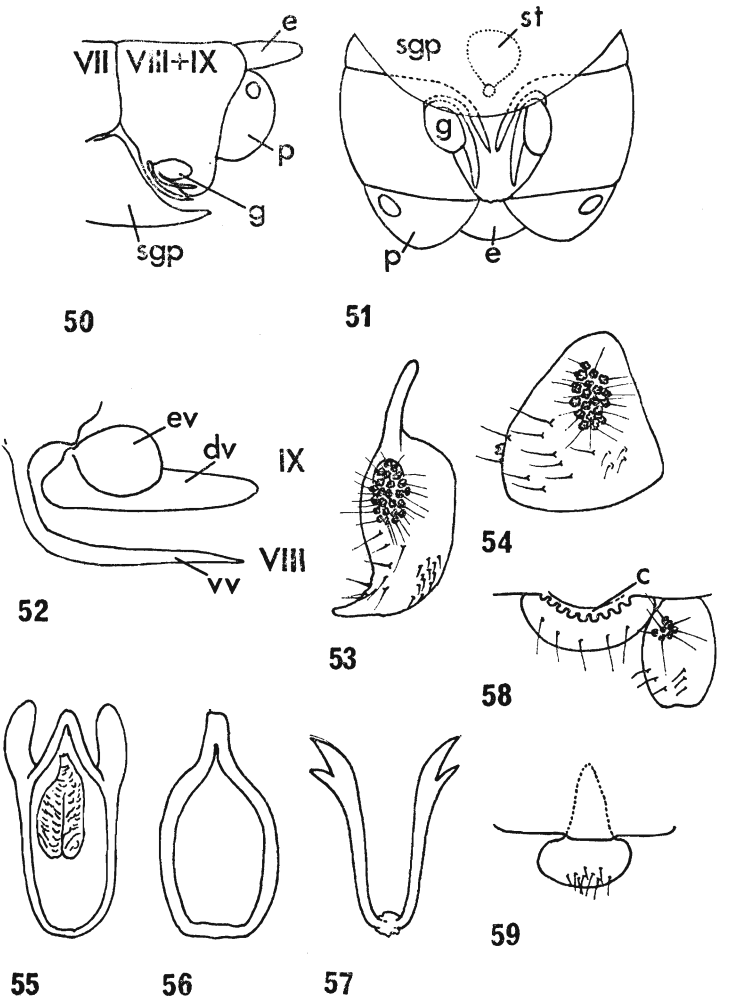
The anterior sternites are membranous. In Caeciliidae and allied groups there is a series of two or three large median "eversible vesicles". These are presumed to aid the insect in holding on to smooth surfaces, probably functioning as suction pads.

Epiproct and paraprocts. The epiproct is normally simple, of rounded, trapezoidal or roughly triangular shape in both sexes. In males of some species (Ectopsocidae, some Caeciliidae, for examples) it carries rows or fields of hooks or denticles, or (Myopsocidae—non-British, some Psocidae) has a basal anterior projection (fig. 59). Alternatively, or in addition, its base may be overlapped by a projection from the margin of the ninth tergite —this may be toothed to form a well-defined "clunial comb" (fig. 58) (Peripsocidae). In many psocids, however, the epiproct remains simple.

The paraprocts may be rounded, arcuate or more or less triangular in outline: those of males of some Psocidae (especially) are elongate. On the dorsal basal region of each paraproct there is often a well-defined area, sometimes divided or raised, containing a number of long fine setae each rising from a sunken rosette-like socket (figs. 53, 54). These setae are presumed sensory and are termed "trichobothria": they are analogous with the pygidial setae of fleas and the structures of some Neuroptera and, as they are reduced in number in apterous and brachypterous psocids, may be involved with orientation in flight or air currents. They may be few in number (six or less) or many (more than 40), with all intermediate gradations, and their number is often reasonably constant within a species or genus. They are found only on adults. When only a few trichobothria are present (as in many Lepidopsocidae, for example) they may be arranged in a row or a more loosely defined group than the normal "field".

Near the apex of the paraprocts of some families (in both adults and nymphs) is a long, thickened and slightly curved spine—the "anal spur" (fig. 65, of Lepidopsocidae). Less noticeable shorter spines often occur, either singly or in groups of two or three, in the same relative position of adults of other species: these are often confined to one sex. In many cases where nymphs do not possess an anal spur, this is replaced by "duplex" spinelets (fig. 54) or "hyaline cones", which may be found in adults (many Caeciliidae, for example).

Paraprocts of males of some groups (Psocidae) terminate in a stout spine or hook (fig. 53) and have a strong basal projection. A few females also have a hooked process, which is ventral rather than apical. Males of some



FIGS. 50–59.—Terminal abdominal structures. (50) Profile and (51) ventral aspect of generalized female to show relationships of structures. *VII–IX*, abdominal segment number; *e*, epiproct; *p*, paraproct; *sgp*, subgenital plate; *g*, gonapophyses; *st*, spermatheca. (52) Gonapophyses, to show relationship of constituent structures: *ev*, external valve; *dv*, dorsal valve; *vv*, ventral valve. (53–54) Paraprocts of (53) male Psocidae and (54) Caeciliidae (with small hyaline cones) as examples of structural variation. (55–57) Examples of phallosome structure: (55) complete, (56) outer parameres reduced, (57) reduced to inner parameres and open posteriorly. (58) Peripsocidae male, to show clunial comb (*c*) on border of last abdominal tergite. (59) Myopsocidae (non British), dorsal aspect of epiproct to show anterior extension (dotted).

families (Caeciliidae, for example) may have patches of denticles or rugose sculpturing on the paraprocts: these may also be of use for specific identification.

Female genitalia. In the majority of species, all three pairs of ovipositor valvulae (anterior (ventral) and posterior (dorsal and external) gonapophyses) are present, and these are overlapped ventrally by the subgenital plate. However, in some there has been considerable reduction, and in a few cases the gonapophyses are completely absent. The subgenital plate may be small, with a curved or straight margin, but more commonly it is a large broad plate having the apical margin rounded or variously modified. In many groups a pronounced median posterior lobe is present, and this may be divided. This lobe has been termed the "egg guide", and is considered by some workers to be a remnant of the eighth sternite. The subgenital plate often has a strongly sclerotized or pigmented pattern, and bears setae in definite areas or arrangements—all these are of systematic value. The overall shape of the plate may be useful in familiar and generic classification and details at the specific level.

The ventral gonapophyses from each side run close together near the midventral line of the abdomen: this valve is almost invariably shorter than the others, without setae, and apically pointed. There are often small cuticular spicules near the apex. The dorsal edge is sometimes stiffened, but the valve is predominantly membranous. Considerably more variation occurs in the posterior gonapophyses. The dorsal valve is generally narrow and sometimes resembles the ventral valve in appearance: it may become considerably attenuated, but in other species it is broad with the styliform apical prolongation reduced. Cuticular spicules are frequently present, as on the ventral valve.

The broad setose external valve is attached to the surface of the base of the dorsal valve. It assumes a great range of forms—in what can be regarded as a basic condition it is a large spatulate or "ear-shaped" flap attached to the dorsal valve over a narrow area. This becomes transformed into a relatively smaller body set transversely across the base of the dorsal valve, and a recurving flap-like lobe may be produced, projecting in part beyond the end of the main lobe (Psocidae). In extreme cases, the whole valve becomes fused with the dorsal valve and greatly reduced, being recognizable only as a small papilliform extension (Caeciliidae). Usually, however, the dorsal and external valves are recognizable by differences in setation: only very rarely is the external valve bare—it usually has long setae set in large sockets, which often form a marginal row.

The spermathecal structures also yield good taxonomic characters. The median opening of the duct between the gonapophyses is sometimes heavily sclerotized to form a distinct plate—the "gonopore plate", details of which are useful in specific identification of some Psocidae. In other species, the duct opens on the body wall, where it is overlapped by a sternal fold (Badonnel, 1934). Characters of the spermatheca itself have only been examined in detail in a few groups. In *Lepinotus* (Trogiidae) it bears secondary structures ("maculae"), the extent and position of which give useful specific characters. In many Caeciliidae the region of the duct near the spermatheca has very thickened walls (the "glandular region") and the extent and ratio of this to the spherical or ovoid spermatheca is of use for

separating some species. Examination of spermathecal structures requires very careful dissection and mounting, and more easily usable specific characters are usually found in the subgenital plate and gonapophyses.

Male genitalia. The hypandrium, which appears to represent the ninth sternite, may be a broad shield (slightly convex and weakly sclerotized) or it may be greatly elaborated into a strongly convex and heavily sclerotized structure bearing symmetrical or asymmetrical apophyses of different kinds (see figs. 298–302, of Psocidae). More simple patterns can also bear apophyses (Lachesillidae—figs. 186, 187), and the hypandrium may have accessory lateral structures, detached from it. In some Lachesillidae such "lateral hypandrial sclerites" are strongly developed. The origin of these is in doubt: it has been suggested that they are secondarily detached portions of the hypandrium, but alternatively may represent parts of the eighth sternite.

Similarly, the affinities of the copulatory structure (phallosome) are not wholly clear. This comprises rigid sclerites completely separated from the exoskeleton and attached to the ejaculatory duct (or seminal vesicles if the duct is very short). But there are muscular connections to the hypandrium, implying that they are derived from the posterior sternites. Two pairs of structures are involved in the phallosome (figs. 55–57): the outer pair (parameres or outer parameres) are sometimes strongly reduced, and the inner pair (aedeagus or inner parameres). Both come together to form basal rods which form a more or less complete frame. Between these lateral arms, there are often complex sclerified structures which appear to be formed partially from the ejaculatory bulb and partially from the above sclerites. This inner complex ("penial bulb") often bears very complex "radular" sclerites (e.g. Peripsocidae). The numerous variations on this basic pattern are exemplified by figures in the following account. In general the overall form of the phallosome is of considerable value in delimiting many families and genera or groups of genera. Details of shape and of sclerification of the penial bulb are useful at the specific level in many groups. As parts of the phallosome are moveable relative to others, care is necessary in interpretation: in particular, the appearance of the complex series of radular sclerites in Ectopsocidae is markedly altered when the organ is everted. In a few groups the phallosome is reduced to the parameres which may be partially fused to form a median rod-like stem (Lachesillidae) or a simple V or U-shape (Psocidae : Amphigerontiinae).

Preservation and Examination

Most Psocoptera are best preserved in 70% alcohol, although, for some of the scaly-winged tropical species, additional dry specimens are invaluable for checking coloration. Whenever possible, the coloration of living or freshly killed specimens should be noted, as many of the brighter colours rapidly disappear in alcohol: in descriptions the colours given should be referred to the preservation method used. In this account colours given are those of living or freshly killed specimens. Because of their small size, and intricacy of some of the usual taxonomic characters, at least a low power microscope is necessary for identification of psocids, and some dissection is frequently necessary. For this, very fine forceps (either "watch-

maker's" or other similar type) and a selection of dissecting needles are necessary: the latter can be made easily by gluing fine "micro-pins" into the ends of matchsticks. It is useful to have a range of sizes, some extremely fine and some of which can be ground into blades, made into hooks, or bent to serve the individual worker's preference. A pair of fine dissecting scissors is also useful.

Most workers have their own methods for preparation of psocids: the following are all well-tried and some are becoming standardized. Dry specimens should first be softened by transferring to 70% alcohol. If they have long antennae and legs (such as most Psocidae), breakages can usually be averted by first partially relaxing the specimens by exposure to a humid atmosphere—as, for example, in a lepidopterist's relaxing tin. Scaly-winged specimens preserved dry should first have the wings from one side removed, either by scissors or fine forceps—either of which should be dampened so that the removed wings adhere to them rather than drop or be "catapulted" and probably lost.

In alcohol, the antenna, wings and hind leg of one side of the specimen are removed, dehydrated by transferring into absolute alcohol, cleared and made into a permanent microscopical preparation without further treatment. The exact mounting medium used is not critical, but "Euparal" (following clearing in Euparal Essence) appears to be particularly good. Otherwise Canada Balsam (after clearing in Xylol or Clove Oil) is recommended.

It is usually necessary to make a permanent preparation of the dissected genitalia, and often also of the mouthparts. In some cases adequate details of mouthparts can be seen on whole mounts of the cleared head, and of genitalia from direct observation of the whole specimen, but the following directions assume complete dissection is necessary. The head is removed from the rest of the body by cutting through the cervical membrane and, for genitalia, the apex of the abdomen is cut off.

These are then macerated in dilute (10–15%) potassium or sodium hydroxide solution either by boiling (using a waterbath) or by leaving in cold solution overnight or for up to two or three days. The latter treatment is preferable to boiling in the case of more delicate specimens. The soft body contents are removed, if necessary, by gentle squeezing or with fine needles: in many genitalia preparations, the abdominal apex at this stage will contain a hard faecal pellet and the posterior region of the rectum—these should be left for the time being.

The specimens are subsequently washed in very dilute acetic acid and then in distilled water. For these, and ensuing stages, it is useful to have a series of labelled watchglasses containing the various liquids in sequence, and to transfer the specimens with forceps, a fine pipette or small spatula. The specimens are then stained. This may not be necessary for heavily sclerotized structures, but is generally useful. The exact technique is largely a matter of personal preference, but the following four methods are all satisfactory for psocids.

(i) *Acid Fuchsin.* 1–5% in 1 or 2% acetic acid. Transfer specimen from water, stain for two hours minimum or up to overnight. Dehydrate through 70% alcohol (which will remove excess stain) (two changes, 5–10 minutes each) and absolute alcohol (5 minutes). This stain gives more contrast between setae and the background chitin than the other stains.

(ii) *Fast Green.* 1–2% in 1% acetic acid. Transfer specimen from water, stain for 1–3 hours. Dehydrate as for Acid Fuchsin.

(iii) *Lignin Pink.* Stain in a saturated aqueous solution for at least 3 hours: can safely leave in stain for several days. Dehydrate in 50% and pure cellosolve, as alcohol crystallizes the stain.

Specimens stained by the above three methods can be mounted in Euparal or Canada Balsam after clearing as previously directed.

(iv) *Chlorazol-Black E* is particularly useful for demonstrating cuticular thickening in morphological studies. Stain with a saturated solution in either methyl or ethyl alcohols, watching carefully to avoid overstaining—the actual optimal period for each species can be found only by experiment. Specimens can be mounted in polyvinyllactophenol or in a methyl cellulose/carbowax medium.

The specimens are, after staining and dehydration, cleared and transferred to a drop of mountant on a slide for dissection.

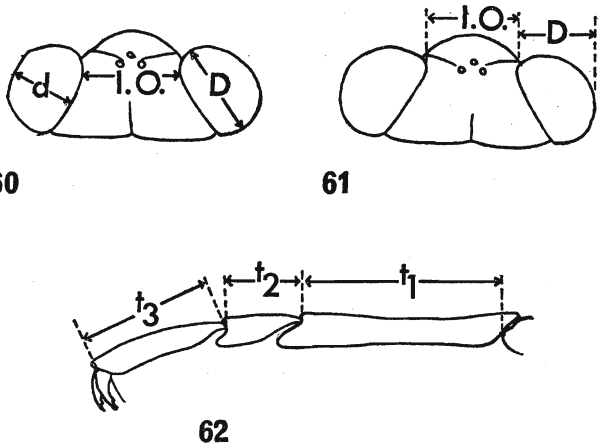
(a) *Head.* Dissecting from the ventral surface, remove the labium by cutting at the sides and pushing forwards. Then remove the maxillae, including the lacinia, by cutting at the base and pulling away from the head capsule. The mandibles are then separated, the labrum/epipharynx removed from the head by a transverse cut, and all parts spread out. The hypopharynx sometimes comes away with the labium, but in some cases it is necessary to separate this independently from the head. If the head capsule itself becomes fragmented, it may be desirable to remove the mouthparts to a clean slide for permanent mounts, but otherwise the head capsule is also mounted.

For some purposes, partial separation of the mouthparts by compression of temporary or permanent mounts of the whole head will enable sufficient details to be seen. Some workers recommend examination of whole heads mounted temporarily in glycerine, alcohol, or lactic acid in cavity slides for lacinial structures, and such are ideal for measuring I.O/D and P.O. (see below).

(b) *Genitalia.*

(i) *Female.* The subgenital plate is separated by inserting a needle between it and the gonapophyses and cutting at the lateral edges. The gonapophyses of left and right sides are separated in the mid-ventral line, care being taken to preserve any sclerified gonopore plate between them—if one is present, cut across tergites VIII and IX above the gonapophyses, along the lateral wall of the abdomen, and keep the two sets of gonapophyses together. Finally, the paraprocts are separated ventrally, the remainder of the rectum and any faecal traces removed and the tissue between paraprocts, and paraprocts and epiproct removed. These dissected parts are then transferred to a clean slide, and mounted spread out with external surfaces uppermost.

(ii) *Male.* The hypandrium is removed by cutting at the lateral edges, and the phallosome gently eased from it or from the body. Careful manipulation may be necessary to separate the phallosome from the strongly convex hypandrium of some Psocidae. The epiproct and paraprocts are treated as in the female. All parts are mounted with the outer side uppermost, the phallosome with the ventral side uppermost. The enlarged hypandrium of some Psocidae is better mounted under a separate, raised



60 61 62

FIGS. 60–62.—Diagnostic measurements (see text for explanation). (60) Head, to show I.O./D (Badonnel). (61) The same (Pearman). (62) Tarsus, to show method of measuring tarsal segment lengths (t_1, t_2, t_3, tarsal segments 1–3).

coverslip, or retained in alcohol with the specimen to which it belongs: undue compression of such structures can cause marked distortion and breakage. Interpretation, especially of asymmetrical structures, suffers accordingly.

The same staining and mounting schedules are used for other parts of the animal, such as the tergites of Liposcelidae for examination of sculpturing.

Much of the taxonomy of Psocoptera depends on accurate measurements and a micrometer eyepiece is necessary for these. Unfortunately, confusion over some measurements has arisen and different authors have sometimes measured the same character in different ways, making comparisons difficult. In particular, confusion can arise from the following:

(a) I.O/D and P.O. These two head measurements are often used for specific separation and, although much variation sometimes occurs in long series of a species, they can be very useful. Two distinct methods of measuring I.O/D have arisen, due to Pearman (1934) and Badonnel (see Ball 1943), and both these have been slightly misinterpreted by some later authors.. These are shown in figs. 60 and 61, and are:

(i) Pearman: The ratio of the shortest interocular distance (I.O) to the greatest horizontal eye diameter (D) as seen from the front of the head (facial aspect).

(ii) Badonnel: The ratio of the shortest interocular distance (I.O) to the length of the longest axis of the eye (D) as seen from the top of the head (dorsal aspect).

These two measurements often give considerably different figures, and the author of the method used should be stated in all descriptions incorporating this ratio. P.O. (d/D) (fig. 60) (Badonnel) is the ratio of shortest eye axis (d) to greatest eye axis (D) as seen dorsally.

(b) f1/f2: the ratio of the lengths of the first and second flagellar segments. The actual length of each segment, omitting any intersegmental space, should be measured.

(c) Ratio of hind tarsal segment lengths. Some workers measure the greatest length of each segment, whereas others take the (smaller) condyle to condyle measurements (fig. 62). The latter is perhaps more useful and reliable.

Measurements of leg and antennal segments can only be made satisfactorily from slide-mounted specimens, and should be correct to within one or two microns.

Such numerical data are not given in the following keys, but their use may be necessary when comparing specimens with original descriptions or with specimens from other parts of the world.

Keys to Suborders and Families

The Psocoptera can be divided into three suborders on the basis of antennal and hypopharynx characters, and all are represented in the British fauna:

1. Antennae with more than 20 segments, not secondarily annulated. Labial palps 2-segmented. Hypopharynx with chitinous filaments separated throughout their length. Adults with 3-segmented tarsi.....**Trogiomorpha**
(British families: Lepidopsocidae, Trogiidae, Psoquillidae, Psyllipsocidae).

2. Antennae 11–17 segmented, rarely with fewer segments (none British), the flagellar segments beyond the fifth usually with secondary annulations. Labial palpi 1- or 2 segmented. Hypopharynx with chitinous filaments separated only in distal region. Adults with 3-segmented tarsi.....**Troctomorpha**
(British families: Liposcelidae, Pachytroctidae, Sphaeropsocidae).

3. Antennae with 13 or fewer segments, never with secondary annulations. Labial palpi 1-segmented. Hypopharynx with chitinous filaments separated in posterior region. Adults with 2- or 3-segmented tarsi.....**Psocomorpha**
(British families: Epipsocidae, Caeciliidae, Stenopsocidae, Lachesillidae, Ectopsocidae, Peripsocidae, Trichopsocidae, Elipsocidae, Philotarsidae, Mesopsocidae, Psocidae).

The Psocomorpha are generally considered to be the most advanced psocids. The following artificial key to families neglects the above divisions, which may be difficult to utilise fully as dissection is necessary to disclose mouthpart characters and antennae are frequently broken in preserved specimens.

Families containing polymorphic species are keyed out for all alternative cases, and simple characters are used wherever possible. "Artefact" conditions are also keyed out alternatively—thus some Trogiidae and Mphaeropsocidae easily lose their short elytriform forewings on handling and are keyed out for both "brachypterous" and "apterous" alternatives. The coverage is slightly greater than for the recorded British fauna: for example, apterous Pachytroctidae are not yet known from Britain, but several are common in tropical regions and may be casually introduced. In general, all morphs of families recorded in Britain by at least one morph are catered for. Owing to the abbreviated nature of the key, determinations should be subsequently checked against the fuller diagnoses of each family given later.

Key to Families

1 Adults apterous, brachypterous or micropterous: wings, if present, not reaching beyond the abdominal apex 2
Adults macropterous, the wings reaching beyond the abdominal apex.....21

2 Apterous 3

– Brachypterous or micropterous 11
3 Adults with 3-segmented tarsi 4
– Adults with 2-segmented tarsi 10
4 Antennae with 13 segments 5
– Antennae with more than 13 segments 6
5 Antennae almost as long as body (large species, body c. 3·5 mm. long) MESOPSOCIDAE (p. 75)
– Antennae short, not extending beyond anterior region of abdomen (smaller species) ELIPSOCIDAE (p. 66)
6 Hind femora strongly dilated (fig. 118) ..... LIPOSCELIDAE (p. 37)
– Hind femora normal 7
7 Antennae of 20 or more segments, not secondarily annulated. Claws without a subapical tooth 8
– Antennae of not more than 17 segments, at least some flagellar segments with secondary annulations. Claws with a subapical tooth 9
8 Head short, broad. Maxillary palpi with conical sensillum on inner side of second segment (fig. 94). Hind tibia and tarsus together shorter than abdomen TROGIIDAE (p. 29)
– Head long, vertical. Maxillary palpi without conical sensillum on inner side of second segment. Hind tibia and tarsus together longer than abdomen PSYLLIPSOCIDAE (p. 35)
9 Compound eyes reduced to few (up to 10) ommatidia .... SPHAEROPSOCIDAE (p. 45)
– Compound eyes larger, normal ..... PACHYTROCTIDAE (p. 42)
10 Head elongate; labrum traversed by two strongly sclerotized ridges, converging anteriorly. Lacinia with apex broadened and divided into about 7 tines (fig. 134). Antennae long ..... EPIPSOCIDAE (p. 45)
– Head normal; labrum without traversing sclerotized ridges. Lacinia with apex not divided into several tines (fig. 23). Antennae short .... ELIPSOCIDAE (p. 66)
11 Tarsi 3-segmented 12
— Tarsi 2-segmented 17
12 Antennae with many (more than 20) segments, not secondarily annulated. Claws with or without a subapical tooth 13
— Antennae with fewer (up to 17) segments, at least some flagellar segments with secondary annulations. Claws with a subapical tooth 16
13 Body, wings and legs with flattened scales. Claws with a subapical tooth LEPIDOPSOCIDAE (p. 27)
— Body, wings and legs without scales. Claws without a subapical tooth 14
14 Head elongate. Maxillary palpi without a conical sensillum on inner side of second segment ..... PSYLLIPSOCIDAE (p. 35)
— Head normal, short. Maxillary palpi with a conical sensillum on inner side of second segment 15
15 Lacinia with apex divided into few large tines ..... TROGIIDAE (p. 29)
— Lacinia with apex divided into 2 tines ..... PSOQUILLIDAE (p. 33)
16 Compound eyes reduced to a few (up to 10) ommatidia .. SPHAEROPSOCIDAE (p. 45)
— Compound eyes larger, normal ..... PACHYTROCTIDAE (p. 42)
17 Claws with a subapical tooth; pulvillus narrow 18
— Claws without a subapical tooth; pulvillus broad 19
18 Brachypterous or micropterous forms lack areola postica in forewing. (♂) Phallosome with parameres fused anteriorly and posteriorly to form closed frame, pointed posteriorly; penial bulb with complex radular sclerites. Hypandrium simple. (♀) Subgenital plate with strongly developed median posterior lobe. Gonapophyses complete ..... PERIPSOCIDAE (p. 58)
— Brachypterous or micropterous individuals with areola postica in forewing. (♂) Phallosome usually Y-shaped, not forming closed frame. Hypandrium frequently with strongly curved or hooked processes. (♀) Subgenital plate simply rounded or emarginate. Gonapophyses reduced to external valve LACHESILLIDAE (p. 55)
19 Brachypterous or micropterous forms lack areola postica in forewing. (♂) Ninth tergite with strongly developed clunial comb. Phallosome with penial bulb bearing complex, often asymmetrical, radular sclerites. (♀) Subgenital plate bilobed, with strong setae at the apex of each lobe. Gonapophyses complete ECTOPSOCIDAE (p. 56)

— Brachypterous or micropterous forms with areola postica in forewing. (♂) No clunial comb. Phallosome with penial bulb having symmetrical rugose sclerifications. (♀) Subgenital plate simple. Gonapophyses with external valve greatly reduced; dorsal and ventral valves slender and pointed.....20
20 Pterostigma with crossvein from posterior apex to Rs ....STENOPSOCIDAE (p. 53)
— Pterostigma without crossvein to Rs .....CAECILIIDAE (p. 47)
21 Tarsi 3-segmented 22
— Tarsi 2-segmented 29
22 Venation greatly reduced; forewing with only two longitudinal veins which become evanescent before reaching margin.....LIPOSCELIDAE (p. 37)
— Venation more complex.....23
23 Antennae with 20 or more segments.....24
— Antennae with at most 17 segments, usually less.....26
24 Body, wings and legs covered with flattened scales. Claw with subapical tooth LEPIDOPSOCIDAE (p. 27)
— Body, wings and legs without scales. Claw without subapical tooth.....25
25 Maxillary palpi with conical sensillum on second segment. In forewing, Cu2 and 1A end separately on posterior margin. Pulvillus fairly broad, apex expanded PSOQUILLIDAE (p. 33)
— Maxillary palpi without conical sensillum on second segment. In forewing, Cu2 and 1A meet on posterior margin. Pulvillus narrow....PSYLLIPSOCIDAE (p. 35)
26 Antennae with 15 segments, annulations on distal flagellar segments. Wings elongate, apically rounded, and held flat on abdomen in repose PACHYTROCTIDAE (p. 42)
— Antennae with never more than 13 segments, not secondarily annulated. Wings not held flat on abdomen in repose.....27
27 Veins and wing margins completely glabrous.....MESOPSOCIDAE (p. 75)
— Veins and wing margins with setae.....28
28 Hindwing marginal setae limited to radial fork; setae not crossing ELIPSOCIDAE (p. 66)
— Hindwing marginal setae more extensive; setae crossing..PHILOTARSIDAE (p. 73)
29 Areola postica present in forewing.....30
— Areola postica absent in forewing.....36
30 Head elongate, labrum traversed by two sclerotized ridges which converge anteriorly EPIPSOCIDAE (p. 45)
— Head not markedly elongate, labrum without sclerotized ridges.....31
31 Areola postica in forewing joined to media.....32
— Areola postica in forewing free, not joined to media.....33
32 Areola postica completely fused to media.....PSOCIDAE (p. 77)
— Areola postica joined by crossvein to media.....STENOPSOCIDAE (p. 53)
33 Forewings completely glabrous.....LACHESILLIDAE (p. 55)
— Forewings setose 34
34 Hindwings glabrous except for marginal setae in radial fork..ELIPSOCIDAE (p. 66)
— Hindwing with whole of margin setose.....35
35 Posterior margin of hind wing with long and short setae alternating (fig. 237) TRICHOPSOCIDAE (p. 66)
— Posterior margin of hindwing with long setae only.....CAECILIIDAE (p. 67)
36 Claws with a subapical tooth, pulvillus narrow; genitalia as couplet 18(i) PERIPSOCIDAE (p. 58)
— Claws without a subapical tooth, pulvillus broad; genitalia as couplet 19(i) ECTOPSOCIDAE (p. 56)

SYSTEMATIC ACCOUNT

Family **Lepidopsocidae** (figs. 63–73)

Belonging to the Trogiomorpha.

Antennae with 20–50 segments, without secondary annulations. Forewings, legs and body clothed with scales. Forewing usually acuminate; pterostigma unthickened; wing coupling a simple row of comb-like teeth. Tarsi 3-segmented; claws strongly curved near apex, with one or more subapical teeth and sometimes smaller subsidiary

teeth; pulvillus fine, may be expanded at apex. Paraprocts with strong anal spine; defined trichobothrial field absent, but usually some setae with basal rosettes. Gonapophyses reduced; a large elongate setose external valve and a small (sometimes absent) lightly sclerotized dorsal valve. Phallosome with anteriorly divergent parameres.

Four British species, of which three are rare casual introductions and one, *Pteroxanium kelloggi*, well established and widely distributed in litter and more rarely on vegetation. This species is found in many parts of the world and may also have been distributed through commerce. The world species are at present distributed in about 15 genera, found predominantly in the tropics with a few species extending into temperate regions. Some are known to frequent bark, others are found in litter and similar habitats, and several are associated with domestic habitats—having been found on house walls and in stored products. About 100 species have been described, and others are known.

The British species represent different genera:

Key to Species

1 Macropterous 2
– Brachypterous 3

2 Forewing broad, the subcosta not divided into two parts. Hindwing with anterior border sinuous. Claw with two subapical teeth (fig. 67). Apical segment of maxillary palp obliquely truncate. Three ocelli close together, the anterior one small. Antennal joints long in relation to width (Forewing length about 2·5 mm., forewing membrane dark blackish brown; scales dark brown, sometimes appearing reddish; a row of yellow marginal setae; veins dark brown; fig. 64)

Soa flaviterminata Enderlein, 1906

A single record in stored products. This widely-distributed species represents a genus with about five known species, apparently mainly frequenting leaf litter and dead foliage in the tropics. The yellow marginal setae distinguish it from other known species, and the subcosta of the forewing and sinuous hindwing border separate the genus from other Lepidopsocidae.

– Forewing acuminate, with two parts to subcosta. Hindwing with anterior border smoothly rounded. Claw with one subapical tooth. Three widely separated ocelli. Antennae 24-segmented, segments long in relation to width. (Forewing length about 2·6 mm.; forewing membrane hyaline, scales brownish yellow, with large marginal patches of silver scales in each cell; marginal setae long, brown; hindwing veins pale brown; figs. 63, 66)

Nepticulomima sakuntala Enderlein, 1906

A single record in stored products. This species was described from specimens found indoors in Ceylon. About 15 species of the genus have been described, all from the tropics.

(Both the above species are representatives of the subfamily Perientominae, which may be characterized in part by having antennae with less than 30 segments (often broken in preserved specimens), with most segments about four times as long as wide. The following two species have more than 30 antennal segments, which are only about twice as long as wide).

3 Forewings reduced to small scale-like lobes, which extend back only to the anterior region of the abdomen; these are apically rounded, and have no trace of venation (fig. 73), hindwing absent; claw with single subapical tooth (fig. 69). (Pale yellow, with dark blackish red longitudinal bars on head as in fig. 72)

Lepolepis bicolor Broadhead, 1955

A single record from stored products; this species was described from a single specimen found in West African groundnuts. Two other species have been described in this unusual genus, which is usually separated as a distinct subfamily within the Lepidopsocidae; one of these is from eastern North America, the other from Ceylon and Formosa.

Forewings acuminate, extending about half the length of the abdomen; venation greatly reduced. Hindwing absent or represented by small vestiges; claw with single subapical tooth and few small basal serrations (fig. 68). (Head marking, shown in fig. 70, is characteristic for this species; the tibiae each have two dark bands) ..... **Pteroxanium kelloggi** (Ribaga, 1905) (=*Lepidilla kelloggi* Ribaga, 1905; *Hyperetes britannicus* Harrison, 1915; *Pteroxanium squamosum* Enderlein, 1922; *Tasmanopsocus littoralis* Hickmann, 1934).

This species is found in leaf litter and, more rarely, on vegetation. It has been recorded also from North America, Argentina, Australia and New Zealand. One other species of the genus has been described, from Chile, and differs considerably in colour and pattern.

Family **Trogiidae** (figs. 74–94)

Belonging to the Trogiomorpha.

Antennae with more than 20 segments, without secondary annulations. No scales. Maxillary palpi with conical sensillum on inner border of second segment. Wings are absent or weakly developed: small forewing rudiments are found in some genera. Tarsi 3-segmented; claws without subapical tooth, pulvillus fine. Paraprocts with strong anal spine; no trichobothria.

Gonapophyses reduced to elongate external valve, but small dorsal valve sometimes present; spermatheca with conspicuous accessory bodies (maculae). Phallosome with complex aedeagus and anteriorly divergent parameres.

Six British species, all of which are found in stored products, but one (*Cerobasis guestfalica*) is also abundant on bark of many kinds of tree and sometimes in other habitats. One (*C. annulata*) is a rare introduction, but the others appear to be widely distributed, and sometimes common.

Under 20 living species of this family have been described, and three fossil species comprise the subfamily Empheriinae. The subfamily Trogiinae contains all living forms, some of which are associated with litter or low vegetation, but most with human habitation.

Three genera are represented in Britain.

Key to Genera

1 Hind tibia with two apical spines and one or two preapical spines. Basal segment of hind tarsus with 8 plantar spines in irregular double row (fig. 89). (Head with strongly contrasted markings) ..... **Cerobasis** Kolbe (p. 29) (=*Hyperetes* Kolbe, 1880; *Myopsocnema* Enderlein, 1905; *Tichobia* Kolbe, 1882; *Cerobasis* Kolbe, Roesler, 1943).

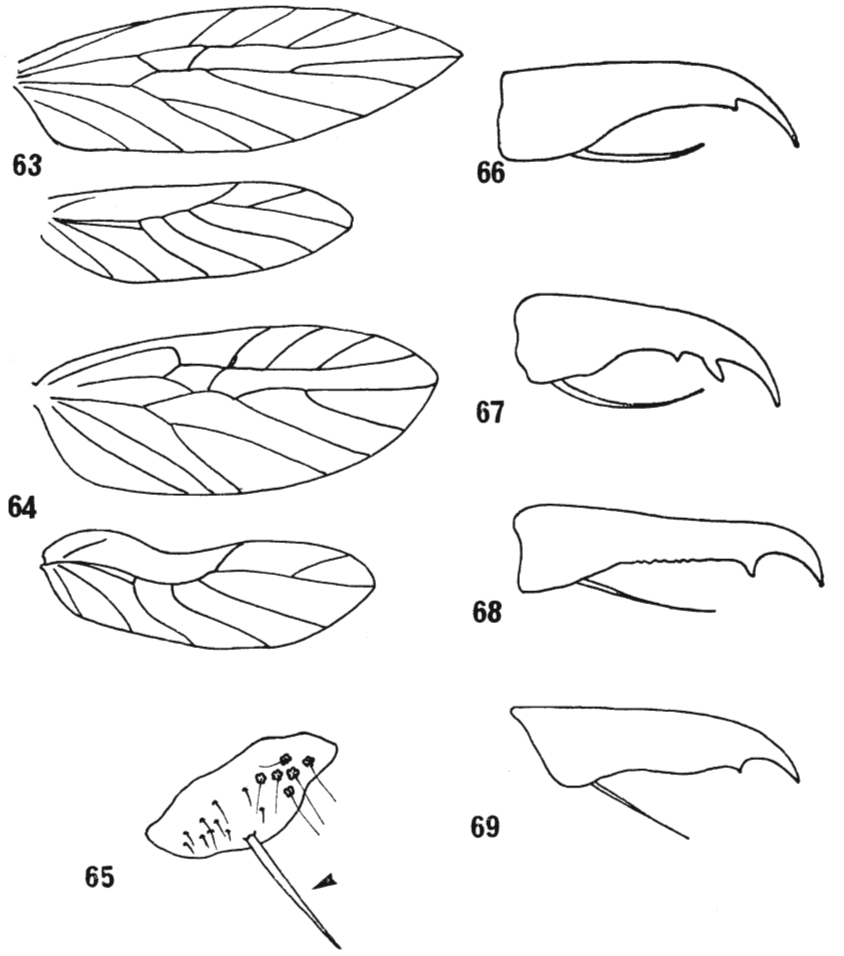
– Hind tibia with two apical spines, and no preapical spines. (No well-defined contrasted head markings) 2

2 Apical segment of maxillary palp more than twice as long as wide (fig. 93). Basal segment of hind tarsus with 3 or 4 plantar spines ..... **Lepinotus** Heyden (p. 31) (= *Paradoxides* Motschulsky, 1851; *Paradoxenus* Motschulsky, 1852; *Cuixa* Navas, 1927; *Heterolepinotus* Obr., 1948).

– Apical segment about twice as long as wide (fig. 94). Basal segment of hind tarsus with 2 plantar spines ..... **Trogium** Illiger (p. 32) (= *Atropos* Leach, 1815; *Clothilla* Westwood, 1841).

Genus **Cerobasis** Kolbe, 1882

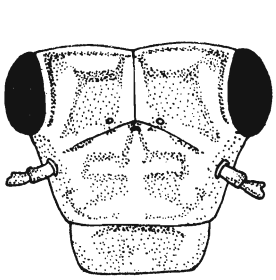
Two British species. About 15 species of this widely distributed genus are known, not all yet described.

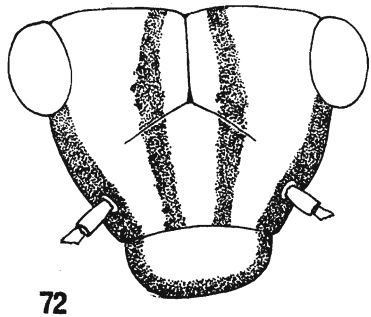


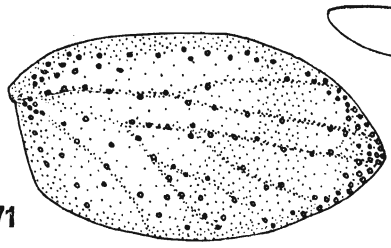
FIGS. 63–69.—Lepidopsocidae. (63) Fore and hind wings of *Nepticulomima sakuntala* to show venation. (64) Fore and hindwings of *Soa flaviterminata*. (65) Paraproct, to show small trichobothrial field and strong "anal spur". (66–69) Claws, (66) *Nepticulomima*, (67) *Soa*, (68) *Pteroxanium kelloggi*, (69) *Lepolepis bicolor*. (63, 64, 66, 67 *after* Enderlein 1906, 69 *after* Broadhead, 1955.)

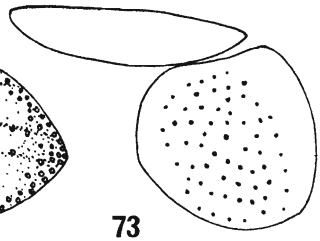
KEY TO SPECIES

1 Apterous. Head marked as in fig. 84, with complete anchor-shaped mark on frons; abdomen marked with 7 or 8 rows of dots, sometimes coalesced into stripes laterally. (♀ with well-developed spermatheca (fig. 85) having pronounced sclerotized "lip"; the nodulose patches of small papillae enclosed in a granular ring; ♂ hypandrial brush with about 100 setae (*teste* Pearman)
guestfalica Kolbe, 1880
(*muraria* Kolbe, 1882)
Female abundant on bark, fences and similar structures; ♂ extremely rare—apparently only one British example. A very widely distributed domestic species.









FIGS. 70–73.—Lepidopsocidae. (70) Anterior aspect of head and (71) forewing of *Pteroxanium kelloggi*. (72), (73) The same of *Lepolepis bicolor*. (72, 73 *after* Broadhead, 1955).

– With small rudimentary forewings, bearing 7–12 dark spots. Head patterning as in fig. 87, the anchor-shaped mark incomplete. (Female, spermatheca of usual Trogiid form; ♂ brush as in above species).....**annulata** (Hagen, 1865)
Very rare, occasionally found in buildings and warehouses. Apparently established, but sometimes imported in stored products. Known also from North America and the Canary Islands.

Genus **Lepinotus** Heyden, 1850

Three British species, all occurring in domestic situations and widely distributed in other parts of the world. Seven species have been described in this genus: a key to the world species was given by Badonnel (1969).

KEY TO SPECIES

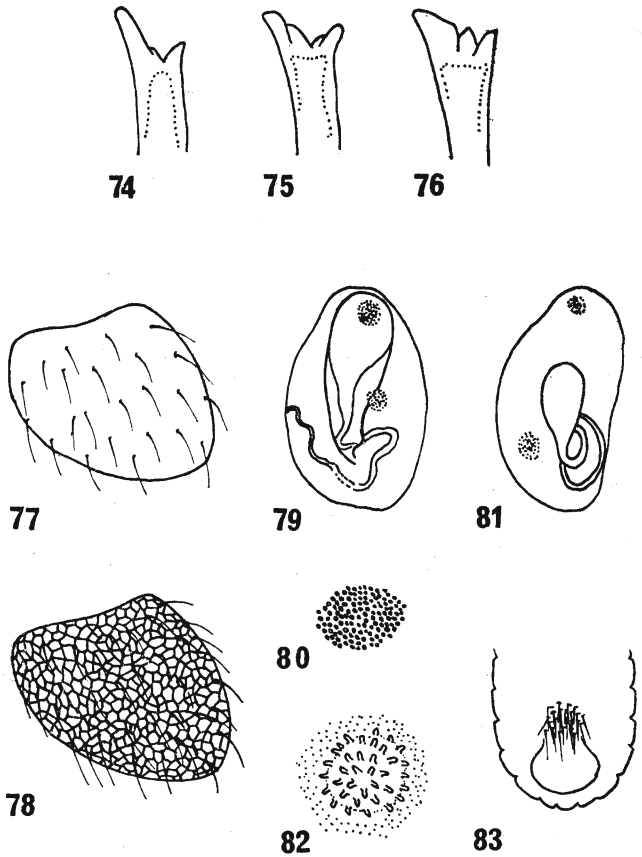
1 Forewing with reticulate sculpturing as in fig. 78; no spermatheca (♂ unknown) **reticulatus** Enderlein, 1905
– Forewing not reticulated (fig. 77); a spermatheca containing two maculae present in the female.....2
2 Spermathecal maculae with pores and papillae (fig. 82). Lacinia with two apical tines. Male hypandrial brush with about 20 setae....**inquilinus** Heyden, 1850
– Spermathecal maculae with pores, without papillae (fig. 80). Lacinia with three apical tines. Male hypandrial brush with about 30 setae **patruelis** Pearman 1931

Genus **Trogium** Illiger, 1798

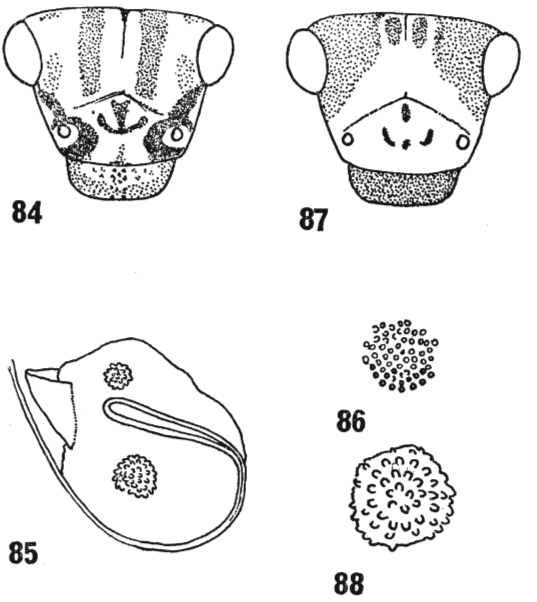
One species, which may be adequately characterized as follows:

– Forewings represented by small prominences; apical segment of maxillary palp broad; lacinia with three apical tines; pale creamy yellow, eyes reddish yellow; head with median longitudinal reddish-brown stripe; partial bands of similar colour across anterior abdominal tergites in some specimens **pulsatorium** (L.)

Almost cosmopolitan and associated with domestic situations. It has been found in many parts of Britain.



FIGS. 74–83.—Trogiidae: *Lepinotus*. (74–76) Apex of lacinia of (74) *L. reticulatus*, (75) *L. inquilinus* and (76) *L. patruelis*. (77–78). Forewings of (77) *L. inquilinus*, (78) *L. reticulatus*. (79–82) Spermathecae and single enlarged spermathecal maculae of (79, 80) *L. patruelis*, (81, 82) *L. inquilinus*. (83) Ventral aspect of male abdomen to show group of hypandrial setae—the "brush". (79–83 partially *after* Pearman, 1931).



FIGS. 84–88.—Trogiidae: *Cerobasis*. (84–86, 88) *C. guestfalica:* (84) anterior aspect of head, (85) spermatheca, (86, 88) spermathecal maculae. (87) *C. annulata*, anterior aspect of head. (85, partially *after* Pearman sketch).

Family **Psoquillidae** (figs. 95–97)

Belonging to the Trogiomorpha.

Antennae with 22 segments, not secondarily annulated; maxillary palpi with conical sensillum on second segment. Lacinia narrow, with apex divided into two tines. No ocelli. Forewing with rounded apex, and Cu2 and 1A reaching hind margin separately; sometimes brachypterous. Tarsi 3-segmented; claws without a subapical tooth; pulvillus fairly broad, with apex expanded. Paraprocts with a strong anal spine. Gonapophyses reduced to an elongate external valve; a small dorsal valve present in some forms. Spermatheca complex and with accessory structures; with some sclerotization. Phallosome with complex median aedeagus and anteriorly divergent parameres.

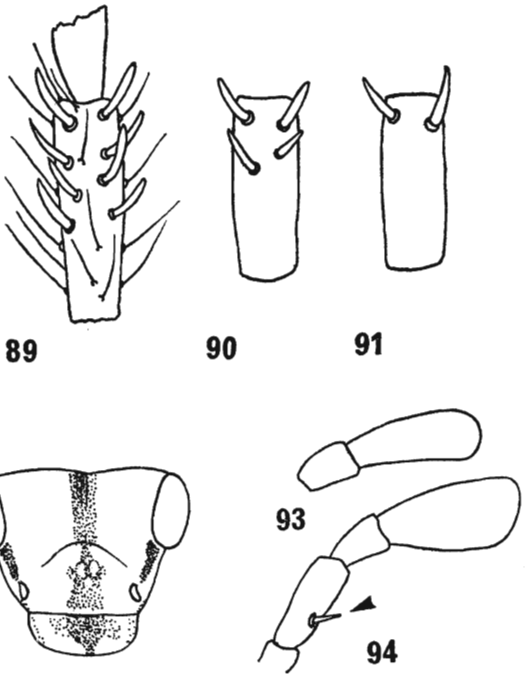
Three British species, all rare introductions in stored products. Some twenty species of this family have been described, and some are associated with dead foliage. They may also be found on bark, in nests and buildings, and are a predominantly tropical family. Members of two of the four described genera have been captured in Britain. The genera are very similar in many characters, and species in both may be macropterous or brachypterous.

KEY TO GENERA

1 Forewing predominantly black, with white or hyaline lunules as in fig. 97; Cu2 usually shorter than stem of cubital fork, sometimes of about the same length **Psoquilla** Hagen (p. 34)

(= *Heteropsocus* Vorrill, 1902).

3



FIGS. 89–94.—Trogiidae. (89–91) Basal hind tarsal segments, ventral aspect to show plantar spines of (89) *Cerobasis*, (90) *Lepinotus*, (91) *Trogium*. (92) *T. pulsatorium*, anterior aspect of head. (93–94) Maxillary palpi: (93) apical two segments of *Lepinotus*, (94) *Trogium*, to show spine on second segment.

– Forewing hyaline, as in fig. 95; Cu2 usually longer than stem of cubital fork **Rhyopsocus** Hagen (p. 34)
(= *Deipnopsocus* Enderlein, 1903b; *Rhyopsocopsis* Pearman, 1929).

Genus **Psoquilla** Hagen, 1865

A single British species.....**marginepunctata** Hagen, 1865
(= *Heteropsocus dispar* Verrill, 1902).

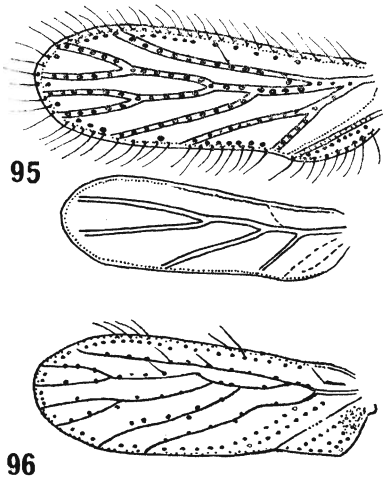
Imported occasionally in stored products. It can be distinguished readily on wing pattern from all other Psocoptera. One further species has been described in this genus (*P. infuscata* Badonnel, 1949, from the Ivory Coast).

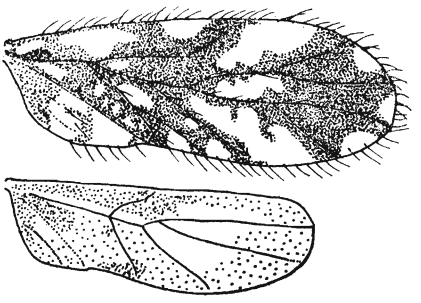
P. marginepunctata *is extremely widely distributed and appears to be almost cosmopolitan in domestic situations.*

Genus **Rhyopsocus** Hagen, 1876

Twelve described species, found on dead foliage, in bird nests and in domestic situations, and recorded from Africa, North and South America. All have venation of the type shown in fig. 95 and, although the two British forms were originally described in separate subgenera, there seem to be few grounds for maintaining these.

The exact status of the two British "species" is uncertain. Both are





FIGS. 95–97.—Psoquillidae: wings. (95) Fore and hind wings of *Rhyopsocus disparilis*. (96) Forewing of *Rhyopsocus peregrinus*. (97) Fore and hind wings of macropterous *Psoquilla marginepunctata*. (95, 96 *after* Pearman, 1931, 1929).

introduced, but their countries of origin are not certain. Neither has been examined in detail, and comparison with other described species is necessary to confirm their identity.

KEY TO SPECIES

1 Anal margin of forewing sharply angled at base (fig. 96); forewings considerably larger than hindwings. Head and thorax dark brown
peregrinus (Pearman, 1929)
(=*Rhyopsocopsis peregrinus*)
One specimen, sex undetermined, found in store in Manchester. Not confirmed elsewhere, but apparently similar to some African forms.

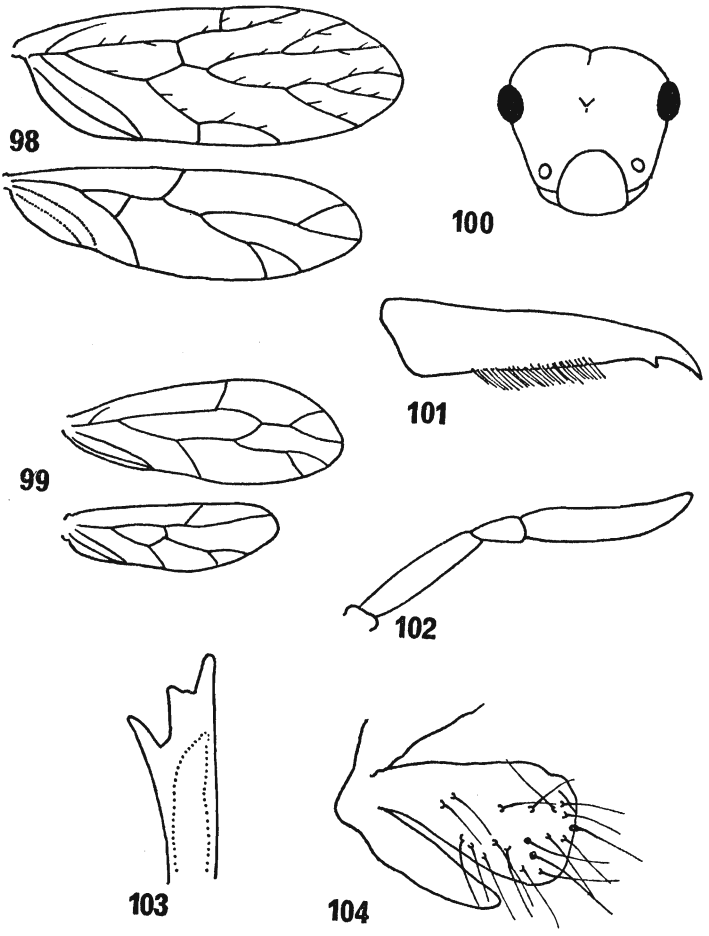
Anal margin of forewing smoothly rounded (fig. 95); forewing only slightly longer than hindwing; males macropterous, known females brachypterous. Head and thorax pale brown ..... **disparilis** (Pearman, 1931)
(=*Deipnopsocus spheciophilus* var. *disparilis* Pearman, 1931; *Deipnopsocus disparilis* Pearman, Badonnel 1949).
Ten specimens in Accra Cacao, London; few individuals in ships holds. Not known elsewhere.

Family **Psyllipsocidae** (figs. 98–104)

Belonging to the Trogiomorpha.

Antennae of more than 20 segments, not annulated. Head vertical, genae long. No ocelli. Maxillary palpi without conical sensillum on second segment. Lacinia apex divided into few large tines. Forewing with pterostigma unthickened; areola postica long; Cu2 and 1A meet together on hind margin. Tarsi 3-segmented; claws with very weakly developed subapical tooth; pulvillus narrow. Gonapophyses reduced; external valve broad, membranous, setose; dorsal valve small; ventral valve extremely small. Phallosome with complex aedeagus and anteriorly divergent parameres.

One British species, associated with domestic situations and almost cosmopolitan, sometimes found in caves. The 22 described species in this



FIGS. 98–104.—*Psyllipsocus ramburii*. (98) Fore and hind wings. (99) Wings of brachypterous form. (100) Anterior aspect of head. (101) Tarsal claw. (102) Maxillary palp. (103) Apex of lacinia. (104) Gonapophyses. (99 *after* Badonnel, 1943).

family are placed in five genera, all distinctive, and mostly occur in human habitations or caves. Some 15 species are included in *Psyllipsocus*.

Genus **Psyllipsocus** Sélys-Longchamps, 1872

(= *Nymphopsocus* Enderlein, 1903c; *Ocelloria* Weber, 1906; *Ocellatoria* Weber, 1907, *Fita* Navas, 1913; *Fabrella* Lacroix, 1915).

One British species, **ramburii** S-L., 1872 (= *Nymphopsocus destructor* Enderlein 1903c).

Occurs in many polymorphic forms; the wings are sometimes absent, and many degrees of brachyptery are found, the morphs having sometimes been given "varietal" names. About 2·5 mm. long, usually very pale brown or greyish, with abdominal apex darker; wings hyaline with venation brown; eyes black, ocelli reddish brown. Apex of lacinia with three strong teeth; apical segment of maxillary palp elongate, tapered. Tarsal claw with reduced subapical tooth and basal row of small fine processes (fig. 101). Gonapophyses as in fig. 104; ♂ unknown. Paraproct without strong anal spine. Hind tibia and tarsus long, leg extending well beyond abdominal apex.

Separation from American species is described by Gurney, 1943. Representatives of two further genera of Psyllipsocidae have been recorded in domestic situations in Europe, and may be rarely imported into Britain. These are *Dorypteryx* Aaron, 1883 (small (1–2 mm. long)) pale insects, characterized by the long narrow forewing with venation reduced to two longitudinal veins; hind wing absent; lacinia with four short apical tines) and *Psocatropos* Ribaga, 1899 (small (to 1·4 mm. long); forewing acuminate, reduced in size and venation; hindwing very small; lacinia with three apical teeth).

Family **Liposcelidae** (figs. 105–124)

Belonging to the Troctomorpha.

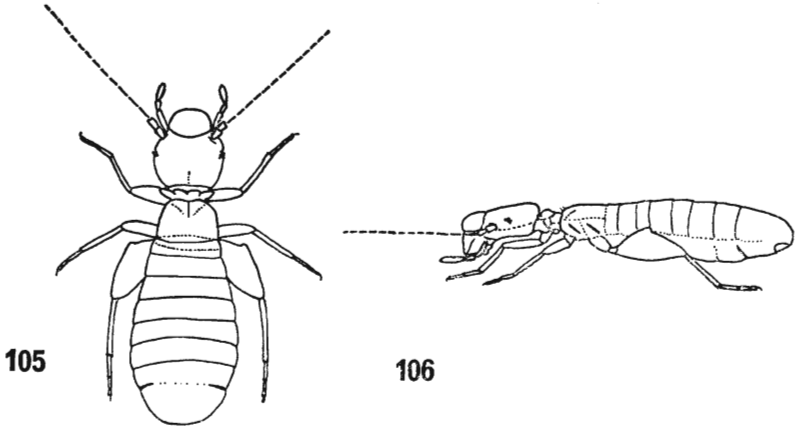
Body strongly depressed dorsoventrally, abdomen elongated. Antennae usually 15-segmented, relatively short and flagellum with secondary annulations. Epicranial suture almost obsolete, indicated by slight break in sculpturing in most species. Eyes greatly reduced in many forms. Pronotum divided into three lobes. Meso- and metathorax fused in apterous specimens, separate in (rare) winged forms; thoracic sterna very broad. Hind femora strongly dilated; tarsi 3-segmented, claw with one subapical tooth. Wings elongate, rounded at apex; venation greatly reduced—forewing with two longitudinal veins (R and M) both unbranched and becoming evanescent before wing margin. Apical abdominal tergites fused. Gonapophyses complete; external valve broad. Phallosome with complex aedeagus and curved parameres.

Two genera, and nineteen species of this family have been recorded in Britain, the majority being casual imports. Only four of them have been found in outdoor, "natural" situations. The large genus *Liposcelis* comprises the well-known "booklice" and *Embidopsocus* are species predominantly found under bark (Broadhead, 1947b, 1950). Most species are small (< 1–1·8 mm.).

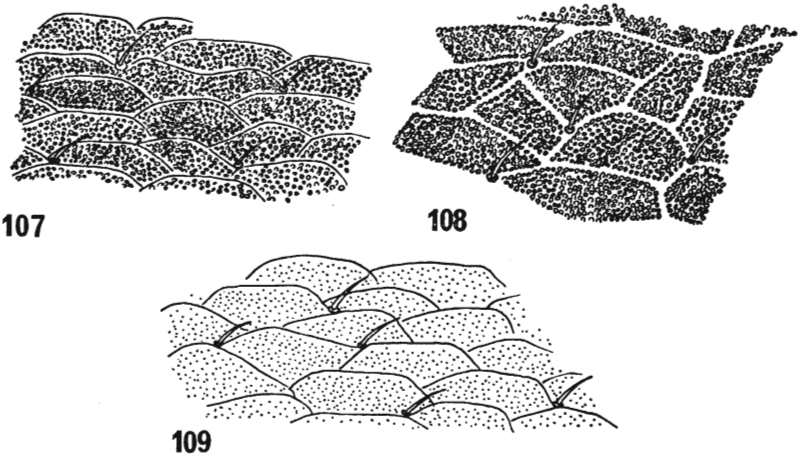
The taxonomy of both genera is complicated and, whereas superficial colour characters are sometimes of value, detailed examination of body sculpturing and of the arrangement of setae on the thorax and abdominal apex is usually necessary, as well as accurate measurements of setal length. Identification to species level can only be achieved from microscopical preparations, and casual examination of whole unmounted insects is likely to lead to error. *Liposcelis* are all apterous, and *Embidopsocus* dimorphic; males and some females are apterous, but a few females macropterous.

Key to Genera

1 Hind femora with small peg-like prominence on outer edge at point of greatest width (fig. 119). Hind tibia without apical spur. Female subgenital plate with T-shaped sclerite (fig. 114). (Apterous, moderately depressed, no ocelli, eyes of 2–8 ommatidia) ..... **Liposcelis** Motschulsky (p. 39) (= *Troctes* auct.: for detailed synonymy, and discussion of this name see Broadhead 1950, 1952; Pearman 1952).

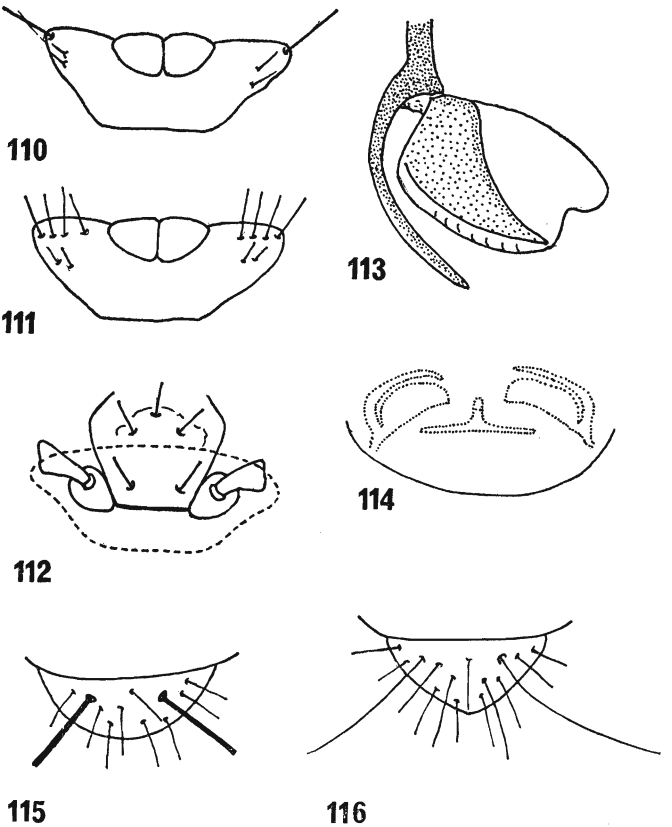


FIGS. 105–106.—*Liposcelis* sp., general facies. (105) dorsal; (106) lateral.



FIGS. 107–109.—Liposcelidae: sculpturing of third abdominal tergites of *Liposcelis* spp. (107) *L. mendax*—areas of tubercles separated by arched lines. (108) *L. simulans*—areas of tubercles bordered by rows of tubercles. (109) *L. pubescens*—areas of fine dots separated by arched lines. (Anterior towards top of page.)

– Hind femora without a peg-like prominence on outer edge. Hind tibia with strong apical spur. Female subgenital plate without a T-shaped sclerite. (Extremely depressed, apterous or macropterous: in winged forms large eyes and ocelli; in apterous forms, eyes of two ommatidia only, and no ocelli)
Embidopsocus Hagen (p. 41)
(=*Tropusia* Hagen, 1883; *Stenotroctes* Enderlein, 1905; *Embidotroctes* Enderlein, 1905; *Trigonosceliscus* Enderlein, 1910).



Figs. 110–116.—Liposcelidae: *Liposcelis*. (110–111) Dorsal aspect of prothorax of (110) *L. liparus*, (111) *L. pubescens*. (112) Prosternal region of *L. paetus*. (113) Gonapophyses, general form. (114) Ventral aspect of apex of female abdomen to show position of gonapophyses and "t-shaped sclerite" (dotted). (115–116) Epiproct of (115) *L. mendax*, (116) *L. liparus* (*partially after* Broadhead, 1950).

Genus **Liposcelis** Motschulsky, 1852

Sixteen recorded British species, of which only three are known to occur out-of-doors (*L. bicolor*, *myrmecophilus*, *terricolis*), the rest being associated with domestic situations and stored products. Some of these are extremely rare and have been recorded from very few specimens; others appear to be widely distributed and common. The following key is based largely on that of Broadhead (1950), and it is emphasized that all determinations should be checked against the more detailed descriptions given in his paper or in Pearman (1951) (*L. gallicus*), Broadhead (1954a) (*L. obscurus*, *L. mendax*) (1955) (*L. albothoracicus*). About 50 valid species have been described in this genus and, as only females are known for some British species, the sexes are keyed separately. Many species of *Liposcelis* have been identified under

the name of "*divinatorius*" Mueller, but it is at present impossible to state to which the name is properly applied. Pearman's (1946) redescription of "*divinatorius*" apparently refers to *terricolis* Badonnel, and it is preferable to avoid further indiscriminate use of this name.

Key to Species

1 Males (elongate phallosome usually visible from ventral surface) 2
– Females (T-shaped sclerite present; gonapophyses of type shown in fig. 113) 12
2 Prothoracic sternum with one pair of apically truncated setae on posterior half (fig. 112) 3
– Prothoracic sternum with no apically truncated setae 4
3 Each eye with five ommatidia: body uniform medium brown **subfuscus** Broadhead, 1947a
In stored products, few records. England, Japan, Chile.
– Each eye with two or three ommatidia: abdomen yellow, head darker **paetus** Pearman, 1942
In stored products, England, Rhodesia, India.
4 Each eye with only two ommatidia (body very pale yellow) **paetulus** Broadhead, 1950
In buildings.
– Each eye with four or five ommatidia 5
5 Lateral lobe of pronotum with 2–4 long apically truncated setae 6
– Lateral lobe of pronotum with one long apically truncated seta 8
6 Body uniformly brown. Abdominal tergal sculpturing of transverse spindle-shaped areas lacking tubercles (fig. 109) ..... **pubescens** Broadhead, 1947a
In stored products, England, Argentina.
– Body either with reddish brown bands across abdomen or with the thorax white. Abdominal tergal sculpturing with distinct tubercles 7
7 Medium brown, with meso-metathorax and first abdominal segment white; reddish brown granules on pronotum and abdominal tergites II and III **albothoracicus** Broadhead, 1955
Imported in Turkish millet.
– Yellowish brown, with conspicuous dark reddish bands (interrupted medially) across abdomen ..... **entomophilus** (Enderlein, 1907) (=*bakeri* Pearman, 1928; *virgulatus* Pearman, 1929).
Predominantly stored products, very widely distributed.
8 Head and abdomen dark glossy brown, almost black. Thorax pale yellow **bicolor** (Banks, 1900)
On or under bark, Europe and North America.
– Body coloration different from above 9
9 A long slender seta with pointed apex present either side of the midline near the base of the epiproct: these setae longer than the basal width of the epiproct (fig. 116) ..... **liparus** Broadhead, 1947a
In buildings.
– No such fine setae, but the same positions having a broad, apically-truncated seta (fig. 115), shorter than the basal width of the epiproct 10
10 Abdominal tergal sculpturing of spindle-shaped areas separated by arched lines (fig. 107) ..... **mendax** Pearman, 1946
In buildings, Europe.
— Abdominal tergal sculpturing of spindle-shaped or polygonal areas separated by rows of tubercles (fig. 108) 11
11 Body pale to medium brown (anterior half of prothoracic sternum with three-five apically truncated setae) ..... **simulans** Broadhead, 1950
In buildings.
— Body deep reddish brown (anterior half of prothoracic sternum with two or three apically truncated setae) ..... **rufus** Broadhead, 1950
? In stored products, England and Chile.
12 Prothoracic sternum with one pair of apically truncated setae on posterior half .. 13
— Prothoracic sternum with no such apically truncated setae on posterior half 15
13 Each eye with two-four ommatidia ..... **paetus** Pearman, 1942

— Each eye with seven ommatidia....14
14 Humeral seta (fig. 110) about equal to, or always less than twice the length of, adjacent pronotal setae; areas of sculpturing separated by arched rows of tubercles ....**bostrychophilus** Badonnel, 1931 (=*granicola* Broadhead & Hobby, 1944).
Cosmopolitan—in litter, on bark, or in stored products).
— Humeral seta two to three times length of adjacent pronotal setae; areas of sculpturing separated by arched lines....**subfuscus** Broadhead, 1947a
15 Each eye with two ommatidia (body very pale yellow)..**paetulus** Broadhead, 1950
— Each eye with four to eight ommatidia....16
16 Each eye with four ommatidia....**obscurus** Broadhead, 1954a
In stored products, one record.
— Each eye with five to eight ommatidia....17
17 Body coloration: head and thorax very dark brown, abdomen pale yellowish brown **gallicus** Pearman, 1951
(N.B. The brief published description of this species, known only from the Scilly Isles and France, does not permit its inclusion in this key with full confidence. It is diagnosed in part as "similar to *meridionalis*", and is keyed here on structural characters of the latter species. Günther (1971) recorded "*L. gallicus*" from Mongolia and figured cuticular sculpturing, but it is not completely certain whether this record represents the same taxon.).
— Body coloration different from above....18
18 Lateral lobe of pronotum with at least four long, apically-truncated setae....19
— Lateral lobe of pronotum with three or fewer such setae....21
19 Uniformly dark brown. Abdominal sculpturing without tubercles **pubescens** Broadhead, 1947a
— Body coloration different from above. Abdominal sculpturing with tubercles..20
20 Body medium brown, with meso-metathorax and first abdominal segment white **albothoracicus** Broadhead, 1955
— Body yellowish brown, with dark reddish brown bands (interrupted medially) across abdomen ....**entomophilus** (Enderlein)
21 Each eye with eight ommatidia....**myrmecophilus** Broadhead, 1950
In ant nests.
— Each eye with four to seven ommatidia....22
22 Abdominal tergal sculpturing with spindle-shaped areas separated by arched lines **mendax** Pearman, 1946
— Abdominal tergal sculpturing with spindle-shaped areas, if present, separated by tubercles 23
23 Head and thorax very dark brown, almost black, thorax pale yellow **bicolor** (Banks, 1900)
— Body coloration different from above....24
24 A long slender seta with pointed apex either side of midline near base of epiproct, this seta longer than basal width of epiproct. Pronotum with two long apically truncated setae on each lateral lobe....**liparus** Broadhead, 1947a
— No such slender setae present on epiproct, but their positions occupied by a truncated seta which is shorter than basal width of epiproct. Pronotum with single humeral seta on each lateral lobe....25
25 Prothoracic sternum with two or three truncated setae on anterior half. Body deep reddish brown ....**rufus** Broadhead, 1950
— Prothoracic sternum with four to seven truncate setae on anterior half....26
26 Body medium brown. Abdominal terga III–V sculptured with irregular quadrilateral or pentagonal areas, sometimes weakly defined, each bearing tubercles **simulans** Broadhead, 1950
— Body yellowish brown. Abdominal terga III–V sculptured with transverse spindle-shaped areas each containing tubercles....**terricolis** Badonnel, 1945 (=*luridus* Broadhead, 1947a).
In stored products and litter, widely distributed.

Genus **Embidopsocus** Hagen, 1866

The study of this complex genus, many members of which are subcortical, and which appears to be especially diverse in Africa and South America,

has been hampered by its polymorphism. Three species have been recorded from Britain, only one of which (*E. enderleini*) is known to be native, and this is the only one for which macropterous females have been found.

Both *E. oleagina* and *E. minor* have been recorded only once from Britain, are known from few specimens, and have not been described in detail. As other species of *Embidopsocus* may well occur as casual imports, the value of discussing these two taxa in isolation is minimal. However, *minor* is still the smallest known form in the genus and was considered as a tentative synonym of *oleagina* by Badonnel (1955), who also discussed characters for separating species groups in *Embidopsocus*. All the British species are in Badonnel's Group II, characterized in part by having the sclerified bands of the mesothoracic sternum arched and not reaching the pro-mesothoracic spina (fig. 122). The main function of the following key is to characterize the native *E. enderleini*, and all other species should be carefully checked through keys of more comprehensive coverage (Badonnel, 1955; Mockford, 1963).

Key to Species

1 Lateral borders of pronotum making a strong angle with the posterior border of the prothorax; claws without denticles basal to subapical tooth (fig. 124). (Body 1·5–1·7 mm. long, medium brown; three fine setae before the lateral seta of the mesonotum) ..... **enderleini** (Ribaga, 1905) (=*Embidotroctes rectivenis* Pearman, 1925).

Subcortical on trees with laminated bark, such as Acer, Pinus; *rare, perhaps local, southern England; recorded elsewhere from Europe, Argentina, S. Africa.*

– Lateral borders of pronotum extending in a rounded arc to the posterior; claws with denticles basal to the subapical tooth (fig. 123) (cuticle with very fine granulations: all tibiae ending in a stout spine) ..... **oleagina** (Hagen, 1865) (*?=Stenotroctes minor* Pearman, 1931; *Embidopsocus minor* (Pearman). Badonnel, 1955).

Rare introduction(s). E. oleagina *was first recorded from Ceylon as "imported in English oilcake" (Hagen, 1865), and has since been recorded from Germany.* E. minor *is apparently paler in colour than* oleagina *(which was described in part as "head maroon-brown") and is smaller (♀ 1·37 mm., ♂ 0·9 mm., c.f.* oleagina *1·5 mm.). It was described from two specimens found in Accra cacao (Pearman, 1931): certainly imported, but no similar species have yet been described from West Africa.*

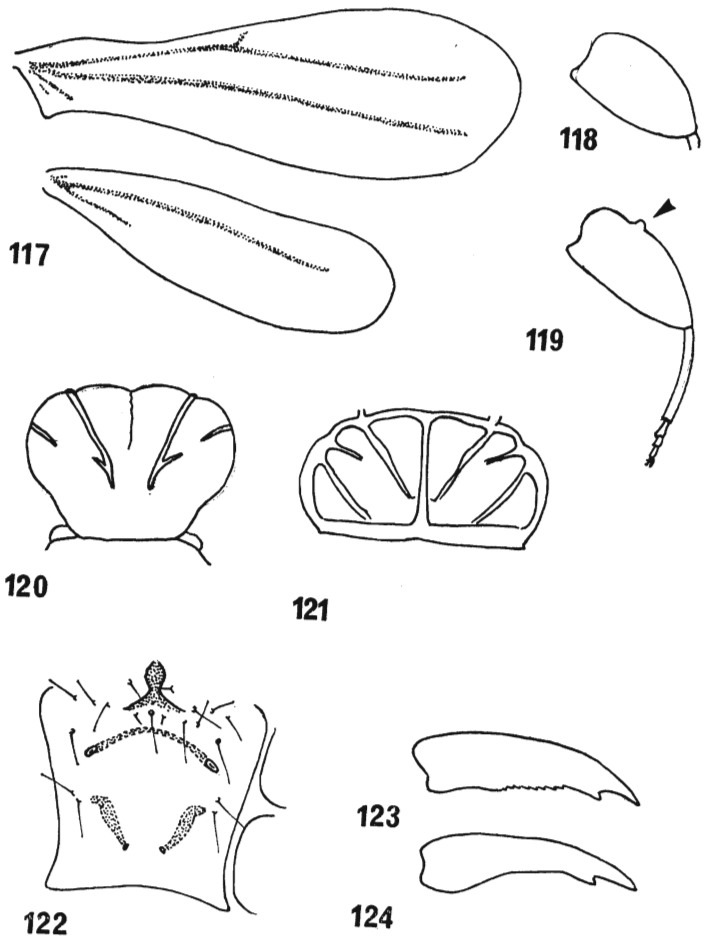
Family **Pachytroctidae** (figs. 125–129)

Belonging to the Troctomorpha.

Body not flattened dorsoventrally. Antennae with 15 or 17 segments, basal four or five flagellar segments not secondarily annulated. Lacinia with few apical teeth. Compound eyes large, even when insect apterous. Pronotum not divided into lobes; meso- and metathoracic nota not fused. Thoracic sterna narrow.

Hind legs long, almost always extending beyond abdominal apex. Hind femora normal, not dilated. Claw with subapical tooth. Wings, when present, elongate and rounded at apex; venation complete (fig. 125). Gonapophyses complete; external valve large, without setae; dorsal valve often broadened. Phallosome with complex aedeagus flanked by inwardly curved parameres.

One British species, described from a specimen found on Canary bananas —almost certainly a casual introduction. More than 40 species of the family have been described; these are at present placed in five genera, but only two of these (*Tapinella* Enderlein, 1908; *Pachytroctes* Enderlein, 1905) are at all well known. Together, these include some 35 described species and

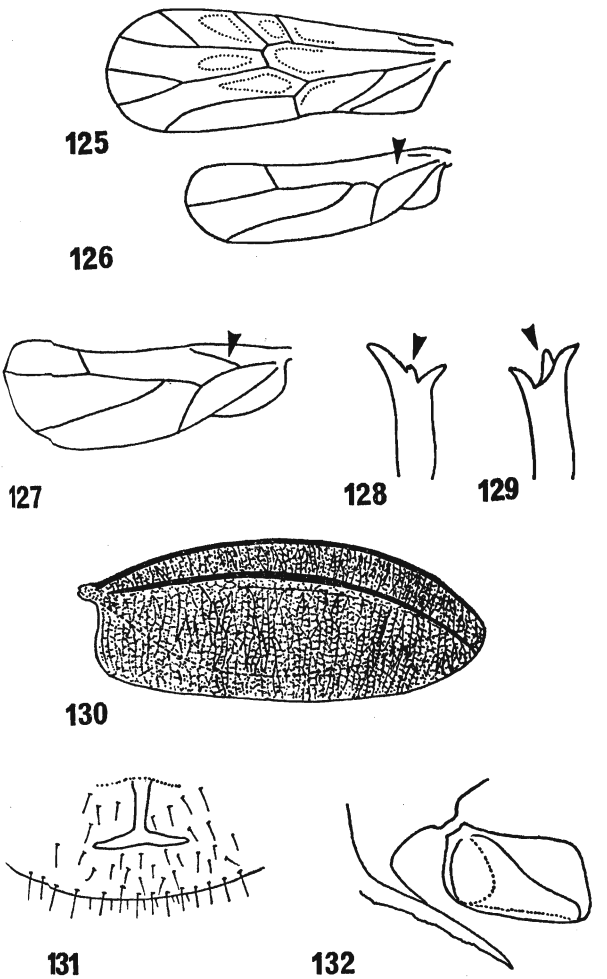


FIGS. 117–124.—Liposcelidae. (117) Fore and hind wings of *Embidopsocus enderleini*. (118–119) Hind femora of (118) *Embidopsocus* and (119) *Liposcelis*. (120–121) Dorsal aspect of prothorax of (120) *Embidopsocus enderleini*, (121) *E. congolensis* (species group containing *E. minor*). (122) Ventral aspect of pterothorax of *E. congolensis*. (123–124) Tarsal claws of (123) *E. congolensis*, (124) *E. enderleini*. (121, 122 *after* Badonnel, 1955).

are found on dead foliage, in litter, nests and domestic situations in many parts of the world. Apterous and winged forms are known in many species. The species recorded from Britain is briefly characterized as follows:

Deep reddish brown; forewing (fig. 125) translucent greyish brown with deeper brown patches of colouring in central areas, length 1·3 mm.; claws symmetrical

Tapinella castanea Pearman, 1932b



FIGS. 125–132.—Pachytroctidae, Sphaeropsocidae. (125) Forewing of *Tapinella castanea* (dotted areas browned). (126–127) Hindwings of (126) *Tapinella*, (127) *Pachytroctes*. (128–129) Apex of lacinia of (128) Tapinella, (129) Pachytroctes. (130) Forewing of *Badonnelia titei*. (131) Subgenital plate and (132) gonapophyses of *B. titei*. (125 *after* Pearman, 1932b; 130–132 *after* Pearman, 1953, 1958).

This species is not known elsewhere and, like other *Tapinella* species, may prove to be polymorphic. It appears to be closely related to several African species, amongst them *T. curvata* Badonnel, *T. africana* Badonnel and *T. squamosum* Badonnel (see comments in Badonnel, 1969, 1971), which do not have areas of contrasting colour on the forewing. In this sense, *Onychotroctes* Badonnel, which is differentiated from *Tapinella* s. str. by having the tarsal claws asymmetrical, is included with *Tapinella*. It is likely that

individuals of other Pachytroctidae may be rarely imported into Britain, and the two most likely genera are separated as follows:

Key to Genera

1 Hindwings with R1 present (fig. 127) (macropterous). Eyes not reaching vertex. Lacinia with three conspicuous tines at apex (fig. 129). Female subgenital plate without T-sclerite ..... **Pachytroctes**

– Hindwings with R1 absent (fig. 126) (macropterous). Eyes reaching level of vertex. Lacinia with two conspicuous tines at apex; the third tine very small (fig. 128). Female subgenital plate with T-sclerite..... **Tapinella**

Family **Sphaeropsocidae** (figs. 130–132)

Belonging to the Troctomorpha.

Body not depressed dorsoventrally. Antennae 15-segmented, with annulations on basal flagellar segments. Eyes of both alate and apterous forms composed of few (up to 10) ommatidia. Pronotum not divided into lobes; meso- and metathorax fused in apterous forms. Thoracic sterna narrow. If alate, only forewings are present: these are convex, thickened and elytriform, with reduced venation and a reticulate pattern on the membrane; brachypterous. Hind legs long; femora not dilated, claw with a subapical tooth. Gonapophyses complete; external valve large, and without setae; dorsal valve broadened. Phallosome with complex aedeagus, closed anteriorly, parameres curved inwards apically.

The single British species, found indoors at Tring (Herts.) represents a genus containing five known species and known also from France, Switzerland and Chile. The other eight known living species of Sphaeropsocidae are placed in the genus *Sphaeropsocopsis* Badonnel (1963), and occur in Australia (1), Africa (1) and South America (6). A fossil species (*Sphaeropsocus kunowii* Hagen, 1882) is also known. Generic differences include the numbers of main veins in the wing (*Badonnelia*—2, *Sphaeropsocopsis*—4) and the number of ommatidia (*Badonnelia*—7, *Sphaeropsocopsis*—3–10).

The European species is characterized as follows:

Female with elytriform forewings, male apterous. Head pale brown, eyes black, antennae and palpi greyish; forewing creamy white; thorax and abdomen creamy white, except basal and apical abdominal regions dark brown. Length c. 1·5 mm. Other features as in figs. 130–132..... **Badonnelia titei** Pearman, 1953

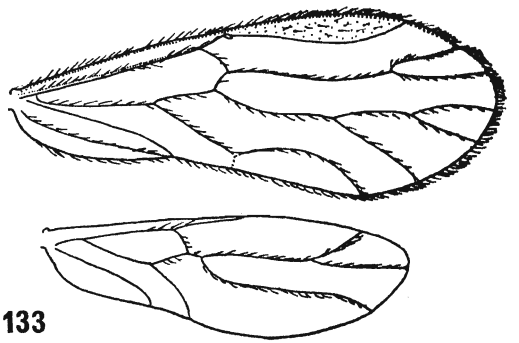
Status uncertain; possibly native, more probably introduced. Found in Britain only at Tring.

Other species in this genus are darker brown in colour, and have longer and denser body pubescence. Details of head sculpturing also differ, and the male phallosomes are distinctive (see notes in Badonnel, 1963, and Pearman, 1958).

Family **Epipsocidae** (figs. 133–136)

Belonging to the Psocomorpha.

Antennae 13-segmented. Head long and vertical; labrum with two internal sclerotized ridges running along it, usually converging anteriorly. Lacinial apex broadened and usually divided into many (7–10) tines (fig. 134). Outer edge of mandible bluntly angled. Tarsi 2-segmented; claws straight, with one subapical tooth; pulvillus fine. Macropterous, brachypterous or apterous; areola postica present in forewing, not joined to media; wing veins and margin setose; pterostigma free. Gonapophyses reduced; external valve elongate and setose; ventral valve, when present, long and pointed.



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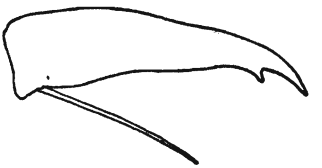

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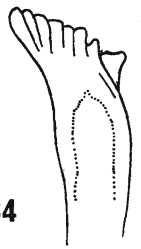

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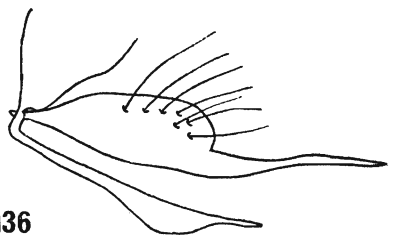

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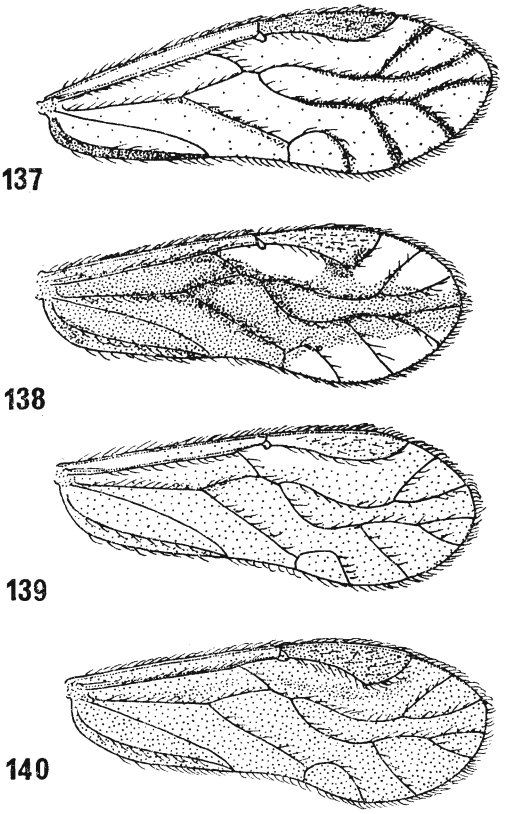
FIGS. 133–136.—Epipsocidae: *Epipsocus lucifugus*. (133) Fore and hind wings (♂). (134) Apex of lacinia. (135) Tarsal claw. (136) Gonapophyses.

Subgenital plate simple. Hypandrium simple. Phallosome usually open anteriorly and aedeagus forming a pointed posterior arch; parameres broad; sometimes with complex sclerification on penial bulb.

One native British species. Females are apterous and parthenogenetic, males macropterous and extremely rare—only about ten are known. This species is not known outside Europe, but two North American species (*Epipsocus crosbyanus* (Chapman, 1930) and *E. lepicidinarius* (Chapman, 1930)) appear to be very closely related. The three species are sometimes separated from *Epipsocus* Hagen (1866) as the genus *Bertkauia* Kolbe (1882), but other workers consider the correct status of the latter taxon is a subgenus.

Epipsocidae are found in most parts of the world, but appear to be absent from Australia. They appear to be most diverse in central and South



Figs. 137–140.—Caeciliidae. Forewings of (137) *Caecilius flavidus*, (138) *C. fuscopterus*, (139) *C. atricornis*, (140) *C. piceus*.

America, but are also well-represented in Africa and parts of Asia. Only one species is known to occur in Europe:

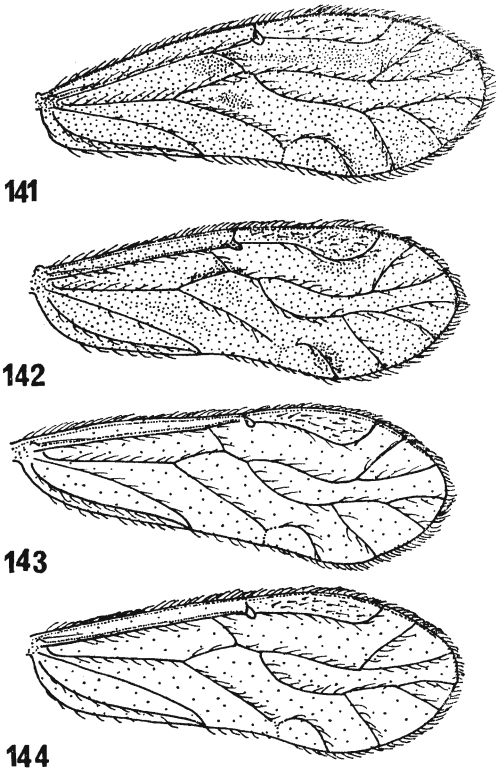
Head dark brown; thorax ivory with a median dorsal dark brown stripe, pleura wholly dark brown; abdomen dark brown dorsally with (sometimes indistinct) longitudinal pale stripes either side of midline. Antennae long and fine. Other characters as in figs. 133–136 ..... **Epipsocus (Bertkauia) lucifugus** (Rambur, 1842) (=*Psocus lucifugus* Rambur, 1842, *Bertkauia prisca* Kolbe, 1882; *Lapithes pulicarius* Bertkau, 1882; *Bertkauia lucifuga* (Rambur) Enderlein 1919; *Epipsocus lucifugus* (Rambur) Pearman, 1935).

Found in leaf litter or sometimes under stones and apparently widely distributed but not common.

Family **Caeciliidae** (figs. 137–172, 176)

Belonging to the Psocomorpha.

Antennae 13-segmented. Apex of lacinia bluntly rounded, with incipient blunt tines. Labium with protruding triangular palpi. Tarsi 2-segmented; claws without



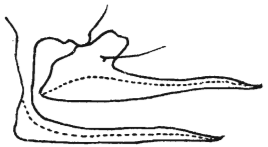
FIGS. 141–144.—Caeciliidae. Forewings of (141) *C. kolbei*, (142) *C. rhenanus*, (143) *C. burmeisteri*, (144) *Enderleinella obsoleta*. (142 *after* Badonnel, 1943).

a subapical tooth; pulvillus broad. Macropterous or brachypterous, rarely apterous. Pterostigma free. Areola postica free in British species. Veins (except, sometimes, Cu2) and margin of forewing setose.

Subgenital plate simple. Gonapophyses reduced to dorsal and ventral valves, usually slender and pointed; external valve represented by a small sclerified area with a strong seta. Hypandrium simple. Phallosome closed anteriorly, with more or less well-defined rugose sclerifications on penial bulb.

Seven British species, in three genera. All of these occur also on the mainland of Europe, and other European species may be confused with British forms. The Caeciliidae are one of the largest families of Psocomorpha: some 300 species have been described, many more are known, and the family is of world-wide distribution. Genital structures are remarkably similar throughout the family, and the main generic divisions have been based largely on features of the wing venation.

The British species are all associated with foliage, some being arboreal and others usually found on low vegetation or grasses. *Caecilius flavidus* is one of the commonest British psocids but some others (*C. atricornis* and *Kolbea quisquiliarum*) are very rare.



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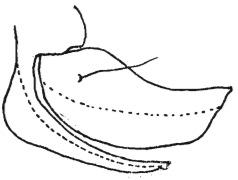

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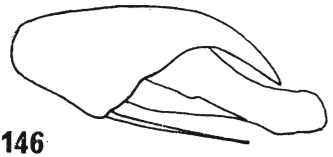

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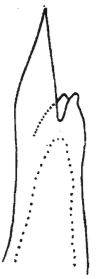

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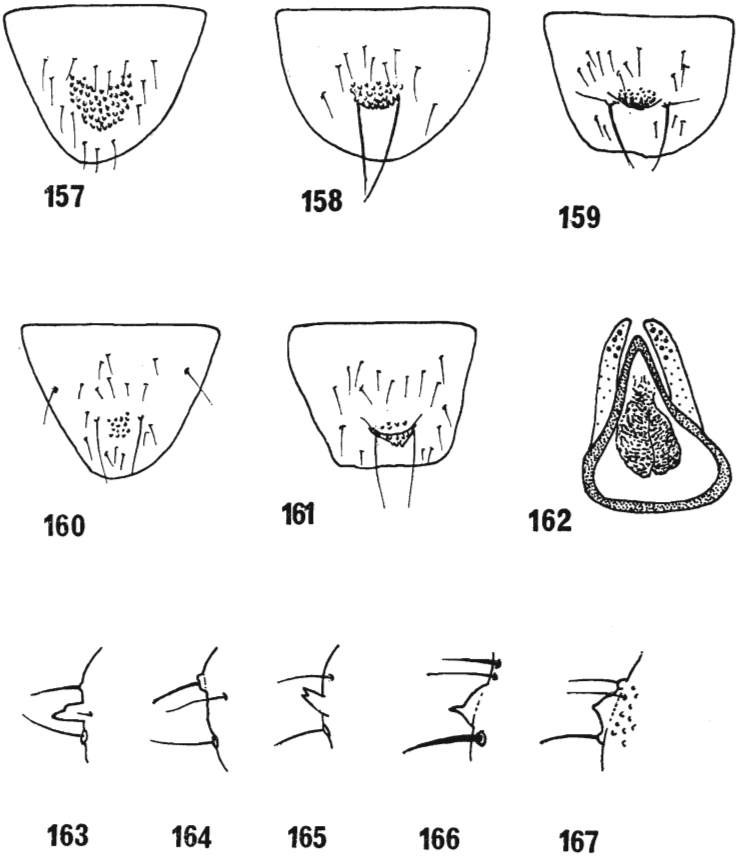
FIGS. 145–156.—Caeciliidae. (145, 147) Gonapophyses of (145) *Caecilius*, (147) *Enderleinella*. (146, 148) Tarsal claw of (146) *Caecilius*, (148) *Enderleinella*. (149–156) Apex of lacinia of (149) *C. flavidus*, (150) *C. atricornis*, (151) *C. fuscopterus*, (152) *C. burmeisteri*, (153) *C. kolbei*, (154) *C. piceus*, (155) *C. rhenanus*, (156) *E. obsoleta*. (149–155 *partly after* Badonnel, 1943).

KEY TO GENERA

1 Veins of forewing and hindwing (♂) with more than one row of setae, except Cu2 in forewing (1 row). ♀ apterous or with extremely small wing rudiments **Kolbea** Bertkau (p. 50)

– Veins of forewing with one row of setae, Cu2 sometimes glabrous. Males macropterous, females macropterous or brachypterous 2



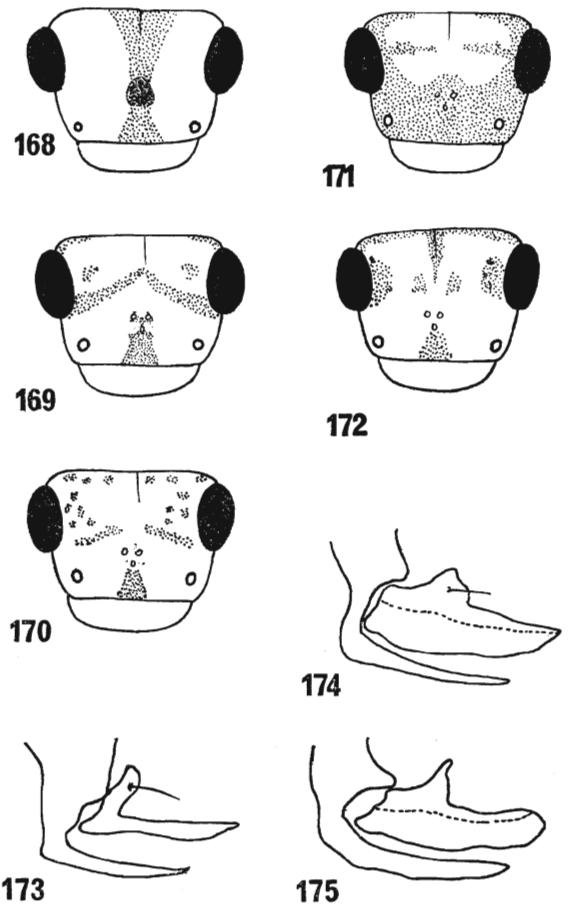
FIGS. 157–167.—Caeciliidae. (157–161) Male epiproct of (157) *C. fuscopterus*, (158) *C. atricornis*, (159) *C. kolbei*, (160) *C. burmeisteri*, (161) *C. piceus*. (162) *Caecilius*—general form of phallosome. (163–167) Inner paraproct borders, to show detail of hyaline cones. (163) *C. kolbei*, (164) *C. piceus*, (165) *C. rhenanus*, (166) *C. burmeisteri*, (167) *C. atricornis*. (158, 159, 161, 165, 167 *after* Badonnel, 1943).

2 Pterostigma usually with posterior border sinuous; Rs sinuous; lacinia with narrow transverse apex, usually showing some incipient division into few separate tines (figs. 149–155). Claws simple, with no preapical or subapical prominences. Epiproct and paraproct of male sometimes with rugose areas. Gonapophyses slender (fig. 145) ..... **Caecilius** Curtis (p. 51)

– Pterostigma with posterior border almost parallel to anterior wing margin; Rs more or less straight, lacinia with apex extended into narrow point (fig. 156). Claws with small peg-like projection on dorsal edge, near base. Epiproct and paraproct of male without rugose areas. Gonapophyses broader, membranous (fig. 147) ..... **Enderleinella** Badonnel (p. 53)

Genus **Kolbea** Bertkau, 1883

As mentioned on p. 2, *Kolbea* is more correctly placed in the Amphipsocidae. Ten recent species are at present included in this genus, nearly all from the Old World tropics.



FIGS. 168–175.—Caeciliidae, Stenopsocidae. (168–172) Anterior aspect of head of *Caecilius* spp., to show pattern. (168) *C. flavidus*, (169) *C. burmeisteri*, (170) *C. rhenanus*, (171) *C. atricornis*, (172) *C. kolbei*. (173–175) Stenopsocidae: gonapophyses of (173) *Graphopsocus cruciatus*, (174) *Stenopsocus immaculatus*, (175) *S. stigmaticus*.

– Pale yellowish brown; ♂ forewing length about 3 mm., wings translucent pale yellow with veins brown (fig. 176); ♀ apterous. . **quisquiliarum** (Bertkau, 1883)
The single British and European species is rare and has been found on low vegetation in southern and central England, but is recorded from several European countries.

Genus **Caecilius** Curtis, 1837

This large genus, even after being restricted considerably from its former wide usage by the definition of Mockford (1965), still contains about 200 described species, from all parts of the world. Five British species were

recorded by Broadhead (1964), but there are strong indications that one or two further European species may occur, and these are included in the following key. In particular, the separation of *C. rhenanus* and *C. kolbei* is difficult, and the two species may have been confused in Britain in the past. Female genitalia of all the species are very similar, and the simplified key below is based largely on wing and lacinial characters: the male epiproct and paraprocts often also provide specific characters.

Key to Species

1 Forewing with longitudinal dark brown band as in fig. 138, and with marginal hyaline areas. Hindwing almost entirely brown. (Body colour deep reddish brown. Forewing length about 3·5 mm., rarely to about 4·2 mm. Lacinia as fig. 151, male epiproct and paraproct as fig. 157) . . . . **fuscopterus** (Latreille, 1799) (*Psocus fuscopterus* Latreille, 1799; *Caecilius fuscopterus* (Latreille) Hagen, 1866).
Fairly common on foliage of broadleaved trees; known throughout Europe, and a record from Tonkin which has not been confirmed recently.

– Forewing without such a longitudinal band 2

2 Forewing hyaline, veins in apical half of wing outlined with reddish brown (body yellow, with thoracic terga brown; head yellow with brown median stripe along face; antenna about as long as forewing; f1, 2 yellow, f3-11 blackish. Forewing about 3 mm. long. Lacinia as in fig. 149) . . . . . **flavidus** (Stephens, 1836)
Male unknown, females abundant and very widely distributed on foliage of broad-leaved trees.

– Forewing membrane suffused with greyish yellow, brown or black; body never bright yellow 3

3 Very dark species, body dark brown: abdomen sometimes reddish. Forewing wholly greyish brown with darker markings as in fig. 140. (Females sometimes brachypterous, recognizable by reddish brown abdomen. Forewing length (macropterous) 2·4–2·6 mm., antenna shorter than forewing. Lacinia and male terminalia as in figs. 154, 161) . . . . . **piceus** Kolbe, 1882
Shortwinged females sometimes termed f. brevipennis *Enderlein* (1903b), *but this name is now believed to refer to* C. kolbei. *Apparently local, found mainly on low vegetation and shrubs.*

– Paler species, greyish or brownish yellow 4

4 Tawny or orange-yellow; forewing almost wholly tawny (light brownish yellow), with slightly paler or more intensely marked areas as in fig. 139. (Forewing length about 2·6–2·8 mm. Head with facial area suffused with dark brown, otherwise pale. Antenna longer than forewing. Lacinia and male terminalia as in figs. 150, 158) . . . . . **atricornis** McLachlan, 1869
A rare, perhaps local species, found on low vegetation.

– Dull greyish or brownish yellow; head without contrasted facial colouring as above 5

5 Forewing wholly and uniformly suffused with greyish yellow, about 2·5–2·8 mm. long. Head unmarked or with slight markings as in fig. 169. (Lacinia and male terminalia as in figs. 152, 160) . . . . . **burmeisteri** Brauer, 1876
A species common on conifers in many parts of Britain. Often found with Enderleinella obsoleta, *which it superficially resembles.*

– Forewing with pale brown suffusion, with distinctly darker areas. Body brownish yellow 6

6 Head with a longitudinal brown stripe on the vertex. (Lacinia and male terminalia as in figs. 153, 159) . . . . . **kolbei** Tetens, 1891
Females sometimes brachypterous; few recent British records, but some earlier records of "piceus" *may refer to this species.*

– Head either tinged with brown or with more extensive suffusion as in fig. 170, with discrete spots dorsal to eyes and across posterior of vertex. (Lacinia apex rounded as in fig. 155) . . . . . **rhenanus** Tetens, 1891
An unconfirmed manuscript record from Somerset (Pearman), but should be looked for elsewhere on low vegetation.

Two further European species may occur in Britain.

1. *C. gynapterus* Tetens, 1891, known from France and Germany. Coloration rather similar to *piceus*. Forewing (♂) with brownish suffusion, antenna longer than forewing. Female brachypterous, wings very short. Low vegetation.

2. *C. despaxi* Badonnel, 1936, known from France and Germany. Most resembles *C. burmeisteri*, from which it can be distinguished by Cu2 in the forewing being glabrous (as *Enderleinella*), and by the female having a longitudinal brown mark on the vertex. Conifers.

Genus **Enderleinella** Badonnel, 1932

One European species. This small genus also includes a species from New Zealand. It is distinguished from *Caecilius* by the characters given in the key and by the female head being small, with the postclypeus very bulbous.

– Pale orangy brown, with thoracic terga brown; vertex with six parallel brown stripes. Wings with pale brown suffusion, forewing length 2·6–2·8 mm.; other structures as in figs. 144, 147, 148, 156..... **obsoleta** (Stephens, 1836) (=*Psocus obsoletus* Stephens, 1836; *Enderleinella obsoleta* (Stephens) Badonnel, 1943).
Found on conifers and rarely on broadleaved trees; often confused with C. burmeisteri (*q.v.*).

Family **Stenopsocidae** (figs. 173–175, 177–179)

Belonging to the Psocomorpha.

Antennae 13-segmented. Labium with protruding triangular palpi. Pterostigma with crossvein extending from posterior apex to Rs; areola postica joined to M by crossvein. Forewing veins with one row of setae, except Cu2 which is glabrous. Tarsi 2-segmented; claws without subapical tooth; pulvillus broad. Subgenital plate simple, gonapophyses reduced to slender tapered ventral and dorsal valves; external valve represented by a small sclerified setose area. Hypandrium simple. Phallosome closed anteriorly, and with rugose sclerifications on penial bulb.

This family, with three British species in two genera, is sometimes considered to be a subfamily of the Caeciliidae, but is usually separated on the above forewing characters. About 40 species in six genera have been described, and most are associated with foliage. The family is of world wide distribution.

Key to Genera

1 Forewing strongly marked with brown, the hind margin glabrous **Graphopsocus** Kolbe (p. 53)
(=*Teratopsocus* Reuter, 1894).

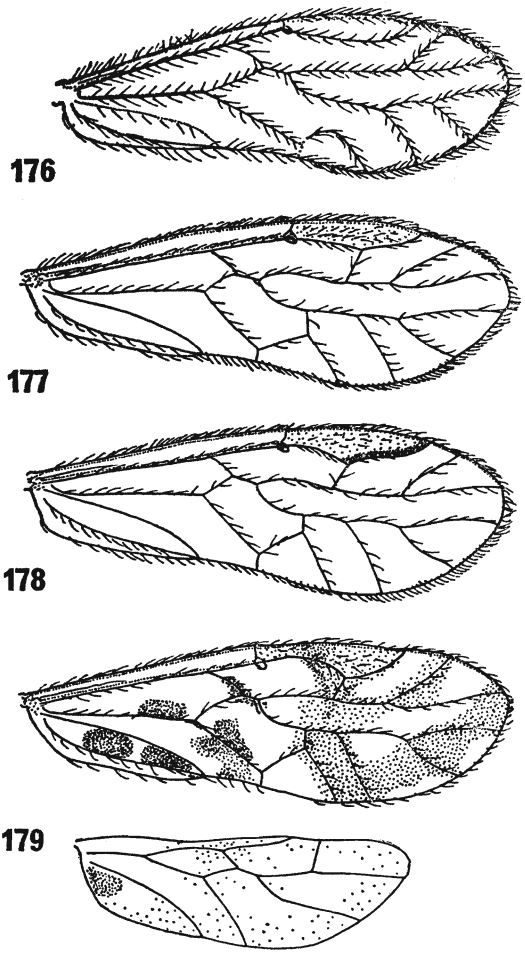
– Forewing not marked with brown spots, the margin wholly pubescent **Stenopsocus** Hagen (p. 54)

Genus **Graphopsocus** Kolbe, 1880

One European species.

– Head pale yellow with brown markings on vertex and postclypeus. Thorax with terga dark brown; abdomen greenish yellow, with brown apex. Forewing (fig. 179) about 3–3·4 mm. long. Hindwing with two brown patches in anal cell. Gonapophyses as in fig. 173..... **cruciatus** (L., 1768) (=*Hemerobius cruciatus* L., 1768; *Graphopsocus cruciatus* (L.) Kolbe, 1880; *Teratopsocus maculipennis* Reuter, 1894).
Brachypterous females are sometimes referred to as var. *brevipennis* Enderlein, (1903b).

Found also in Africa, Japan, China, Argentina and North America. In Europe it is common on many kinds of broadleaved trees, and is unmistakably identifiable on the forewing pattern.



FIGS. 176–179.—Caeciliidae, Stenopsocidae. Forewings of (176) *Kolbea quisquiliarum*, (177) *Stenopsocus immaculatus*, (178) *S. stigmaticus*. (179) Fore and hind wings of *Graphopsocus cruciatus*

Genus **Stenopsocus** Hagen, 1866

Three European species, of which two occur in Britain. Both are large psocids, often appearing green or bluish green, and occur on foliage of a wide range of trees and shrubs. About 20 species of the genus are known.

Key to Species

1 A dark brown or black band along the apical region of R1 (posterior border of pterostigma) (fig. 178). (Yellow or green; dark brown markings on head, thoracic terga and pleura; abdomen pale; wings hyaline, pterostigma green or yellowish. Antennae slightly shorter than forewing, forewing length about 4·0–4·5 mm. Gonapophyses as in fig. 175) **stigmaticus** (Imhoff & Labram, 1846) (=*Hemerobius striatulus* F., 1775; *Psocus stigmaticus* Imhoff & Labram, 1846; *Stenopsocus stigmaticus* (I. & L.) Enderlein, 1919).

– No dark band along posterior border of pterostigma (fig. 177). (Yellow or pale greenish-white, with dark markings as in *stigmaticus;* forewing hyaline 5·0–5·5 mm. long, shorter in some males. Gonapophyses as in fig. 174) **immaculatus** (Stephens, 1836) (=*Psocus immaculatus* Stephens, 1836; *Stenopsocus immaculatus* (Stephens) Hagen, 1866).

Both species are widely distributed and often common in Britain.

The third European species, whose presence has been suggested but not confirmed in Britain, is *S. lachlani* Kolbe (1880). It resembles *S. immaculatus* but has the thorax wholly dark brown or black and also differs, according to Badonnel (1943) in the ratio I.O/D (Badonnel: *immaculatus* ♂ 1, ♀ 1·68; *lachlani* ♂ 1·5, ♀ 2). Forewing length 4·5–4·8 mm.

Family **Lachesillidae** (figs. 180–193)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewing with pterostigma and areola postica free. Forewing and hindwing glabrous. Tarsi 2-segmented; claws with a subapical tooth; pulvillus narrow. Subgenital plate simple or bilobed; gonapophyses reduced to setose external valve. Hypandrium transverse, often with complex apophyses or associated sclerites. Parameres fused anteriorly to form a median internal stem; ventral border of male paraproct often with a conspicuous sclerotized hook; epiproct sometimes ornamented.

Four British species, one common and native, the others rare and probably introduced. *Lachesilla* Westwood (1840) (= *Pterodela* Kolbe, 1880) is a large genus found throughout the world and contains a number of "opportunistic colonizers" which frequent such habitats as dead foliage, haystacks and thatching. Several hundred species of *Lachesilla* are known, many not yet described. The second genus at present placed in the family is known from one species from Chile.

Key to Species

1 Large species: forewing length more than 2 mm. (usually pale brown, rarely darker), wings faintly infuscated; ♂ with hypandrial processes bifurcate, the shorter external fork leaving the main stem at right angle (fig. 187); a prominent paraproct hook. ♀, subgenital plate apically bilobed; gonapophyses with 6–8 strong setae and, usually, one more slender seta (fig. 182); epiproct without apophyses **quercus** (Kolbe, 1880) (=*Caecilius* (*Pterodela*) *quercus* Kolbe, 1880).

A rare species known from many European countries. In Britain, two individuals found associated with imported goods—? not established.

– Smaller species: forewing length 1·8 mm or less; sometimes micropterous or brachypterous 2

2 Body pale yellow, eyes dark. Wings hyaline, with venation pale yellow (♂, hypandrial hooks bifurcate at apex: each paraproct with single reflexed hook serrate on inner edge; a pair of short (? epiproctal) upturned processes (figs. 188–190); ♀ undescribed) ..... **livida** (Enderlein, 1903b) (=*Pterodela livida* Enderlein, 1903b; *Lachesilla livida* (Enderlein, 1927)).

This species, of which the above details are from Enderlein's description, is known from a few examples from Germany and Switzerland. It is included on the British list on the basis of one (unconfirmed) record from oak trees in Northumberland (Whittledene, Ovingham, July 1915: *Bagnall,* 1915).

– Body dark brown, abdomen sometimes reddish brown; venation, if distinct, brown, reddish brown or black 3

3 Abdomen strongly annulated with reddish brown. (Macropterous, or with wings more or less reduced. ♂, hypandrium with lateral processes curved and meeting in midline, not forked (fig. 186); paraprocts without hooks; epiproct with a median strongly raised and curved hook, flanked by two slightly sinuous apophyses on the last tergite. ♀, subgenital plate simple; gonapophyses with external valve bearing a dorsal row of long setae (fig. 184). Forewing of macropterous form about 1·8 mm. long) ..... **pedicularia** (L., 1758) (=*Hemerobius pedicularius* L., 1758; *Lachesilla pedicularia* (L.) Enderlein, 1919; the many synonyms of this species are listed by Smithers, 1967).

Often common, cosmopolitan, and can reach large numbers in dry grass, haystacks and similar structures. Sometimes found indoors. Native, but also imported at times.

– Abdomen uniformly reddish brown, apex dark brown. (Macropterous, or with wings greatly reduced. ♂, hypandrium with lateral processes longer and more pointed than *pedicularia*; paraproct with small conical tubercle, no hook; epiproct with curved hook as in fig. 192, lateral apophyses of last tergite as in fig. 192; forewing length 0·3–0·65 mm., venation greatly reduced and wing rudiment with spicules (fig. 193). ♀, subgenital plate simple; gonapophyses with all setae behind dorsal border (fig. 183). Macropterous form (Germany): forewing length c. 1·8 mm.; usual form with forewings represented by small spiculate lobes (fig. 193), and very small hindwing rudiments; pterothorax reduced **greeni** (Pearman, 1933) (=*Terracaecilius greeni* Pearman, 1933; *Lachesilla* (*Terracaecilius*) *greeni* (Pearman). Roesler, 1939).

Local in Britain, but apparently established. Surrey, on logs in woodshed, November 1932. *? Domestic species.*

Family **Ectopsocidae** (figs. 194, 195, 197, 199–211)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewing without areola postica; pterostigma free, rectangular. Hindwing with Rs and M connected by a crossvein; marginal setae between R_{2+3} and R_{4+5}. Tarsi 2-segmented; claws without a subapical tooth; pulvillus broad. ♀, subgenital plate bilobed or with median lobe. Gonapophyses strongly reduced (*Ectopsocopsis* Badonnel, 1955) or complete (others, including all British spp.): ventral valve tapered, weakly sclerotized; dorsal valve broad; external valve broad and setose. ♂, epiproct ornamented and clunial comb more or less developed. Phallosome with external parameres distinct posteriorly; complex irregular radular sclerites on penial bulb.

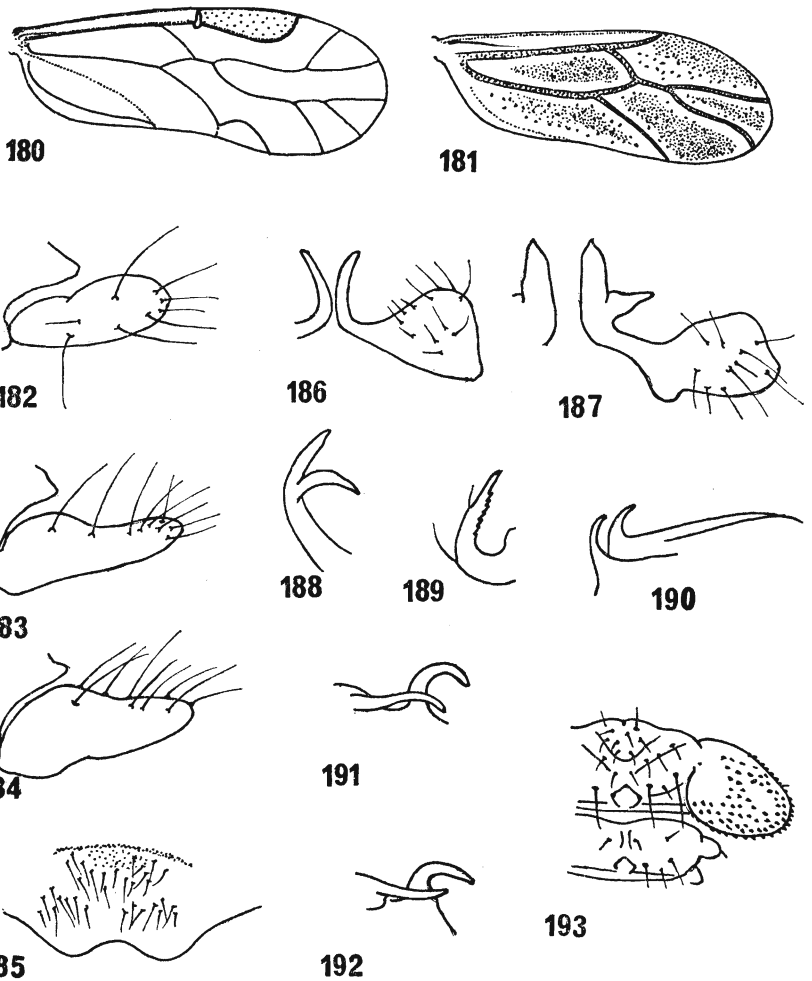
Ectopsocidae and Peripsocidae have often been linked (as Peripsocidae) on account of lacking the areola postica and having 2-segmented tarsi. These resemblances are misleading, and the differences justify their separation as two not closely-related families (c.f. Peripsocidae, p. 58).

Four (?five) British species, of which two are native, the others casual introductions. About 100 species have been described, most of them in the genus *Ectopsocus* McLachlan, 1899 (to which all British species belong), and the family is known throughout the world. Some are generally foliage-frequenters, others more closely associated with litter or stored products.

Genus **Ectopsocus** McLachlan, 1899

Key to Species

1 Macropterous 2
– Brachypterous or micropterous 5
2 Veins at margin of forewing without dark spots 3
– Veins at margin of forewing with dark spots (fig. 194) 4



FIGS. 180–193.—Lachesillidae. (180–181) Male forewings of (180) *L. pedicularia*, (181) *L. greeni*. (182–184) Gonapophyses of (182) *L. quercus*, (183) *L. greeni*, (184) *L. pedicularia*. (185) Subgenital plate of *L. greeni*. (186, 187) Hypandrial sclerites of (186) *L. pedicularia*, (187) *L. quercus*. (188–190) *L. livida* (188) hypandrial hook, (189) paraproct hook, (190) apex of abdomen, profile, showing (? epiproctal) process. (191, 192). Apex of male abdomen (profile, dorsal region) of (191) *L. pedicularia*; (192) *L. greeni*. (193) Pterothorax (dorsal) of *L. greeni*, showing reduced wing rudiments. (185–192 partly *after* Badonnel, 1943 and Enderlein, 1906; 193 *after* Pearman, 1933).

3 Body and wings pale yellow (♀, apophyses of subgenital plate without long setae; a dark line along the outer margin of each lobe (fig. 206). ♂, apical border of epiproct with two symmetrical combs separated by a bare region; numerous small denticles anterior to basal comb).....**maindroni** Badonnel, 1935

One record, introduced and associated with stored products (Broadhead, 1954b). Widely distributed, but apparently native to Africa.

– Body pale brown, wings hyaline, slightly tawny. (♀, subgenital plate apically bilobed, each lobe with 3 or 4 setae towards apex; border between lobes with fine spicules (fig. 205)).....**vachoni** Badonnel, 1945 (=*E. dimorphus* Mockford & Gurney, 1956).

N.B. No macropterous British specimens are known, and all known males are brachypterous: characters for this sex are given in couplet 6, but anomalous macropterous males should be carefully checked.

A rare introduction into Britain, two individuals being recorded (Broadhead, 1954b). *Recorded also from Morocco (type locality), France, Chile, Argentina and southern U.S.A.*

4 ♀, subgenital plate with apophyses strongly incurved and ornamented with strong setae; median lobe without brown basal markings, ♂, phallosome with two small flanking parameres, with two small styliform apophyses and penial sclerification as in fig. 209; border of last tergite with short comb of about 15 teeth; apical border of epiproct with comb of about 30 teeth. Paraproct with divided hyaline cone, the two halves almost equal in length (fig. 199)....**briggsi** McLachlan, 1899.

Widely distributed, and very common on foliage in late summer. Known also from Europe, Congo, Central and South America. Rarely brachypterous (couplet 5).

– ♀, subgenital plate with apophyses straight or very slightly curved inwards, ornamented with long setae; two diffuse dark brown spots at base of median area of plate (fig. 210). ♂, unknown. Paraproct with divided hyaline cone, the two halves markedly uneven in length (fig. 200)..**meridionalis** Ribaga, 1904.

This species is very widely distributed in many parts of the world and is superficially similar to briggsi. *It is abundant in Europe, and unconfirmed reports of its occurrence in England and Scotland deserve serious consideration. No definite British records other than for Ireland (Fahy,* 1970), *but specimens of* briggsi *should be carefully examined. The status of* E. borealis *Harrison* (1916, *from Durham) also needs clarification: it was tentatively synonymized with* briggsi *by Broadhead* (1964).

5 Forewings with small dark markings at margins of veins (genitalic characters as in couplet 4) .....**briggsi** McLachlan, 1899.

*Occasional brachypterous specimens, the wings extending about half the length of the abdomen. N.B. All brachypterous specimens with marked wings should be checked with special care: there appears to be an undescribed brachypterous species of the "*briggsi*-group" in Britain, but adequate series are not yet available.*

- Forewings without dark markings at apex of veins; wings sometimes extremely reduced 6

6 ♀, subgenital plate without lateral apophyses, posterior border with row of about nine long setae. ♂, aedeagus with median styliform apophyses; last tergite with field of small pointed denticles, not forming a distinct comb **richardsi** (Pearman, 1929) (=*Chaetopsocus richardsi* Pearman, 1929; *Ectopsocus richardsi* (Pearman), 1942).

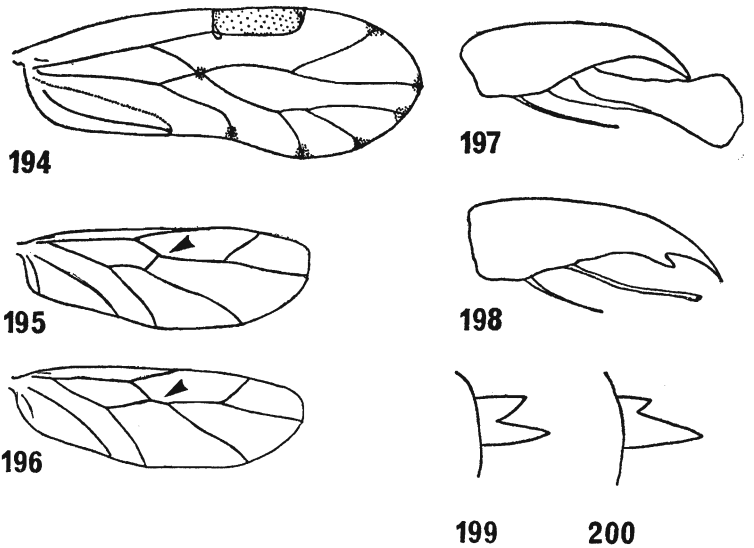
Apparently introduced, and known also from N. America, W. Africa and the Pacific region.

– ♀, subgenital plate bilobed, each lobe with 2 or 3 long setae; margin of plate between lobes with few small spicules. ♂, aedeagus without median styliform apophysis; clunial comb of about 25 blunt teeth.....**vachoni** Badonnel—see couplet 3,

Family **Peripsocidae** (figs. 196, 198, 212–236)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewing without areola postica, pterostigma free. Hindwing with Rs and M fused for a short length, glabrous. Forewing glabrous in British species. Tarsi 2-segmented; claws with subapical tooth; pulvillus narrow. Subgenital plate with median posterior lobe. Gonapophyses complete; external valve



FIGS. 194–200.—Ectopsocidae, Peripsocidae. (194) Forewing of *Ectopsocus briggsi*. (195, 196) Hindwings of (195) *Ectopsocus*, (196) *Peripsocus*. (197, 198) Tarsal claws of (197) *Ectopsocus*, (198) *Peripsocus*. (199, 200) Inner paraproct border of (199) *E. briggsi*; (200) *E. meridionalis*.

sometimes somewhat reduced; ventral and dorsal valves strongly developed. Male epiproct without ornamentation, but clunial comb often well developed. Phallosome with parameres fused posteriorly; radular sclerites well-defined and rodlike (British species)--often forming triangular structure—the "fork sclerite". See comment under Ectopsocidae (p. 56).

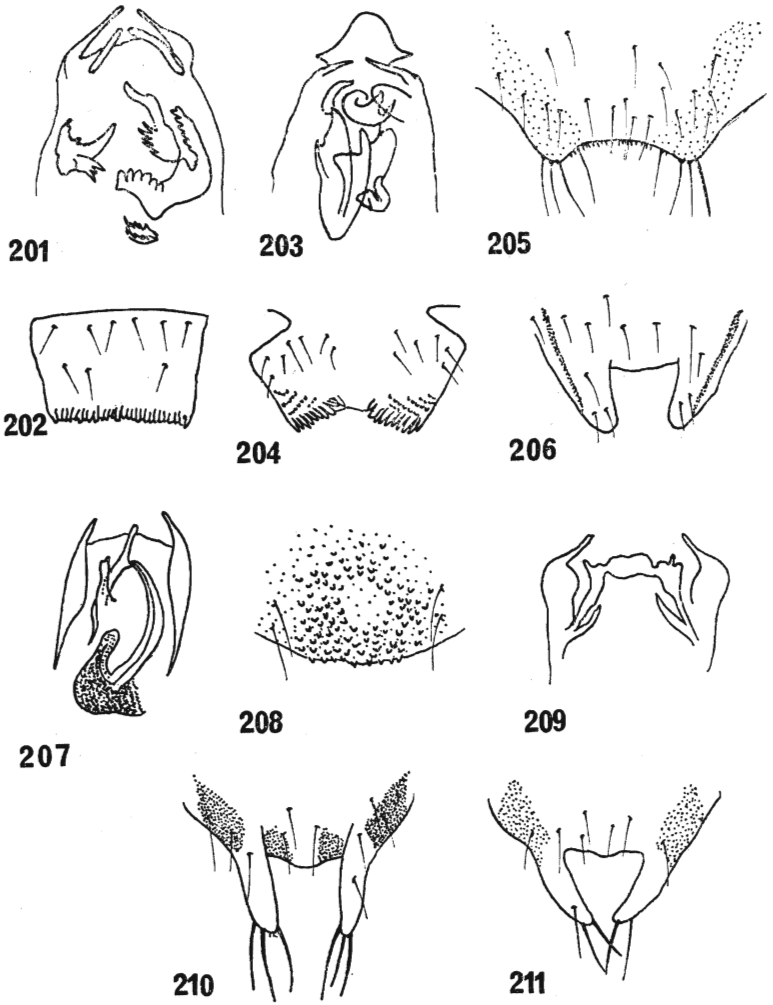
Seven British species, of which five are native and two apparently rare introductions: three are known from females only. Most species found out of doors are apparently bark-frequenters: many are arboreal and others associated with low vegetation. The British species are all in *Peripsocus* (Hagen, 1866), a genus of world wide distribution and containing about a hundred described species.

Genus **Peripsocus** Hagen, 1866

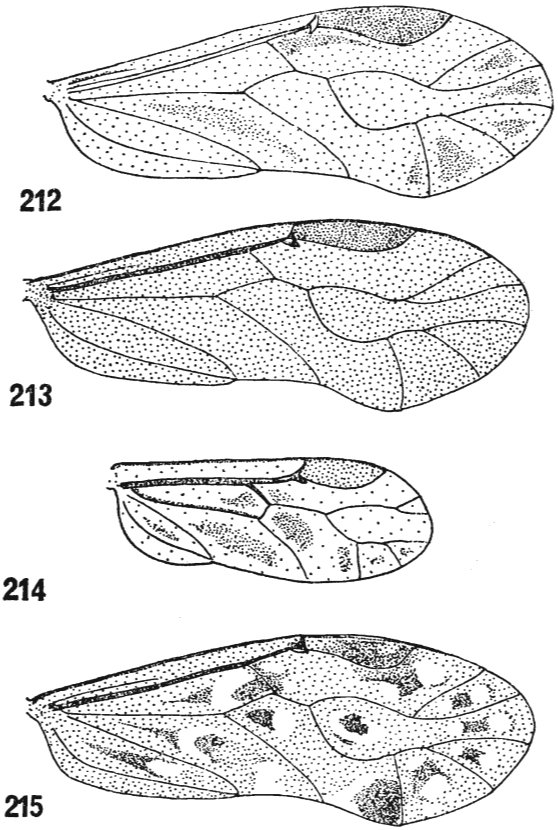
KEY TO SPECIES

1 Forewing uniformly pale to medium brown.....2
– Forewing marked with patches or bands of contrasted colour.....4
2 Forewing length under 2·5 mm. (brown, with dark median dorsal line along abdomen. ♀, subgenital plate with median lobe strongly defined (fig. 223), and arms of sclerotized area thickened; gonapophyses: external valve rectangular; dorsal valve with group of small setae at apex (fig. 228). ♂, phallosome with narrow anterior stem, extending into broad ovoid area with narrow posterior apex (fig. 236); fork sclerite broad, lateral tines convergent and crossing in midline)
parvulus Kolbe, 1880

Found in several European countries. Apparently only one British record: McLachlan (1890) *found it in the New Forest—? Introduced or precariously established.*



FIGS. 201–211.—Ectopsocidae, *Ectopsocus*. (201, 202) Apical region of phallosome, and last abdominal tergite of *E. vachoni*. (203, 204) Apical region of phallosome, and epiproct of *E. maindroni*. (205, 206) Subgenital plates of (205) *E. vachoni*; (206) *E. maindroni*. (207, 208) Apical region of phallosome and last abdominal tergite of *E. richardsi*. (209) Apical region of phallosome of *E. briggsi*, (210, 211) Subgenital plates of (210) *E. meridionalis*, (211) *E. briggsi*. (201, 202 *after* Mockford & Gurney, 1956; 203, 204 *after* Badonnel, 1935; 207 *after* Pearman, 1929; 208 ssp. *tridentatus*, *after* Thornton, 1962).

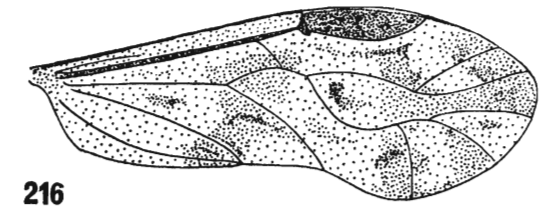


FIGS. 212–215.—Peripsocidae, *Peripsocus*. Forewings of (212) *P. consobrinus*, (213) *P. parvulus*, (214) *P. parvulus* brachypterous, (215) *P. alboguttatus*. (212 *after* Pearman, 1952; 214 *after* Pearman, unpublished).

– Forewing length well over 2·5 mm., usually 2·8–3·1 mm. (occasional smaller specimen should be checked against above if they fail to key satisfactorily below)..3

3 ♀, subgenital plate with sides of median lobe parallel or slightly divergent towards apex (fig. 219). Gonapophyses (fig. 226) with external valve shorter than broad, length less than half that of dorsal valve. ♂, clunial comb with 8–17 broadly rounded teeth (fig. 58). Phallosome (fig. 234) with lateral tines of fork sclerite relatively short; central area of sclerite with anterior and posterior processes of similar length..... **phaeopterus** (Stephens, 1836) (=*Psocus phaeopterus* Stephens, 1836; *Peripsocus phaeopterus* (Stephens) Hagen, 1866).

Fairly common and well established in Britain. Arboreal and bark frequenting. Early records are dubious, as the following species was distinguished only in 1939.



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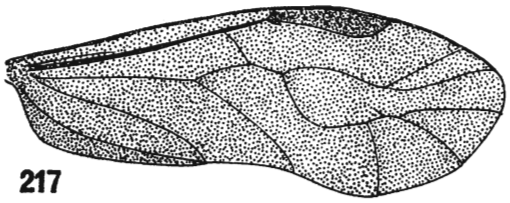

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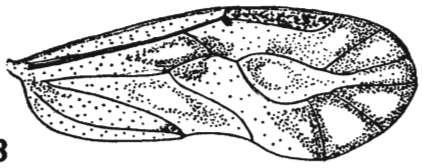

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FIGS. 216–218.—Peripsocidae, *Peripsocus*. Forewings of (216) *P. subfasciatus*, (217) *P. phaeopterus*. (*P. didymus* is similar); (218) *P. reductus*. (218 *after* Badonnel, 1943).

– ♀, subgenital plate with sides of median lobe converging slightly towards apex, sinuate (fig. 221). Gonapophyses (fig. 231) with external valve about twice as long as broad, its length more than half that of the dorsal valve. ♂, clunial comb with 7–15 teeth (usually more uniform in size than in *phaeopterus*). Phallosome (fig. 223) with lateral tines of fork sclerite relatively long and crossing in midline; central area of sclerite with posterior spine much longer than anterior spine ..... **didymus** Roesler, 1939 (=*P. truncatus* Pearman, 1951).

Established in Britain, and occurs in similar situations, to phaeopterus. *Apparently considerably rarer than* phaeopterus, *but the two may easily be confused without dissection. Both species are found on mainland Europe.*

4 Macropterous, forewing reaching well beyond apex of abdomen 5

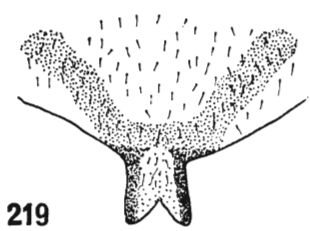
– Brachypterous 7

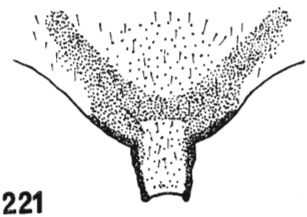
5 Forewing predominantly pale brown, with darker patches as shown in fig. 212 (♀, subgenital plate with short broad median lobe, having sides slightly convergent towards apex; apex not emarginate; sclerotization pattern not forming a complete basal band (fig. 225). Gonapophyses (fig. 232) with external valve a little less than half the length of the dorsal valve. ♂ unknown)

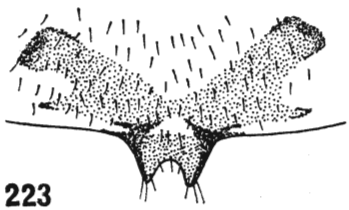
consobrinus Pearman, 1951

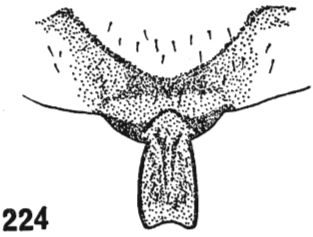
A single specimen from Somerset. Apparently established but rare. Not yet recorded elsewhere.

– Forewing with more contrasted markings: greyish brown with markings in apical cells and a well-defined transverse band extending from apical region of Cu2 towards base of pterostigma 6

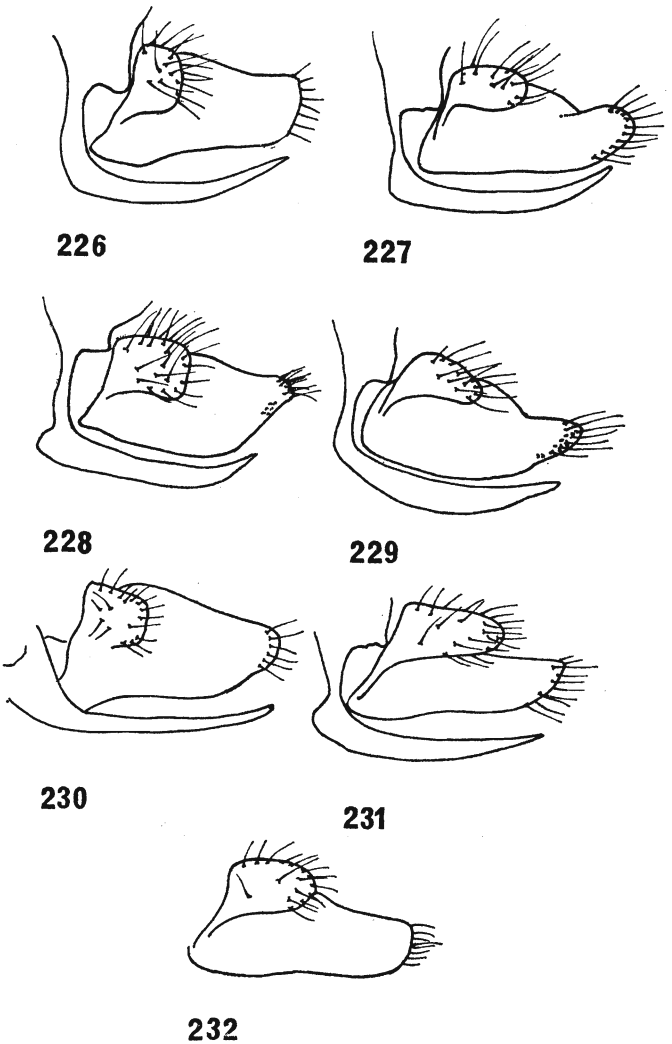




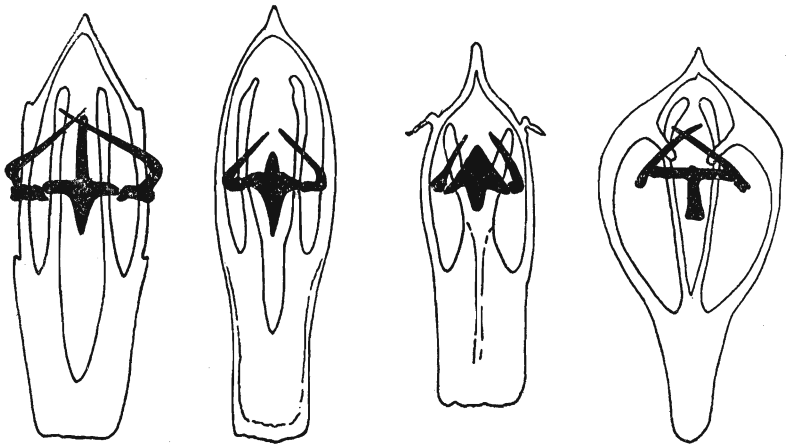




FIGS. 219–225.—Peripsocidae, *Peripsocus* ♀♀. Subgenital plates of (219) *P. phaeopterus*, (220) *P. subfasciatus*, (221) *P. didymus*, (222) *P. alboguttatus*, (223) *P. parvulus*, (224) *P. reductus*, (255) *P. consobrinus*. (224 *after* Badonnel, 1943; 225 (setation omitted) *after* Pearman, 1952).



FIGS. 226–232.—Peripsocidae, *Peripsocus*, ♀♀. Gonapophyses of (226) *P. phaeopterus*, (227) *P. subfasciatus*, (228) *P. parvulus*, (229) *P. alboguttatus*, (230) *P. reductus*, (231) *P. didymus*, (232) *P. consobrinus*. (230 *after* Badonnel, 1943; 232 (ventral valve omitted) *after* Pearman, 1952).



233 **234** **235** **236**

FIGS. 233–236.—Peripsocidae, *Peripsocus*, ♂♂. Phallosomes of (233) *P. didymus*, (234) *P. phaeopterus*, (235) *P. alboguttatus*, (236) *P. parvulus*.

6 Forewing as in fig. 215: the dark patches in the apical cells adjacent to paler unpigmented areas. (♀, subgenital plate with median lobe rounded, with group of preapical setae (fig. 222). Gonapophyses as in fig. 229. ♂, phallosome with pointed posterior apex, and slight lateral projections behind apex. Fork sclerite with outer tines sinuous; central region of sclerite strongly developed, solid, triangular ..... **alboguttatus** (Dalman, 1823)
(=*Psocus alboguttatus* Dalman, 1823; *Peripsocus alboguttatus* (Dalman) McLachlan, 1867).

Rare on trees, more common on low vegetation (in Southern England, especially heaths). European and introduced (?) into North America. Its distinctive wing markings immediately separate it from all other British species, but similarly-marked species occur in America (discussed by Mockford, 1971).

– Forewing as in fig. 216: no hyaline areas and more defined transverse bands. (♀, subgenital plate with sides of median lobe strongly sclerotized, convex; apex emarginate with few short setae (fig. 220). Gonapophyses as in fig. 227, with row of small setae around apex of dorsal valve. ♂ unknown
subfasciatus (Rambur, 1842)
(=*Psocus subfasciatus* Rambur, 1842; *Peripsocus subfasciatus* (Rambur) Enderlein, 1919).

Sometimes common on trees, but apparently local. Appears to be completely parthenogenetic. Very similar to the North American P. quadrifasciatus (*Harris,* 1869), *and found throughout Europe.*

7 Forewing predominantly brown, with darker patches as in fig. 214
parvulus Kolbe, 1880

– Forewing predominantly greyish brown, with paler areas 8

8 Genitalic characters as in couplet 6(i) ..... **alboguttatus** (Dalman, 1823)
Few brachypterous specimens known.

– Forewing as in fig. 218. ♀, subgenital plate with long median lobe, sides slightly convex, apex slightly emarginate (fig. 224). Gonapophyses with external valve small, rectangular; dorsal valve with preapical row of about 6 setae (fig. 230)
reductus Badonnel, 1943

Two British specimens, found in ships holds at Liverpool in 1953 (*? African origin*) (*Broadhead & Datta,* 1960). *Introduced. Described from one female taken on* Acer *bark in France.*

Family **Trichopsocidae** (figs. 237–242)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewing with pterostigma and areola postica free; margin setose; a single row of setae on the veins; apical marginal setae not crossing. Hindwing with veins glabrous, margin setose. Tarsi 2-segmented; claws without subapical tooth; pulvillus broad. Subgenital plate simple; gonapophyses complete, with external valve very broad, dorsal valve with strong subapical process, ventral valve slender. Hypandrium simple; penial bulb with sclerifications.

Two British species, both in the genus *Trichopsocus* Kolbe (1882), and both foliage-frequenters. Three further species of *Trichopsocus* have been described, and the fossil genus *Palaeopsocus* Kolbe (1883) is usually also included in this small family.

Genus **Trichopsocus** Kolbe, 1882

Key to Species

1 Areola postica short and regularly rounded (fig. 237). Hindwing with brown spot at apex of Cu1 short, and extending on both sides of vein. Pale yellow species, with thoracic terga weakly or not marked with brown. Forewing length 2·4–3·0 mm. ♀, gonapophyses as in fig. 241; external valve almost square, dorsal rounded projection of dorsal valve relatively short, subapical process becoming well separated from this. ♂, phallosome as fig. 242; a central denticulate radula, a longitudinal broad-based spine tapering towards the apex, and a ventral median coarsely denticulate sagittiform sclerite . . . . . **dalii** (McLachlan, 1867) (=*Caecilius dalii* McLachlan, 1867; *Trichopsocus dalii* (McLachlan) Badonnel, 1943).

– Areola postica elongated and not regularly rounded (fig. 238). Hindwing with brown mark at apex of Cu1 extending along vein and confined to basal side of vein. Very pale yellow, almost white, with thoracic pleura strongly marked with brown. Forewing length about 2·2–2·5 mm. ♀, gonapophyses as in fig. 239; external valve markedly wider than long, dorsal rounded projection of dorsal valve relatively long and subapical process remaining close to this. ♂, phallosome as in fig. 241; a central transverse denticulate radula, and a median lightly sclerotized oval sclerite bearing five ventral teeth in midline towards apex **acuminatus** Badonnel, 1943

Rarer than dalii; *in England usually in hot houses or similar situations, implying that it may be a casual straggler from mainland Europe. It appears to be more numerous and established outside in Ireland* (*Fahy* 1970).

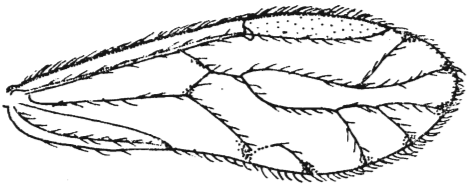
Family **Elipsocidae** (figs. 243–268)

Belonging to the Psocomorpha.

Antennae 13-segmented (reduced in some non-British forms). Forewing with pterostigma free, areola postica present (absent or joined to media in some non-British forms); margin and veins setose in British spp. Hindwing with marginal setae only between R_{2+3} and R_{4+5}. Tarsi 2- or 3-segmented; claws with a subapical tooth; pulvillus of various forms, usually slender. Subgenital plate usually with apex bilobed (single median lobe in some non-British genera). Gonapophyses complete; external valve large and setose, dorsal valve usually with a subapical process. Hypandrium simple or lobed. Phallosome: frame closed, with radular sclerites.

Brachypterous or apterous forms in some genera, which show neotenic characters.

Seven British species, in four genera. These are mainly bark-frequenting forms, and found on a wide range of trees. Some 70 described species in this family are distributed in nearly 20 genera.



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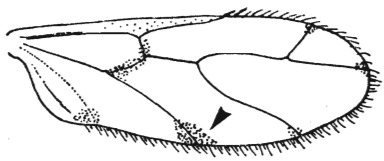

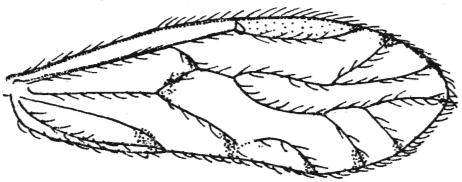

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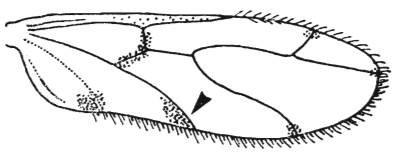


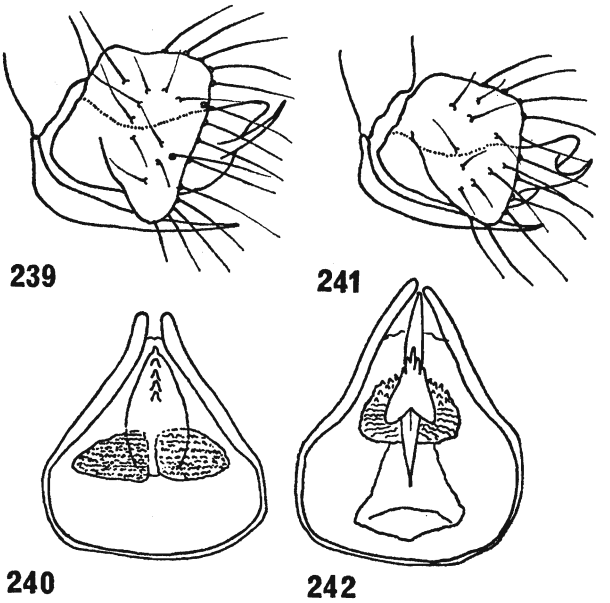
FIGS. 237–238.—Trichopsocidae. Fore and hind wings of (237) *Trichopsocus dalii*, (238) *T. acuminatus*.

KEY TO GENERA

1 Tarsi 2-segmented ..... **Reuterella** Enderlein
– Tarsi 3-segmented 2
2 Apical segment of maxillary palp short, broadly truncate (fig. 256). (Cu2 in forewing usually bare, few setae in some specimens.... **Cuneopalpus** Badonnel
– Apical segment of maxillary palp elongate, oval (fig. 255)..... 3
3 Cu2 in forewing setose; ♀ macropterous (pulvillus slender, R and M in hindwing usually fused for a short length)..... **Elipsocus** Hagen (= *Cabarer* Navas, 1908).
– Cu2 in forewing bare; ♀ apterous or brachypterous (pulvillus slightly expanded at apex, R and M in hindwing (♂) linked by crossvein)..... **Pseudopsocus** Kolbe =*Leptella* Reuter, 1894; *Leptodella* Reuter, 1904; *Anisopsocus* Ribaga, 1910).

Genus **Reuterella** Enderlein, 1903

One British and European species, males of which are macropterous and females apterous. Found on bark, usually in colonies under silken webs. A monotypic genus.



FIGS. 239–242.—Trichopsocidae. (239, 241) Gonapophyses and (240, 242) phallosomes of (239, 240) *Trichopsocus acuminatus* and (241, 242) *T. dalii*. (240 *after* Pearman unpublished sketch).

– Body dark brown, head blackish brown, eyes black; abdomen paler except at apex. Tarsi with claw elongate (fig. 254). Apex of lacinia broadly transverse. Body length 1·5–2·1 mm. ♀, antenna very short; subgenital plate and gonapophyses as in figs. 257, 258. ♂, forewing as in fig. 262: Cu2 glabrous; phallosome with parameres broad, weak sclerification on penial bulb

helvimacula (Enderlein, 1901)

(=*Leptella helvimacula* Enderlein, 1901; *Reuterella helvimacula* (Enderlein), 1903d; *Caecilius corticis* Pearman, 1924).

Found throughout Europe. Apparently not common in Britain, and usually found in small numbers. Recorded also from North America (*Mockford*, 1955).

Genus **Cuneopalpus** Badonnel, 1943

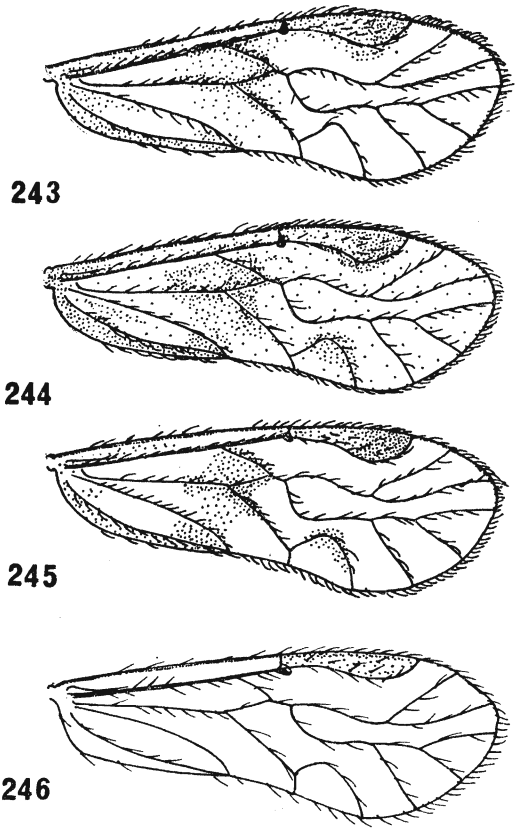
A single British and European species, both sexes macropterous. Found on bark, predominantly of conifers.

– Body entirely pale orange-yellow, with darker head patches; eyes with ommatidia black, encircled with bluish-white. Wings faintly tawny. Apical segment of maxillary palp truncate as in fig. 256. Claw with pulvillus expanded at apex (fig. 252). Forewing length about 2·5 mm. ♀, subgenital plate bilobed (fig. 259); gonapophyses as fig. 260. ♂, phallosome elongate, penial bulb sclerified

cyanops (Rostock, 1876)

(=*Elipsocus cyanops* Rostock, 1876; *Cuneopalpus cyanops* (Rostock) Badonnel, 1943).

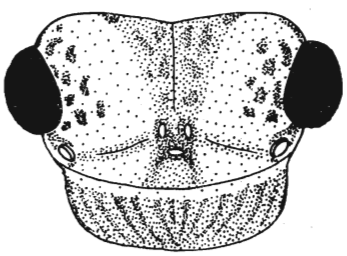
Found throughout Europe and recently recorded from North America. Sometimes common on conifers.



FIGS. 243–246.—Elipsocidae, *Elipsocus*. Forewings of (243) *Elipsocus hyalinus*, (244) *E. mclachlani*, (245) *E. westwoodi*, (246) *Cuneopalpus cyanops*.

Genus **Elipsocus** Hagen, 1866

Three British species, all macropterous. Found on bark of many kinds of trees. Nearly 30 species have been described in this genus, and many of them appear rather similar. Thornton & Broadhead (1954) separated females of the British species on pigmentation characters, and abdominal coloration of fresh specimens is the most simple diagnostic character. All are found in Europe but, due to confusion over specific identification, their ranges are not wholly clear—and the specific status of other European forms is in doubt. Such taxa as *E. pallidus* Jentsch (1938a) may prove to be varieties of other species.



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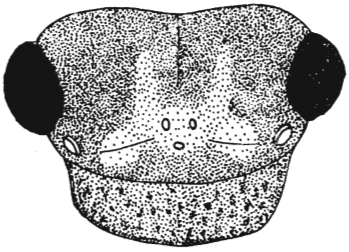

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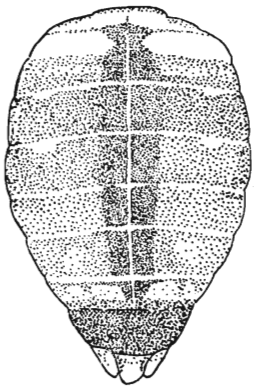

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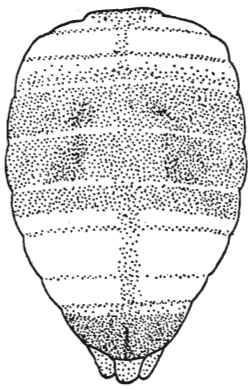

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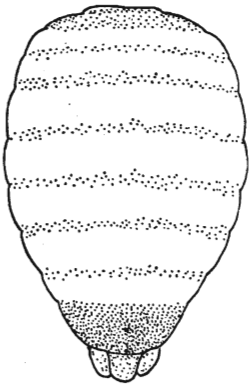

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FIGS. 247–251.—Elipsocidae: *Elipsocus*. (247, 248) Anterior aspect of head, to show pattern of (247) *E. westwoodi*; (248) *E. hyalinus*. (249–251) Dorsal aspect of abdomen, to show pattern, of (249) *E. westwoodi*; (250) *E. hyalinus*; (251) *E. mclachlani*.

KEY TO SPECIES

The three species are of overlapping sizes, forewing length 2·4–3·5 mm., but *E. mclachlani* is often the smallest.

1 Head dorsally uniformly dark brown, except for paler area between ocelli and antennal bases as in fig. 248. (Abdominal terga transversely banded as in fig. 250; paler areas yellowish brown, darker medium or reddish brown central region, and apex very dark brown. Forewing of female without fuscous mark over apex of areola postica; subgenital plate and gonapophyses as in fig. 267, 268. ♂ extremely rare). ..... **hyalinus** (Stephens, 1836) (=*Psocus hyalinus* Stephens, 1836; *Elipsocus westwoodi* McLachlan, 1867 (part); *E. abietis* Kolbe, 1880).

Widely distributed and found on many kinds of trees. Appears to be the most common Elipsocus *in southern England.*

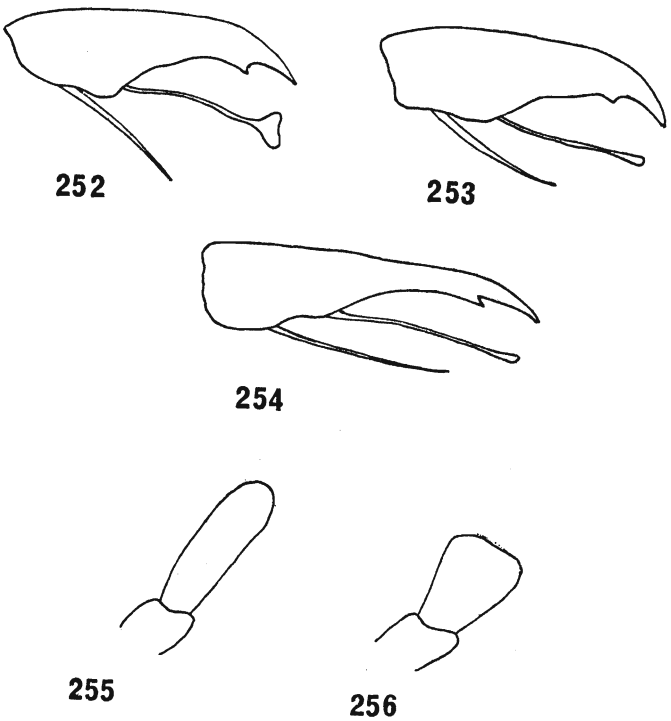
– Head dorsally with longitudinal dark brown median band, a broad yellowish band on either side, and a cluster of discrete small brown spots above each eye (fig. 247). (Abdomen patterning not as in fig. 250; forewing of female with a fuscous patch over apex of areola postica) 2

2 Abdomen dorsally predominantly pale, as in fig. 251. (Sexes occur in about equal numbers; ♀, forewing with markings usually concentrated in a transverse band as in fig. 244; ♂, forewing unmarked except for fuscous pterostigma)
mclachlani Kimmins, 1941
(*E. hyalinus* var. *abdominalis* Reuter, 1904).
Found on many kinds of trees, sometimes common.

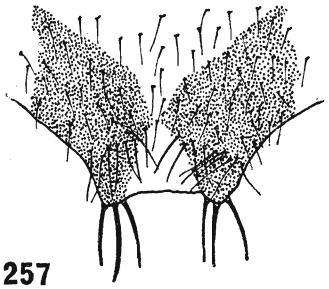
– Abdomen dorsally predominantly dark, as in fig. 249. (Sexes occur in about equal numbers; ♀, forewing markings usually more diffuse, as in fig. 245; ♂, forewing unmarked except for fuscous pterostigma ..... **westwoodi** McLachlan, 1867 (=*E. westwoodi* McLachlan, 1867 (part); *E. moebiusi* Tetens, 1891).
Found on many kinds of trees.

Genus **Pseudopsocus** Kolbe, 1882

Two British species, with apterous females and macropterous males, found on and under lichens and bark. Both appear to be rare, one being placed on the British list on the basis of a single unconfirmed record. Two other European species are known.



FIGS. 252–256.—*Elipsocidae*. (252–254) Tarsal claw of (252) *Cuneopalpus*, (253) *Elipsocus*, (254) *Reuterella*. (255, 256) Apex of maxillary palp of (255) *Elipsocus*, (256) *Cuncopalpus*.



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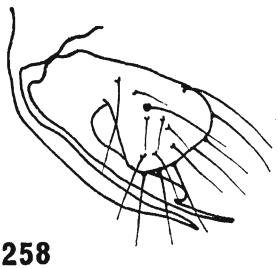

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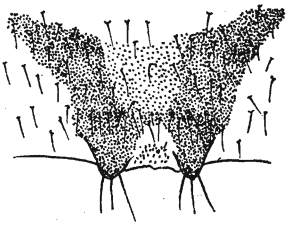

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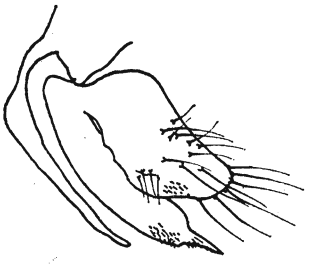

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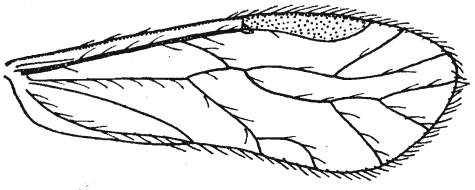

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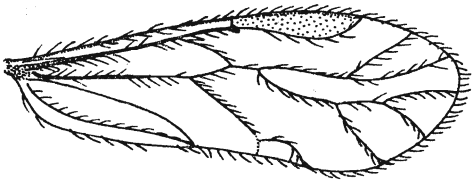

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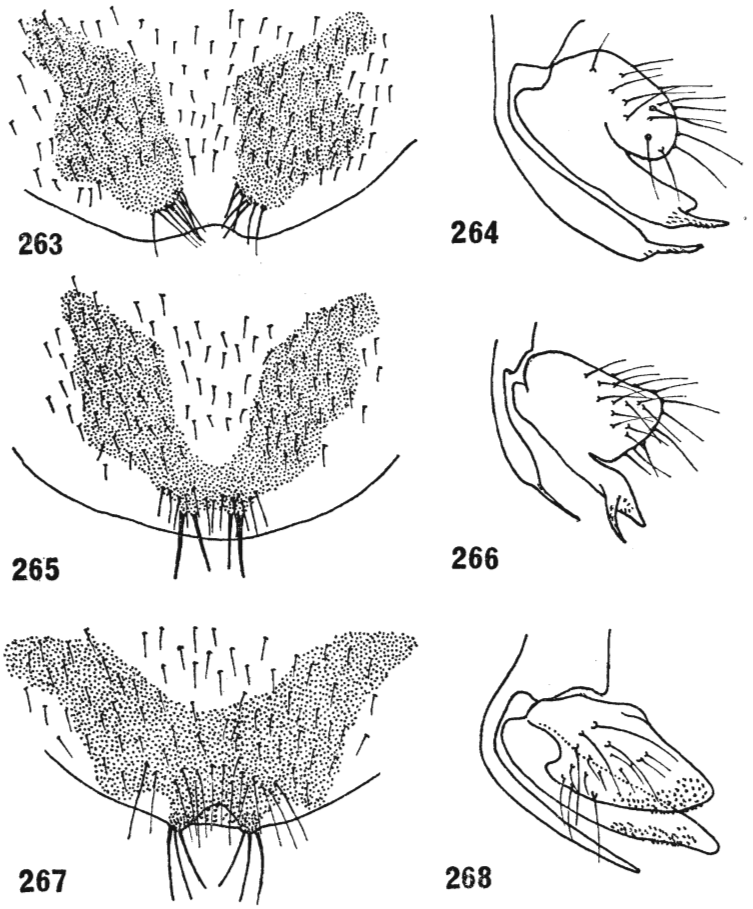
FIGS. 257–262.—Elipsocidae. (257, 258) Subgenital plate and gonapophyses of *Reuterella helvimacula*. (259, 260) Subgenital plate and gonapophyses of *Cuneopalpus cyanops*. (261, 262). Forewings of (261) *Pseudopsocus*, (262) *Reuterella*.

KEY TO SPECIES

1 ♀, thorax brown; abdomen buff, with dark brown markings basally and at apex; subgenital plate and gonapophyses as in figs. 265, 266. ♂, forewing (fig. 261) length 1·8 mm.; head and thorax reddish brown, abdomen yellowish with reddish brown banding..... **fusciceps** (Reuter, 1894) (=*Leptella fusciceps* Reuter, 1894; *Elipsocus reyi* Enderlein, 1901; *Leptodella fusciceps* Reuter, 1904; *Pseudopsocus* (*Leptodella*) *fusciceps* (Reuter) Badonnel, 1943).

Northumberland, one record only: unconfirmed as resident.



FIGS. 263–268.—Elipsocidae. (263, 264) Subgenital plate and gonapophyses of *Pseudopsocus rostocki*. (265, 266) Subgenital plate and gonapophyses of *P. fusciceps*. (267, 268) Subgenital plate and gonapophyses of *Elipsocus hyalinus*. (263–266 partly *after* Badonnel 1943).

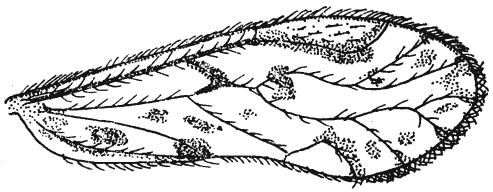
– ♀, with double row of dark brown spots along dorsum of abdomen; subgenital plate and gonapophyses as in figs. 263, 264; body length 2·2–2·5 mm. ♂ unknown
rostocki Kolbe, 1882

Small colonies under web on bark; few records from southern England, but probably more widely distributed.

Family **Philotarsidae** (figs. 269–271)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewing with pterostigma and areola postica free; margin and veins of forewing strongly setose; branches of main veins normally with more than one row of setae, marginal setae crossing at apex of wings. Margin and some



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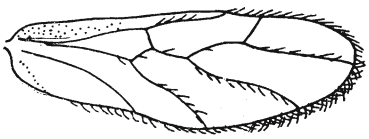

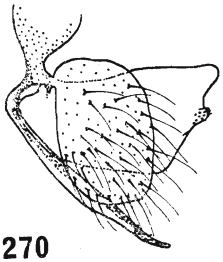

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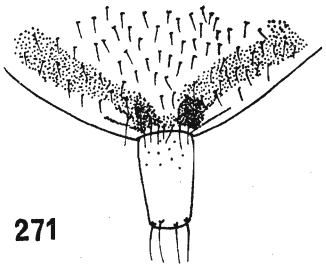

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FIGS. 269–271.—Philotarsidae: *Philotarsus picicornis*. (269) Fore and hindwings. (270) Gonapophyses. (271) Subgenital plate.

veins of hindwing setose. Tarsi 3-segmented; claws usually with subapical tooth; pulvillus narrow. Subgenital plate with median posterior lobe. Gonapophyses complete. Phallosome usually with sclerification on penial bulb (not in British sp.).

One British species, which is often common and found on bark of many kinds of trees. This belongs to the genus *Philotarsus* Kolbe (1880), characterised in part by:

Forewing with Cu2 glabrous, hindwing with R1, R_{4+5}, M and Cu1 setose; median lobe of subgenital plate elongate, usually about twice as long as broad, setose at or near apex; male, paraproct narrow with elongated trichobothrial field; hypandrium broad with small median emargination; phallosome complex at apex but without sclerification of penial bulb.

Nearly 50 species of Philotarsidae have been described, and many others are known. *Philotarsus*, a genus with some 15 described species, is found in many parts of the world.

– Yellow or yellowish white, marked with dark brown; abdomen pale brown, with longitudinal yellow lines. Forewing hyaline, with characteristic brown markings as in fig. 269; all cells with dark markings; hindwing unmarked. Forewing length 3–3·8 mm. ♀, subgenital plate and gonapophyses as in figs. 271, 270 **picicornis** (F., 1793)

(=*P. flaviceps* (Stephens, 1836)).

Although *P. flaviceps* is usually reduced to a synonym of *picicornis*, some workers (including Pearman) have considered it to be distinct. In this case, only tracing and detailed study of the types can show which name is properly applied to the British species. For the time being, *picicornis* is preferred, having been used in a number of recent publications on British Psocoptera. The forewing markings immediately separate this species from all other British Psocoptera. Males are less numerous than females in some populations.

Family **Mesopsocidae** (figs. 272–286)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewing with pterostigma and areola postica free: veins and wing margins glabrous. Females of some species apterous. Tarsi 3-segmented; claws with subapical tooth; pulvillus slender. Subgenital plate with strongly developed median lobe. Gonapophyses complete; dorsal valve usually with subapical process. Hypandrium simple. Phallosome with external parameres dilated before apex; no complex sclerification of penial bulb.

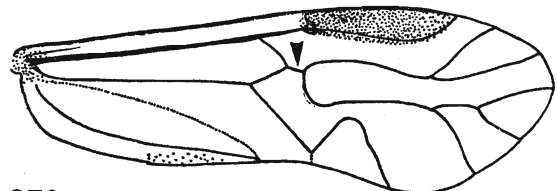
Three British species, all placed in *Mesopsocus* Kolbe (1880), which contains about 20 described species from many parts of the world. Two further genera in the family, each represented by a single African species, have been inadequately characterized.

The British species, two of which have apterous females, are found on bark of many kinds of trees in early summer. Two are common and one apparently very rare. All are widely distributed in Europe and two, *M. laticeps* and *M. unipunctatus*, also occur in North America. Large psocids, body length about 4 mm.

Genus **Mesopsocus** Kolbe, 1880

Key to Species

1 Macropterous 2
– Apterous, or almost apterous (♀) 4
2 (♂♀). Forewing usually with R and M fused for a short length. (Forewing length about 4·5–5 mm.; ♀, subgenital plate with apex rounded to narrow point (fig. 281); gonapophyses (fig. 282) with external valve having appearance of longitudinal fold; ♂, phallosome with apex rounded and with internal projection of parameres extending well beyond apex (fig. 278). Abdomen yellow, banded with brown; head markings as fig. 280 ..... **laticeps** (Kolbe, 1880) (=*Holoneura laticeps* Kolbe, 1880; *Mesopsocus laticeps* (Kolbe) Gurney, 1949).
This species is rare in Britain, and few records exist. Essex, Cambridge.
– (♂) Forewing usually with R and M meeting in a point or linked by a short crossvein (apex of phallosome different from above) 3
3 Parameres with external lobe strongly dilated and hooked at apex (fig. 276). Forewing length 4·5–5·4 mm.; body pale yellow with brown markings; each abdominal tergite with anterior border bearing line of brown spots (fig. 274); head marked as in fig. 279 ..... **unipunctatus** (Mueller, 1764) (=*Hemerobius unipunctatus* Mueller, 1764; *Caecilius vitripennis* Curtis, 1837; *Psocus naso* Rambur, 1842; *Elipsocus unipunctatus* (Mueller) Tetens, 1891; *Mesopsocus unipunctatus* (Mueller) Kolbe, 1880).
A common species, often occurring on trees in company with the following. Widely distributed.



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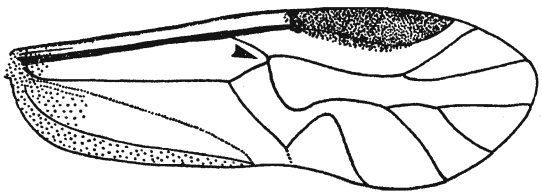

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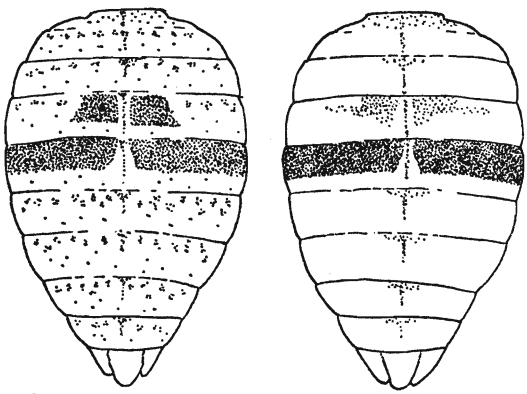

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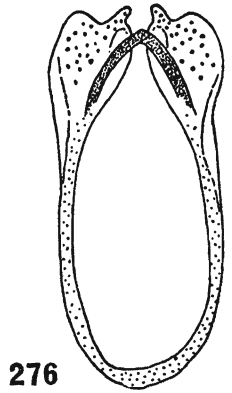
FIGS. 272–275.—Mesopsocidae. (272, 273) Male forewings of (272) *Mesopsocus laticeps*, (273) *M. immunis*. (274, 275) Dorsal aspect of abdomen of (274) *M. unipunctatus*, (275) *M. immunis*, to show pattern.

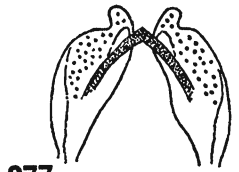
– Parameres with external lobes weakly dilated (fig. 277). (Forewing length about 5·0 mm.; body less strongly marked with brown than the preceding species; abdominal markings reduced to wide transverse bands across fourth tergite (fig. 275) ..... **immunis** (Stephens, 1836) (=*Psocus immunis* Stephens, 1836; *Mesopsocus immunis* (Stephens) Badonnel, 1936).

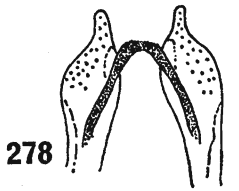
A common species in Europe. Found also in Morocco. See comment under unipunctatus.

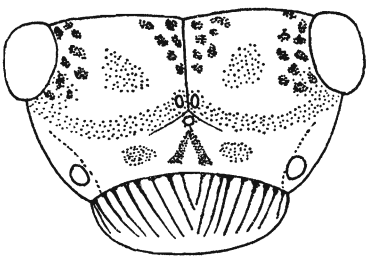
4 Wing rudiments with border of hairs; apex of subgenital plate rounded (fig. 285); gonapophyses as in fig. 286, with external valve very long. Coloration as male **unipunctatus** (Mueller)

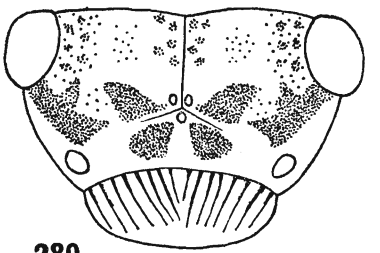
– Wing rudiments without border of hairs; apex of subgenital plate pointed (fig. 283); gonapophyses as in fig. 284. Coloration as male.... **immunis** (Stephens, 1836)











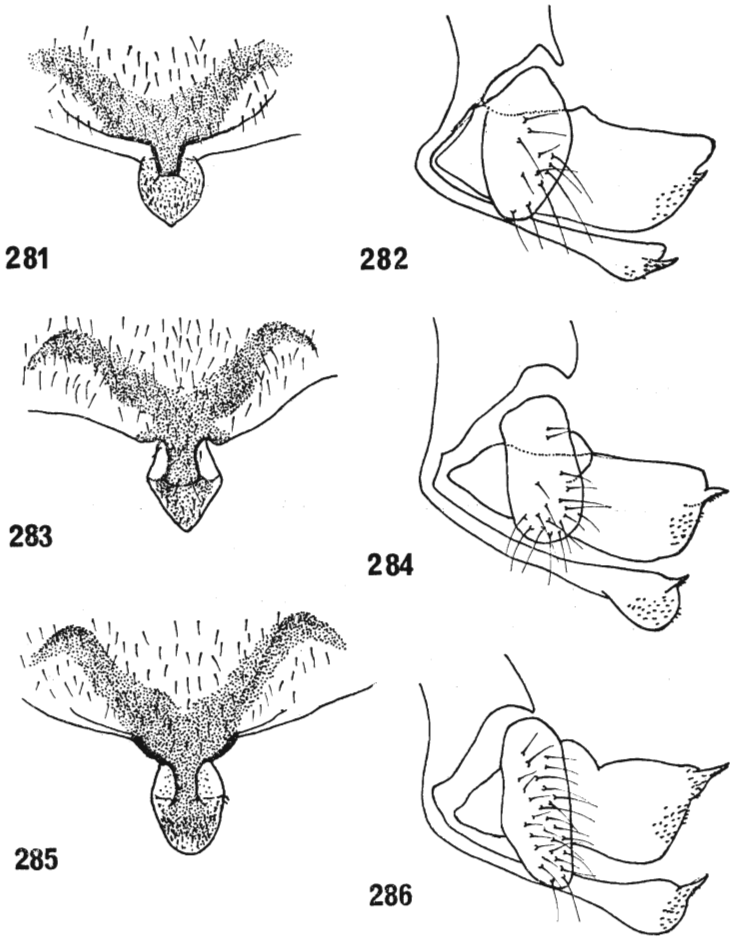
FIGS. 276–280.—Mesopsocidae. (276) Phallosome of *M. unipunctatus*. (277, 278) Apical region of phallosome of (277) *M. immunis*, (278) *M. laticeps*. (279, 280) Anterior aspect of head, to show pattern, of (279) *M. unipunctatus*, (280) *M. laticeps*.

M. dubosqui Badonnel (1931), a species known from France by females only, is most similar to *unipunctatus* in having the apex of the subgenital plate rounded; this structure differs in that the apex is considerably narrower and the sides are parallel rather than divergent to the midregion and then convergent, as in *unipunctatus*.

Family **Psocidae** (figs. 287–349)

Belonging to the Psocomorpha.

Antennae 13-segmented. Forewings with pterostigma free; areola postica joined to M at a point, for a length or (rarely) by crossvein. Hindwing with R and M fused for a short length. Forewings glabrous except for few small marginal setae in some genera (non-British). Tarsi 2-segmented; claws with or without a subapical tooth; pulvillus slender. Subgenital plate usually with pronounced median posterior lobe with apical setae. Gonapophyses complete; ventral valve slender and pointed; dorsal valve usually broader, sometimes apically pointed, in other forms blunt; external valve large, often transverse with strong setae. Gonopore plate usually sclerotized.



FIGS. 281–286. Mesopsocidae, ♀♀. (281, 282) Subgenital plate and gonapophyses of *M. laticeps*. (283, 284) Subgenital plate and gonapophyses of *M. immunis*. (285, 286) Subgenital plate and gonapophyses of *M. unipunctatus*.

Hypandrium greatly developed and convex; symmetrical or asymmetrical and often ornamented with apophyses, spines, ridge, teeth and/or hooks in varying combinations. Paraproct of male with curved and pointed apical process (fig. 53). Phallosome either (i) a simple closed frame without apically-free parameres or (ii) reduced to two separated, usually anteriorly-fused arms (fig. 57).

Thirteen British species, representing eight genera and nine subgenera, and several of which are extremely rare. This large family, distributed throughout the world, contains many of the largest and most conspicuous psocids. Many are bark frequenters, found on a wide range of plants, and a few appear to be more specialized in habitat requirements. A number of

the genera in this family have been inadequately characterized, and their relationships are not always clear. Usually, three subfamilies are recognized, in which the genera represented in Britain are distributed as follows:

AMPHIGERONTIINAE	*Amphigerontia*, *Blaste* (*Euclismia*).
CERASTIPSOCINAE	*Metylophorus*, *Psococerastis*.
PSOCINAE	*Atlantopsocus*, *Copostigma* (*Clematostigma*), *Psocus*, *Trichadenotecnum* (*Trichadenotecnum*, *Loensia*).

KEY TO GENERA

1 Apical segment of maxillary palp short (fig. 330), less than twice as long as wide. (Antennae at least twice as long as forewing; subgenital plate with a short median lobe; dorsal valve of gonapophyses with short apical point; hypandrium asymmetrical; phallosome frame closed; forewing with R_{2+3} and R_{4+5} separating at a wide angle (90° or more) ..... **Psococerastis** Pearman (p. 84)

– Apical segment of maxillary palp long (fig. 329), at least 2·5 times as long as wide . . 2

2 Antennae at least 1·5 times forewing length (Sc in forewing ending free in membrane; subgenital plate with long posterior lobe; dorsal valve of gonapophyses broad, with apex rounded; external valve long, not lobed; hypandrium with asymmetrical apophyses. Phallosome frame closed; symmetrical, elongate) **Metylophorus** Pearman (p. 84)

– Antennae barely as long as forewing, often considerably shorter 3

3 Forewing with first and second sections of Cu1A without an angle between them, forming almost a straight line; distal section of Cu1A recurved after leaving M or running to hind margin of wing at right angles, giving characteristic shape to AP (fig. 332). (Wings strongly patterned; subgenital plate with short broad posterior lobe; gonapophyses with dorsal valve tapered to narrow apex, external valve transverse; hypandrium usually asymmetrical, sometimes with complex hooks or apophyses; phallosome frame closed in British species, simple, sometimes with broad flattened posterolateral expansions) **Trichadenotecnum** Enderlein (p. 89) (s.l. Roesler, 1943) 4

– Forewing with first and second sections of Cu1A with distinct angle between them; AP of different form from above 5

4 Forewing with R and M usually meeting at a point; with no submarginal row of spots in the apical cells; phallosome with lateral expansions s.g. **Loensia** Enderlein (p. 90)

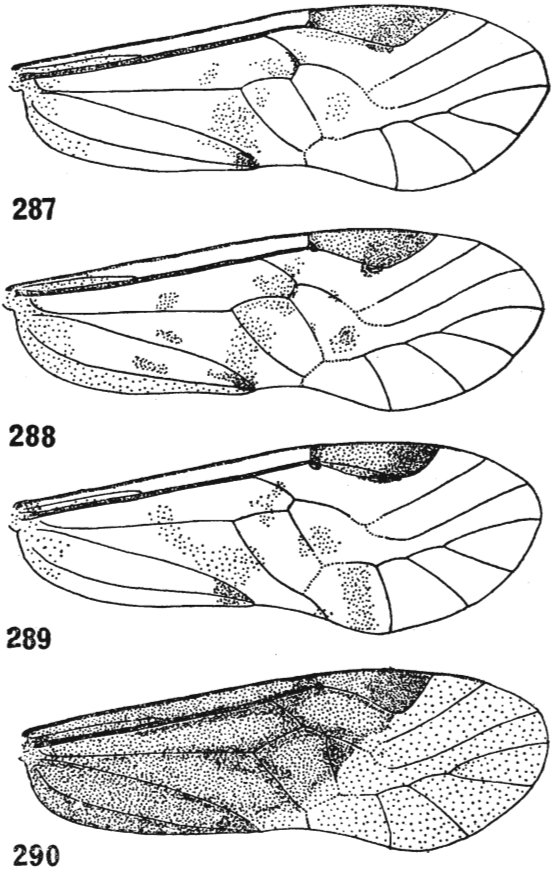
– Forewing with R and M usually fused for a short length; with submarginal row of 5 or 6 spots in apical cells; phallosome without lateral expansions s.g. **Trichadenotecnum** Enderlein (p. 89)

5 Forewing with AP very high (fig. 289), with first section of Cu1A separating from Cu1B well before wing margin. (Forewing with Sc ending in R; subgenital plate with broad rounded median lobe; dorsal valve of gonapophyses ending in a long spiculate point; hypandrium and preceding sternite heavily sclerotized, apex bilobed; phallosome reduced to parameres, membranously joined anteriorly, free posteriorly and ending in one or two outwardly directed hooks) **Blaste** Kolbe: s.g. **Euclismia** Enderlein (p. 84)

– Forewing with AP different from above 6

6 Forewing with first section of Cu1A shorter than second (Rs and M usually joined by crossvein; subgenital plate with short posterior lobe; gonapophyses with ventral valve pointed and with subapical expansion; dorsal valve broad; external valve transverse, bilobed —with short lobe applied to dorsal valve; hypandrium and preceding sternite heavily sclerotized, symmetrical, apex with three unarmed lobes; parameres separate, enlarged and broadened posteriorly) **Amphigerontia** Kolbe (p. 81)

– Forewing with first section of Cu1A longer than second (gonapophyses different from above; phallosome frame closed posteriorly) 7

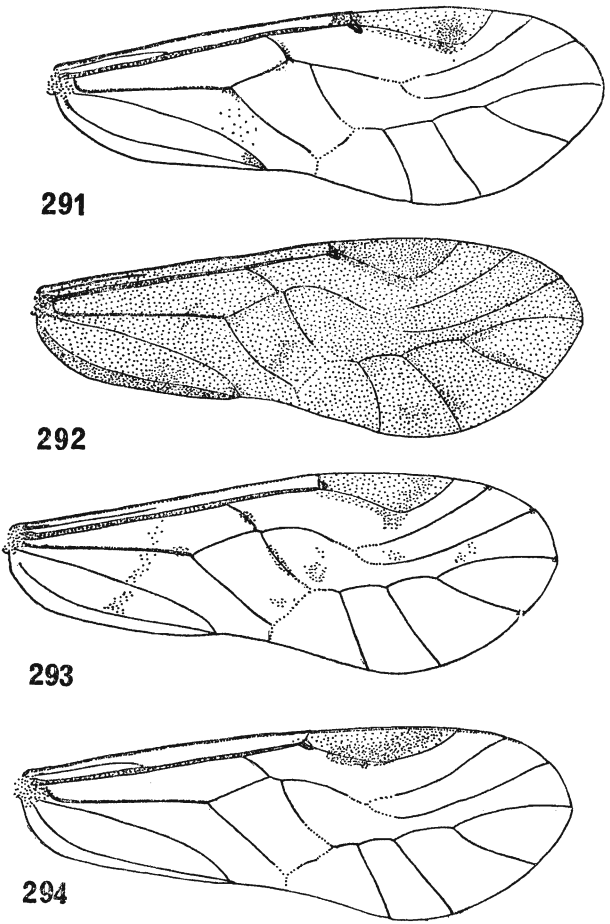


FIGS. 287–290.—Psocidae. Forewings of (287) *Amphigerontia contaminata*, (288) *A. bifasciata*, (289) *Euclismia quadrimaculata*, (290) *Clematostigma morio*. (290 *after* Badonnel, 1943).

7 Pterostigma convex n basal half (fig. 294) (Basal Sc ending free in membrane, Rs and M meeting at point or fused for a short length; apex of subgenital plate blunt; gonapophyses with ventral valve long and pointed; dorsal valve bluntly pointed; external valve large, slightly lobed; hypandrium with longitudinal band bearing row of large teeth either side of midline, symmetrical; phallosome with long apical process, frame very narrow anteriorly)
Atlantopsocus Badonnel (p. 85)

– Pterostigma concave in basal half (genital structures different from above).....8

8 Forewing with slight spur vein from hind angle of pterostigma (forewing entirely brown, the basal half darker; subgenital plate with broad rounded posterior lobe; gonapophyses with small lobe on external valve; hypandrium symmetrical; phallosome frame simple, closed, and with posterior end extended)
Copostigma Enderlein: s.g. **Clematostigma** Enderlein (p. 88)



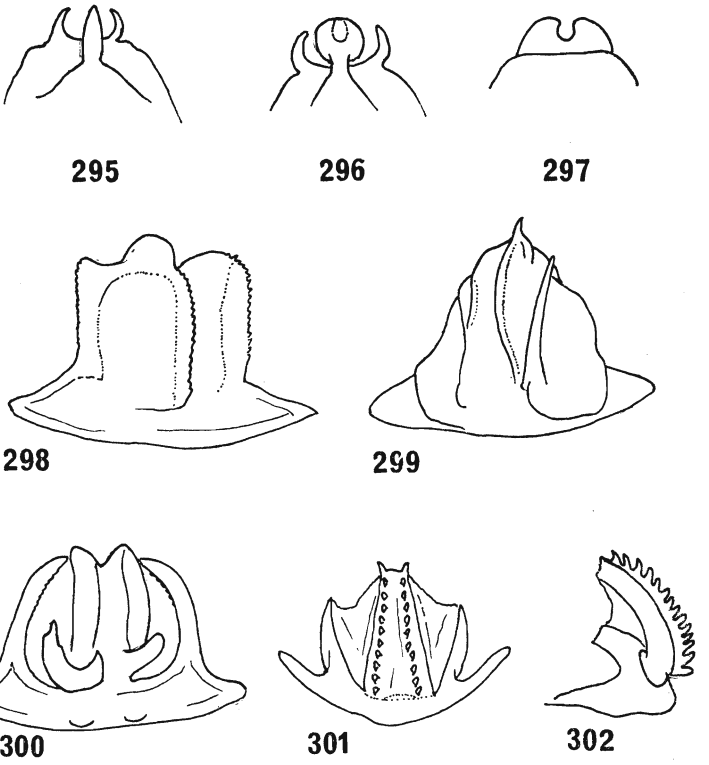
FIGS. 291–294.—Psocidae. Forewings of (291) *Psocus bipunctatus*, (292) *Metylophorus nebulosus*, (293) *Psococerastis gibbosa*, (294) *Atlantopsocus personatus hibernicus*.

– Forewing with no spur vein from hind angle of pterostigma. (Forewing predominantly hyaline; subgenital plate with elongate tapering lobe; gonapophyses with external valve large and oval; hypandrium with asymmetrical apophyses; phallosome elongate, closed, with apex produced into an asymmetrical lobe) **Psocus** Latreille (p. 89)

Genus **Amphigerontia** Kolbe, 1880

Two British species. Forewing, length 3·7–4·6 mm. and with markings, if present, greyish brown and not intruding on the areola postica.

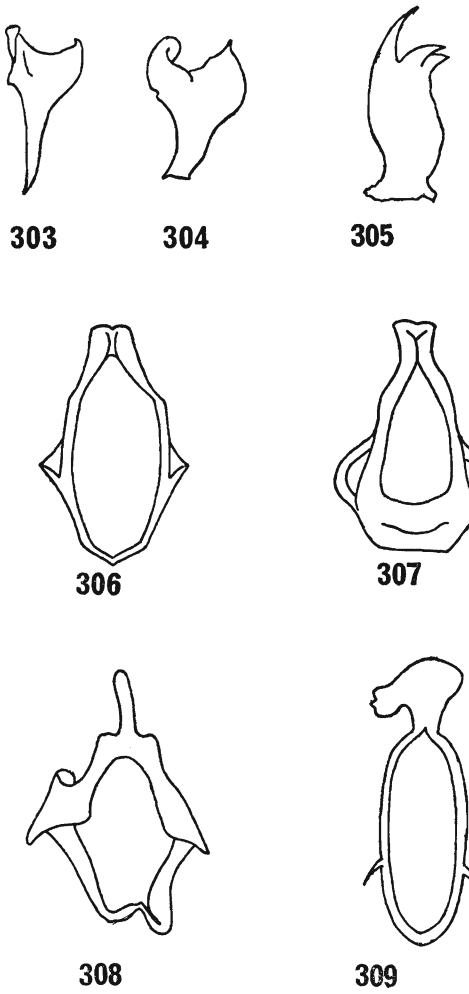
Distribution records before 1932 are unreliable due to confusion. Both species are fairly common on a wide range of trees, and are found throughout Europe and one (*A. bifasciata*) also in North America. *Amphigerontia* at present contains about 30 species, and is of world-wide distribution.



FIGS. 295–302.—Psocidae, male hypandria. (295–297) Apex of hypandrium of (295) *Amphigerontia bifasciata*, (296) *A. contaminata*, (297) *Euclismia quadrimaculata*. (298–301) Posterior aspect of hypandrium of (298) *Psococerastis gibbosa*, (299) *Psocus bipunctatus*, (300) *Metylophorus nebulosus*, (301) *Atlantopsocus personatus hibernicus*. (302) Lateral aspect of hypandrium of *A. p. hibernicus*. (298, 299 *after* Badonnel, 1943).

KEY TO SPECIES

1 Forewing with Rs, if projected, meeting AP (fig. 287). ♀, subgenital plate with sclerotized region extending posteriorly either side of median sclerotized line (fig. 311), apex slightly pointed; gonapophyses with ventral expansion of dorsal valve strongly developed. ♂, hypandrium (fig. 296) with central apical lobe expanded at apex and divided into two teeth; parameres (fig. 304) strongly expanded, with outer point extended. (Abdomen yellowish, annulated with brown; ♂ forewing lightly marked, no transverse band of pigment)
contaminata (Stephens, 1836)
(=*Psocus contaminatus* Stephens, 1836; *Psocus megastigmus* Stephens, 1836; *Amphigerontia bifasciata* (Latreille) Kolbe, 1880; *Amphigerontia contaminata* (Stephens) Badonnel, 1943).



FIGS. 303–309.—Psocidae, male phallosomes. 303–305. Paramere of (303) *Amphigerontia bifasciata*, (304) *A. contaminata*, (305) *Euclismia quadrimaculata*. (306–309) Phallosomes of (306) *Metylophorus nebulosus*, (307) *Psococerastis gibbosa*, (308) *Atlantopsocus personatus hibernicus*, (309) *Psocus bipunctatus*. (309 *after* Badonnel, 1943).

– Forewing with Rs, if projected, meeting cell m_3 (fig. 288). ♀, subgenital plate without patches of lateral sclerotization posterior to transverse bar (fig. 310), apex rounded; gonapophyses with ventral expansion of dorsal valve relatively small (fig. 316). ♂, hypandrium (fig. 295) with median apical process slender and undivided. Parameres (fig. 303) moderately expanded at apex, outer tooth distinct but not as prominent as preceding species. (Abdomen yellowish with brown spots, sometimes confluent but never forming well-defined bands; ♂ forewing with transverse band of pigment).....**bifasciata** (Latreille, 1799) (=*Psocus bifasciatus* Latreille, 1799; *Amphigerontia subnebulosa* Kolbe, 1880; *Amphigerontia bifasciata* (Latreille) Jentsch, 1938b).

A third European species of this genus, *A. intermedia* Tetens (1891), has not yet been found in Britain, but could be confused with *bifasciata* in colouring and female genitalia. The hypandrium is similar to that of *contaminata* in having the median apical lobe expanded and divided, but the parameres are serrate towards the apex and the outer tooth projects well beyond the inner expansion. Subgenital plate pigmented as in *bifasciata*, but the median anterior expansion of the transverse bar is not bifurcated.

Genus **Blaste**: subgenus **Euclismia** Enderlein, 1925

One British species, which is local and rarely seen. It is found most usually on lichen-covered rocks, especially in limestone areas (*teste* Pearman). Rarely found on trees. In Britain, the subgenus is immediately recognizable on the form of AP: *Blaste* s.l. is found in all parts of the world, and some of its constituent subgenera are inadequately known.

– Yellowish brown, with brown markings. Forewing (fig. 289) length 2·7–3·5 mm.; thoracic lobes almost black, abdomen with brown markings forming a cross. ♀, subgenital plate (fig. 322) with apex rounded and strong V-shaped sclerotization pattern; gonapophyses with spatulate extension to dorsal valve. ♂, hypandrium (fig. 297) with apex bifurcate; parameres (fig. 305) with strongly developed external hook and two shorter inner hooks. . . . **quadrimaculata** (Latreille, 1794) (=*Psocus quadrimaculatus* Latreille, 1794; *Psocus subnebulosus* Stephens, 1836 (♂); *Psocus maculipennis* Stephens, 1836 (♀); *Euclismia quadrimaculata* (Latreille) (Enderlein, 1925)).

A second European species, *B.* (*E.*) *conspurcata* (Rambur, 1842) is known from France and Germany. It is usually larger than *quadrimaculata* (forewing to 4 mm. long); the subgenital plate has the sclerotization pattern very weak in the midline and the anterior arms not as strongly divergent. The hypandrial apex is more deeply divided and the outer hook on the parameres very strongly developed and curved round beyond the inner hooks.

Genus **Metylophorus** Pearman, 1932a

One British and European species.

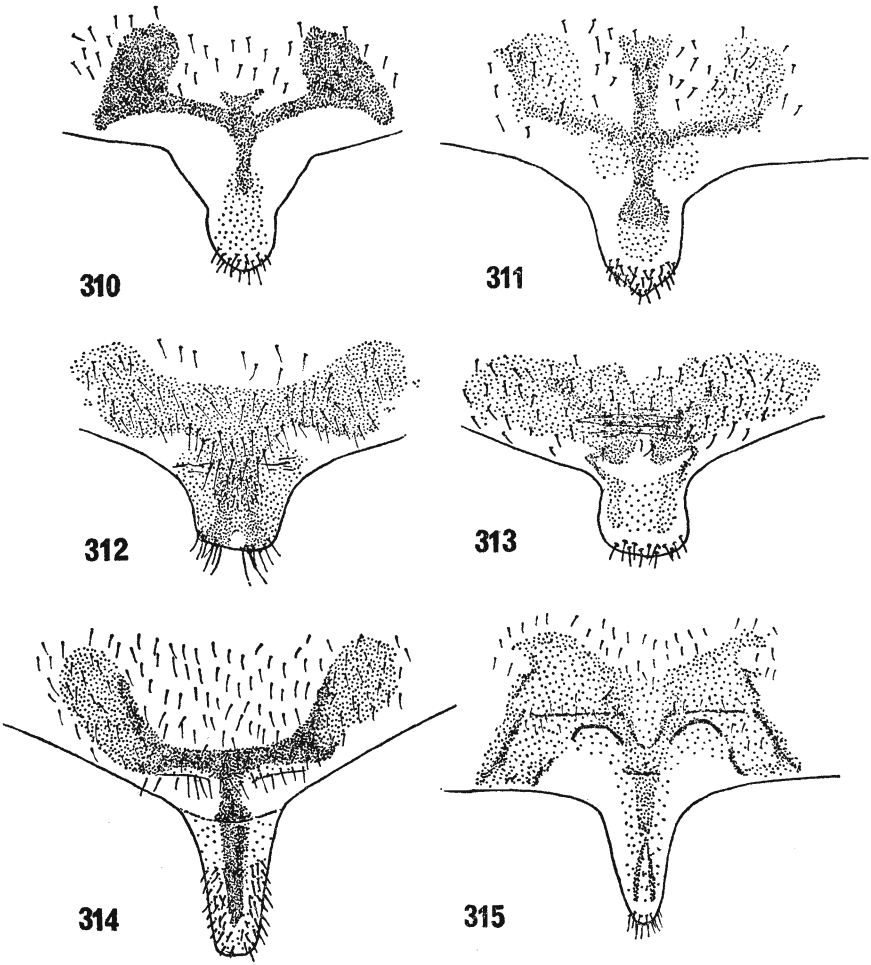
– Forewing (fig. 292) brown, 5–5·5 mm. long. ♀, subgenital plate (fig. 314) with long narrow posterior lobe; gonapophyses (fig. 318) with dorsal valve spatulate and bluntly rounded; external valve narrow, transverse. ♂, hypandrium (fig. 300) with asymmetrical posterior apophyses; phallosome (fig. 306) with frame slightly open posteriorly and with prominent lateral processes towards anterior end **nebulosus** (Stephens, 1836) (=*Psocus nebulosus* Stephens, 1836; *Metylophorus nebulosus* (Stephens) Pearman, 1932a).

Apparently widely distributed in Britain but local and usually found in only small numbers on bark of many kinds of trees. The same species has been recorded also from India, China and Japan.

Genus **Psococerastis** Pearman, 1932a

One British and European species, reported also from Asia.

– Forewing (fig. 293) faintly browned, with small brown markings as shown, length 5·4–6·8 mm. ♀, subgenital plate (fig. 323) with T-shaped sclerotized area; a short broad posterior lobe; gonapophyses with dorsal valve broad and pointed. ♂, hypandrium (fig. 298) asymmetrical, with rows of denticles along posterior ridges; phallosome (fig. 307) with strong lateral processes, transverse posteriorly, and with narrow apex. . . . . **gibbosa** (Sulzer, 1776)



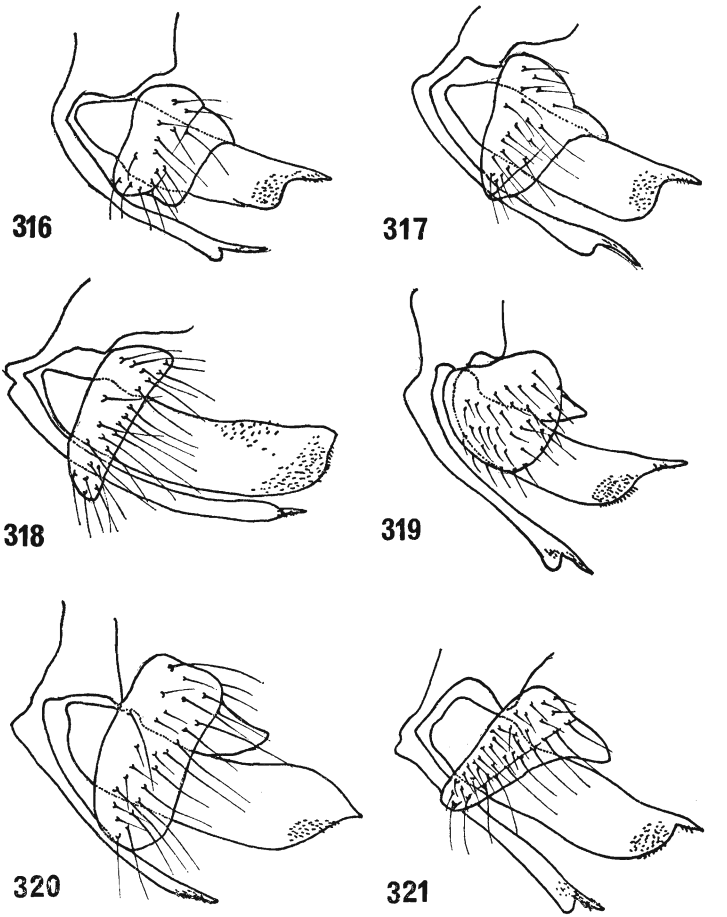
FIGS. 310–315.—Psocidae, female subgenital plate. (310) *Amphigerontia bifasciata*, (311) *A. contaminata*, (312) *Atlantopsocus personatus hibernicus*, (313) *Clematostigma morio*, (314) *Metylophorus nebulosus*, (315) *Psocus bipunctatus*. (313, 315 after Badonnel, 1943).

(=*Phryganea gibbosa* Sulzer, 1776; *Hemerobius longicornis* F., 1777; *Psocus saltatrix* (L.) Hagen, 1866; *P. gibbosus* (Sulzer) Enderlein, 1919; *Psococerastis gibbosa* (Sulzer) Pearman, 1932a).

This is the largest British psocid, and is found locally on many kinds of trees, especially in southern and central England.

Genus **Atlantopsocus** Badonnel, 1944

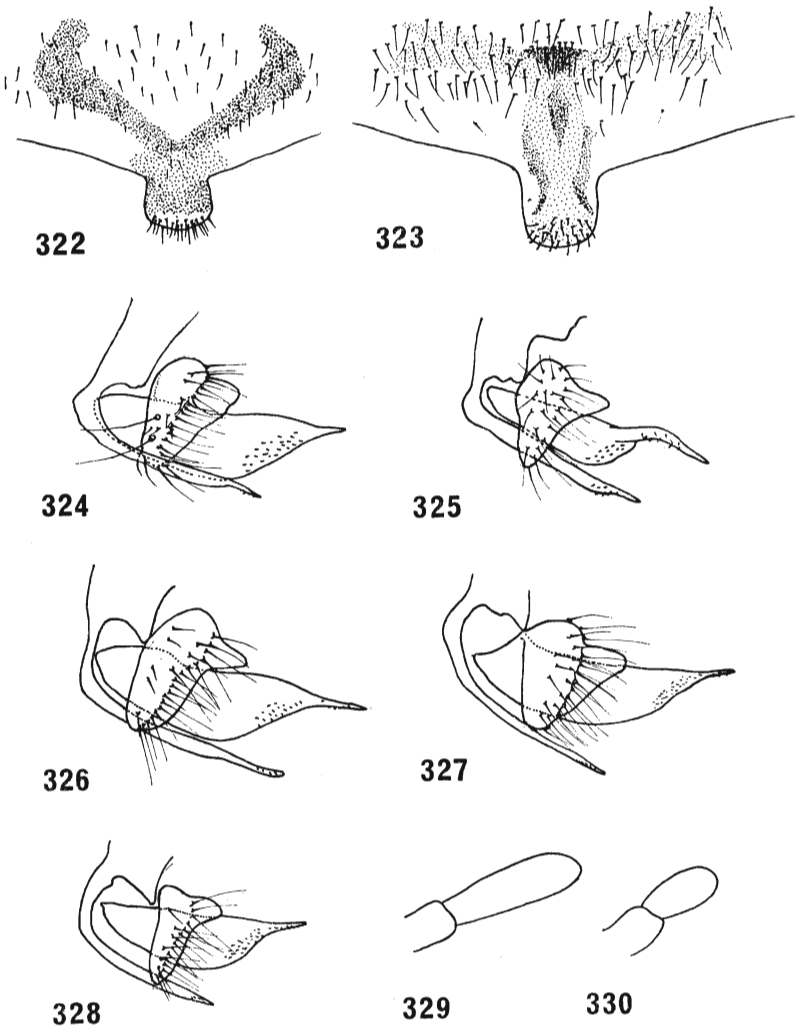
One apparently endemic Irish subspecies of a species occurring in Madeira and the Canary Islands.



FIGS. 316–321.—Psocidae, female gonapophyses. (316) *Amphigerontia bifasciata*, (317) *A. contaminata*, (318) *Metylophorus nebulosus*, (319) *Psocus bipunctatus*, (320) *Psococerastis gibbosa*, (321) *Clematostigma morio*. (319, 321 *after* Badonnel, 1943).

– Forewing (fig. 294) hyaline except for pterostigma, length about 3·5 mm. ♀, subgenital plate with broad transverse apex (fig. 312); gonapophyses (fig. 324) with apex of dorsal valve long and tapering; ventral valve slender. ♂, hypandrium (figs. 301, 302) symmetrical, with double posterior row of strong teeth; phallosome frame (fig. 308) narrow anteriorly, apex narrow and elongate
personatus ssp. **hibernicus** Fahy, 1968
Found on a range of tree species in Western Ireland (*Fahy* 1968).

This genus of six described species is found predominantly in the Canary Islands and the Azores, although one species is known from Morocco. Separation of its species is discussed by Badonnel (1944) and Meinander (1966).



FIGS. 322–330.—Psocidae. (322, 323) Female, subgenital plate of (322) *Euclismia quadrimaculata*, (323) *Psococerastis gibbosa*. (324–328) Gonapophyses of (324) *Atlantopsocus personatus hibernicus*, (325) *Euclismia quadrimaculata*, (326) *Trichadenotecnum fasciatum*, (327) *T. majus*, (328) *T. sexpunctatum*. (329, 330) Apex of maxillary palp of (329) *Amphigerontia*, (330) *Psococerastis*.

Genus **Copostigma**: subgenus **Clematostigma** Enderlein, 1906

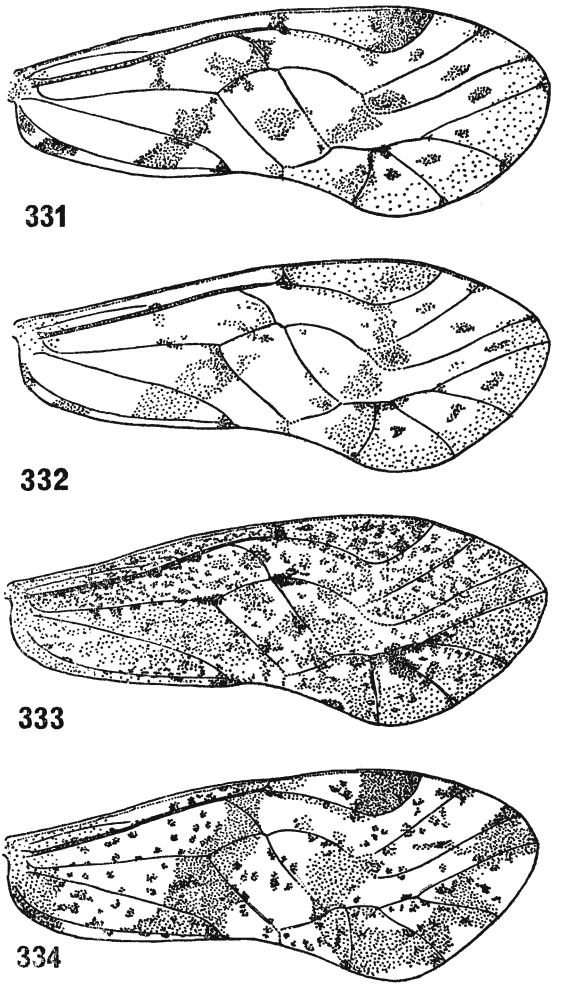
One British and European species. The male is unknown (but generic characters for this sex are given in the key), and the female found on bark.

– Immediately recognizable on the dark brown forewing (fig. 290), length about 2·8–3 mm.; subgenital plate and gonapophyses as in figs. 313, 321

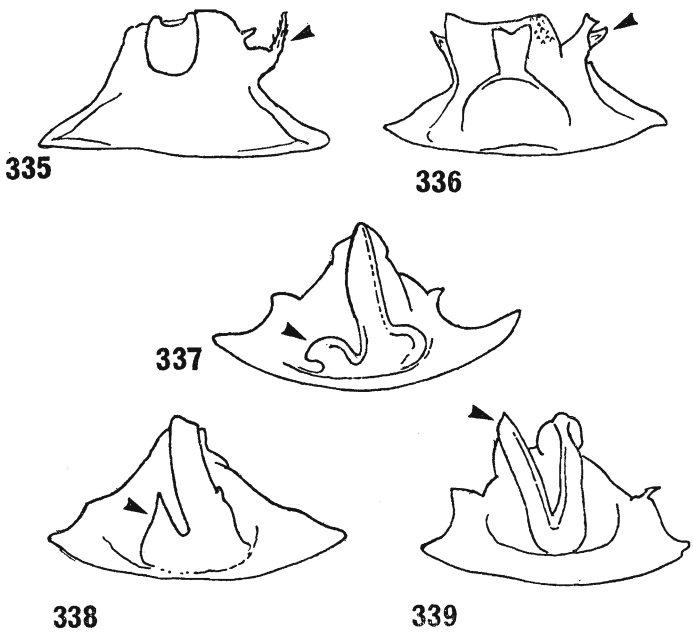
morio (Latreille, 1794)

(=*Psocus morio* Latreille, 1794; *Clematostigma morio* (Latreille) Enderlein, 1903; *Psocus allaudi* Lacroix, 1915).

Very rare, and apparently not recorded from Britain since 1867, *in Kent.*



FIGS. 331–334.—Psocidae. Forewings of (331) *Trichadenotecnum sexpunctatum*, (332) *T. majus*, (333) *T. variegatum*, (334) *T. fasciatum*.



FIGS. 335–339.—Psocidae, male hypandrium. Posterior aspects of hypandria of (335) *Trichadenotecnum sexpunctatum*, (336) *T. majus*, (337) *T. variegatum*, (338) *T. pearmani*, (339) *T. fasciatum*.

Genus **Psocus** Latreille, 1794

One British and European species.

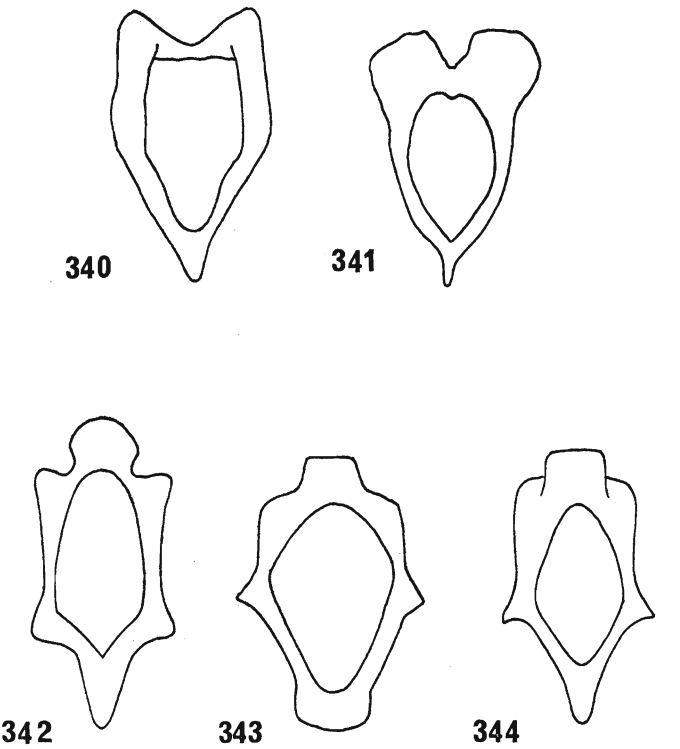
– Forewing with dark spot on pterostigma; that of ♀ also with transverse band as in fig. 291, forewing length about 4 mm. ♀, subgenital plate and gonapophyses as in figs. 315, 319. ♂, hypandrium and phallosome as in figs. 299, 309 **bipunctatus** (L., 1761)
(=*Hemerobius bipunctatus* L., 1761; *Psocus bipunctatus* (L.) Latreille, 1794).
Not recorded in Britain since 1837 (*"found occasionally within the metropolitan district and in Suffolk, in the summer"—Stephens*). *Found throughout Europe on bark of various trees and on rock surfaces.*

Genus **Trichadenotecnum**: subgenus **Trichadenotecnum** Enderlein, 1909

Two British species, both common in Europe and one (*T. majus*) known from North America. Both are bark frequenters found on a wide range of trees and are widely distributed (though not usually common) in Britain.

KEY TO SPECIES

1 Forewing with brown patterning in discal cell composed of a large brown patch (forewing (fig. 331) about 3·7–4·0 mm. long. ♀, subgenital plate with broad blunt, parallel-sided apical lobe; broad Y-shaped sclerotization pattern; gonapophyses as in fig. 328. ♂, hypandrium with long lateral apophyses on right side (fig. 335); phallosome as fig. 341) ..... **sexpunctatum** (L., 1761)
(=*Hemerobius sexpunctatus* L., 1761; *Psocus sexpunctatus* (L.) F., 1798; *Trichadenotecnum sexpunctatus* (L.) Enderlein, 1909).



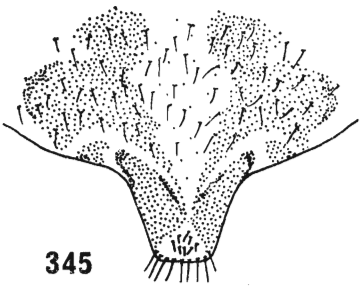
FIGS. 340–344.—Psocidae, male phallosomes. (340) *Trichadenotecnum majus*, (341) *T. sexpunctatum*, (342) *T. fasciatum*, (343) *T. variegatum*, (344) *T. pearmani*.

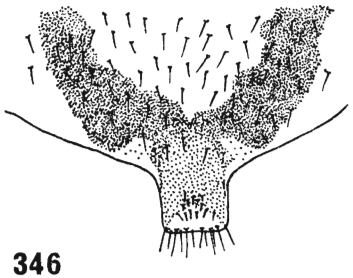
– Forewing with brown patterning in discal cell composed of numerous small dots. (Forewing (fig. 332) 3·6–4·6 mm. long. ♀, subgenital plate (fig. 345) with broad apex having lateral margins converging posteriorly and lateral hyaline areas behind apex; gonapophyses as fig. 327. ♂, hypandrium (fig. 336) with short blunt apophysis on right side. Phallosome as in fig. 340. . **majus** (Kolbe, 1880) (=*Psocus sexpunctatus* var. *major* Kolbe, 1880; *Psocus major* (Kolbe) Loens, 1890; *Trichadenotecnum majus* (Kolbe) Enderlein, 1909).

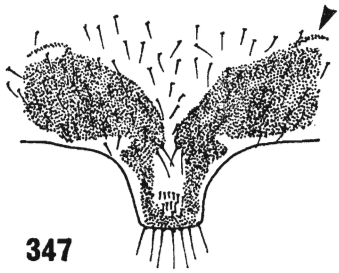
A third European species in this group, *T. germanicum* Roesler (1939), has the forewing most resembling *sexpunctatum*, from which the species can be separated on the broader sclerotization pattern of the subgenital plate and by the hypandrium lacking the slender apophysis on the right side.

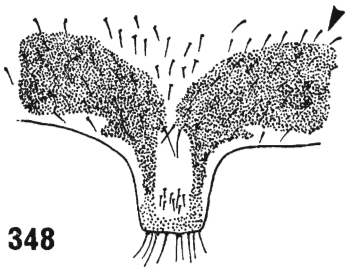
Genus **Trichadenotecnum**: subgenus **Loensia** Enderlein, 1924

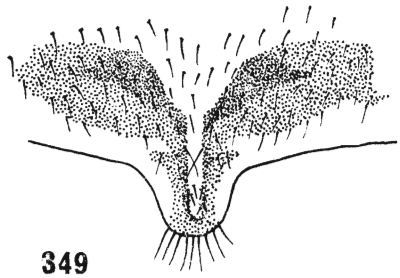
Three British and European species, all found on bark of a range of trees and none common in Britain. Early records of specific identification should be treated with caution due to confusion between *variegatum* and *pearmani*.











FIGS. 345–349.—Psocidae, female subgenital plates. (345) *Trichadenotecnum majus*, (346) *T. sexpunctatum*, (347), *T. variegatum*, (348) *T. pearmani*, (349) *T. fasciatum*.

KEY TO SPECIES

1 Forewing with brown pigmentation concentrated in transverse bands; intervening hyaline areas with small brown spots (fig. 334). (Forewing length about 4·5–4·8 mm. ♀, subgenital plate (fig. 349) with apex rounded, sclerotized areas broad anteriorly; gonapophyses as in fig. 326. ♂, hypandrium with two long posterior apophyses; phallosome as in fig. 342, with anterior region elongated) **fasciatum** (F., 1787)
(=*Hemerobius trifasciatus* Mueller, 1776; *H. fasciatus* F., 1787; *Amphigerontia fasciata* (F.) Enderlein, 1906; *Loensia fasciata* (F.) Enderlein, 1924).

– Forewing without such concentrated bands of brown pigment (Forewing length under 4 mm.) 2

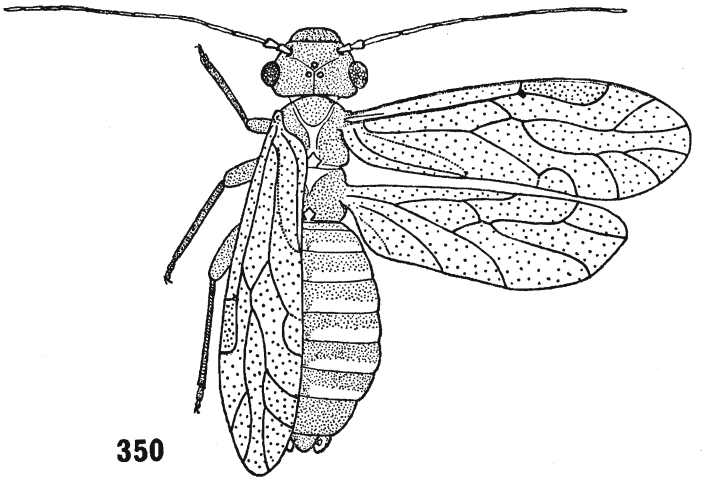


FIG. 350.—*Lachesilla pedicularia*, adult female.

2 Forewing (fig. 333) about 3·8 mm., with heavy mottled brown pigmentation. ♀, subgenital plate as in fig. 347, with two narrow sclerotized lines in antero-lateral regions. ♂, hypandrium (fig. 337) with one long posterior apophysis, and a small outwardly curved basal apophysis to the left of this; phallosome (fig. 343) with broad transverse anterior region . . . . **variegatum** (Latreille, 1799) (=*Psocus variegatus* Latreille, 1799; *Amphigerontia variegata* (Latreille) Kolbe, 1880; *Loensia variegata* (Latreille) Pearman, 1932a).

– Forewing usually slightly smaller than above (3·5–3·6 mm.), pigmentation similar. ♀, subgenital plate (fig. 348) lacking narrow antero-lateral sclerotized lines. ♂, hypandrium (fig. 338) with one long posterior apophysis and a small straight basal apophysis to the left of this; phallosome (fig. 343) broad, with anterior end strongly tapered . . . . . **pearmani** Kimmins, 1941 (=*Psocus picicorne* Stephens, 1836; *Loensia picicornis* (Stephens) Pearman, 1932a; *Loensia pearmani* Kimmins, 1941—nom. nov. for *Psocus picicornis* Stephens).

REFERENCES

AARON, S. F. 1883. Description of new Psocidae in the collection of the American Entomological Society. *Trans. Am. ent. Soc.* **11** : 37–30.

BADONNEL, A. 1931. Contribution à l'étude de la faune du Mozambique. Voyage de M. P. Lesne (1928–29). 4e note. Copeognathes. *Annls Sci. nat.* (*Zool.*) (10) **14** : 229–60.

—— 1932. Copeognathes de France (IVe note). I. Sur un nouveau genre de famille des Caeciliidae. *Bull. Soc. ent. Fr.* **37** : 77–9.

—— 1934. Recherches sur l'anatomie des Psoques. *Bull. biol. Fr. Belg.* Suppl. **18** : 241 pp.

—— 1935. Psocoptères nouveaux d'Afrique et d'Arabie. *Rev. fr. Ent.* **2** : 76–82.

—— 1936. Les Caeciliides européens à ailes ocracées. *Rev. fr. Ent.* **3** : 177–89.

—— 1943. Psocoptères. *Faune Fr.* **42** : 1–164. (Reprinted 1970 by Kraus Reprint, Nendeln/Lichtenstein.)

—— 1944. Contribution à l'étude des Psocoptères de l'Atlantide. *Rev. fr. Ent.* **11** : 47–60.

—— 1945. Contribution à l'étude des Psocoptères du Maroc. Voyage de L. Berland et M. Vachon. *Rev. fr. Ent.* **12** : 31–50.

—— 1949. Psocoptères de la Côte d'Ivoire. Mission Paulian–Delamere (1945). *Rev. fr. Ent.* **16** : 20–40.
—— 1951. in Grassé, P. P. (ed.). *Traité de Zoologie*, Paris. **10** : 1301–40.
—— 1955. Psocoptères de l'Angola. *Publções cult. Co. Diam. Angola*, **26** : 1–267.
—— 1963. Psocoptères terricoles, lapidicoles et corticoles du Chili. *Biologie de l'Amerique australe*, Paris, **2** : 291–338.
—— 1969. Psocoptères de l'Angola et de pays voisins, avec révision de types africains d'Enderlein (1902) et de Ribaga (1911). *Publções cult. Co. Diam. Angola.* **79** : 1–152.
—— 1970. *see* Badonnel, 1943.
—— 1971. *Sphaeropsocopsis reisi* n. sp., premier représentant africain connu de la famille des Sphaeropsocidae (Psocoptera, Nanopsocetae) avec compléments à la faune des Psocoptères angolais. *Publções cult. Co. Diam. Angola.* **84** : 13–28.
Bagnall, R. S. 1915. *Pterodela livida* Enderlein, a psocid new to the British fauna. *Entomologist's Rec. J. Var.* **27** : 228.
Ball, A. 1943. Contribution à l'étude des Psocoptères. III. *Ectopsocus* du Congo belge, avec une remarque sur le rapport I.O./D. *Bull. Mus. Hist. nat. Belg.* **19** : 1–28.
Banks, N. 1900. Two new species of *Troctes*. *Ent. News*, **11** : 559–60.
Becker-Migdisova, E. E. and Vishniakova, V. N. 1962. *Principles of Palaeontology.* Moscow, pp. 226–35.
Bertkau, P. 1883. Ueber den Geschlechtsdimorphismus und die Speicheldruzen der Psociden und ein Verzeichniss der bisher bei Bonn Beobachten Arten. *Verh. naturh. Ver. preuss. Rheinl.* **39** : 127–33.
Brauer, F. 1876. Die Neuropteren Europas, und insbesondere Oesterreichs, mit Rucksicht auf ihre geographische Verbreitung. *Festsch. zool.-bot. Ges. Wien.* **4** : 265–600.
Broadhead, E. 1947a. New species of *Liposcelis* Motschulsky (Corrodentia, Liposcelidae) in England. *Trans. R. ent. Soc. Lond.* **98** : 41–58.
—— 1947b. The life history of *Embidopsocus enderleini* (Rib.) (Corrodentia) (Liposcelidae). *Entomologist's mon. Mag.* **83** : 200–3.
—— 1950. A revision of the genus *Liposcelis* Motschulsky with notes on the position of this genus in the order Corrodentia and on the variability of ten *Liposcelis* species. *Trans. R. ent. Soc. Lond.* **101** : 335–88.
—— 1952. The nomenclature of some British Psocoptera. *Entomologist's mon. mag.* **88** : 83.
—— 1954a. A new parthenogenetic psocid from stored products, with observations on parthenogenesis in other psocids. *Entomologist's mon. Mag.* **90** : 10–16.
—— 1954b. The infestation of warehouses and ships' holds by psocids in Britain. *Entomologist's mon. mag.* **90** : 103–5.
—— 1955. Two new psocid species from stored products in Britain. *Proc. R. ent. Soc. Lond.* (*B.*) **24** : 7–12.
—— 1964. *Order XVI: Psocoptera*, in Kloet, G. S. & Hincks, W. D. *A Check list of British Insects*, pp. 23–25. 2nd edition. Royal Entomological Society of London.
—— and Datta, B. 1960. The taxonomy and ecology of British species of *Peripsocus* Hagen. (Corrodentia, Pseudocaeciliidae). *Trans. Soc. Br. Ent.* **14** : 131–46.
—— and Hobby, B. M. 1944. Studies on a species of *Liposcelis* (Corrodentia, Liposcelidae) occurring in stored products in Britain. I. *Entomologist's mon. Mag.* **80** : 45–59.
Burmeister, H. 1839. *Handbuch der Entomologie*, Berlin. Vol. 2.
Chapman, P. J. 1930. Corrodentia of the United States of America. I. Suborder Isotecnomera. *Jl. N.Y. ent. Soc.* **38** : 219–90, 319–402.
Clay, T. 1971. A new species of *Austrogonioides* (Phthiraptera : Philopteridae) from a duck (Anseriformes). *J. Aust. entomol. Soc.* **10** : 293–98.
Curtis, J. 1837. *British Entomology.* London. Part 14 : 649–651.
Dalman, J. W. 1823. *Analecta Entomolgica.* Holmiae.
Enderlein, G. 1901. Neue deutsche und exotische Psociden sowie Bemerkungen zur Systematik. *Zool. Jb.* (*Syst.*) **14** : 537–48.
—— 1903a. Die Copecgnathen des indo-australischen Faunengebietes. *Annls. hist.-nat. Mus. natn. hung.* **1** : 179–344.
—— 1903b. Zur Kenntnis europaischer Psociden. I–III. *Zool. Jb.* (*Syst.*) **18** : 365–82.
—— 1903c. Ein neuer Copeognathentypus, zugleich ein neuer deutscher Wohnungsschadling. *Zool. Anz.* **27** : 76.

—— 1903d. Uber die Stellung von *Leptella* Reut. und *Reuterella* nov.-gen., die Vertreter zweier neuer europaischer Copeognathensubfamilien. *Zool. Anz.* **27** : 131–4.
—— 1905. Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901. 18. Morphologie, Systematik und Biologie der Atropiden und Troctiden sowie Zusammenstellung aller bisher bekannten recenten und fossilen Formen. 58 pp.
—— 1906. The scaly-winged Copeognatha. *Spolia zeylan.* **4** : 39–122.
—— 1908. Die Copeognathenfauna der Insel Formosa. *Zool. Anz.* **33** : 759–79.
—— 1910. Eine dekade neuer Copeognathengattungen. *Berlin SitzBer. Ges. naturf. Freundl.* **1910** : 63–77.
—— 1911. Die fossilen Copeognathen und ihre Phylogenie. *Palaeontographica.* **58** : 279–360.
—— 1919. Copeognatha. *Coll. zool. du Baron Edm. de Sélys-Longchamps.* **3** : 1–55.
—— 1922. A scaly-winged Psocid, new to science, discovered in Britain. *Entomologist's mon. Mag.* **58** : 101–4.
—— 1924. *Copeognathen.* in Damph, A., Zur kenntnis der estlandischen Moorfauna (II). *Berlin SitzBer. Ges. naturf. Freundl.* **31** : 34–7.
—— 1925. Beitrage zur kenntnis der Copeognathen IX. *Konowia* **4** : 97–108.
—— 1927. *Copeognatha* in Brohmer, P., Ehrmann, P. & Ulmer, G. *Tierwelt Mitteleur.* 4.2. 16 pp.
FAHY, E. D. 1968. A new subspecies of *Atlantopsocus personatus* (Psocoptera) from southern Ireland. *Entomologist's mon. Mag.* **103** : 205–7.
—— 1970. The distribution of the Irish Psocoptera. *Proc. R. Ir. Acad.* (B) **69** : 139–63.
GUNTHER, K. K. 1971. 215. Psocoptera II. Ergebnisse der zoologischen Forschungen von Dr. Z. Kaszab in der Mongolei. *Faunistische Abhandlungen, Berlin.* **3** (10) : 92–109.
GURNEY, A. B. 1943. A synopsis of the psocids of the tribe Psyllipsocini, including the description of an unusual new genus from Arizona (Corrodentia, Empheriidae, Empheriinae). *Ann. ent. Soc. Am.* **36** : 196–220.
—— 1949. Distributional and synonymic notes on Psocids common to Europe and North America, with remarks on the distribution of Holarctic insects (Corrodentia). *J. Wash. Acad. Sci.* **39** : 56–65.
HAGEN, H. 1861. Synopsis of the British Psocidae. *Entomologist's Annual.* **1861** : 17–32.
—— 1865. Synopsis of the Psocina without ocelli. *Entomologist's mon. Mag.* **2** : 121–4.
—— 1866. On some aberrant genera of Psocina. *Entomologist's mon. Mag.* **2** : 170–2.
—— 1876. *Pseudoneuroptera.* in Kidder, J. H. *Contributions to the natural history of Kerguelen Island. Bull. U.S. natn. Mus.* **1** : 1–122.
—— 1882. Beitrage zur Monographie der Psociden. Ueber psociden im Bernstein. *Stettin. ent. Ztg.* **43** : 217–37.
—— 1883. Beitrage zur Monographie der Psociden. Familie Atropina. *Stettin. ent. Ztg.* **44** : 285–332.
HARRIS, T. W. 1869. Entomological correspondence of Thaddeus William Harris M.D. (ed. S. H. Scudder). *Occ. Pap. Boston Soc. nat. Hist.* **1** : 375 pp.
HARRISON, J. W. H. 1916. A November week at Grange-over-Sands. V. Psocoptera collected by Richard S. Bagnall, F.L.S. *Lancs. Nat.* **9** : 107–9.
HAUB, F. 1972. Das Cibarialsklerit der Mallophaga-Amblycera und der Mallophaga-Ischnocera (Kellogg) (Insecta). *Z. Morph. Ökol. Tiere.* **73** : 249–61.
HEYDEN, G. H. 1850. Zwei neue deutsche Neuroptera-Gattungen. *Stettin. ent. Ztg.* **11** : 83–5.
HICKMAN, V. V. 1934. A contribution to the study of Tasmanian Copeognatha. *Pap. Proc. Roy. Soc. Tasm.* **1933** : 77–89.
ILLIGER, J. C. W. 1798. *Kugelann Verzeichniss der Käfer Preussens, ausgearbeitet von Illiger, mit einer vorrede von Hellwig und angehangten Versuch einer naturlichen ordnung und Gattungsfolge der Insecten.* Halle. 510 pp.
IMHOFF, L. and LABRAM, J. D. 1846. *Insecten der Schweiz.* Basel.
IMMS, A. D. 1964. *A General Textbook of Entomology* (9th ed., revised by Richards, O. W. & Davies, R. G.). 886 pp.
JENTSCH, S. 1938a. Beitrage zur kenntnis der Uberordnung Psocoidea. Zur Copeognathenfauna Nordwesfalens. *Abh. westf. ProvMus. Naturk.* **9** : 3–42.
—— 1938b. Beitrage zur kenntnis der Uberordnung Psocidea. 3. Die Gattung *Amphigerontia* (Copeognatha). *Zool. Anz.* **122** : 87–94.

KÉLER, S. VON. 1963. 12 Ordnung: Flechtlinge. *Tierwelt Mitteleur.*, Leipzig, *IV* (VIIa) : 1–24, +6 plates.
—— 1966. Zur Mechanik der Nahrungsaufnahme bei Corrodentien. *Z. Parasitkde.* **27** : 64–79.
KIMMINS, D. E. 1941. Notes on British Psocoptera. I. *Elipsocus hyalinus* (Steph.) and its allies. *Ann. Mag. nat. Hist.* (II) **7** : 520–30.
KLIER, E. 1956. Zur Konstruktionsmorphologie des mannlichen Geschlechtsapparates der Psocoptera. *Zool. Jb.* (*Anat.*) **75** : 207–86.
KOLBE, H. J. 1880. Monographie der deutschen Psociden mit besonderer Berucksichtigung der Fauna West-falens. *Jber. westf. ProvVer. Wiss. Kunst.* **8** : 73–142.
—— 1882. Neue Psociden der paläarktischen Region. *Ent. Nachrbl.* **8** : 207–12.
—— 1883. Neue Beitrage zur kenntniss der Psociden der Bernstein-Fauna. *Stettin. ent. Ztg.* **44** : 186–91.
LACROIX, J. 1915. Psocides nouveaux (Nevr.). *Bull. Soc. ent. Fr.* **1915** : 192–5.
LATREILLE, P. A. 1794. Découverte de nids de Termes, et *Psocus* decrits. *Bull. Soc. philomath. Paris*, **1** : 84–5.
—— 1799. Le genre *Psocus*. In Coquebert, A. J., *Illustrata Iconographica Insectorum.* **1** : 8–14.
LEACH, W. 1815. *The Edinburgh Encyclopaedia.* Edinburgh. **9** : 139.
MATSUDA, R. 1966. Morphology and evolution of the insect head. *Mem. Am. ent. Inst.* **4** : 324 pp.
—— 1970. Morphology and evolution of the insect thorax. *Mem. ent. Soc. Canada*, **76** : 431 pp.
MCLACHLAN, R. 1867. A monograph of the British Psocidae. *Entomologist's mon. Mag.* **3** : 177–81, 194–7, 226–31, 241–5, 270–6.
—— 1869. Description of a new species of Psocidae (*Caecilius atricornis*) inhabiting Britain. *Entomologist's mon. Mag.* **5** : 196.
—— 1890. Two species of Psocidae new to Britain. *Entomologist's mon. Mag.* **26** : 269–70.
—— 1899. *Ectopsocus briggsi*, a new genus and species of Psocidae found in England. *Entomologist's mon. Mag.* **35** : 277–8.
MEINANDER, M. 1966. Psocoptera from the mid-Atlantic Islands and Morocco. *Notul. ent.* **46** : 107–21.
MOCKFORD, E. L. 1955. Studies on the Reuterelline Psocids (Psocoptera). *Proc. ent. Soc. Wash.* **57** : 97–108.
—— 1963. The species of Embidopsocinae of the United States (Psocoptera : Liposcelidae). *Ann. ent. Soc. Amer.* **56** : 25–37.
—— 1965. The genus *Caecilius* (Psocoptera : Caeciliidae). Part 1. Species groups and the North American species of the *flavidus* group. *Trans. Am. ent. Soc.* **91** : 121–66.
——1971. *Peripsocus* species of the *alboguttatus* group. (Psocoptera : Peripsocidae). *Jl.N.Y. ent. Soc.* **79** : 89–115.
—— and GURNEY, A. B. 1956. A review of the psocids, or booklice and barklice, of Texas. (Psocoptera). *Jl. Wash. Acad. Sci.* **46** : 353–68.
MOTSCHULSKY, V. VON. 1851. Énumerations des nouvelles espèces des Coléoptères rapportés par M. Victor Motschulsky de son dernier voyage. *Bull. Soc. imp. Nat. Moscow*, **24** : 479–511.
—— 1852. *Etudes entomologiques.* Helsingfors.
MUELLER, O. F. 1764. *Fauna insectorum Freidrichsdalma* . . . Hafniae. 96 pp.
NAVAS, L. 1908. Neuropteros nuevos. *Mems. R. Acad. Cienc. Artes Barcelona* (3) **6** : 401–23.
—— 1913. Socidos de Espana, nuevos. *Revta. R. Acad. Cienc. exact. fis.-nat. Madr.* **12** : 329–35.
—— 1927. Insetti raccolti nel Porto di Genova sulle Banane delle Canarie. *Boll. Soc. ent. ital.* **59** : 150–2.
NEW, T. R. 1971. An introduction to the natural history of the British Psocoptera. *Entomologist*, **104** : 59–97.
OBR, S. 1948. A la connaissance des Psocoptères de Moravie (Tchecoslovaquie). *Publ. Fac. Sci. Univ. Masaryk.* **360** : 108 pp.
PEARMAN, J. V. 1924. A new species of *Caecilius* (Psocoptera). *Entomologist's mon. Mag.* **60** : 58–61.
—— 1925a. Additions to the British Psocid fauna. *Entomologist's mon. Mag.* **61** : 124–9.

—— 1925b. A short account of British psocids. *Rept. Bristol Nat. Soc.* **6** : 222–8.
—— 1927. Notes on *Pteroxanium squamosum* End. and on the eggs of the Atropidae (Psocoptera). *Entomologist's mon. Mag.* **63** : 107–11.
—— 1928a. On sound production in the Psocoptera and on a presumed stridulatory organ. *Entomologist's mon. Mag.* **64** : 179–86.
—— 1928b. Some Psocoptera from the New Hebrides. *Entomologist's mon. Mag.* **64** : 133–7.
—— 1929. New species of Psocoptera from warehouses. *Entomologist's mon. Mag.* **65** : 104–9.
—— 1931. More Psocoptera from warehouses. *Entomologist's mon. Mag.* **67** : 95–8.
—— 1932a. Notes on the genus *Psocus*, with special reference to the British species. *Entomologist's mon. Mag.* **68** : 193–204.
—— 1932b. A new species of *Tapinella* (Psocoptera). *Stylops*, **1** : 240–2.
—— 1933. A new species of *Terracaecilius* (Psocoptera). *Entomologist's mon. Mag.* **69** : 81–3.
—— 1934. New and little known African Psocoptera. *Stylops*, **3** : 121–32.
—— 1935. Notes on some dimorphic psocids. *Entomologist's mon. Mag.* **71** : 82–5.
—— 1936. The taxonomy of the Psocoptera: preliminary sketch. *Proc. R. ent. Soc. Lond.* (B) **5** : 58–62.
—— 1942. Third note on Psocoptera from warehouses. *Entomologist's mon. Mag.* **78** : 289–92.
—— 1946. A specific characterization of *Liposcelis divinatorius* (Mueller) and *L. mendax* sp. n. (Psocoptera). *Entomologist*, **79** : 235–44.
—— 1951. Additional species of British Psocoptera. *Entomologist's mon. Mag.* **87** : 84–9.
—— 1952. Nomenclature of some British Psocoptera. *Entomologist's mon. Mag.* **88** : 150.
—— 1953. A new generic form allied to *Sphaeropsocus* Hagen (Psocoptera, Pachytroctidae). *Entomologist's mon. Mag.* **89** : 262.
—— 1958. Augmented description of *Badonnelia titei* Pearman (Psoc. Sphaeropsocidae) with notes on the genus *Sphaeropsocus*. *Entomologist's mon. Mag.* **94** : 49–52.
RAMBUR, J. P. 1842. *Histoire naturelle des Insectes. Neuroptères.* Paris. 534 pp.
REUTER, O. M. 1894. Corrodentia Fennica. I. Psocidae. Forteckning och beskrifning ofver Finlands Psocider. *Act. Soc. Fauna Flora fenn.* **9** : 1–49.
—— 1904. Neue Beitrage zur kenntnis der Copeognathen Finnlands. *Act. Soc. Fauna Flora fenn.* **25** : 1–28.
RIBAGA, C. 1899. Descrizione di nuovo genera e di una nuovo specie di Psocidi trovato in Italia. *Riv. Patol. veg., Padova.* **8** : 156–9.
—— 1904. Sul genere *Ectopsocus* McLach. e descrivizone di una nuova varieta dell *Ectopsocus briggsi* McLach. *Redia*, **1** : 294–8.
—— 1905. Descrizione di nuovi Copeognati. *Redia*, **2** : 99–110.
—— 1910. "*Anisopsocus lichenophilus*", nuovo Copeognato, trovato in Italia. *Redia*, **6** : 272–81.
ROESLER, R. 1939. Beitrage zur kenntnis der Copeognathenfauna Deutschlands. *Zool. Anz.* **125** : 157–76.
—— 1943. Uber einige Copeognathengenera. *Stettin. ent. Ztg.* **104** : 1–14.
—— 1944. Die Gattungen der Copeognathen. *Stettin. ent. Ztg.* **105** : 117–66.
ROSTOCK, M. 1876. Psocidenjagd im Hause. *Ent. Nachr.* **2** : 190–2.
SÉLYS-LONGCHAMPS, E. DE. 1872. Notes on two new genera of Psocidae. *Entomologist's mon. Mag.* **9** : 145–6.
SHIPLEY, A. E. 1904. The orders of insects. *Zool. Anz.* **27** : 259–62.
SMITHERS, C. N. 1967. A catalogue of the Psocoptera of the world. *Aust. Zool.* **14** : 1–145.
—— 1972. The Classification and Phylogeny of the Psocoptera. *Mem. Aust. Mus.* **14** : 349 pp.
STEPHENS, F. 1836. *Illustrations of British Entomology, or synopsis of indigenous insects etc.* London. **6** : 115–29.
SULZER, J. H. 1776. *Agbekurzte Geschichte der Insekten nach dem Linneischen System. Wintethur*, Vol. 1, 274 pp. Vol. II, 72 pp.
TETENS, H. 1891. Zur kenntnis der deutschen Psociden. *Ent. Nachr.* **17** : 369–84.
THORNTON, I. W. B. 1962. The Peripsocidae (Psocoptera) of Hong Kong. *Trans. R. ent. Soc. Lond.* **114** : 285–315.

—— and BROADHEAD, E. 1954. The British Species of *Elipsocus* Hagen (Corrodentia, Mesopsocidae). *J. Soc. Br. Ent.* **5** : 47–64.

TILLYARD, R. J. 1926. Kansas Permian Insects. 8: The order Copeognatha. *Am. J. Sci.* **11** : 315–49.

VERRILL, A. E. 1902. The Bermuda Islands, their scenery, climate, production, physiography, natural history and geology. *Trans. Conn. Acad. Arts Sci.* **11** : 413–957.

VISHNIAKOVA, V. N. 1967. *Psocoptera* in Bei-Bienko, G. Ya. (ed.). *Keys to the insects of the European part of U.S.S.R.* I. 935 pp. Israel Program for Scientific Translation.

WEBER, S. E. 1906. The possible dissemination of tubercle bacilli by insects. *N.Y. med. J.* **84** : 884–8.

—— 1907. A new genus of Atropidae. *Ent. News*, **18** : 189–94.

WESTWOOD, J. O. 1840. *Synopsis of the genera of British Insects.* London. 158 pp.

——1841. Observations on the structural characters of the deathwatch, with the description of a new British genus belonging to the family Psocidae. *Ann. Mag. nat. Hist.* **6** : 480.

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