MORPHOLOGY AND TAXONOMY OF ADULT MALES OF THE FAMILY COCCIDAE (HOMOPTERA: COCCOIDEA)

by

JOHANNES HUMAN GILIOMEE M.Sc. (Agric.)

Thesis submitted for the degree of Doctor of Philosophy in the University of London.

Dept. of Zoology & Applied Entomology,
Imperial College of Science & Technology,
South Kensington,
London, S.W.7.

June, 1964.

ABSTRACT

The males of 23 species (representing 19 genera) of the family Coccidae have been described and illustrated in detail and a general account of the external morphology of male Coccidae is given. A number of structures present in other male Coccoidea but not hitherto observed in the Coccidae have been recorded. The relationships of the lecanoid type of male with the margaroid and diaspidoid types have been discussed and the males of two families of the lecanoid type (Coccidae and Pseudococcidae) have been compared with each other. Within the Coccidae the males were often found to reveal different relationships from the female and a classification is suggested which differs from the classifications based on female characters. The results of this study is in accordance with recent discoveries that the characters of the male are valid at all taxonomic levels, including genera and species. Detailed keys to groups of genera, genera and species have been provided.

C O N T E N T S

		Page:
	ACKNOWLEDGMENTS	6
I.	INTRODUCTION AND REVIEW OF THE LITERATURE	8
	(a) Introduction	8
	(b) Review of the Literature . .	II
II.	MATERIAL AND TECHNIQUE	I5
III.	GENERAL MORPHOLOGY	I9
	A. General Characteristics . .	20
	B. The Head	22
	1. Head Capsule	22
	2. Antennae	30
	C. The Thorax	33
	1. Prothorax	33
	2. Mesothorax	37
	3. Metathorax	46
	4. Wings and Halteres . .	50
	5. Legs	52
	D. The Abdomen	55
	(a) The pregenital segments .	56
	(b) The genital segment and external genitalia . . .	6I

IV. DESCRIPTION OF THE SPECIES 63

Eulecanium Group 63

1. Eulecanium tiliae (L) . . 63

2. Nemolecanium abietis Borchs. 70

3. Physokermes piceae (Schr.). 77

4. Rhodococcus spiraeae (Borchs.) 83

5. Palaeolecanium bituberculatum (T.T.) 89

6. Phyllostroma myrtilli (Kalt.) 96

7. Filippia viburni (Sign.) I05

8. Ctenochiton sp II4

9. Ericerus pela (Chav.) . . I23

10. Genus A I32

11. Sphaerolecanium prunastri (Fonsc.) I4I

Eriopeltis group I50

12. Eriopeltis festucae (Fonsc.) I50

13. Eriopeltis sp. I60

14. Luzulaspis luzulae (Dufour) I70

Inglisia group 180

15. Inglisia theobromae Newst. . 180

Coccus group 190

16. Coccus hesperidum L. . . 191

17. Genus B (near Pulvinaria) sp. 201

18. Pulvinaria betulae (L.) . 209

19. Pulvinaria acericola (Walsh & Riley). 218

20. Parthenolecanium corni (Bouché) 226

21. Parthenolecaium pomeranicum (Kaw.) 237

22. Ceroplastes berliniae Hall . 245

23. Ceroplastes sp.. . . . 253

V. DISCUSSION 261

(a) Taxonomic Significance of the Characters 264

(b) Classification and Interrelationships of the Coccidae based on the Males 284

(i) Groups of Genera . . 284

(ii) Genera 301

(iii) Species 311

(c) Relationships of the Coccidae with other subdivisions of the Coccoidea 311

VI. KEYS 324

VII. SUMMARY 343

VIII. REFERENCES 347

IX. LIST OF FIGURES 353

X. EXPLANATION OF FIGURES 354

XI. LIST OF ABBREVIATIONS 355

XII. FIGURES 359

ACKNOWLEDGMENTS

I would like to express my gratitude to Dr. K. Boratynski who supervised the work, Mr. R.G. Davies for advice and constructive criticism and Prof. O.W. Richards, F.R.S., for providing facilities at the Imperial College of Science and Technology. I wish to thank Dr. D.J. Williams of the Commonwealth Institute, London, and Mr. G. de Lotto of the Research Institute for Plant Protection, Pretoria who supplied and identified some of the material, and also the large number of other workers who so generously made material available for this study. They are: Prof. N.S. Borchsenius, Zoological Institute, Academy of Sciences, Leningrad; Dr. J.M. Cherret, University College of North Wales, Bangor, Wales; Dr. M.S.K. Ghauri, Commonwealth Institute of Entomology, London; Prof. M. Kosztarab, Virginia Polytechnic Institute, Blacksburg, Virginia; Prof. Z. Kawecki, Agricultural University, Warsaw; Dr. G. Matesova, Institute of Zoology, Academy of Sciences, Alma-Ata, Kazakhstan; Ing. Mitić-Mužina, Institute for Plant Protection, Belgrade; Mr. J. Munting, Plant Protection Research Institute, Pretoria; Dr. J. Řeháček, Virological Institute, Bratislava; Dr. J.G. Theron, University of Stellenbosch, Stellenbosch.

I am also indebted to the Trustees of the British Museum (Nat. Hist.) for permission to study material in their collection.

Finally, I wish to thank the authorities of the Commonwealth Scholarship and Fellowship Plan for financial assistance, and the University of Stellenbosch and the Government of the Republic of

South Africa for granting me leave to undertake this study.

I INTRODUCTION AND REVIEW OF THE LITERATURE

(a) INTRODUCTION

The economic importance of the Coccoidea attracted the attention of many research workers to this superfamily and numerous detailed studies of various aspects of its morphology, internal anatomy, taxonomy, bionomics and also genetics have been carried out. With the exception of the genetical studies most of the work has been concerned only with the adult females while the males have received very little attention. Conforming to the treatment of other insects, some of the earlier workers like Targioni-Tozetti (1867), Putnam (1879) and Berlese (1893, 1896) tried to give equal attention to both sexes, but soon afterwards interest in the males declined and reference to them consisted only of brief, superficial descriptions which contributed little to the already existing knowledge. As already pointed out and discussed by Theron (1958), Beardsley (1960) and Ghauri (1962) this situation arose mainly because of the biological peculiarities of the superfamily, which render the males very difficult to obtain, and because the general characteristics of the male make morphological studies technically difficult. It was also commonly accepted, perhaps for the sake of convenience, that the males - which apart from the absence of functioning mouth parts are "normal" insects - were of but little taxonomic value. Consequently the identification and classification of the Coccoidea were, and still are, based mainly on the characters of the comparatively large and easily obtainable females. These females afford many characters which can be used to separate species and groups of species but it is very unsatisfactory to determine phylogeny and interrelationships on the basis of their characters alone - not so much because they are neotenic, highly specialised and more or

less degenerate, but because one is using only a fraction of the potential information. Not surprisingly therefore, considerable disagreement and confusion have arisen regarding the affinities of larger or smaller groups within the superfamily.

Morrison (1928) in a paper on the classification of the Margarodidae, was one of the first to question the reliability of a system of classification based on the characters of the adult female alone. He also studied stages other than the adult female and found that the limits of any association of genera based on the characters of one stage disagreed from that based on the characters of any other stage. He made the interesting discovery that "the adult male stage of any species possesses morphological characters that appear to be of marked value in indicating the broader relationships of the genus to which it may belong", and he compiled keys to separate the adult males even within genera (e.g. Drosicha). The fact that the male was of importance in distinguishing lower taxonomic categories was also illustrated by the work of Stickney (1934a), who constructed keys to the adult males of the species that he included in the Phoenicococcinae.

Subsequently the necessity to study the males gradually began to be realised and Ferris (1942, 1950, 1957) repeatedly stressed the need for detailed studies of the male. Ferris (1937, 1957) and also Balachowsky (1937) were of the opinion that a knowledge of the morphology of the male would only be of importance in determining relationships of the higher categories, but of little value on the specific level.

As a result of the revival of interest in the males a series of papers dealing with this sex alone was published (Jancke, 1955; Ezzat, 1956; Bustshik, 1958); the male also received more attention in general works (Borchsenius, 1957) and in the descriptions of new species (Hadzibejli, 1955).

Although these studies were lacking in detail and proper interpretation of the morphology, they seemed to support the view that males could be used to separate lower categories as well.

A major advance was made when Theron (1958)carried out a detailed study of the general morphology of the males of 7 genera, representing 4 families. He suggested homologies for the various structures and indicated the relationship of these families with each other and the other Sternorrhyncha, thus laying a firm foundation on which future studies could be built. This work was followed up by detailed studies of the males of 3 species of the Pseudococcidae (Giliomee, 1961) and 24 species of the Diaspididae (Ghauri, 1962), while Beardsley (1960, 1962) published brief descriptions and notes on 35 species of the Pseudococcidae. In the Diaspididae, which is probably the best known of all the Coccoidea, a number of subdivisions (subfamilies, tribes, subtribes and groups) have been recognised on the basis of female characters alone. Ghauri (loc.cit.) was able to confirm the major subdivisions and clarify the status of a few whose position was disputed, and his work finally proved the great usefulness of male characters at all taxonomic levels.

As far as the Coccidae are concerned it is true to say that this large and important family is still very inadequately known, especially as regards the interrelationships of its members. This is partly due to the fact that satisfactory preparations of the adult females can usually only be obtained from freshly moulted specimens, which are seldom available; preparations of the old, frequently heavily sclerotized females show only a very limited number of characters and the identity of many species described from such specimens is uncertain. A few workers (Steinweden, 1929; Sulc, 1941; Bodenheimer, 1953) indicated the close relationship of a small number of genera, but the only comprehensive classification which has so far been published, is

that of Borchsenius (1957), who divided the family into 3 subfamilies, and one of the subfamilies into 2 tribes. His classification was based mainly on a small number of characters of the adult female, among which he used also the way in which the body of the female and the eggs are protected. This classification has not been generally accepted. It was therefore considered that a study of the male would substantially contribute to our knowledge of this family and make it possible to support or modify the classification suggested by Borchsenius, just as Ghauri's work has done with regard to the Diaspididae. Thus the scope of the present work was: (i) to make a detailed study of the morphology of a representative sample of the family Coccidae; (ii) to describe the species in detail; (iii) to determine what characters are of taxonomic importance and on what levels they can be used, and (iv) to advance our understanding of the relationships of members within the family, and of this family with other subdivisions of the Coccoidea.

(b) REVIEW OF THE LITERATURE

The literature pertaining to male Coccoidea has been adequately reviewed by Ghauri (1962) and all that needs to be done here is to mention a number of papers, particularly referring to the Coccidae, that have not been discussed by him or were published subsequent to his review.

An early publication, not mentioned by Ghauri, is Newstead's (1901, 1903) monograph on the British Coccoidea. Newstead described the males whenever they were available, but mentioned only the most obvious features. He pointed to the fact that the number and position of the eyes might be of generic importance. Another early paper is that of Moulton (1907), who studied the montery pine scale, Physokermes insignicola (Craw). Following the pattern established by Putnam (1879) he gave

equal attention to all stages and included some information on their internal anatomy. The morphology of the adult male was only briefly outlined, but special attention was given to the eyes and terminal antennal segments.

Silvestri (1919a, 1919b, 1920) published three papers dealing with Sphaerolecanium prunastri (Fonsc.), Eulecanium coryli (L.) and Ceroplastes sinensis D. Guerc. respectively. His descriptions and illustrations of the male lack detail, but such useful information as the number of eyes, and the structure of the genital and pregenital segments are given. These papers are included as an appendix to Leonardi's (1920) monograph on the Coccoidea of Italy. Leonardi (1920) himself briefly described the males of a wide variety of Coccoidea of which the following are only a few examples:
(names as given by Leonardi): Aspidiotus hederae (Vall.), Lichtensia viburni Signoret, Aclerda berlesii Buffa, Pseudococcus citri (Risso), Eriococcus auricariae Mask., Micrococcus silvestrii Leon., Trabutina leonardii Silv. and Ceroputo superbus Leon. In all these descriptions only the more obvious features were mentioned, but such information as the length of the body, antennae, hind legs and wings are included.

A paper by Kawecki (1958b) on Eulecanium coryli (L.) contains a brief reference to the male. He suggested that the term "pseudohalteres" should be used for the reduced hind wings.

A number of Russian workers gave some attention to male Coccidae. Hadzibejli (1955) when describing a new species (Neopulvinaria imeretina), also gave an account of the male. Borchsenius (1957), in a monograph on the Coccoidae of the USSR, included original descriptions and illustrations of the males of 11 species, short notes on others, and repeated some of the descriptions from the literature; he also briefly

described the male of the Kermococcidae, Asterolecaniidae, Aclerdidae (Borchsenius, 1960). Bustshik & Saakjan-Baranova (1962) dealt with some aspects of the life history, morphology and internal anatomy of the male of Coccus hesperidum. The descriptions of these workers follow the same general pattern, i.e. the morphology is described in general terms only, but some attention is given to the details of the head, antennae, scutellum, as well as the genital and pregenital segments. The main contribution of these papers collectively, and that of Borchsenius in particular, is that they clearly show the availability of characters in the male which can be used for taxonomic purposes.

As far as families other than the Coccidae are concerned, mention can be made here of a paper on the Aclerdidae by McConnel (1953), in which the male of the family is briefly described, with the statement that "considerable diversity of form existed among the few species available."

As pointed out by Ghauri (1962) a new standard of detail and accuracy was reached by Theron (1958) and his study should form the foundation on which any study of male Coccidae is based. Using Theron's interpretations and terminology, Giliomee (1961) gave a detailed account of the morphology of 3 species of the genus Pseudococcus (Pseudococcidae); he also studied the chaetotaxy and discussed a number of characters which can be used to separate the 3 species. One of the species (P.maritimus Ehrhorn) is described as consisting of two "types" which show small differences, rather smaller than those observed between the other two species of Pseudococcus or the interspecific differences recorded by Beardsley (1960). However, in view of Wilkey & Mckenzie's (1961) finding (from a study of the females) that more than one distinct, but very similar species have been involved under the name P.maritimus, it now seems

likely that the two "types" of male described were in fact two species.

Ghauri (1962), in an excellent paper on the males of the Diaspididae, critically examined and amended Theron's (1958) definition of the male of this family. Ghauri studied 24 species (representing 4 tribes and 16 genera) and proved convincingly that male characters could be used at all taxonomic levels.

A few papers on male Coccoidea have appeared since the publication of Ghauri's work. Beardsley (1962) published a paper in which he described the males of another 5 species of the Pseudococcidae, including the interesting species Puto yuccae (Coquillet) and Rhizoecus falcifer Kunckel d'Herculais. Husseiny & Madsen (1962)dealt with the life history of Lecanium kunoensis Kuw. and included a description of the adult male which, however, is very inadequate and shows that the authors were not aware of Theron's paper. Theron (1962) in a paper on the same lines as his earlier publication, gave an account of the structure and relationships of the male of Phenacoleachia zealandica (Mask.) and stated that it "ostensibly belongs to the margaroid group", showing certain similarities to the male of Steingelia.

II MATERIAL AND TECHNIQUE

The males of 23 species, belonging to 19 genera were studied. It was found that the classification of Borchsenius (1957), based on female characters, was not corroborated by the characters of the male, which revealed different relationships within the family. This will be discussed later and in the list below the studied species are arranged into the suggested four new groups.

A. The Eulecanium group
   1. Eulecanium tiliae (L.)
   2. Nemolecanium abietis Borchs.
   3. Physokermes piceae (Schr.)
   4. Rhodococcus spiraeae (Borchs.)
   5. Palaeolecanium bituberculatum (Targ.)
   6. Phyllostroma myrtilli (Kalt.)
   7. Filippia viburni (Sign.)
   8. Ctenochiton sp.
   9. Ericerus pela (Chav.)
   10. Genus A
   11. Sphaerolecanium prunastri (Fonsc.)

B. The Eriopeltis group
   12. Eriopeltis sp.
   13. Eriopeltis ?festucae (Fonsc.)
   14. Luzulaspis luzulae (Du four)

C. The Inglisia group
   15. Inglisia theobromae (Newst.)

D. The Coccus group
   16. Coccus hesperidum L.
   17. Genus B (near Pulvinaria) sp.
   18. Pulvinaria ?betulae (L)
   19. P. acericola (Walsh & Riley)
   20. Parthenolecanium corni (Bouché)
   21. P. pomeranicum (Kaw.)
   22. Ceroplastes berliniae Hall
   23. Ceroplastes sp.

The two genera here called genus A and genus B are representing two apparently new genera, but no definite statement can be made here as the females are still being studied. In the Inglisia group only one species (I. theobromae) was studied in detail, but 3 specimens of another (Ceroplastodes chiton Green) were compared with it, and their characters used in the discussion.

Most of the species were obtained from workers all over the world who generously made material from their collections available, or collected material specially for the purpose of this study. The specimens were usually received in 70% alcohol, but specimens of 4 species received from J. Rehacek were remounted from Swann's mountant. In most cases the received material was already identified; unidentified material obtained from various sources were identified by K. Boratynski, G. De Lotto and D.J. Williams. The males of six species were collected by myself, one of them (Ctenochiton sp.) in Stellenbosch, South Africa, and the rest at the Imperial College Field Station, Sunninghill, Berks., where their habitats were known to Dr. Boratynski.

In nearly all the cases 10 specimens of each species were examined, the various measurements taken and the setae counted. For each sample the range of variation was recorded and the average calculated. The specimens were prepared for microscopic study according to the method described by Ghauri (1962). It was found, however, that 45 minutes in KOH was usually the shortest period needed to clear the specimens and often several hours were necessary for the larger specimens. Only one stain, Chlorazol Black E, was used and the specimens were stained for one hour. After the removal of excess stain they were transferred to terpineol, in which they were mounted on cavity slides.

In making the illustrations, the same techniques and procedure were followed as described in an earlier paper

(Giliomee,1961).

In order to standardise the measurements and prevent repetition in the individual descriptions the way in which the various structures were measured is explained in detail below (see also fig.1). Cases where there are no reasonable grounds for doubt, are omitted.

The body length was measured from the anterior margin of the head to the apex of the penial sheath.

The head exhibits no definite structure posterodorsally and its length was therefore measured from the anterior margin to the first ridge on the thorax, the pronotal ridge; its width was measured across the genae. The external margin of the cornea is not very distinct and the internal diameter was therefore taken. Antenna: The length of the scape was measured along the dorsal margin, the width across the middle of the segment; the length of the pedicel was measured from the articular process posteroventrally to the apex of the segment, and the maximum width was taken; the width of the 3rd and 10th segments was measured where they are widest but that of the 4th - 9th segments across the middle because they are sometimes rather wider at the apex.

The length of the thorax was measured from the pronotal ridge to the posterior margin of the mesopostphragma (the latter also used by Ghauri (1962) in estimating the length of the thorax of the Diaspididae). The length of the prescutum was measured from the anterior margin (topographically) to the prescutal suture, without including the broad internal ridge of the latter; the width was measured across the middle of the sclerite, including the lateral ridges. The measurement of the maximum length and width of the median membranous area of the scutum, the length and width across the middle of the scutellum, and the maximum length and width of the basisternum (but not including the ridges) was taken. The length of the wing was measured from the base of the costal complex of wing veins to the tip of the wing, and the width across

its maximum expansion. The length of the segments of the leg was measured as had been indicated for Pseudococcus (Giliomee, 1961), i.e. the maximum length of each segment was taken; the tarsus, however, was measured along the outer margin instead of the inner, the former being more accurate. The width of each segment was measured at its maximum, with the exception of the tibia which was measured across the middle because it is usually somewhat wider at the apex.

The length of the abdomen was measured from the mesopostphragma to the anus, and the width across the 3rd segment. The penial sheath may be somewhat curved and for accuracy its length was measured in pleural view, following the curve; its width was measured at the level of the base of the aedeagus.

III GENERAL MORPHOLOGY

The first serious attempt to study the morphology of the male of the Coccidae was made by Putnam (1879) in his paper on Pulvinaria innumerabilis. Apart from morphological observations, he suggested that the shape and proportions of the scutellum (which he called apodema) would be of some value in distinguishing the species of Pulvinaria. After Putnam's work attention was shifted almost completely to the female. However, some authors, e.g. Moulton (1907), Silvestri (1919a, 1919b, 1920), Cusciana (1931), Hadzibejli (1955), Kawecki (1958b) and Husseiny & Madsen (1962) included brief descriptions of the male when describing the females of single species. Other workers, like Newstead (1903), Green (1904-1909), Leonardi (1920), Sulc (1932) and Borchsenius (1957) each dealt with a series of females from definite localities; they included short descriptions of the males that were available and usually gave a general account of the male of the family. Of all these, the works of Sulc and Borchsenius are the most significant. Sulc's interpretation of the thoracic structures is fairly accurate, and he pays special attention to the eyes, halteres and chaetotaxy of the head in differentiating the species studied. Borchsenius' paper contains a number of inaccuracies concerning the homologies of the various structures, but he describes and illustrates the differences in the head, 3rd and 10th antennal segments, scutellum and terminal abdominal segments (including the genital segment) in the species that he studied. A small number of workers, namely Pesson (1941), Dürr(1954), Habib (1956) and Bustshik & Saakjan-Baranova (1962) devoted papers to the description of the males of individual species, but their descriptions are rather superficial and contain many errors. Jancke (1955), Ezzat (1956) and Theron (1958) made comparative

studies of the males of a number of families; each of them included one member of the Coccidae: Physokermes piceae, Pulvinaria ericicola and Parthenolecanium pomeranicum (described as Eulecanium taxi) respectively. While Ezzat and Jancke contributed little that is morphologically significant, Theron gave a very detailed and accurate account, and was the first to make a comprehensive study of the pleural region.

In the present investigation it was possible, by studying a more representative sample (23 species), to substantiate Theron's findings, to record a number of characters which have hitherto been unknown or overlooked, and to gain information on the range of variation within the family. In the general description of the morphology of male Coccidae that follows, Theron's terminology is followed, except where otherwise stated; the account is illustrated by a generalised figure (fig.1) and all abbreviations in brackets refer to this figure, unless otherwise indicated.

A. GENERAL CHARACTERISTICS

Compared with other Coccoidea the males of the Coccidae are medium-sized, being smaller than the Margarodidae and larger than the Diaspididae. Among the species studied the smallest was L. luzulae (1020-1290, av. 1141 μ long) and the largest E. pela (2500-3100, av. 2864 μ long); L. luzulae had the shortest wing-span (2090-2350, av. 2213 μ) and E. pela the longest (5330-5700, av. 5563 μ). Some species are slender in appearance (e.g. C. hesperidum) while others are rather robust (e.g. Ceroplastes spp.).

The body colour of living specimens varies from light reddish brown (E. festucae) to purplish (P. bituberculatum); the sclerotized areas are darker, brown to black, and the legs and the antennae yellowish; the wings are hyaline, often with a purplish tinge between anterior margin and first wing vein.

In some species (e.g. the Coccus group, figs. 16-23) the head carries numerous setae, which give it a "hairy" appearance; when the setae are few in number (the Eulecanium group, figs. 2-12) the head looks rather bare.

The body is divided into the head, thorax and abdomen; the head is separated from the thorax by a distinctly constricted "neck", characteristic of Coccidae and Pseudococcidae.

The head (fig.1B,C) irregular in shape; generally wide near the base dorsally, and narrowed anteriorly and ventrally. In dorsal view it is somewhat cone-shaped, broad and rounded posteriosly with a tapering, more or less protruding apex. Inlateral view the antero ventral surface slopes backwards, towards the conspicuously conical medioventral bulge which carries a pair of ventral eyes. The head is comparatively well sclerotized with fewer and less developed secondary ridges than in the Diaspididae (see Ghauri; 1962); with 2-5 pairs of simple eyes and a pair of lateral ocelli. Mouth parts are absent, but an oval, non-functional mouth opening is present behind the medioventral bulge. The antennae are long, filiform and ten-segmented.

Thorax: The prothorax is considerably desclerotized, with a few more or less developed ridges and small sclerites. The meso-thorax is well developed, sclerotized and with strong supporting ridges; prescutum, scutum, scutellum and postnotum distinct, the latter curving down into the metathoracic cavity; pleural sclerites well developed, with a strong pleural ridge; basisternum large, usually with a median ridge. The fore wings are well developed, with two veins. The hind pair is reduced to halteres or absent; when present, with 1-4 apically hooked setae. The legs are long and slender with a one-segmented tarsus and a single claw. The meso- and metathorax each carry a spiracle laterally.

The abdomen is parallel sided, with a slightly tapering posterior end. It consists of 8 pregenital segments and the

genital segment; the latter is narrow, elongated, partly sclerotized, and carries the genital organs. The pregenital segments are usually almost entirely membranous (e.g. E. ?festucae), but sometimes with a small tergite and sternite on each segment (e.g. E. tiliae). Sometimes (the Coccus group) the 7th and 8th segments are each produced laterally into a finger- or lobe-like caudal extension; posteriorly the 8th segment usually carries a subdorsal glandular pouch, from the bottom of which two long setae arise: they serve as a supporting core for a long wax filament.

B. THE HEAD

1. HEAD CAPSULE

Theron (1958) showed that, of the three regions of the generalised homopteran head (Weber, 1928; 1935), only one of them, i.e. the epicranium makes up almost the entire head capsule in the Coccoidea; of the other two regions the so-called "Vorderkopf" is reduced to a small area around the non-functional mouth opening, while the third, the labium, is absent altogether. Compared with other families the head of the Coccidae is peculiar in having the anterodorsal part of the head capsule considerably expanded with the apex sometimes produced into an anterodorsal bulge. Apparently the enlarged dorsal part has shifted forwards and the ventral part backwards; this process of transformation appears to resemble rotation about a point near the lateral ocellus. As a result some structures, which in the other Coccoidea are situated on the dorsal surface of the head, have been translocated forwards or even to the ventral side. Thus the antennae occupy a ventral position, the median crest extends anteriorly over the apex of the head and terminates between the antennae, and the ventral part of the midcranial ridge does not reach the apex of the head. At the same time the dorsal membranous area of the posterior part of

the head and neck has become extended. The degree of this deformation of the head varies within the family from a condition that is comparatively normal and similar to the Pseudococcidae (e.g. E. tiliae, fig. 25) to the extreme as shown by C. hesperidum (fig. 39).

The dorsomedial part of the epicranium, which corresponds to the median crest (mc) of the Diaspididae (see Theron, 1958; Ghauri, 1962) is slightly raised, weakly sclerotized and usually polygonally reticulated, but in a few cases (F. viburni, Ctenochiton sp.; figs. 8,9; B) with only weak striations. The posterior margin is usually broadly rounded, but sometimes obtuse (I. theobromae, fig. 16B), and somewhat more heavily sclerotized, although no distinct ridge is present as found by Theron (1958) and Giliomee (1961) in the Pseudococcidae. The heavier sclerotization probably serves to strengthen the epicranium in a region where, according to Theron (1958) the mesothoracic muscles are attached. Borchsenius (1957) referred to the median crest as the cephalic longitudinal plate.

In the anterior part of the median crest there is sometimes a linear vestigial ridge (dmcr), which corresponds to a similar structure found in Planococcus citri (Theron, 1958) and interpreted by Theron as a detached dorsal part of the midcranial ridge. It is best developed in N. abietis (fig. 3B) where it stretches anteriorly from behind the level of the posterior margin of the eyes to the anterior margin of the head, but even in this case it is not joined to the ventral part of the midcranial ridge (vmcr). The latter is usually well developed and Y-shaped. The median part of the ridge merges posteriorly into the ocularsclerite, but in some cases (I. theobromae, fig. 16,C, the Eriopeltis group, figs 13-15,C) it fades away before doing so and in Ceroplastodes chiton Green it is vestigial. The lateral arms (lmcr) run to the base of each scape, but do not articulate with it. The arms are long

in some species (I. theobromae, fig. 16, C), short in others (Eriopeltis sp., fig. 13,C), or even absent (E. ?festucae, fig. 14,C). The area around the posterior section of the median part of the midcranial ridge is usually membranous and weakly polygonally reticulated. Rarely, however, the reticulation is entirely absent (F. viburni, fig. 8,C; Ctenochiton sp., fig. 9,C), or the area is both reticulated and sclerotized (Eriopeltis spp., P. myrtilli, I. theobromae; figs. 13 & 14, 7, 16; C). This area corresponds to the ventromedial part of the epicranium of the more primitive margaroid Coccoidea, where it is sclerotized. The ventral part of the midcranial ridge was described as the chitinous impression by Pesson (1941), the mesantennal plate by Borchsenius (1957) and the sclerotized fork by Bustshik & Saakjan-Baranova (1962). The Russian workers suggested, quite erroneously, that it might represent the rudiment of the mouth apparatus.

The large ocular sclerite (ocs), dorsally separated from the median crest by a membranous band surrounding the latter, constitutes most of the ventral and part of the lateral surface of the head capsule; ventrally it extends uninterrupted from one side of the head to the other. It is distinctly polygonally reticulated. The ocular sclerite is partly bounded anteriorly by the preocular ridge (procr), which provides a process for articulation with the scape. In some species (the Eriopeltis group, Ctenochiton sp. E. pela. Genus A; figs. 13-15, 9-11; C) it is fused with, or closely approximates its opposite number where it may also be joined by the median bar of the midcranial ridge. More often, however, it fades away at some distance from the articulating process.

The posterior margin of the ocular sclerite is bounded mostly by the well developed postocular ridge (pocr). Dorsally the ridge originates behind the dorsal eye at about the level

of the posterior margin of the median crest, passes behind the ocellus and extends posteromedially across the lateroventral surface of the head. Near the median line it curves backwards and extends for a short distance beyond the anterior end of the procpisternum + cervical sclerite, either as a definite ridge or as a small sclerite. In most species the ridge forks below the ocellus, with the short anterior branch surrounding or partly surrounding the ocellus. In the Coccus group the postocular ridge is strong and thick throughout, but in the other groups the dorsal part of it is weaker, uniformly thin or gradually narrowing; occasionally the part of the ridge immediately behind the ocellus is missing or very weak (R. spiraeae, Genus A; figs. 28, 34). In the literature the ridge has been illustrated, but not discussed by Leonardi (1920), Silvestri (1919a, 1919b, 1920), Sule (1932) and Jancke (1955), while it has been called the chitinous apodeme (Pesson, 1941) and lateral arches (Borchsenius, 1957; Bustshik & Saakjan-Baranova, 1962).

Sometimes the pre- and postocular ridges are joined together below the ocellus by a strong ridge; it has not been observed before and is here called the interocular ridge (ior). Its presence is constant in a few species (the Eriopeltis group; figs. 36, 37), where it is a broad ridge; in one other species (Genus A; figs. 11,C; 34) its occurrence is irregular and it is very narrow if present, sometimes it is present on one side only and occasionally it is absent on both sides. On the preocular ridge in I. theobromae (fig. 38) a small posteriorly directed process below the articular process apparently represent a rudiment of this ridge. The homology of the interocular ridge and its possible relation to the condition found in the Pseudococcidae will be discussed later.

The ocular sclerite bears a number of simple eyes and a pair of lateral ocelli. The simple eyes comprise a pair of dorsal and a pair of ventral eyes, and 1-3 pairs of additional lateral ones.

The dorsal eyes (dse) are situated on the anterolateral part of the head above the bases of the antennae and are widely separated from each other. The ventral eyes (vse) are located on the medio-ventral bulge close to each other in a submedian position; the area between the ventral eyes is somewhat raised (e.g. E. tiliae, fig. 25) or flat (e.g. L. luzulae, fig. 37). The lateral eyes (lse) occur on each side of the head, more or less in line with the dorsal and ventral eyes. The dorsal and ventral eyes are usually large and subequal in size, while the lateral ones are considerably smaller. Sometimes, however, (I. theobromae, fig. 16, 38; Ceroplastodes chiton Green) the lateral eyes are only slightly smaller or as large as the others. The corneae of all these simple eyes are circular, deeply produced into the head-capsule and surrounded by a narrow membranous ring. The dorsal and ventral eyes are always present and are the only ones which occur in a number of species (the Eriopeltis and Coccus groups and some species of the Eulecanium group; figs. 13-24, 4,6,12.); some other species have one (N. abietis, fig. 3), two (R. spiraeae, P. myrtilli, Ctenochiton sp., Genus A I. theobromae; figs. 5,7,9, 11, 16) or three (E. tiliae, F. viburni and E. pela; figs. 2,8,10) additional lateral eyes. The lateral ocellus (o) usually appears as a weakly sclerotized spot on a membranous bulge, which is somewhat conical in Eriopeltis spp. (figs. 13, 14). It is situated posterolateral to the dorsal simple eye, immediately anterior to the postocular ridge. The structure of the eyes and their innervation in P. corni were studied by Pflugfelder (1936). From his work it seems certain that the simple eyes on one side represent the isolated facets of a single compound eye. He also claimed that the lateral ocelli are persisting larval ocelli, a view already held by Putnam (1879) and Moulton (1907).

The large lateral bulge posterior to the postocular ridge corresponds to the gena (g). It is weakly sclerotized and in most

species it is distinctly reticulated (e.g. Eriopeltis spp., Parthenolecanium spp.; figs. 13 & 14, 21 & 22). The sclerotization and reticulation were not described by Theron (1958). The deep cervical groove immediately behind the genae indicates the posterior margin of the head.

Ventromedially, immediately behind the ocular sclerite, the preoral ridge (pror) is situated. It has the form of an inverted V and is very narrow. It fuses posteriorly with the postocular ridge. Sometimes it is completely absent (the Eriopeltis group, P. piceae, Genus A; figs. 13-15, 4, 11; C).

The preoral ridge gives support to the cranial apophysis (ca), which is a strong scoop-like structure (figs. 13, 22; T). Its apex is usually bifurcate, but sometimes trifurcate (Eriopeltis sp., fig. 13, C) or truncate (E. pela, E. ?festucae, L. luzulae; figs. 10,14,15; C). In some cases the apex also carries an irregular central lobe, which is very pronounced in Genus A (fig. 11C).

Theron (1958) found that, in P. pomeranicum, eight antennal muscles are attached to the apex of the cranial apophysis. The length of the cranial apophysis varies within the family. It is long in some species (e.g. C. hesperidum, Genus B; figs. 17,18;C) and reaches the level of the anterior margin of the ventral eyes, while in others (e.g. E. tiliae, P. piceae and E. pela; figs. 2,4, 10) it does not extend beyond the posterior level of these eyes.

An irregular mouth opening (mo) issituated on a slight membranous bulge behind the cranial apophysis. On each side of the mouth opening, immediately median to the junction of the preoral and postocular ridges, a tendon-like apodeme (t) is present. According to Theron (1958) it serves for the attachment of a muscle which extends to the posterior margin of the median crest. In R. spiraeae this apodeme has a broad base and in Genus A it arises from the anterior part of an elongated sclerite which

appears to represent the ventral sclerite described by Theron (1958) in the margaroid Pseudaspidoproctus ?fulleri.

The tentorial pits are situated in the membrane around the mouth opening. In a few species (e.g. the Eriopeltis group; figs. 13-15;C) four tentorial pits are present. The two anterior ones (atp) are situated anterolateral to the mouth opening, near the preoral ridge when the latter is present; these pits are usually absent, however. The posterior tentorial pits (ptp) are found posterolateral to the mouth opening, immediately median to the posterior ends of the postocular ridges; they are always present. From each posterior pit a thread-like posterior tentorial arm (figs. 13,22;T;pta) extends towards the heavily sclerotized tentorial bridge. From the bridge the somewhat stouter anterior tentorial arms (figs. 13, 22,T;ata) extend towards the cranial apophysis. It is difficult to make out exactly how these arms are associated with the cranial apophysis. When the anterior tentorial pits are present, a thread-like extension from each tentorial arm, possibly representing the dorsal tentorial arm, links the anterior arms with the edges of the cranial apophysis (fig. 13,T). When the anterior pits are absent, however, the arms are intimately associated with the cranial apophysis, as shown in fig 22,T . The latter condition appears to be the result of a process in which the anterior pits have drifted forwards until they reached the cranial apophysis and apparently the anterior arms have completely fused with the "dorsal" ones. No sclerotized ventral cavity as illustrated (fig. 22) by Theron (1958) is apparent and the illustration does not seem to agree with his description and fig. 13 where the ventral cavity is shown to be situated behind the preoral ridge. The tentorium has not been described by other workers, but from an examination of specimens in which the head is distorted,it is clear that what Borchsenius (1957) called the cephalic sclerotized arch and

Bustshik & Saakjan-Baranova (1962) regarded as the occipital ridge, is in fact the tentorial bridge.

Chaetotaxy:

Two distinct types of setae, similar to those found in Pseudococcus (Giliomee, 1961) are present on the head of male Coccidae. They are:

(i) a thick-set, fleshy type(fs), which has a rather blunt apex and the setae membrane not surrounded by a distinct basal ring, and (ii) a slender, hair-like type (hs) which has an acute apex and the setal membrane surrounded by a strong basal ring.

Generally the hair-like setae occur in all the species in comparatively small numbers and when only these setae are present the head appears to be rather bare. In those species where fleshy setae are also present the head has a "hairy" appearance, the number of these additional setae being generally much larger.

The setae on the head are arranged in the following groups:

(i) Dorsal head setae (dhs) which are situated on the median crest, but may also occur on the surrounding membrane in front of the dorsal simple eyes. This group consists either of hair-like setae only (the Eulecanium and Eriopeltis groups; figs. 2-15,B) or of both fleshy and hair-like ones (the Inglisia and Coccus groups; figs. 16-24,B). The number of hair-like setae, which are present in all the species, varies from 1-7 (av.5) in P. acericola to 16-19 (av.17) in P. corni; the number of the additional fleshy setae, in the species in which theyoccur, varies from 4-11 (av.7) in I. theobromae to 26-42 (av.35) in C. hesperidum.

(ii) Dorsal ocular setae (dos): which are found on each side on the dorsal part of the ocular sclerite between the dorsal simple eye and the postocular ridge and consist of both fleshy and hair-like setae. The total numbers of these setae are small and

variable and the proportion of the two types of setae is also variable within the species.

(iii) Ventral head setae (vhs): This group occurs on the ventral and lateral parts of the ocular sclerite and may extend up to the lateral arms of the midcranial ridge. In the Coccus and Inglisia groups (figs. 16-24,C), but not in the other species examined, the setae also occur between and behind the ventral eyes. In most species of the Eulecanium group the setae are situated only on or anterior to the level of the preocular ridge. In a few species (Genus A, S. prunastri, L. luzulae; figs. 11,12,15) one pair of median hair-like setae is distinctly longer than the other setae. The hair-like setae occur in all the species in small numbers, varying from 1-2 (av.1.3) in N. abietis to 7-17 (av.12) in E. ?festucae, but in R. spiraeae they may be entirely absent in some individuals. The additional fleshy setae occur only in Eriopeltis, Coccus and Inglisia groups (figs. 13-24,C), in rather large numbers, varying from 9-16,(av.12) in Eriopeltis sp. to 54-108 (av.84) in Pulvinaria ?ribesiae.

(iv) Genal setae (gs)which are found on the genae and are only present in the Coccus and Inglisia groups (figs. 16-24,B) consist of both fleshy and hair-like setae. The number of hair-like setae is usually small, varying from 0-4 (av.1.2) in I. theobromae to 7-13 (av.9) in P. corni, and the number of fleshy setae large, varying from 5-11 (av.7) in I. theobromae to 17-30 (av.23) in P. corni.

No other dermal structures, like disc pores or specialised sensilla are present on the head.

2. ANTENNAE

All the workers that studied the head of male Coccidae also mention the antennae, but their descriptions are very brief and usually cover little more than the number of segments and the

general shape of the antennae.

The antennae are inserted fairly low down on the antero-lateral margin of the head with the diverging lateral arms of the midcranial ridge between them. They are generally filiform in shape and normally comprise ten segments, but sometimes two or more of the segments between the 4th and 9th are intimately fused. The relative length of the antennae varies considerably within the family. They are very long in the Eriopeltis group, being about $\frac{2}{3}$ - 5/6 as long as the body in Eriopeltis sp., and short in the Coccus group, being usually less than half as long as the body. The antennae with the shortest relative length are found in E. tiliae (Eulecanium group) where they are $\frac{1}{3}$ - 2/5 as long as the body. The average absolute length varies from 622 µ in C. berliniae to 1922 u in E. pela.

The antennae always carry a large number of setae which give them a "hairy" appearance. The setae consist of both fleshy and hair-like ones which are similar to those occurring on the head. The fleshy setae (fs) appear usually on the 2nd to 10th segments, but in E. pela they occur regularly on the 1st segment as well. They are usually only slightly longer than the width of the antennal segments although a few on the distal part of the 4th to 9th segments may be considerably shorter. In E. pela, however, the fleshy setae are exceptionally long, being about 4-5 times as long as the width of the 3rd segment, and in Genus A they are very short and stout, and only about half as long as the width of the 3rd segment. The hair-like setae (hs) are always present on the first two segments and in a number of species (e.g. E. tiliae, F. viburni, Genus A, figs. 2,8,11,F) also on the 3rd, but only in F. viburni and Genus A do they occur regularly on the 4th to 10th segments. In addition to the fleshy and hair-like setae two different types of setae occur on the distal segments. The setae of one of them

somewhat resemble the ordinary fleshy setae, but are usually much larger, bristle-like and have a large setal membrane; they can be called antennal bristles (ab).On the 10th segment there also occur the long subapical, apically knobbed setae (set.scla) found in the Pseudococcidae (Sulc 1943; Giliomee, 1961) and Diaspididae (Bustshik, 1958; Ghauri, 1962). Sulc called them setae semi-claviformes. Both types probably have a sensory function.

Specialised sensilla are present on the 2nd, 3rd and 10th segments.

The scape (scp) is short, wide and subrectangular in shape, with the basal part sclerotized and the distal part mostly membranous. The dorsal margin is longer than the ventral one. The scape articulates with the pedicel by means of a ventral projection which is situated opposite a corresponding projection on the basal ridge of the pedicel. Posterolaterally it articulates with the preocular ridge by means of a process on its basal ridge. The scape usually carries 3 hair-like setae and in E. pela 2-4 (av. 2.6) fleshy setae also occur on this segment.

The pedicel (pdc) is short, broad and subglobular in shape. It is generally well sclerotized with the distal part, especially dorsally, distinctly polygonally reticulated. In P. myrtilli (fig. 7B), however, the reticulation is represented by a few wavy lines and in P. ?betulae (fig. 19,B) and I. theobromae (fig. 16,B) the reticulation is usually entirely absent. The base of the pedicel is partly surrounded by a strong basal ridge which is well developed ventrally, but weaker or absent dorsally. At the dorsal end there is a shallow depression in which the constricted basal part of the 3rd segment is received. Both hair-like and fleshy setae are present; they are mostly located on the ventral and lateral surfaces. A small circular sensillum, probably a sensillum placodeum, is situated dorsally or dorsolaterally. It

is also present in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962).

The flagellum (F_{III-X}) is composed of the 3rd to 10th segments. The 3rd segment (figs.,F) varies considerably in size and shape; in Eriopeltis spp. (figs. 13,14; F) it is long and club-shaped, while it is short and barrel-shaped in P. ?betulae (fig. 19F). This segment carries ventrally a number of small sensilla, which are probably sensilla basiconica (bs). Their number varies individually and may do so on the two antennae of the same specimen, but it rarely exceeds a total of four. Sensilla were also found in the same area in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri; 1962). The 8th and 9th segments each has an antennal bristle, which is sometimes difficult to distinguish from the ordinary setae; the bristle is situated ventrally near the apex.

In most species the 10th (terminal) segment is broadly rounded at its apex, but in some (e.g. C. hesperidum; fig. 17,G) the distal part of the segment is tubularly constricted. In addition to the fleshy and occasional hair-like setae this segment also bears a number of antennal bristles (ab) and capitate subapical setae (set.scla). The former consist of 3 long and 2 shorter setae. The subapical setae are usually 3 in number, but in I. theobromae there are only 2 and in Genus A there are 4-6 (av.5.0). On the ventral surface of the 10th segment 2 small sensilla are found, one near the apex and the other somewhat more proximal. They are probably sensilla basiconica and correspond to sensilla on this segment in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962).

C. THE THORAX

1. PROTHORAX:

The prothorax is largely membranous, with only a few sclerites

and ridge-like structures present. It is distinctly separated from the head by a deep cervical constriction. In this respect the Coccidae resemble the Pseudococcidae (Theron, 1958; Giliomee, 1961).

Dorsally, immediately behind the neck region the collar-like pronotal ridge (prnr) runs continuously from one side to the other, extending ventrally and closely approximating the proepisternum + cervical sclerite. It is usually interrupted by weak sclerotization dorsomedially, but in E. pela the ridge is apparently uninterrupted, although very narrow medially. This structure has been called the protergal sclerite (Habib,1956), the prothoracic suture (Ezzat, 1956) and the prothoracic arch (Borchsenius, 1957). Dorsolaterally, behind the pronotal ridge, a small sclerite is closely associated with it; this sclerite appears to be homologous with the lateral pronotal sclerite (prn) described by Giliomee (1961) in the Pseudococcidae and Ghauri (1962) in the Diaspididae. The sclerite was called the prothoracic sclerotized plate by Borchsenius (1957). Theron (1958) did not mention them.

In the posterolateral part of the prothorax a small sclerite is situated; it constitutes the so-called posttergite (pt). It sometimes shows irregular wavy striations (e.g. most species of the Coccus group). In Eriopeltis sp. the sclerite is apparently absent and only represented by striations of the derm. The posttergites have not been observed in this family before.

In the pleural region the pleurites and neck sclerites are reduced to a single ridge-like structure, called the proepisternum + cervical sclerite (pepcv)(Ghauri, 1962). Anteriorly it passes just below the ventral end of the pronotal ridge and appears to be joined by weak sclerotization to the postocular ridge. For a short distance behind the level of the pronotal ridge this sclerite is less strongly sclerotized. This phenomenon was also observed in

Pseudococcus (Giliomee, 1961). Posteriorly the sclerite is delimited by a short pleural ridge (plr_1), which articulates ventrally with the basal process of the coxa; dorsally it is invaginated to form a small pleural apophysis (pla_1). Crampton (1926) calls the structure a neck plate or laterocervicale in Coccus. He also distinguishes an episternum and epimeron, but no structure corresponding to the latter was observed in the species studied here. From his illustration (fig. 55) it appears that he misinterpreted the position of the pleural ridge. The procpisternum + cervical sclerite has also been referred to as the pleural sclerite of the prothorax (Ezzat, 1956), the propleural sclerite (Habib, 1956) and the sclerotized plate of the anterior leg (Borchsenius, 1957).

The prosternum (stn_1) is represented by a single sclerite, of which the degree of development shows considerable interspecific and also some intraspecific variation. In its most complete form it consists of a triangular, sometimes oval sclerite, which is bounded posteriorly by a strong transverse ridge and traversed by a longitudinal median ridge. Sometimes the prosternal sclerite is more or less reduced (C. hesperidum, fig. 17), while the median ridge may be complete (e.g. P. myrtilli, C. hesperidum; figs. 7,17), interrupted in the middle (e.g. E. tiliae, E. ?festacae, P. corni; figs.2,14,21), developed anteriorly only (e.g. Eriopeltis sp., P. pomeranicum; figs. 13,22), or represented by a basal stalk (R. spiraeae, L. luzulae; figs. 5,15). In some species the degree of reduction of the median ridge varies individually, e.g. in F. viburni and P. ?betulae the ridge may be complete or developed anteriorly only, while in P. bituberculatum and S. prunastri it may be absent or represented by a short basal stalk only. On each side of the transverse ridge two shallow depressions probably represent the sternal apophyses. Their position corresponds to that of the sternal apophyses in the more primitive

Phenacoleachiidae (Theron 1962). In some individuals of most species a small apophysis is situated medially anterior to the prosternum. It probably serves for the attachment of muscles, as four muscles originate in the corresponding area in the Pseudococcidae (Mükel, 1942). Theron (1962) describes a "mammillate organ" from the same region in the Phenacoleachiidae, saying that it is probably homologous with the so-called salivary gland of Pseudaspidoproctus. The derm of the prosternum is occasionally polygonally reticulated (C. hesperidum, fig. 17) or covered with numerous small spines (I. theobromae, fig.16). The prosternum was overlooked by most earlier workers. Crampton (1926) figured a linear basisternum and sternellum, while Ezzat (1956) called this region a basisternum; Borchsenius (1957) regarded it as part of the mesosternum.

Dermal Structures: Both fleshy and hair-like setae are present in various regions of the prothorax. They occur in the following groups:

(i) Lateral pronotal setae (lpns), which occur on or immediately posterior to the lateral pronotal sclerites on each side, and may consist of up to 3 fleshy or hair-like setae. They are of very little taxonomic significance as they are only present in some individuals of certain species (e.g. P. pomeranicum, fig. 22).

(ii) Medial pronotal setae (mpns) which are situated between the pronotal ridge and the posttergites and usually consist of two widely separated hair-like setae (e.g. P. myrtilli, S.prunastri, C. hesperidum, figs. 7,12,17); in P. bituberculatum (fig.6) the two setae are situated close together on the median line. In other species (e.g. N. abietis, I. theobromae) one or both setae may be absent, while medial pronotal setae are absent altogether in some species (e.g. E. tiliae, L. luzulae). One or two fleshy setae. One or two fleshy setae are occasionally associated with these setae. Medial pronotal setae are also found in the Pseudococcidae (Giliomee, 1961).

(iii) Posttergital setae (pts) occurring on, or behind and below the posttergites. They consist of fleshy setae only (up to 13) and were found in the closely related genera Pulvinaria, Coccus and Genus B (figs. 17-20), but not in the other species.
(iv) Anteprosternal setae ($astn_1s$) consisting of a number of fleshy setae (up to 7) which occur immediately ventral to the anterior part of the prosternum + cervical sclerite (pepcv). They are present in the Coccus group (figs. 17-24) and sometimes in L. luzulae.
(v) Prosternal setae (stn_1s) which are found on and around the prosternum, anterior to the level of the transverse ridge; in the Coccus group they extend laterally to occur anterior to the mesothoracic spiracle. This group therefore corresponds to the prosternal and antespiracular ventral setae of the Pseudococcidae (see Giliomee, 1961). They include both fleshy and hair-like types. The number of these setae varies considerably individually and within the family. The fleshy setae are usually numerous (up to 54) in the Coccus group and less numerous (up to 25) in the Eriopeltis and Inglisia groups; they are absent in the Eulecanium group with the exception of S. prunastri, which has 7-16 setae. The hair-like setae are never more than 4 in number and are often entirely absent.

In Ctenochiton sp., C. hesperidum and Genus B a number of circular pores, somewhat reminiscent of vacant hair sockets, are situated on each side dorsally, posterior to the pronotal ridge. They number 3-7 (av. 6.1), 0-1 (av. 0.4) and 2-5 (av. 3.6) respectively.

2. MESOTHORAX:

The mesothorax, as the principal wing-bearing segment, is well developed and sclerite degeneration is much less pronounced than in the other thoracic segments; in addition some of the sclerites are bounded by strong ridges. The shape of the

sclerotized areas varies comparatively little within the family and consequently provides only a few characters of taxonomic importance.

(a) Mesotergum: The usual subdivisions of the mesotergum can easily be discerned. Thus the notum (or alinotum) is widely separated from the postnotum, the former being distinctly divided into a prescutum, scutum and scutellum; this was already recognised by Sulc (1932), Pesson (1941) and Jancke (1955).

The prescutum (prsc) is situated anteromedially and is surrounded laterally and posteriorly by the scutum. It has the shape of a large subrectangular bulge. Anteriorly it curves sharply downwards and forms the mesoprephragma (figs.D); the latter has the shape of a simple lamina with the inner margin slightly emarginated in the middle. This emargination varies somewhat individually, but it is inconspicuous or absent in some species (e.g. E. ?festucae, fig. 14,D) and pronounced in others (e.g. C. hesperidum and Genus B; figs. 17,18:D). The phragma was regarded as the prescutum by Ezzat (1956). Laterally the prescutum is separated from the scutum by strong prescutal ridges (pscr) which are fused anteriorly with the mesoprephragma, and extend posteriorly for some distance along the sides of the membranous area of the scutum. The posterior margin is bounded by the prescutal suture (pscs) with its corresponding internal ridge. The median part of the prescutum is often more heavily sclerotized and sometimes with a median, ridge-like structure at the posterior (P. bituberculatum, fig. 6) or near the anterior margin (Ceroplastes spp.). In some species the cuticle of the prescutum shows reticulation, which may be regularly polygonal (e.g. P. piceae, L. luzulae Parthenolecanium spp.; figs. 4,15, 21 & 22) or irregular (C. hesperidum, Genus B; figs. 17, 18); The prescutum has been called the scutum of the prothorax (Putnam, 1879), the proscutum (Jancke, 1955) and the scutum

(Ezzat, 1956).

The scutum (sct) has a rather curious shape. The median membranous area which is comparatively small in the margaroid Pseudaspidoproctus and Steingelia (Theron, 1958), in this family has become so expanded that it completely and widely separates the two lateral sclerotized parts. These extend anteriorly along the sides of the prescutum and posteriorly along the sides of the scutellum. In the antero-lateral region the scutum is produced into a prealare (pra), separated from the former by an internal lamina. The prealare is semitubular in shape, with the more heavily sclerotized and infolded anterior margin continuous with the mesoprephragma. The distal part of the prealare is differentiated into a heavily sclerotized convex triangular plate (tp), which extends to the episternum. Behind the prealare the lateral margin of the scutum is infolded and somewhat more heavily sclerotized, the infolded section of the margin terminating in a small rounded projection which constitutes the anterior notal wing process (anp). From this level the posterior extension of the scutum is depressed, laterally emarginated and with a rounded posterior lobe which can be regarded as the posterior notal wing process (pnp). The posterior margin of the scutum probably incorporates the lateral part of the so-called marginal fold of the notum; posterolaterally it is attached to the postalare by means of a sclerotized band. Part of the scutum adjacent to the scutellum is more heavily sclerotized and usually reticulated. This probably led Theron (1958) to misinterpret it as part of the scutellum, as indicated in his illustration of P. pomeranicum. The anterior part of the scutum may also show reticulation (e.g. Ceroplastes spp., figs. 23,24) and even the median membranous area is reticulated (Eriopeltis sp., L. luzulae sp.; figs. 13,15).

The scutellum (scl) in dorsal view has the shape of a transverse rectangle. The anterior and posterior edges, constituting the scutoscutellar ridge and the posterior marginal fold of the notum respectively, curve sharply inwards, are deflected under the scutellum and extended internally. The inner edges usually have become intimately fused, leaving only an oval median foramen (sclf) (F. viburni, Ctenochiton sp., S. prunastri , Eriopeltis group, Coccus group). This gives the scutellum the appearance of a dorsoventrally flattened tube. In some species, however, the inner edges do not unite with each other (I. theobromae and most species of the Eulecanium group). In the species where the scutellum is tubular it is usually shorter and wider than in those where the scutellum is not tubular. The scutellum was called the apodema by Putnam (1879), Green (1904-1909) and Dürr (1954) while Habib (1956), Borchsenius (1957) and Bustshik & Saakjan-Baranova (1962) regarded it as part of the scutum. The scutellar foramen was referred to as a membranous area by Pesson (1941), Jancke (1955), Ezzat (1956) and Borchsenius (1957). Bustshik & Saakjan-Baranova (1962) state that it is absent in C. hesperidum.

The scutellum is followed by a large, subtriangular membranous area which separates it from the postnotum. This membranous area was regarded as the scutellum by Putnam (1879), Green (1904-1909), Habib (1956) and Borchsenius (1957), and as the postnotum by Sulc (1932), Pesson (1941) and Jancke (1955). The postnotum (pn_2) is a curved structure which extends deeply into the metathoracic cavity and is overlapped by the similarly inflected metanotum. The anterior margin of the postnotum is usually weakly sclerotized and irregular, and may be exposed (e.g. P. myrtilli, Ctenochiton sp. Eriopeltis spp, Ceroplastes spp.; figs. 7,9, 23 & 24) or overlapped by the metathoracic fold

(e.g. E. tiliae, Genus A, I. theobromae; figs. 2,11,16), but this varies somewhat individually. Antero-laterally the postnotum bears a deep finger-like apophysis (pna)on each side. Sometimes the whole postnotum is polygonally reticulated (Ceroplastes spp.) or reticulation occurs near the anterior margin only (P. corni). At the posterior margin of the postnotum a mesopostphragma is formed which is usually deeply emarginated medially. On each side the postnotum is produced into a strong postalare (pa), which extends anterolaterally to articulate with the mesopleural ridge. The anterior postalar ridge (apar) is well developed, while the posterior postalar ridge (ppar) is weak. The anterolateral part of the postalare is densely reticulated. Dorsally the postalare is produced into two small processes; the hind margin of the wing is attached to the anterior one, and the posterior marginal fold of the notum to the posterior.

(b) Mesopleuron: A striking feature of the mesopleural region is the strong mesopleural ridge (plr_2). The ridge winds obliquely across the pleuron, with a sharp bend which separates the strongly developed vertical part from the weaker ventral section, the latter extending obliquely towards the coxa. The dorsal part of the ridge gives firm support to the pleural wing process, the ventral extremity articulates with the coxa. The ventral part is partly overlapped by the postalare and at this point a pleural apophysis (pla_2) is invaginated. In some species (e.g. F. viburni; Ctenochiton sp., E. pela; figs. 31-33) the ridge fades away into the pleural sclerite, as is also the case in the margaroid Steingelia (Theron, 1958) and some Pseudococcidae (Giliomee, 1961). The pleural wing process (pwp_2) is a large rounded structure. On its lower anterior margin there is a small tendon-like apodeme (t) from which a muscle extends anterodorsally to the tegula. Posterodorsal to the pleural wing process a small, meniscate, subalare (fig.1,A_1,sa; 10,N.sa; 10,P.)is found.

Dorsally it is produced into a finger-like process, which apparently articulates with the second axillary sclerite (fig. 10,N). The basalare (bas) is a narrow but distinct sclerite (in the Eulecanium, Eriopeltis and Inglisia groups; figs. 2-15) which connects the anterior margin of the wing process with the episternum, or it is vestigial and incorporated into the pleural wing process (in the Coccus group). The vertical part of the pleural ridge is separated from the episternum by a strip of membrane which corresponds to the basalar cleft of Matsuda (1960). The episternum (eps_2) is large and well sclerotized; a membranous cleft, extending anteriorly from the region of the pleural apophysis completely divides it into dorsal and ventral parts. The dorsal part is strongly convex and sometimes reticulated (e.g. C.hesperidum, Ceroplastes spp; figs. 32, 42 & 43); the ventral part is a narrow elongated sclerite which joins the lateropleurite anteriorly. The dorsal part is bounded anteriorly by a well developed subepisternal ridge (ser). This ridge extends dorsally from the triangular plate of the prealare towards the marginal ridge of the basisternum. Below the membranous cleft, however, it is reduced to an area of darker sclerotization. The lateropleurite (lpl) is always well developed and the anterior margin often bounded by an extension from the anterior part of the marginal ridge (e.g. E. tiliae, L. luzulae, I. theobromae; figs. 2,15,16). The epimeron (epm_2) is represented by a small sclerite posterodorsal to the coxal articulation. The mesothoracic spiracle (sp_2), with its supporting peritreme (ptr_2), is situated in the membrane anterior to the subepisternal ridge. Except for Theron (1958), none of the earlier workers on the Coccidae studied the mesopleuron in any detail. Essat (1956) referred to the subepisternal ridge as the pleural bridge and

to the pleural ridge as the pleural sclerite. It is difficult to determine with certainty the homologies of the structures described above with those of the basic pleurosternal region, as proposed by Matsuda (1960). The membranous cleft probably represents or incorporates his anapleural cleft. According to his definitions the dorsal part of the episternum then represents the anepisternum (called pre-episternum by Weber, 1928) and the ventral part the preepisternum, with the katepisternum either absent or incorporated into the latter. Theron (1958) following Weber (1928) referred only to the area anterior to the ventral part of the subepisternal ridge as a lateropleurite (preepisternum). Roberti (1946) called the same area a laterosternite, a term used by Weber (1928) to describe a more ventral part of the precoxal region.

(c) Mesosternum: The mesosternum is almost entirely represented by the large hexagonally shaped basisternum (stn_2). At the junction of the basisternum and episternum there is a strong marginal ridge (mr), which extends medially to delimit the basisternum anteriorly. Posteriorly it fuses with the pleural ridge immediately above the coxal articulation. Anterior to the coxa an equally strong precoxal ridge (pcr_2) originates from the marginal ridge and curves round the posterolateral edge of the basisternum, but fades away before reaching the median line. A strong longitudinal median ridge (mdr) completely divides the basisternum into two halves; sometimes, however, the ridge is more or less reduced (Eriopeltis spp; figs. 13, 14) or vestigial (I. theobromae; fig. 16). The posterior margin of the basisternum is invaginated to form a transverse furcal pit (fp) from which a well developed furca (f) originates. The furca consists of a broad basal stalk and two strong furcal arms. No separate sternellum is found; Mäkel (1942), from a study of some Pseudococcidae suggested that it is represented by the base of the

furca. The sclerite which Ghauri (1962) regards as the sternellum in the Diaspididae is probably part of the metathorax (as discussed later). Ezzat (1956) referred to the basisternum as the furcasternum and called the transverse part of the marginal ridge a sternacostal suture; Borchsenius (1957) called the basisternum a mesosternal frame.

(d) Articulation of the wings: The articulation of the wing is facilitated by a number of minute alary sclerites or pteralia which lie embedded in the basal articular membrane of the wing (figs.1; 10N) . They consist of the tegula, the first, second and third axillary sclerites, and the additional sclerite. Other structures involved in the wing articulation are the anterior notal wing process, the pleural wing process, the epipleurites and the costal complex of wing veins.

The small meniscate tegula (teg) is situated far anterior to the wing base, from which it is separated by a large membranous bulge. This bulge carries a small weak sclerite posteriorly and in some cases (e.g. the Eriopeltis group) it is weakly reticulated. The first axillary sclerite (figs. 1, 10, N; ax_1) is triangular in shape and its mesal edge lies against the lateral margin of the scutum just behind the anterior notal wing process. The anterior part of the sclerite is drawn out into a slender arm, which curves round the anterior apex of the second axillary sclerite and articulates with the costal complex of wing veins. The posterolateral part of the sclerite articulates with the second axillary sclerite. The first axillary sclerite (figs. 1,10N; ax_1) rather closely resembles those of the more primitive Coccoidea described by Theron (1958). The second axillary sclerite (figs. 1,10N;ax_2) is elongate, slightly curved, with both the anterior and posterior apices acute. The anterior part articulates with the first axillary and the posterior apex with the third

axillary. Apparently it also articulates with the subalare which lies directly below it. The structure of the third axillary (figs. 1,10,N; ax_3) is more complex and it shows some variation in the species studied. The distal, somewhat triangular part, articulates anteriorly with the posterior apex of the second axillary while its posterior margin is confluent with the hind margin of the wing. Mesally this plate extends into a narrow arm which is twisted in such a way that the plane changes from horizontal to vertical (fig.10,O); this arm has an anterior,scoop-like extension which is attached to a process on the postalare by means of a tiny axillary cord. In some species (e.g. Eriopeltis group, C.hesperidum, Parthenolecium spp; figs. 13-15,17,19,20;I) this anterior extension is very small or absent. The additional sclerite (asc) is situated at the base of the wing immediately distal to the second and third axillary sclerites, but does not articulate with them. It is weakly sclerotized and irregularly elongate. As suggested earlier (Giliomee, 1961) this structure may represent the second median sclerite, defined by Snodgrass (1935).

The costal complex of wing veins will be discussed later.

(c) Chaetotaxy: Both fleshy and hair-like setae may occur on the mesothorax. Setae are found on the scutum, scutellum, tegular bulge, the membrane anterior to the basisternum and episternum, and on the basisternum itself. No setae were found on the prescutum.

(i) The scutal setae (sctse) are scattered over the median membranous area of the scutum. In some species (Ceroplastodes chiton Green, and sometimes in E.?festucae) they also extend beyond the posterolateral corner of the membranous area to occur on the sclerotized parts. In a number of species (Inglisia group and most species of the Coccus group) the scutal setae comprise both fleshy and hair-like setae in various proportions,

but usually in fair numbers (e.g. 10-32, av.24 fleshy setae in C. hesperidum and 14-22, av.18 hair-like setae in Genus B). In the other species the scutal setae are either absent (E. tiliae, N. abietis, P. piceae, R. spiraeae and E. pela) or consist of hair-like setae only; the hair-like setae may be few (up to 4) in some species (P. bituberculatum, P. myrtilli, S. prunastri) or numerous (up to 30) in others (e.g. Pulvinaria spp.).

(ii) Scutellar setae (scls): One or two hair-like setae are sometimes present on the scutellum, but their occurrence is very irregular and variable even within a species.

(iii) The tegular setae (tegs) are carried on the anterior part of the tegular bulge and consist usually of a small number (up to 11) of hair-like setae. Fleshy tegular setae were only observed in Ceroplastodes chiton Green and occasionally in I. theobromae.

(iv) The postmesostigmatal setae (pms) are arranged in a broad band on the membrane posterior to the prosternum and mesostigmata. When they are numerous some setae may also occur on the episterna. They consist almost entirely of fleshy setae and are only present in the Coccus and Inglisia groups. Their numbers vary from 14-29 (av.21) in Ceroplastes to 71-97 (av.89) in P. corni.

(v) The basisternal setae (stn_2s) are situated on or near the median ridge in the posterior part of the basisternum. They were found in only 3 species, consisting of 1 or 2 hair-like setae (N.abietis and P. piceae; figs.3,4)and 2-9 (av.5) fleshy setae (Genus B; fig. 18).

3. METATHORAX:

The metathorax is very weakly sclerotized and the sclerites have to a large extent been replaced by membrane; this is due to the reduction of the hind wings. The metanotum, however, is

relatively well developed. It consists of a large plate which closely overlaps the invaginated mesopostnotum. The dorsal edge (morphologically posterior margin) of the sclerite is heavily sclerotized, forming a ridge-like structure which usually extends continuously from one side to the other, but in a number of species (e.g. E.tiliae, F. viburni, Ceroplastes spp.) its median part is somewhat desclerotized. Externally the metanotum is represented by a small lateral suspensorial sclerite, connected to the haltere by means of a sclerotized band. These sclerites are absent when the halteres are lacking. Somewhat more posteriorly an additional, small, weak sclerite is sometimes present (e.g. in E. tiliae, L. luzulae, P. corni: figs.2,15, 21), but it may be absent or present within the same species. In the intersegmental region, between the metathorax and 1st abdominal segment there is an irregular, transverse, lateral sclerite which corresponds to the acrotergite or postnotum (pn_3) of the more primitive Coccoidea (see Theron, 1958). In one of the species (L. luzulae, fig.15) the sclerites of the opposite sides meet or closely approximate each other, and in another species (I. theobromae, fig.16) they are divided by the intersegmental line.

The degree of development of the pleural region depends to a considerable extent on the absence or presence of halteres. The pleural ridge (plr_3) extends from the coxal articulation in an anterodorsal direction across the pleuron. When the haltere is absent (e.g. Eriopeltis, Inglisia and Coccus groups; figs. 36-43) the ridge only extends for a short distance above the coxal articulation. When the haltere is present, however, (most of the Eulecanium group), it extends towards the base of the haltere where it is slightly expanded to form a small metapleural wing process (pwp_3). In this condition the ridge becomes weaker or is interrupted at about halfway from the coxal articulation;

a shallow depression in this area appears to represent a reduced metapleural apophysis (pla_3).

The episternum (eps_3) is small and subtriangular in shape, but when the haltere is present it expands in a ventral direction; in some species (e.g. E. tiliae and R. spiraeae; figs. 25, 28) its anterior margin is partly bounded by a more or less developed ridge, resembling the subepisternal ridge of the mesothorax. The epimeron (epm_3) is represented by an irregular, posteriorly produced sclerite. In most species a vestigal precoxal ridge (pcr_3) extends anteriorly for a short distance along the ventral margin of the episternum, but the absence or presence of this ridge varies individually. The metathoracic spiracle (sp_3), supported by a peritreme (ptr_3), is situated in the membrane anterior to the episternum.

The metasternum (stn_3) is usually represented by a fairly large, irregular, median plate, which is generally more heavily sclerotized anteriorly and weaker posteriorly, but in some species (e.g. S. prunastri, fig. 12; Ceroplastes spp; figs. 23, 24) its posterior part is entirely membranous and only a narrow strip of it remains anteriorly. In Eriopeltis sp. (fig. 13) small and irregular sclerotized areas are situated anterior to this plate. The sternal apophyses are absent and this makes it difficult to establish the homologies of the metasternal structures. The rather similar topographical conditions in the Pseudococcidae, in which the metasternal apophyses are present (Giliomee, 1961) indicate that the large metasternal plate of the Coccidae represents a sternellum and that the small sclerites found in Eriopeltis sp. corresponds to a basisternum. This conclusion is supported by the position of the sternal apophyses and the large sternellum in Margarodes (Theron, 1958), and the general structure of the meso- and metasterna in Aphis

(Weber, 1928). Ghauri's (1962) interpretation of corresponding sclerites in the Diaspididae as metabasisternum and mesosternellum respectively, consequently appears to be incorrect.

Habib (1956) recognised the inverted nature of the metanotum; Ezzat (1956) and Borchsenius (1957) illustrated the pleural sclerotization but do not discuss it in any detail; Theron (1958) overlooked the postnotal and sternal sclerites in P. pomeranicum.

Dermal structures: The fleshy and hair-like setae are arranged in the following groups:

(i) Metatergal setae (mts), occurring laterodorsally, anterior to the postnotal sclerite. They usually consist of a single hair-like seta on each side, but in the Inglisia and Coccus groups (figs. 16-24) up to 10 fleshy setae may also be present in this region. In Ceroplastes spp. only fleshy setae are present and in E. tiliae, P. piceae, E. pela and Genus A no metatergal setae were observed. The setae of this region are sometimes difficult to observe because of the heavy sclerotization of the invaginated structures which lie directly underneath.

(ii) Dorsostigmatal setae (dss) which are situated pleurally, dorsal to the mataspiracle and in line with the pleural setae of the abdomen. When they are numerous they are sometimes difficult to separate from the metatergal setae. They are only present in the Inglisia and Coccus groups (figs. 38-43). The number of fleshy setae varies from 1-8 (av.3.6) in I. theobromae to 10-23 (av.15) in P.acericola; the hair-like setae are rarely present and never total more than 3.

(iii) Antemetastigmatal setae (ams), which are found immediately anterior to the metaspiracle and consist entirely of fleshy setae (up to 12). They are present only in the Inglisia and Coccus groups (figs. 38-43).

(iv) Postmetastigmatal setae (eps_3s) which occur in the pleural region posterior to the metaspiracle, partly on the metepisternum, and may extend ventrally towards the metasternum without reaching it. The fleshy setae are generally numerous in the Coccus group (up to 35 in P. corni), but few in the other groups and absent in some species of the Eulecanium group (e.g. E. tiliae). The hair-like setae occur irregularly in small numbers (0-3), but in E. pela they are always present (4-8, av.5.6).

(v) Anterior metasternal setae (amss) situated in the membranous area between the meso- and metasternal plates. Fleshy setae are present in the Eriopeltes, Inglisia and Coccus groups (figs. 13-24) and in S. prunastri (fig. 12) of the Eulecanium group. Their number varies from 8-17 (av.12) in E.?festucae to 74-94 (av.86) in P. corni. A few hair-like setae are present in some individuals of most species.

(vi) Posterior metasternal setae (pmss), occurring on the metasternal plate, or in the area normally occupied by this sclerite. Fleshy setae are found in the Eriopeltis, Inglisia and Coccus groups (figs. 13-24) where their number varies from 5-16 (av.8) in I. theobromae to 31-60 (av.42) in P. corni. In S. prunastri (Eulecanium group) up to 3 fleshy setae may be present in some individuals, but are absent in others. A few hair-like setae (up to 3) may be present in some individuals of a number of species.

In Ctenochiton sp. 3-11 (av.6.3) circular pores, somewhat reminiscent of vacant hair sockets, occur near the metatergal seta on each side.

4. WINGS AND HALTERES

The fore wings are large, with a narrow basal part and a broadly rounded apex. They may be relatively short and broad,

i.e. the length 1.9 - 2.3 times the width (e.g. the Coccus group, figs. 17-24), or long and narrow, i.e. the length 2.8 - 3.3 times the width (e.g. the Eriopeltis group, figs. 13-15). Posteriorly, near the base, a small pouch or alar lobe (al) (Stickney, 1934b) is formed by the dilation of the margin of the wing. It is ventrally invaginated and provides a receptacle for the hooked distal ends of the apical setae of the haltere. When the haltare is lacking the alar lobe is absent.

The wing is semitransparent, although in some species e.g. P. bituberculatum, the area between the anterior margin and the first wing vein has a purplish tinge. The surface of the wing is covered by minute hairs (microtrichia), with those on the margins somewhat longer than elsewhere. Only two distinct veins are present. Patch (1909) suggested that corresponding veins in the Pseudococcidae represent the radius (rad) and media (med); these veins were also called radius and "medius + subcosta" by Dürr (1954), but the last mentioned designation is obviously incorrect. The radius runs parallel to the anterior margin of the wing, the media deflects towards the hind margin. As in the Pseudococcidae (Patch, 1909) the two veins are not visibly connected. At the base of the wing, near the anterior margin, an elongate sclerite forms the costal complex of veins (Fig. 1, 10N; ccx). The proximal part of the sclerite is pointed and articulates with the anterior notal wing process. Near the base an anterior extension is found which curves ventrally (see fig. 10N, ~~ccx~~) to articulate with the pleural wing process. A small number of hair-like alar setae (as) are found in the anterior part of the base of the wing in E. tiliae, N. abietis, R. spiraeae and Ctenochiton sp. (figs. 2,3,4,9). Their number does not exceed 3; they are sometimes absent on one of the two wings.

The hind wings are either absent (P. myrtilli, S.prunastri, the Eriopeltis, Inglisia and Coccus groups; figs. 12-24) or

reduced to halteres(h) (most of the Eulecanium group). The anterior half of the haltere is weakly sclerotized and near the base the anterior margin is strengthened by a ridge, which resembles a wing vein. At the apex each haltere carries at least one long seta, but in E. tiliae, N. abietes, R. spiraeae, P. piceae and E. pela (figs. 2-5) three or four may be present. These setae are curved apically and hook on to the alar lobe. It is worthy of note that the halteres of Margarodes (see Theron 1958) resemble the hind wings of certain Aphididae e.g. Anomalaphis comperi and Microparsus variabilis (see Baker, 1920) to a considerable degree, presumably through convergence. The halteres were called pseudohalteres by Kawecki (1958b).

5. LEGS

The three pairs of legs are very similar, long and slender, and composed of the usual segments, with a one-segmented tarsus and a single claw. The fore legs are usually the shortest and the hind legs the longest, but conditions vary and there are species in which the latter or the middle legs are the shortest. All the segments of the leg are well sclerotized and all except the claw are covered with numerous fleshy (fs) and hair-like (hs) setae, although the fleshy ones are sometimes absent on the tarsus (Genus A and E.?festucae). They are not arranged into groups, but scattered over the whole surface of the segment. These setae are similar to those occurring elsewhere on the body. Conforming with the conditions on the antennae, the fleshy setae of E. pela are very long, from 3 to 5 times as long as the width of the tibia, and in Genus A they are very short, about 3/4 as long as the width of the tibia; in the other species they are slightly longer than the width of the tibia. In E. tiliae the fleshy setae are very thin and it is difficult to distinguish them with certainty from the hair-like setae. The hair-like setae are very similar in all the species studied and are usually a

little longer than the width of the tibia. Distinctly different setae occur on the inner margin of the anterior coxae of some species. They are large, rigid, sometimes capitate, with the setal membrane surrounded by a distinct basal ring; they are called here coxal bristles (cb). They are probably sensory in nature. A pair of tarsal digitules (tdgt), i.e. long, capitate setae, is present near the dorsal apex of each tarsus and two smaller ungual digitules (udgt) occur on each claw.

The coxa (cx) is short and broad. Its base is strengthened by a well sclerotized basal ridge which articulates dorsally with the pleural ridge by means of a short basal process. The apical margin is also ridge-like and bears an anterior and a posterior process which articulate with corresponding processes on the trochanter. The hair-like setae on the coxae vary considerably in length, those near the basal process being very short and those near the apex being longer. The longest seta on the inner terminal part, called the apical seta (ase) may be short, i.e. length about half that of the trochanter (e.g. E. tiliae, F. viburni, Pulvinaria spp.; figs 2,8,19 & 20) or long, i.e. as long as the trochanter (Eriopeltis group; figs. 13-15). Coxal bristles were found in some species of the Eulecanium group (e.g. E. tiliae, N. abietis; figs. 2,3; M;cb) and all the species of the Coccus group (figs.16-21,23), except C. berliniae. They appear to be capitate in all the species of the Coccus group except P. pomeranicum and pointed in most species of the Eulecanium group; in some specimens of E. tiliae both capitate and pointed bristles may occur. The number of coxal bristles varies from 1-2 (av. 1.4) in P. bituberculatum to 5-8 (av. 6.2) in E. tiliae.

The trochanter (tr) is elongate, narrow basally and broad distally. The strong basal ridge bears an anterior and posterior articular process and continues for some distance along the outer

margin. The trochanter is separated from the femur by a narrow membrane. A minute hair-like seta occurs both anteriorly and posteriorly in the membrane near the basal ridge and a small rigid seta is always present on the outer margin. These setae appear to be proprioceptors. Ventrally near the apex there is usually one, but in some species (e.g. E.tiliae, P. piceae, R.spiraeae) two long hair-like setae. The longest seta the apical seta (ase) is either comparatively short, i.e. less than $1\frac{1}{2}$ times as long as the width of the trochanter (Genus A, C. hesperidum; figs. 11,17) or long, i.e. more than 3 times as long as the width of the trochanter (E. tiliae, N. abietis, Eriopeltis spp.; figs. 2,3, 13 & 14). A ring of oval campaniform sensilla are found in the basal half of the trochanter. They are usually 6 in number, but in E. pela up to 8 may be present.

The femur (fm) varies in shape from being long and narrow, i.e. 6 times longer than wide (C. hesperidum, Genus B; figs.17, 18) to short and broad, i.e. $3\frac{3}{4}$ times longer than wide (Genus A, S. prunastri; figs. 11,12). The distal ridge is well developed and bears an anterior and posterior process which articulate with corresponding processes on the tibia. All the setae are of the ordinary fleshy and hair-like types.

The tibia (tib) is long and slender. The width/length ratio varies from about 1:11 in S. prunastri and L. luzulae (figs. 12,15) to about 1:21 in C. hesperidum (fig. 17). Basally it articulates with the femur by means of two processes and distally it is connected to the tarsus by means of a narrow membrane, with no sclerotized joint. The relative numbers of fleshy and hair-like setae vary; in the Coccus and Inglisia groups and some species of the Eulecanium group the fleshy setae are more numerous and in the Eriopeltis group and some species of the Eulecanium group the hair-like setae are more

numerous. On the inner margin, near the apex, an apical spur (tibs) is present in all the species studied. In some species, e.g. E. pela some of the hair-like setae near the apex, also have a spur-like appearance. In I. theobromae the apical spur on the front leg is short, about half as long as on the other tibiae.

The tarsus (tar) is elongate; the length varies from being about 3 times longer than wide (P. piceae, fig. 4) to about 9 times that (Genus B, fig. 18). The tarsus is broadest near the base or in the middle and tapers distally. Distally it articulates with the claw by means of a small dorsal process. As is the case with the tibia there are more fleshy than hair-like setae in some species and more hair-like than fleshy setae in others. In Genus A the fleshy setae are completely absent on the middle, hind and sometimes the front tarsi, while they are sometimes absent on the tarsi of E.?festucae. Two long, subequal, capitate tarsal digitules (tdgt) are found dorsally near the apex.

The claw (cl) is well developed, curved, pointed,with a small denticle ventrally near the apex. In some species e.g. P. myrtilli and C. hesperidum the denticle is minute. Each side of the base of the claw bears a capitate ungual digitule (udgt), which is usually about as long as the claw. The claws on all three legs are subequal and they show little variation within the family.

Most of the earlier workers give brief descriptions of the leg. The tarsal and ungual digitules were already observed by Putnam (1879).

D. THE ABDOMEN

The abdomen is elongated, more or less parallel sided, with the posterior end tapering and carrying the narrow and

sclerotized genital segment. In cross section it is strongly convex ventrally and only moderately so dorsally. In most of the species the pregenital segments are almost completely membranous. The segmentation is not very distinct, but it is indicated by shallow intersegmental grooves, and the segmental arrangement of the setae and transverse bands of minute dermal denticulations. These denticulations, which are also present in male Diaspididae (Ghauri, 1962), Pseudococcidae and some female Coccoidea and Aphididae occur on the dorsal and ventral surfaces of the median part of each segment. The abdomen is composed of eight pregenital segments and the 9th or genital segment; this was recognised by Putnam (1879), Silvestri (1919a, 1919b, 1920), Sulc (1932), Pesson (1941), Borchsenius (1957), Theron (1958) and Bustshik & Saakjan-Baranova (1962).

(a) The pregenital segments:

The 1st segment is developed dorsally and pleurally, but not ventrally; the other segments are complete. The sclerotization of the abdomen varies considerably within the family. Where it is most fully developed, as in E. tiliae, N. abietis, P. piceae, P. myrtilli and L. luzulae (figs. 2,3,4,7,15) tergal and sternal plates are found on all the abdominal segments. In other species (P. bituberculatum, F. viburni, Ctenochiton sp., Eriopeltis spp., I. theobromae and P.?betulae; figs. 6,8,9,12 & 13, 16, 19) sternites are present on all the segments, but tergites are absent on one or more of the middle segments and in the remaining species both tergites and sternites are absent on these segments.

The tergites (at) of the first three segments are situated in the intersegmental or antecostal region and they usually consist of a small transverse sclerite on each side. Those in front of the first segment are enlarged and can perhaps best be regarded as the postnotum of the metathorax; in the other

segments they can be regarded as belonging to the segments posterior to them (similar tergites in Planococcus (Theron, 1958) and Pseudococcus (Giliomee,1961) are probably also intersegmental and do not belong to the preceding segments as has been indicated). In some of the species, e.g. Genus B, Pulvinaria spp. (figs. 18, 19 & 20) the tergites of the 2nd and 3rd segments consist of a small sclerite on each side and a separate additional median sclerite, but in Genus A and sometimes in P. myrtilli there is a continuous transverse median sclerite. In the 4th to 8th segments the tergal plates are large, transverse and situated in the middle of each segment.

The sternites (as) also consist of large transverse, segmental plates. In the more anterior and posterior segments they are usually complete, but in the intermediate segments they are either interrupted or completely absent. In some of the intermediate segments the membrane near the segmental boundary is bulging and irregularly folded.

Pleural sclerotization is only found on the caudal extensions of the 7th segment of the Eriopeltis and Coccus groups (figs. 13-24), on the caudal extensions of the 8th in the Coccus group, and in the pleural region of the Inglisia group(fig. 38). In I. theobromae a continuous band of sclerotization extends along the pleural region of the 4th to 7th segments, with a small sclerotized area situated somewhat more ventrally on each of the 5th and 6th segments. This bears some resemblance to the condition in the winged female of Aphis fabae, where the lateral plates occur on the 2nd and 6th abdominal segments (Weber, 1928) and according to Weber are morphologically part of the terga. This resemblance is probably merely superficial and devoid of any phylogenetic significance as no lateral sclerotization is present in any of the other Coccoidea studied so far.

In the Coccus group the 7th segment laterally bears a very

prominent, tapering, caudal extension (ce). In the other groups this extension is small and broadly rounded or somewhat pointed. In the Coccus and Eriopeltis groups they are weakly sclerotized lateroventrally. Theron (1958) incorrectly describes them as belonging to the 8th abdominal segment and Sulc (1932) correctly illustrates the segmental position in one of his figures (fig.23) but incorrectly in another (fig. 25). The caudal extension of the 8th segment is also shaped in a variety of ways. It may form a small, simple lobe (most of the Eulecanium group, the Eriopeltis group, the Inglisia group; figs. 2-11, 12-15) a papilla-shaped lobe (Parthenolecanium spp.; figs. 21,22;Q), a large, straight cylindrical (S.prunastri, fig.12 ; C. hesperidum; fig.17,Q) or somewhat geniculate lobe (Genus B; 18,Q), a mammillate lobe (Pulvinaria spp.; figs. 19,20,Q) or a prominent and semicircular lobe (Ceroplastes spp.; figs.23-24;Q). In the Coccus group the distal part of the lobe is weakly sclerotized and it bears a structure which is usually membranous but weakly reticulated, sometimes (Ceroplastes spp.) it is weakly sclerotized in the middle. The structure, which can conveniently be called a cicatrix (c), varies in shape and relative size; in Ceroplastes spp. it is large, circular and occurs dorsally: in C. hesperidum and Genus B it is also large but occupies the posterior surface of the lobe and in Parthenolecanium spp. it is small and occurs apically. The caudal extensions resemble the fleshy tassels of some Monophlebidae (Morrison, 1928), presumably through convergence.

Dermal structures: Both fleshy and hair-like setae are present on the abdomen. They are segmentally arranged and occur in distinct groups on the dorsal, pleural and ventral surfaces and are referred to as abdominal dorsal (ads), abdominal pleural (aps and vps), and abdominal ventral (avs) setae.
The dorsal setae (ads) normally consist of 2 hair-like setae (one on each side) on all but the 2nd and 3rd segments, but in

P. bituberculatum and Genus B (figs. 6,18) they are regularly present on all segments. In addition to these a small but variable number of fleshy dorsal setae occur in the Eriopeltis and Coccus groups (figs. 13-24).

The pleural setae, can be subdivided into a dorsopleural group (dps) and a ventropleural group (vps). These two groups are not in line with each other, the former being situated nearer to the posterior margin of the segment. When numerous the two groups coalesce to a certain degree. On the 1st segment the ventropleural setae are always absent and on the 7th the two groups are not differentiated. The dorsopleural group consists of both fleshy and hair-like setae, occurring in different proportions and numbers in different species. In some species (most of the Eulecanium group, figs. 25-34) all dorsopleural setae are hair-like; except for the Coccus group, there are no fleshy setae on the 1st to 3rd segments, and frequently the anterior segments have no dorsopleural setae at all. The ventropleural setae usually consist of a single hair-like seta and none or a few fleshy setae; they are never found on the 1st and rarely on the 2nd and 3rd segments.

Ventral setae are arranged in a median group in the middle of each segment. They often consist of both fleshy and hair-like setae. The hair-like setae are always present, arranged on each side of the body into two longitudinal series, one median and one lateral, each series usually with one seta per segment. Both series are usually present on segments V-VII, but on segments II-IV either median or lateral setae are frequently absent, and on segment II hair-like ventral setae are often absent altogether (e.g. L. luzulae, C. hesperidum, Ceroplastes spp.). In most species (S. prunastri, Eriopeltis, Inglisia and Coccus groups; figs. 12-24) fleshy ventral setae are also present. If present, they are usually numerous, except on the 8th segment, but a

comparatively large number (more than 5) on this segment is the characteristic of the Inglisia group. In S. prunastri fleshy setae occur only on the 2nd and sometimes 3rd segments.

In addition to the above-mentioned setae a number of setae are present on the posterior margin of the 8th segment. Lateral to the glandular pouch this segment always carries 3 hair-like setae; occasionally a fleshy seta may also be present, but a comparatively large number (2-7) is characteristic of Ceroplastes spp. (figs. 23,24). In many species setae are present in the region anterior to anus where, in some species, the small tergal plate of the 9th segment (mentioned later) is found; these setae are called ante-anal setae (aas). In most of the species they consist of two long pointed hair-like setae, but in Parthenolecanium spp. one or both are sometimes bifurcate. In some genera (Eriopeltis, Pulvinaria and Ceroplastes; figs. 13 & 14, 19 & 20, 23 & 24) a number of fleshy setae are also present in this region, and in most species one or two small hair-like setae may occur in some individuals.

A group of small circular pores, reminiscent of vacant hair sockets, are found dorsally on each side of the 1st abdominal segment of Ctenochiton sp. (fig. 9) and a small number of these pores are also found in the ante-anal region in Ctenochiton sp., L. luzulae and Genus B (figs. 9, 15, 18). On each side of the base of the penial sheath there is a funnel-shaped pouch (gp), which contains 2 long setae arising from its bottom. From about halfway up to the rim ,, the pouch is lined with numerous quadrilocular, but also with a few tri- and quinquelocular pores. According to Sulc (1931) the basal half of the pouch is lined with tubular pores. The pores secrete a waxy substance which slides along the setae and constitutes the conspicuous long waxy filament of the living male. The structure of the filament and pores was studied in detail by Sulc. In

Ctenochiton sp., E. pela, Genus A and, as reported by Dürr (1954) in Lecanium pumilum Brain (= Saissetia oleae (Bern.)) the setae are knobbed apically. The setae vary in length from short, i.e. the length of the protruding part only twice that of the part concealed within the pouch (e.g. E.tiliae, fig.2) to long, where the length of the protruding part is 4-6 times longer than the concealed section (e.g. C. hesperidum, fig.17). In L. luzulae the pouch is absent and replaced by a shallow depression with one long seta, but no pores at all. From available information it is known that the pouch is also reduced in Vinsonia stellifera (Newstead, 1903) and Ceroplastes japonicus (Borchsenius, 1957). The glandular pouch corresponds to what is called the glandular plate (Pflugfelder, 1939; Giliomee, 1961) in the Pseudoccidae.

(b) The genital segment and external genitalia:

The genital segment has become elongated to form a long tubular style which tapers posteriorly. The anus (an) is situated dorsally in the membrane at the basal part of the segment. The penial sheath (ps), which is composed of the 9th sternum (Theron, 1958) is well sclerotized laterally and membranous ventromedially. The lateral sclerotizations fuse dorsally with each other at some distance posterior to the anus. In some species (e.g. most of the Coccus group) they are also narrowly joined anterior to the anus, a condition which also obtains in the Diaspididae (Theron, 1958; Ghauri, 1962). The apex is sometimes produced into a small membranous extension, which is best developed and finger-like in Ceroplastes spp., (figs. 23,24;R). The ventral membrane widens anteriorly to form a triangular area, which, for descriptive purposes, can be called the basal membranous area (bma). Posterior to this area a narrow ridge is formed on the median line which appears to be homologous to the basal rod (bra) found in other Coccoidea (Theron, 1958,1962), but was overlooked by Theron (1958) in

P. pomeranicum. According to Theron the basal rod may incorporate the basal plate. Parameres are absent.

Posteriorly the basal rod is connected to the base of the aedeagus (aed), which is accommodated in a slit in the ventral wall of the penial sheath. The aedeagus consists of a straight tube which does not narrow appreciably towards the apex. It ends bluntly before reaching the apex of the penial sheath. The ductus ejaculatorius can be seen to run along the ventral wall of the penial sheath, but the position of the gonopore is impossible to observe in mounted specimens. The aedeagus appears to contain an eversible endophallus as is indicated by occasional specimens in which the everted condition has been observed. The genitalia with everted aedeagus, but considered to represent the normal condition, were illustrated by Sulc (1932). The relative length of the penial sheath, aedeagus and basal rod show considerable variation within the family. Silvestri (1919a, 1919b, 1920) and Jancke (1955) correctly illustrated and interpreted the aedeagus, while the illustrations given by Leonardi (1920) and Theron (1958) are inaccurate in some details; Putnam (1879), Dürr (1954) and Husseiny & Madsen (1962) called the entire 9th segment either a penis or aedeagus.

In well stained specimens of some species (e.g. the Coccus group; figs. 17-24) a small 9th tergite (at_9) can be seen in the membrane anterior to the anus, but the 10th and 11th tergites described by Sulc (1932) were not observed.

Dermal structures: A number of small setae (gts) which are possibly tactile sensilla, are scattered over the genital segment. Distally the setae become considerably smaller and at the apex only small circular discs can be discerned; the latter may be campaniform sensilla.

IV DESCRIPTION OF THE SPECIES

In the descriptions of the individual species considerable detail has been included and they may well appear to be unduly long and repetitive. However, detailed descriptions are considered necessary since the taxonomic significance of the characters has, as yet, not been properly evaluated.

For the sake of brevity the usual telegraphic style of describing species has been adopted and the following abbreviations are used: h.s. = hair-like seta(e), f.s. = fleshy seta(e); the figures in brackets signify averages.

EULECANIUM GROUP
GEN. EULECANIUM

1. EULECANIUM TILIAE (L.) (Figs. 2 and 25)

Living specimens reddish, with sclerotized areas dark brown and the appendages light yellow, wings with a purplish tinge between anterior margin and first wing vein; very long and moderately robust, with comparatively short antennae and legs, which carry many setae. When mounted, total body length 2440-2700 (2569)$^{\mu}$; width at mesothorax 570-660(601)$^{\mu}$. Wing expanse 3950-4550 (4296)$^{\mu}$.

Head: subconical in dorsal view; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced; length from apex to pronotal ridge 274-319(303)$^{\mu}$, width across genae 296-338(315)$^{\mu}$. Median crest sclerotized and distinctly polygonally reticulated; with 3-7(5.3) hair-like dorsal head setae, arranged in two groups: one, with 2-4(3.3) short setae, posterior to the level of the dorsal eyes and the other with 0-4(2.0) longer setae, anterior to the eyes. Midcranial ridge: dorsally represented by a short, weak ridge anterior to the level of the eyes; ventrally narrow but well defined, reaching ocular sclerite posteriorly, with surrounding area showing weak polygonal reticulation posteriorly. Genea

large, sclerotized, weakly polygonally reticulated, without setae.

Eyes: five pairs; dorsal and ventral pairs large, subequal, lateral pairs smaller, subequal; corneae of dorsal eyes 34-42 (38)μ in diameter and 2.2 - 2.9(2.5) times as much apart; those of the ventral eyes 32-40(35)μ in diameter and 1.1 - 1.6 (1.3) times as much apart. Ocellus small. Ocular sclerite well sclerotized except between the ventral eyes where the cuticle is produced into a keel; polygonally reticulated throughout. Preocular ridge extending only a short distance below articular process. Postocular ridge very weak dorsally, sometimes missing posterior to ocellus; well developed lateroventrally, but weak posteromedially; below the ocellus the ridge splits up, with the anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent. Ventral head setae consisting of 1-5(3.2) h.s., situated anterior to the ocular sclerite on each side of the midcranial ridge. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis short; apex bifurcate or occasionally truncate, not quite reaching level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 895 - 1075 (988)μ long, i.e. shorter than half body length (ratio 1:2.46 - 2.92, av.2.62); shorter than posterior leg (ratio 1:0.73 - 0.87, av. 0.80) and longer than penial sheath (ratio 1.16 - 1.50, av.1.31). Scape 57-68(61)μ long and 57-67(62)μ wide, with 3 h.s. Pedicel: with distinct, polygonal, dorsal reticulation; 49-57(54)μ long and 49-57(53)μ wide, with 0-3(1.0) f.s., 2-4(2.9) h.s. and a sensillum placodeum.

Segment III club-shaped, 1.8-2.2(2.0) times longer than wide (84-106, av.90.0μ long and 42-49 av. 45μ wide); with 4-12 (8.5) h.s. and 4-12(5.8) f.s., the latter of medium length, 0.7-1.0(0.9)

times as long as width of segment; with 4-9 usual sensilla basiconica. Segments IV-IX: cylindrical, lengths of these segments (in μ) 114-171(152), 137-160(149), 106-148(131), 95-122(112), 80-95(90) and 68-91(78) respectively, widths varying from 30 to 42μ, with distal segments wider than proximal ones; with 18-53(33), 33-55(44), 26 - 46(37) 28 - 43(36), 22 - 32(27), 18 - 34(25) f.s. respectively, but no hs.; antennal bristles on 8th and 9th segments thicker than f.s. Segment X: terminal part not constricted; 57 - 84 (72)μ long and 30 - 38 (33)μ wide; carrying 8-14 (12) f.s. 3 capitale subapical setae and 5 antennal bristles of which the 3 long ones are about half as long as the segment and the 2 shorter ones about as long as the f.s., though thicker; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 806-901 (864)μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites large, without setae. Medial pronotal setae absent. Posttergites medium-sized, without striations and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, interrupted median and a triangular sclerite. Anteprosternal setae absent; prosternal setae: 0-3(0.8) h.s.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum about twice as wide as long (av.268 and 138μ respectively); anterior margin slightly curved; laterally bounded by the prescutal ridge and posteriorly by the prescutal suture; sometimes with very weak polygonal reticulation. Scutum: Median membranous area: transverse; 80-106(95)μ long and 2.06 - 3.00 (2.36) times as wide (width 203-251, av.223μ); without setae.

Scutellum: 93-114(107)μ long and 217-266(236)μ wide, the

ratio being 1:2.0 - 2.5 (2.2); not tubular and without setae. Postnotum with anterior margin usually irregular and partly overlapped by meta-thoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with moderately deep emargination. Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed, becoming appreciably broader ventrally, but below the membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small, Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 383$^{\mu}$ wide and 287$^{\mu}$ long, i.e. 2.70 - 3.62 (3.04) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula comparatively large, its membranous bulge sometimes showing wavy striations and with a small weak sclerite posteriorly; with 6-10(7.7) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with thickening of posterior margin sometimes desclerotized medially; suspensorial sclerite small, irregular; a small sclerite always present anterior to postnotum. Postnotum consisting of a transverse sclerite on each side. Metatergal setae absent. Pleural ridge well developed though interrupted near the middle; with a small wing process. Episternum with anterior margin ridge-like in parts; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal

setae: 0 - 2(0.9) h.s. Metasternal plate weak and irregular. Anterior metasternal setae consisting of 0 - 2(1.4) medial h.s. and occasionally one or two lateral to the posterior part of the basisternum; posterior metasternal setae: usually 2 (range 1-2) h.s. medially.

Wings: hyaline; of medium length (1750 - 2000, av. 1879 μ) but comparatively broad (width 780 - 870, av. 840μ), the ratio width to length being 1:2.13 - 2.35 (2.24); alar lobe present; alar setae: 1-3 (1.7) h.s. on each wing. Halteres well developed, 163 - 201 (178)μ long and 42-61 (53) μ wide, each with 2 - 4 (2.6) apically hooked setae which are about 70μ long.

Legs: short and slender with the fore pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1:2.07 - 2.15(2.10). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	91-103 (95)	118-148 (128)	274-346 (301)	353-437 (391)	93-103 (98)	29-34 30	973-1094 (1043)
II	99-118 (110)	120-133 (129)	251-308 (285)	433-479 (450)	114-133 (124)	29-34 (32)	1058-1203 (1130)
III	106-141 (124)	125-143 (134)	281-315 (295)	456-532 (499)	125-148 (134)	30-34 (32)	1132-1303 (1217)

The f.s. on the legs are very slender, making it impossible to distinguish with accuracy between the f.s. and h.s.

Coxae: with 24-35 setae; fore coxa with 5-8(6.2) coxal bristles, of which some are capitate; apical seta about half as long as trochanter. Trochanters: 34-44μ wide; with 6 oval sensilla and 16-25 setae, including 2 or 3 minute setae near basal ridge, one small seta on the outer margin and 2 long setae, of which the longest (apical) on the fore trochanter, is 2.9-3.4 (3.1) times as long as the width of the trochanter. Femora: of medium width (53-67) the ratio width to length of hind femur being 1:45 - 5.1 (4.9); with 37-65 setae. Tibiae: 29-38μ wide; the ratio width

to length of hind tibia being 1:14.1 - 16.3(15.1); with 74-121 setae which are about as long as the width of the tibia; apical spur of about the same size on all tibiae. Tarsi: 28-34u wide, hind tarsus 4.1-4.9(4.4) times longer than wide; each with 18-37 setae; tarsal digitules subequal, longer than claw. Claws: of medium length, about as long as width of tarsus, slightly curved, with small denticle near tip; anterior ungual digitule with larger apical knob than posterior one, digitules longer than claw.

Abdomen: 670-810(713)μ long and 450-600(521)μ wide.

Segments I-VII: tergites and sternites present on all segments; tergites on the 2nd and 3rd segments represented by a small sclerite on each side on the anterior margin, and on the 4th - 7th by a transverse plate; sternites represented by a weak plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. Caudal extension of the 7th segment small, rounded, not sclerotized. Dorsal setae: f.s. absent; h.s. absent on segment I, sometimes one or two setae present on each of the 2nd to 7th segments. Pleural setae: consisting of h.s. only, which include dorsopleural setae: 0-3(1.3), 2-8(3.8), 1-6(3.5) and 2-6(3.8) on the 3rd to 6th segments, respectively and ventropleural setae: occasionally one on each of the 3rd and 4th, and usually one on each of the 5th and 6th segments. Segment VII with 6-9(7.4) h.s. Ventral setae: h.s. only, usually 2 medially on each of 2nd and 3rd, and 4 on each of the 4th - 7th segments.

Segment VIII: with transverse tergite and sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long setae which are sometimes capitate and whose protruding part is about 1½ times as long as the concealed section; No 9th tergite observed. Ante-anal setae: 2 long h.s.

Posterior margin with 2-4(2.6) h.s. on each side.

Genital segment: Penial sheath long, about 2/7 total body length (ratio 1:3.3-3.7,av.3.4), 654-809(756)μ long and 49-59 (55)μ wide; lateral sclerotizations not joined anterior to anus; length of basal rod 2/5 - 2/3 that of aedeagus, the rod extending anteriorly from the base of the aedeagus for 2/3 - 3/4 of the distance to the apex of the basal membranous area; apex of the sheath without a membranous extension. The area from base of sheath to tip of aedeagus with 27-40(35) small setae; a cluster of small sensilla occuring ventrally near apex of sheath. Aedeagus long (300-376,av.349μ), the penial sheath longer and the basisternum shorter, the ratios being 1:1.9-2.4(2.2) and 1:0.71-0.96(0.82) respectively.

Material examined: 10 specimens, bred in the laboratory from material collected by myself on horse-chestnut (Aesculus hippocastanum L.) at the Imperial College Field Station, Silwood Park, Sunninghill, Berks.; males emerged during May, 1962. Five specimens collected by J. Rehácek in Bratislava, Czechoslovakia on 14.4.53 (remounted from Liquid of Swann) agreed well with the above description.

GEN. NEMOLECANIUM

2. NEMOLECANIUM ABIETIS BORCHS. (Figs. 3 and 26)

A long, slender species with comparatively short antennae and legs; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1930-2270 (2136)μ; width at mesothorax 415-480(445)μ. Wing expanse 3870-4190(4072)μ.

Head: subconical in dorsal view; in lateral view dorso-ventrally elongated, with the anterodorsal bulge not pronounced; length from apex to pronotal ridge 251-293(269)μ, width across genae 251-289(274)μ. Median crest sclerotized, with a small area near posterior margin more heavily sclerotized; weakly polygonally reticulated. Dorsal head setae: 8-12(9.6) h.s.,of which 3-5 are situated posterior and 4-8 anterior to the level of the dorsal eyes. Midcranial ridge: dorsally represented by a weak ridge which usually extends posteriorly to the posterior level of the eyes; ventrally narrow but well defined, reaching ocular sclerite posteriorly, with surrounding area showing weak polygonal reticulation posteriorly. Genae: large, sclerotized, not reticulated, without setae. Eyes: three pairs; dorsal and ventral pairs subequal, lateral pair smaller; corneae of dorsal eyes 22-30(27)μ in diameter and 2.3-3.8(2.9) times as much apart; those of the ventral eyes 21-30(26)μ in diameter and 1.1-2.2(1.5) times as much apart. Ocellus small. Ocular sclerite well sclerotized except between the ventral eyes, where the cuticle is produced into a keel; polygonally reticulated throughout. Preocular ridge long, ventrally extending half-way or more of the distance between the articular process and the midcranial ridge. Postocular ridge very weak dorsally, well developed latero-ventrally, and tapering but well defined posteromedially; below the ocellus the ridge usually splits up, with the anterior

branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent, ventral head setae: 2-4 h.s., situated immediately anterior to ocular sclerite, on each side of midcranial ridge. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis medium-sized; apex bifurcate, extending to around the level of the posterior margin of the ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 927-1087(1025)μ long, i.e. shorter than half body length (ratio 1:2.02-2.13,av.2.09), slightly longer than posterior leg (ratio 1:1.04-1.14,av.1.07) and longer than penial sheath (ratio 1:1.55-1.71,av.1.64). Scape: 53-68(60)μ long and 46-55(51)μ wide, with 3-4(3.2) h.s., area of sclerotization reduced ventrally. Pedicel: with distinct, polygonal, dorsal reticulation; 55-68(59)μ long and 42-51(47)μ wide; with 0-3(2.1) f.s., 1-3(2.5) h.s. and a sensillum placodeum. Segment III somewhat club-shaped, 2.5-3.0(2.7) times longer than wide (80-95, av.90μ long and 30-36, av.34μ wide), with 2-6(4) h.s. and 12-22(15)f.s., the latter of medium length, 1.3-1.8(115) times longer than width of segment; with 1 or 2 usual sensilla basiconica.

Segments IV-IX: cylindrical; lengths of these segments (in μ) 80-95(90), 103-144(124), 133-171(153), 137-178(160), 103-133(124), 87-106(98) and 76-91(84) respectively, all of about the same width, varying from 23 to 30μ and with 20-34(24), 27-36 (32), 27-44(35), 25-41(30), 21-31(25), and 19-30(33) f.s. respectively but no h.s.; antennal bristles on 8th and 9th segments somewhat larger than f.s. Segment X: terminal part not constricted; 68-82(74)μ long, and 23-29(26)μ wide; carrying 8-13(11) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about 4/5 as long as the segment and the 2 shorter ones about as long as the f.s. though somewhat thicker; with 2 sensilla basiconica ventrally, one near apex and

the other more proximal.

Thorax: 619-752(699)μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites large, without setae. Medial pronotal setae absent. Posttergites medium-sized, without wavy striations, and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, interrupted median ridge and narrow triangular sclerite. Anteprosternal and prosternal setae absent.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum less than twice as wide as long (av.197 and 113μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; medially with more heavy sclerotization which is ridge-like posteriorly; not reticulated. Scutum: Median membranous area transverse, subrectangular; 70-95(86)μ long and 1.72-2.27(2.00) times as wide (width 156-190,av.171μ); without setae. Scutellum 72-91(80)μ long and 148-190(164)μ wide, the ratio being 1:2.0-2.3(2.1); not tubular; usually with 2 h.s. Postnotum with anterior margin irregular and partly overlapped by metathoracic fold; postnotal apophyses and postalare well developed, the latter densely reticulated distally. Mesopostphragma with moderately deep emargination. Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed, becoming appreciably broader ventrally, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum large, about 272μ wide and 230μ long, i.e. 2.46-3.03(2.70) times

longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; with 0-2(1.4) h.s. on the median ridge. Furca well developed. Mesothoracic spiracle with well developed peritreme: postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 1-5(2.5) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with thickening of posterior margin sometimes desclerotized medially; suspensorial sclerite small, spot-like; a small sclerite usually present, anterior to postnotum. Postnotum consisting of a transverse sclerite on each side.

Metatergal setae: occasionally one h.s. on each side. Pleural ridge well developed, though interrupted near the middle, with a small wing process. Episternum with anterior margin ridge-like in parts, epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: 0-2(0.7) h.s. Metasternal plate weak and irregular. Anterior and posterior metasternal setae usually consisting of 2(range 1-3) medial h.s. each; occasionally a h.s. occurs lateral to the posterior part of the basisternum.

Wings: hyaline; long (1760-1910, av.1856μ) and of medium width (700-780, av.753μ), the ratio width to length being 2.42-2.51(2.46); alar lobe present; alar setae usually one (range 0-2) h.s. on each wing. Halteres well developed, 125-156(142)μ long and 38-46(43)μ wide, each with 1-3(1.8) apically hooked setae which are about 73μ long.

Legs: short and moderately slender, with the middle pair shortest and the hind pair longest; the ratio length of hind

leg to body length is 1:2.20-2.22(2.21).

Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	76-80 (79)	93-118 (107)	220-266 (245)	344-391 (367)	95-103 (98)	24-29 (26)	857-984 (922)
II	76-87 (83)	95-110 (103)	194-251 (222)	308-365 (345)	101-114 (108)	25-28 (26)	798-955 (886)
III	91-110 (100)	106-125 (114)	210-247 (235)	331-395 (371)	114-125 (118)	27-30 (27)	878-1034 (964)

F.s. slender and sometimes difficult to separate from h.s.

Coxae: with 15-21(19) f.s. on the fore, and 19-27 on the middle and hind coxae, and with 11-19 h.s. on each coxa; fore coxa with 5-6(5.6) coxal bristles, each with a small apical knob; apical seta about half as long as trochanter.

Trochanters: 26-38μ wide; with 6 oval sensilla; with 11-16(12), 7-14(10) and 5-12(8) f.s. on the fore, middle and hind coxae respectively and with 6-11 h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and 2 long setae of which the longest (apical), on the fore trochanter, is 3.0-3.9(3.4) times as long as the width of the trochanter.

Femora: of medium width (42-57μ), the ratio width to length of hind femur being 1.45-5.2(4.8); each with 21-35 f.s. and 12-18 h.s.

Tibiae: 24-30μ wide, the ratio width to length of hind tibia being 1:12.3 - 14.6 (13.5); with 69-85 setae of which 20-34 are h.s. and 44-59 f.s., the latter being about $1\frac{1}{2}$ - $1\frac{3}{4}$ times as long as width of tibia; apical spur of about the

same size on all tibiae. Tarsi: 23-30μ wide, hind tarsus 3.9 - 5.0 (4.5) times longer than wide; each with 12-18 f.s. and 11-19 h.s.; tarsal digitules subequal, longer than claw. Claws: of medium length, about as long as width of tarsus; slightly curved, with small denticle near tip; anterior ungual digitule with longer apical knob than posterior one, digitules about as long as claw.

Abdomen: 490-650 (579) μ long and 360-430 (390) μ wide.

Segments I-VII: tergites and sternites present on all segments; tergites on the 2nd, 3rd and sometimes 4th segment represented by a small sclerite on each side on anterior margin, and on the 4th - 7th by a transverse plate; sternites represented by a weak transverse plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. Caudal extension of 7th segment small, rounded, not sclerotized. Dorsal setae: h.s. only, 1st to 3rd segments occasionally with one and 4th - 7th usually with one seta on each side. Pleural setae absent on 1st and 2nd segments and on 3rd to 6th represented by h.s. only, which usually include 2 (range 1-3) dorsopleural setae and 1 ventropleural seta on each segment. Segment VII with 4-6 (4.4) h.s. Ventral setae: h.s. only, usually one on each side on the 2nd and 4 on each of the 3rd - 7th segments.

Segment VIII with a weak tergite and transverse sternite, caudal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about twice as long as the section within the pouch. No 9th tergite observed.

Ante-anal setae: 2 long, and occasionally one small h.s.

Posterior margin with 3 h.s. on each side.

Genital segment: Penial sheath long, about 2/7 total body length (ratio 1:3.3 - 3.5, av. 3.4), 581-695 (628) μ long and 46-53(49)μ wide; lateral sclerotizations not joined anterior to anus; length of basal rod about 2/3 that of aedeagus, and extending anteriorly from the base of the aedeagus for about 9/10 of the distance to the apex of the basal membranous area; apex of the sheath without a membranous extension. The area from base of sheath to tip of aedeagus with 28-40 (32) small setae; a cluster of small sensilla occurring ventrally near apex of sheath. Aedeagus long (258-315, av.293μ), the penial sheath longer and the basisternum shorter, the ratios being 1:2.0 - 2.3 (2.1) and 1:0.74 - 0.82 (0.78) respectively.

Material examined: 10 specimens, collected by N.S. Borchsenius on Abies sp. in the Nikitskii Botanical Gardens, Crimea, USSR on 25.5.54.

GEN. PHYSOKERMES

3. PHYSOKERMES PICEAE (SCHR.) Figs. 4 and 27

A medium-sized, robust species with comparatively short antennae and legs; with many setae on the appendages, but few on the body itself. When mounted, total body length 1550-2140 (1803)μ; width of mesothorax 380-500 (429)μ. Wing expanse 1300-1450 (1367)μ.

Head: subconical in dorsal view; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced; length from apex to pronotal ridge 2117-270 (242)μ, width across genae 171-224(195)μ. Median crest sclerotized and distinctly polyonally reticulated. Dorsal head setae: 5-8(6.5) h.s., of which a group of 1-4 (2.8) is situated on the anterior margin of the head and a group of 3-4 (3.8) more posteriorly. Midcranial ridge: dorsally represented by a short, weak ridge between the eyes: ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area with weak polygonal reticulation posteriorly. Genae large, sclerotized, not distinctly reticulated, without setae. Eyes: two pairs; subequal; corneae of dorsal eyes 20-30(26)μ in diameter and 3.1-4.6(3.9) times as much apart; those of the ventral eyes with cornea 21-30(26)μ in diameter and 1.0-1.5(1.2) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocula ridge with ventral part reaching or almost reaching midcranial ridge. Postocular ridge weak and tapering dorsally, well developed lateroventrally, but weak posteromedially; below the ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent, ventral head setae consisting of 4-8(5.3) h.s., situated anterior to the ocular sclerite on each side of the midcranial ridge.

Preoral ridge weak, sometimes interrupted. Tendon-like apodeme long. Cranial apophysis short; apex bifurcate, not reaching level of posterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits apparently absent.

Antennae: 10-segmented; filiform; 604-1011 (770)μ long; i.e. shorter than half body length (ratio 1:2.12 - 2.63, av. 2.37), about as long as posterior leg (ratio 1:0.91 - 1.11, av. 0.99) and longer than penial sheath (ratio 1.32 - 1.69, av.1.47). Scape 46-72(59)μ long and 42-61(51)μ wide, with 3 h.s. Pedicel with distinct, polygonal dorsal reticulation; 38-57(46)μ wide, with 2 h.s. and a sensillum placodeum. Segment III bulging in middle, 1.8-2.6 (2.1) times longer than wide (61-91, av.73μ long and 30-42, av.35μ wide), with 1-3 (2.1) h.s. and 7-19(11) f.s., the latter of medium length, 0.9-1.3 (1.1) times as long as width of segment; with 1-6 usual sensilla basiconica. Segments IV-IX: cylindrical; lengths of these segments (in μ) 80-160(114), 68-137 (98), 76-137(101), 65-114 (86), 57-95(94) and 46-84(61) respectively, widths varying from 25 to 34 μ, with distal segments wider than proximal; with 12-37(25), 14-31(23), 21-30(25), 17-27(24), 15-23(19) and 14-19(17)f.s. respectively, but no h.s. : antennal bristles on 8th and 9th segments slightly thicker than f.s. Segment X: terminal part not constricted; 46-68 (58)μ long and 27-31(30)μ wide; carrying 7-11(9) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about 3/4 as long as the segment and the 2 shorter ones not markedly different than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 494-673 (565)μ long.

Prothorax: Pronotal ridge strong, but medially interrupted

by weak sclerotization. Lateral pronotal sclerites large, without setae. Medial pronotal setae absent. Posttergites medium-sized, without striations and without setae. Pleural structures typical for the family. Sternum with transverse ridge strong median ridge reduced to a basal stalk, and a triangular sclerite. Anteprosternal setae absent; occasionally a hair-like prosternal seta present.

Mesothorax: Mesoprephragma with no emargination. Prescutum about twice as wide as long (av.163 and 88 µ respectively); anterior margin slightly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; polygonally reticulated; slightly more heavily sclerotized medially. Scutum: Median membranous area: subrectangular; 68-91(82)µ long and 1.48-2.30(1.79) times as wide (width 122-179, av.146µ); without setae. Scutellum: 59-103(78)µ long and 133-194(151)µ wide, the ratio being 1:1.8-2.4(2.0); not tubular; without setae. Postscutum with anterior margin irregular and partly overlapped by the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with shallow emargination. Mesopleuron: Mespleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated. Subepisternal ridge well developed, but below the membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite bounded anteriorly by an extension from marginal ridge. Basisternum large, about 251µ wide and 168µ long, i.e. 1.7-2.4(2.1) times longer than membranous area of suctum; with strong median ridge and bounded by strong marginal and precoxal ridges; with 1-2(1.8) h.s. on or near median ridge. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent

Tegula small, membranous bulge with a small weak sclerite posteriorly and 2-7(4.2) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with posterior margin usually strong and well developed throughout; suspensorial sclerite small, spot-like. Postnotum consisting of a transverse sclerite on each side. Metatergal setae absent. Pleural ridge well developed, though interrupted near middle; with a small wing process.

Episternum with anterior margin not ridge-like; vestigial precoxal ridge present; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorso-stigmatal setae absent. Postmetastigmatal setae: occasionally one h.s. present. Metasternal plate weak and irregular. Anterior and posterior metasternal setae: 1-5(2.4) and 0-3 (1.8) h.s. respectively, arranged medially.

Wings: hyaline; medium-sized: 1300-1450 (1367)μ long and 470-580(542)μ wide, the ratio width to length being 1:2.44 - 2.77(2.53); alar lobe present; alar setae absent. Halteres well developed, 103-137(117)μ long and 27-43(35)μ wide; each usually with 2 (range 1-3) apically hooked setae, which are about 62μ long.

Legs: short and moderately slender, with the middle pair usually shortest and the hind pair longest; the ratio length of hind leg to body length is 1:2.30 - 2.47(2.41). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57-76 (66)	78-110 (94)	165-217 (187)	209-300 (248)	63-80 (71)	23-27 (25)	600-805 (691)
II	65-91 (73)	78-110 (88)	154-205 (171)	209-289 (242)	74-95 (82)	26-28 (27)	608-815 (684)
III	72-95 (80)	82-110 (94)	163-220 (187)	220-314 (262)	76-110 (90)	27-30 (28)	667-866 (741)

F.s. slender and sometimes difficult to separate from h.s. Coxae: with 1-6(3.4) f.s. on the fore and 5-14 on the middle and hind coxae, and with 9-16 h.s. on each coxa; fore coxa without coxal bristles; apical seta about 3/4 as long as trochanter. Trochanters: 27-38μ wide; with 6 oval sensilla, 1-8 f.s. and 5-6 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and 2 long setae, of which the longest (apical), on the fore trochanter, is 2.1-2.6 (2.4) times as long as the width of the trochanter. Femora: of medium width (42-49μ), the ratio width to length of hind femur being 1:3.6 - 4.4(3.8); with 1-11(5.3), 3-14(7.8) and 4-17(9.8) f.s. on the fore, middle and hind femur respectively and with 6-19 h.s. on each. Tibiae: 23-30μ wide, the ratio width to length of hind tibia being 1:8.3 - 10.0 (9.2); each with 24-49 setae of which 15-26 are h.s. and 7-28 f.s., the latter about as long as width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 23-30μ wide, hind tarsus 2.9-3.9(3.3) times longer than wide; each with 1-6 f.s. and 6-10 h.s.; tarsal digitules subequal, longer than claw. Claws: of medium length, about as long as width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 380-670 (499)μ long and 320-440(376)μ wide.

Segments I-VII: tergites and sternites present on all segments; tergites on the 2nd and 3rd segments represented by a small sclerite on each side on the anterior margin, and on the 4th - 7th segments by weak plates; sternites consisting of weak transverse plates. Caudal extension of 7th segment small, rounded, not sclerotized. Dorsal setae: f.s. absent; h.s. usually absent on 1st - 6th segments, but 7th segment with one on each side. Pleural setae consisting of h.s. only, which include dorsopleural setae: occasionally one on the 2nd,

0-2(1.1) on the 3rd and usually 2 on each of the 4th - 6th segments, and ventropleural setae: sometimes one on the 2nd and 3rd, and one on each of the 4th - 6th segments. Segment VII with 3-4 (3.9) h.s. Ventral setae: h.s. only, usually 2 medially on all segments, but occasionally only one or up to 4 present.

Segment VIII: with transverse tergite and a very large transverse sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about twice as long as the section within the pouch; with 3 h.s. on each side near pouch. Ante-anal area expanded, with 1-2 (1.8) strong h.s. and sometimes with indications of a small 9th tergite.

Genital segment: Penial sheath long, about 2/7 total body length (ratio 1.32 - 3.6, av.3.4), 456-597 (530)μ long and 43-53 (48)μ wide; the basal area anterior to the aedeagus about twice as wide as rest of sheath; lateral sclerotizations not joined anterior to anus; length of basal rod about 1/7 - 1/5th that of aedeagus, the rod extending anteriorly from the base of the aedeagus for about 3/4 of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 23-36 (29) small setae; a cluster of small sensilla occurring ventrally near apex of sheath. Aedeagus long (285-380,av.342μ), the penial sheath longer and the basisternum shorter, the ratios being 1:1.49 - 1.61(1.55) and 1:0.43 - 0.54 (0.49) respectively.

Material examined: 10 specimens, collected by J. Řeháček on Picea sp. on 12.4.53 at Plesivec, Czechoslovakia; remounted from Liquid of Swann.

Comparative notes: P. piceae (Schr.) differs from P. insignicola (Craw) in having only 2 pairs of simple eyes. Moulton (1907) found 4 pairs in P. insignicola. P. piceae is also described as having 2 pairs of eyes by Jancke (1955).

GEN. RHODOCOCCUS

4. RHODOCOCCUS SPIRAEAE (BORCHS.) (Figs. 5 and 28)

A short, robust species with comparatively long antennae and moderately long legs; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1500-1600(1557)μ; width at mesothorax 400-420(411)μ. Wing expanse 2860-3000(2940)μ.

Head: subconical in dorsal view; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced; length from apex to pronotal ridge 198-213(206)μ, width across genae 194-232(217)μ. Median crest broad posteriorly, weakly sclerotized and reticulated, with 3-6(4.7) hair-like dorsal head setae. Midcranial ridge dorsally absent, ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing weak polygonal reticulation posteriorly. Genae large, sclerotized, not reticulated, without setae. Eyes: four pairs; dorsal and ventral pairs large, subequal; lateral pairs smaller, subequal; corneae of dorsal eyes 19-23(21) μ in diameter and 4.4 - 5.6 (5.0) times as much apart; those of the ventral eyes 17-23 (19)μ in diameter and 1.5 - 2.2(1.8) times as much apart. Ocellus small, situated laterally. Ocular sclerite well sclerotized and polygonally reticulated throughout; dorsally widely separated from median crest. Preocular ridge of variable length, ventral part usually extending about halfway from articular process to midcranial ridge. Postocular ridge very weak dorsally, sometimes missing posterior to ocellus; well developed lateroventrally, but weak posteromedially; below the ocellus the ridge splits up, with the anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent, ventral head setae consisting of 0-4(2.1) h.s.,

situated on or immediately anterior to the margin of the ocular sclerite on each side of midcranial ridge. Preoral ridge present, Tendon-like apodeme long, with a broad base. Cranial apophysis broad, of medium length; apex truncate with a central lobe, not reaching level of anterior margin of eyes. Mouth opening irregular. Anterior tentorial pits apparently present anterolateral to mouth opening.

Antennae: 10-segmented; filiform; 980-1017(995)μ long, i.e. longer than half body length (ratio 1:1.52-1.61, av.1.57), longer than posterior leg (ratio 1:1.14-1.21,av.1.17) and longer than penial sheath (ratio 1:2.44-2.63, av.2.53). Scape: 38-51 (45)μ long and 46-49(48)μ wide, with 3 h.s. Pedicel: with distinct, polygonal dorsal reticulation; 46-57(54)μ long and 42-48(45)μ wide; with 3-7(5.3) f.s., 1-2(1.4) h.s. and a sensillum placodeum. Segment III club-shaped, 2.4-3.7 times longer than wide (72-95,av.82μ long and 23-34, av.29μ wide); with 2-4(2.8) f.s. of medium length, 0.9-1.4(1.0) times as long as width of segment, and with 2-4 usual sensilla basiconica. Segments IV-IX: cylindrical; lengths of these segments (in μ) 148-179(162), 152-175(165), 122-171(142), 114-137(125), 80-87 (86) and 65-74(68) respectively, all about the same width, varying from 19 to 27μ, and with 17-22(20), 19-24(22), 20-33(24), 22-28(25), 15-19(17), 13-17(15) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments not markedly different from f.s. Segment X: terminal part not constricted; 61-72(67)μ long and 17-23(21)μ wide; carrying 5-11(8) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about half as long as the segment and the 2 shorter ones rather similar to the f.s; with 2 sensilla basonica ventrally, one near apex and the other more proximal.

Thorax: 505-559(520)μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae absent. Posttergites medium-sized, without striations and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, medium ridge reduced to a basal stalk, and a triangular sclerite. Anteprosternal and prosternal setae absent.

Mesothorax: Mesoprophragma with shallow emargination. Prescutum about twice as wide as long (av.156 and 82μ respectively); anterior margin slightly curved; laterally and posteriorly bounded by the prescutal ridges and posteriorly by the prescutal suture; sometimes with weak polygonal reticulation. Scutum: Median membranous area: subrectangular; 49-65(59)μ long and 1.81-2.36 (2.01) times as wide (width 106-125,av.117μ); without setae. Scutellum large, 76-95(84)μ long and 125-144(135)μ wide, the ratio being 1:1.5-1.7(1.6); not tubular; without setae. Postnotum with anterior margin irregular and partly overlapped by the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with moderately deep emargination. Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 237μ wide and 160μ long, i.e. 2.4-3.4(2.8) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatel setae

absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and 2-5(3.2) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with thickening of posterior margin desclerotized medially; suspensorial sclerite small, spot-like. Postnotum consisting of a transverse sclerite on each side. Metatergal setae absent. Pleural ridge well developed, though interrupted in the middle; with small wing process. Episternum with anterior margin ridge-like in parts; vestigal precoxal ridge present; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: occasionally one h.s. Metasternal plate weak and irregular. Anterior and posterior metasternal setae absent.

Wings: Hyaline ; long (1270-1350,av.1310μ) of medium width (480-540,av.512μ), the ratio width to length being 1:2.49 - 2.65(2.57); alar lobe present; alar setae: 0-3(1.5) h.s. on each wing. Halteres well developed, 114-129 (121)μ long and 27-42(37)μ wide, each with 2 (in one case 3) apically hooked setae, which are about 69μ long.

Legs: moderately long and slender, with the middle pair usually shortest and the hind pair longest; the ratio length of hind leg to body length is 1:1.72 - 1.83(1.78). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	65-76 (68)	99-110 (103)	205-228 (218)	308-315 (312)	76-95 (89)	27-30 (29)	798-834 (819)
II	72-84 (81)	95-105 (101)	182-200 (192)	308-317 (311)	91-99 (97)	30-34 (31)	798-820 (813)
III	76-87 (83)	99-110 (104)	186-209 (200)	312-352 (338)	103-106 (105)	30-34 (32)	834-882 (862)

F.s. slender and sometimes difficult to separate from h.s.

Coxae: with 4-9 f.s. and 10-19 h.s. each; fore coxa without coxal bristles; apical seta about 2/3 as long as trochanter. Trochanters: 29-38μ wide; with 6 oval sensilla; with 5-10 f.s, and 8-10 (8.8), 10-14 (12) and 12-22(16) h.s. on the fore, middle and hind trochanter respectively, the h.s. including 2 minute setae near basal ridge, one small seta on outer margin and 2 long setae of which the longest (apical), on the fore trochanter, is 2.3-3.1(2.9) times as long as the width of the trochanter. Femora: of medium width (42-51)μ, the ratio width to length of hind femur being 1:3.8 - 4.4(4.1); with 6-14 f.s. and 11-25 h.s. Tibiae 23-40μ wide, the ratio width to length of hind tibia being 1:11.4 - 14.2(12.6); each with 45-68 setae of which 30-60 are h.s. and 8-18 f.s., the latter somewhat longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 21-27μ wide, hind tarsus 4.3-4.7(4.6) times longer than wide; each with 4-8 f.s. and 15-26 h.s.; tarsal digitules subequal, long, about 1½ times as long as claw. Claws: long, hind claw about 1½ times as long as width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 430-500(474)μ long and 300-350(331)μ wide.

Segments I-VII: tergites on the 2nd and 3rd segments represented by a small sclerite on each side on the anterior margin, and on the 6th and 7th by a weak plate; sternites on the 2nd, 3rd and 7th segments represented by a weak plate. Caudal extension of 7th segment small, rounded, not sclerotized. Dorsal setae: f.s. absent; h.s. absent on the 1st and usually on the 2nd, but usually one on each side on the 3rd - 7th segments. Pleural setae consisting of h.s. only, which include dorsopleural setae: 0-2(1.0), 2-5(3.7), 4-7(6.0) and 4-8(5.8) on

the 3rd - 6th segments respectively, and ventropleural setae: occasionally one on the 3rd and usually one on each of the 4th - 6th segments. Segment VIII with 6-15(11) h.s. Ventral setae: h.s. only, occasionally one on the 2nd, usually 2 medially on the 3rd and 4 on each of the 4th - 7th segments.

Segment VIII: with transverse tergite and sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being $1\frac{1}{2}$ - 2 times as long as the section within the pouch. A small 9th tergite sometimes observed. Ante-anal setae: 1-2(1.8) long h.s. Posterior margin with 2-3(2.8) h.s. on each side.

Genital segment: Penial sheath long, about $\frac{1}{4}$ total body length (ratio 1:3.8 - 4.1, av.3.9), 376-414(399)μ long and 36-40(38)μ wide; lateral sclerotizations not joined anterior to anus; length of basal rod about 2/3 that of aedeagus, the rod extending anteriorly from the base of the aedeagus for about 3/4 of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 19-23(21) small setae; a cluster of small sensilla occurring ventrally near apex of sheath. Aedeagus long (167-182, av.173μ), penial sheath longer and basisternum shorter, the ratios being 1:2.25 - 2.42(2.30) and 1:0.83-0.98(0.92) respectively.

Material examined: 9 specimens, collected by G.Matesova on Spiraea hypersifolia L. in the ravine Talgar, Zailiiski Alatau, Kazakhstan, USSR., on 14.6.57.

GEN. PALAEOLECANIUM

5. PALAEOLECANIUM BITUBERCULATUM (T.T.) (Figs. 6 and 29)

Living specimens coral red in colour, with the sclerotized areas brown and the appendages light yellow, wings with a reddish tinge between anterior margin and first wing vein; short, slender, with comparatively long antennae and short legs which carry many setae. When mounted, total body length 1380-1460(1419)u; width at mesothorax 290-320(310)u. Wing expanse 1110-1190(1155)u.

Head: subconical in dorsal view; in lateral view obliquely dorsoventrally elongated, with the anterodorsal bulge not pronounced; length from apex to pronotal ridge 205-232(220)μ, width across genae 217-241(233)μ. Median crest sclerotized and distinctly polygonally reticulated; with 6-9(7.4) hair-like dorsal head setae, arranged in a group of one or two near the anterior margin of the head and a group of 5-8(6.2) more posteriorly. Midcranial ridge: dorsally represented by a short, weak ridge near anterior margin; ventrally narrow, but well defined, reaching ocular sclerite posteriorly, surrounding area with weak, polygonal reticulation posteriorly. Genae large, sclerotized, not distinctly reticulated, without setae.

Eyes: two pairs; subequal; corneae of dorsal eyes 21-25 (22)μ in diameter and 3.4-4.2(3.9) times as much apart; those of the ventral eyes 22-27(24)μ in diameter and 1.2-1.8(1.6) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge with ventral part almost reaching midcranial ridge. Postocular ridge weak and tapering dorsally, well developed lateroventrally, but weak posteromedially; below the ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent; ventral head setae:

4-7(5.6) h.s., situated anterior to the ocular sclerite on each side of the midcranial ridge. Preoral ridge present. Tendon-like apodeme short; cranial apophysis of medium length; apex bifurcate with a central lobe, extending to around the level of the posterior margin of the ventral eyes. Mouth opening irregular. Anterior tentorial pits apparently absent.

Antennae: 10-segmented; filiform; 705-883(819)μ long, i.e. longer than half body length (ratio 1:1.63-1.96, av.1.76), longer than posterior leg (ratio 1:1.15-1.22, av.1.19) and longer than penial sheath (ratio 1:2.83-3.26, av.3.09). Scape: 46-57(51)μ long and 40-46(42)μ wide, with 3 h.s. Pedicel: with distinct, polygonal, dorsal reticulation; 42-51(47)μ long and 38-42(40)μ wide; with 1-7(4.3) f.s., 2-5(3.5) h.s. and a sensillum placodeum. Segment III club-shaped, 2.7-3.6 times longer than wide (76-87, av.81 μ long and 21-30, av.26 μ wide), with 2-8(4.8) f.s. of medium length, 1.3-1.7(1.5) times as long as width of segment; with 1-2 usual sensilla basiconica. Segments IV-IX: cylindrical; lengths of these segments (in μ) 87-122(109), 105-125(118), 91-114(101), 80-110(100), 65-91(76) and 57-76(68) respectively, width varying from 17 to 23 μ, with distal segments wider than proximal ones; with 12-19(15), 15-22(18), 12-19(15), 15-20(16), 11-19(14) and 11-14(13) f.s. respectively, but no h.s. : antennal bristle on 8th and 9th segments not markedly different from f.s., sometimes somewhat thicker. Segment X: terminal part not constricted; 53-78(70)μ long and 19-23(21)μ wide; carrying 4-11(8.6) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about half as long as the segment and the 2 shorter ones equal to or somewhat shorter than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 445-517(497)μ long.

Prothorax: Pronotal ridge strong, though medially interrupted by weak sclerotization. Lateral pronotal sclerites medium-sized, without setae. Medial pronotal setae: 2 small h.s., situated close together on the median line. Posttergites: very small and weakly sclerotized, without striations and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, median ridge reduced to a basal stalk or sometimes absent, and a triangular sclerite. Anteprosternal setae absent; prosternal setae; occasionally one h.s. present.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum about twice as wide as long (av.145 and 74 μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; weakly irregularly reticulated; with a median ridge extending for some distance anteriorly from the prescutal suture. Scutum: Median membranous area: subrectangular; 76-91(82)μ long and 1.47-1.75 (1.57) times as wide (width 118-137,av.128); with 1-4(2.7) h.s. Scutellum: 57-68(63μ) long and 118-133(127)μ wide, the ratio being 1:1.9-2.2(2.0); not tubular; occasionally with one or two h.s. Postnotum with anterior margin irregular and partly overlapped by the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge ridge well developed but below membranous cleft indistinct and marked by a band of darker sclerotization. Epimeron small. Lateropleurite anteriorly bounded by an extension from marginal ridge. Basisternum: large, about 199μ wide and 148μ long, i.e. 1.7-2.1(1.8)

times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and 4-7(5.0) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with anterior margin desclerotized medially; suspensorial sclerite small, spot-like. Postnotum consisting of a transverse sclerite on each side. Metatergal setae: one h.s. on each side. Pleural ridge well developed, though interrupted near the middle; with a small wing process. Episternum with anterior margin not ridge-like; vestigial precoxal ridge sometimes present; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: occasionally one h.s. present. Metasternal plate weak and irregular. Anterior and posterior metasternal setae absent.

Wings: hyaline; long (1110-1190,av.1155μ) and of medium width (450-510,av.474μ), the ratio width to length being 1:2.33-2.58(2.44); alar lobe present; alar setae absent. Halteres well developed, 95-114(103)μ long and 20-30(25)μ wide, each with one apically hooked seta, which is about 50μ long.

Legs: short and slender, with the fore pair longest and the middle pair shortest; the ratio length of hind leg to body length is 1:1.94-2.06(1.99). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57-61 (58)	76-84 (80)	171-186 (183)	255-285 (274)	89-99 (95)	25-27 (26)	695-735 (715)
II	61-65 (63)	68-72 (70)	163-175 (169)	247-277 (261)	87-95 (90)	23-25 (24)	654-701 (678)
III	57-68 (65)	67-72 (69)	163-175 (170)	257-289 (273)	87-99 (94)	24-27 (26)	669-722 (697)

Coxae: with 7-14(10) f.s. on the fore and 14-19 on the middle and hind coxa, and each with 7-15 h.s.; fore coxa with 1-2(1.4) pointed coxal bristles, about as long as segment; apical seta about half as long as trochanter. Trochanters: 24-29μ wide; with 6 oval sensilla, 4-8 f.s. and 6-8 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and 2 long setae of which the longest (apical), on the fore trochanter is 1.8-2.2(2.0) times as long as the width of the trochanter. Femora: of medium width (34-40μ), the ratio width to length of hind femur being 1:4.4-5.0(4.7); each with 8-14 f.s. and 12-19 h.s.

Tibiae: 19-23μ wide, the ratio width to length of hind tibia being 1:12.3-14.6(13.1); each with 35-51 setae of which 19-27 are h.s. and 15-13 f.s., the latter somewhat longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 19-23μ wide, hind tarsus 4.2-4.9(4.4) times longer than wide; each with 4-8 f.s. and 11-17 h.s.; tarsal digitules subequal, longer than claw. Claws: of medium length a little longer than width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 420-480(461)μ long and 240-300(263)μ wide.

Segments I-VII: tergites on 2nd and 3rd segments represented by small sclerites on the anterior margin - one on each side and one medially on the 2nd, and one on each side on the 3rd, and on the 6th and 7th segments by weak transverse plates; sternites present on all segments, represented by a weak transverse plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. Caudal extension of 7th segment small rounded, not sclerotized. Dorsal setae: h.s. only, usually one on each side on all segments. Pleural setae consisting of h.s. only, which include dorsopleural

setae: occasionally one on the 3rd and usually 2 on each of the 4th - 6th segments, and ventropleural setae: occasionally one on each of the 4th - 5th segments and usually one on the 6th. Segment VII with 3-5(3.8) h.s. Ventral setae: h.s. only, 2 medially on the 2nd, and 1-3(2.4), 2-4(3.0), 3-4(3.5), 3-5 (3.9) and 3-4(3.8) on the 3rd - 7th segments respectively.

Segment VIII: with transverse tergite and sternite; candal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being 2-2½ times as long as the section within the pouch. No 9th tergite observed. Ante-anal setae: 2 long h.s. Posterior margin with 2-4(2.6) h.s. on each side.

Genital segment: Penial sheath of medium length about 1/5 total body length (ratio 1:5.09 - 5.65, av.5.39), 247-277 (266)μ long and 46-61(52)μ wide; lateral sclerotizations not joined anterior to anus; length of basal rod 1/3 - 2/5 that of aedeagus, the rod extending anteriorly from the base of the aedeagus to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 17-22(19) small setae; a cluster of small sensilla occurring ventrally near apex of sheath. Aedeagus broad at its base and tapering towards tip; long (129-148, av. 141 μ), penial sheath longer and basisternum as long or longer, the ratios being 1:1.8-2.0(1.9) and 1:0.99 - 1.14(1.04) respectively.

Material examined: 10 specimens, bred from material collected by myself on Crataegus sp. (hawthorn) on Putney Heath, London; males emerged in the laboratory between the 19th and 22nd June, 1962. Four specimens, collected by J. Řeháček on Crataegus oxyacantha in Novy Bydžov, Czechoslovakia on 18.6.52 (remounted from Liquid of Swann) agreed

well with the above description, but differed in the following respects: (1) 2 specimens were longer, measuring 1490μ each, (ii) the darker median sclerotization on the prescutum was less well developed and not ridge-like in appearance and (iii) the reticulation on the prescutum was more distinct.

GEN. PHYLLOSTROMA

6. PHYLLOSTROMA MYRTILLI (KALT.) (Figs. 7 and 30)

A small, slender species with comparatively long antennae and short legs; with many setae on the appendages, but few on the body itself. When mounted, total body length, 1460 - 1620 (1553)μ; width at mesothorax 370 - 410 (387)μ. Wing expanse 2870 - 3010 (2940)μ.

Head: subconical in dorsal view, in lateral view obliquely dorsoventrally elongated, with anterodorsal bulge not pronounced; length to pronotal ridge 209 - 247 (226)μ, width across genae 255 - 270 (262)μ. Median crest sclerotized and distinctly polygonally reticulated; with 6 - 10 (7.4) hair-like dorsal head setae, arranged in a group of 3 - 5 near anterior margin of head and a group of 2 - 5 more posteriorly. Midcranial ridge dorsally absent; ventrally narrow but well defined, surrounding area weakly sclerotized and distinctly polygonally reticulated. Genae large, sclerotized, not reticulated, without setae.

Eyes: four pairs; dorsal and ventral pairs large, subequal; lateral pairs smaller, subequal; corneae of dorsal eyes 23 - 27 (24)μ in diameter and 3.4 - 4.5 (4.1) times as much apart; those of the ventral eyes 25 - 30 (28)μ in diameter and

1.3 - 1.7 (1.5) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge short, not extending far below articular process. Postocular ridge weak and tapering dorsally, but well developed lateroventrally and posteromedially; below the ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent; ventral head setae: 8 - 14 (10) h.s., situated around the posterior part of the mideranial ridge. Preoral ridge present. Tendon-like apodeme short. Cranial apophysis of medium length; apex bifurcate with central lobe, not reaching level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits present, situated anterolateral to mouth opening.

Antennae: 10-segmented; filiform; 910 - 1053 (986)μ long, i.e. longer than half body length (ratio 1:1.43 - 1.65, av. 1.57), longer than posterior leg (ratio 1: 1.23 - 1.33, av. 1.27) and longer than penial sheath (ratio 1: 3.15 - 3.47, av. 3.36). Scape: long (length 65 - 68, av. 66μ) and 42 - 48 (45) μ wide, with 1 - 3 (2.0) h.s. Pedicel not reticulated, but with one or two wavy lines, 61 - 68 (65) μ long and 42 - 46 (44) μ wide,

5.10 (7.4) f.s., 3 - 5 (3.7) h.s., and a sensillum placodeum. Segment III club-shaped, 2.5 - 3.1 (2.8) times longer than wide (76 - 84, av. 79 μ long and 42 - 46, av. 44 μ wide), with 4 - 8 (6.0) f.s. of medium width, 1.2 - 1.5 (1.3) times as long as width of segment; with 1 - 3 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 118 - 152 (138), 122 - 148 (137), 118 - 141 (131), 99 - 133 (111), 91 - 106 (97) and 80 - 99 (86) respectively, widths varying from 21 - 27 μ, with distal segments wider than proximal ones; with 15 - 22 (18), 15 - 23 (20), 18 - 28 (23), 16 - 25 (20), 14 - 18 (16) and 15 - 21 (18) f.s. respectively, and occasionally with one or two h.s. on the 4th to 6th segments; antennal bristles on 8th and 9th segments not markedly different from the f.s. Segment X: terminal part not constricted; 67 - 86 (76)μ long and 20 - 23 (22)μ wide; carrying 5 - 8 (6.4) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 longest ones are about half as long as the segment and the 2 shorter ones rather similar to the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 460 - 532 (503)μ long

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, with no setae. Medial pronotal setae: usually 2 h.s. Posttergites: small and irregular, without striations and without setae. Pleural structures typical for the family. Sternum with strong transverse and median ridges, well sclerotized triangular sclerite and rather distinct sternal apophyses. Anteprosternal setae absent; prosternal setae: sometimes one h.s. on each side.

Mesosthorax: Mesoprephragma with shallow emargination. Prescutum about twice as wide as long (av. 160 and 83μ respectively); anterior margin strongly curved; laterally bounded by the prescutal ridges, and posteriorly by the prescutal suture; slightly more heavily sclerotized medially but not reticulated. Scutum: Median membranous area: subrectangular; 68 - 91 (78)μ long and 1.79 - 2.17 (1.94) times as wide (width 137 - 163, av. 150μ); with 1 - 2 (1.7) h.s. Scutellum: 57 - 68 (64)μ long and 160 - 171 (166)μ wide, the ratio being 1: 1.8 - 2.2 (1.9); not tubular; without setae. Postnotum with anterior margin irregular, not overlapped by the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma small, with moderately deep emargination.

Mesopleuron. Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process, well developed, the latter connected with episternum by a narrow basalare. Subalare small.

Episternum not reticulated; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge, Basisternum: large, about 210μ wide and 151μ long, i.e. 1.7 - 2.2 (119) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges, without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and o - 4 (1.9) h.s. Third axillary wing sclerite with a small ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with anterior margin desclerotized medially; suspensorial sclerites absent; a small sclerite sometimes present anterior to postnotum. Postnotum consisting of a transverse sclerite on each side. Metatergal setae: occasionally one h.s. on each side.

Pleural ridge reduced, extending only for a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: 2 - 6 (40)f.s. and 0 - 1 (0.7) h.s. Metasternum represented by a weak transverse plate. Anterior and posterior metasternal setae absent.

Wings: hyaline; long (1260 - 1330, av. 1295μ) and broad (width 570 - 600 av. 585μ), the ratio width to length being 1: 2.19 - 2.24 (2.22); alar lobe and alar setae absent. Halteres absent.

Legs: short and moderately slender, with the fore pair usually longest and the middle pair shortest; the ratio length of hind leg to body length is 1: 1.89 - 2.05 (1.99). Length of segments (inμ)

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	65-80 (74)	91-99 (95)	198-213 (207)	285-304 (295)	99-122 (107)	23-27 (26)	785-828 (804)
II	68-80 (75)	87-93 (91)	182-194 (189)	281-296 (289)	99-106 (102)	23-29 (26)	762-785 (771)
III	76-91 (83)	91-99 (95)	179-190 (184)	289-300 (296)	99-110 (106)	21-29 (26)	771-800 (788)

Coxae: with 11 - 16 (14) f.s. on the fore and 16 - 22 on the middle and hind coxa, and each with 9 - 12 h.s.; fore coxa without coxal bristles; apical seta about ½ as long as trochanter. Trochanters: 30 - 34μ wide; and 6 oval sensilla, 6 - 14 f.s. and 5 - 8 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1.3. - 2.1 (1.8) times as long as width of trochanter. Femora: of medium width (38 - 46μ) the ratio width to length of hind femur being 1: 3.9 - 4.6 (4.2); in all legs with 10 - 19 f.s., and with 15 - 24 (19) h.s. on the fore and 11 - 16 on the middle and hind femur. Tibiae: 23 - 27μ wide, the ratio width to length of hind tibia being 1: 11.3 - 12.7 (12.0); with 36 - 56 setae, of which 17 - 32 are h.s. and 14 - 28 f.s., the latter somewhat longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 22 - 27μ wide, hind tarsus 4.0 - 4.8 (4.5) times longer than wide; each with 2 - 7

and 10 - 19 h.s.; tarsal digitules subequal, longer than claw. Claws: of medium length about as long as width of tarsus; slightly curved, with a very small denticle near tip; Ungual digitules subequal, about as long as claw.

Abdomen: 490 - 580 (531) μ long and 320 - 380 (346)μ wide.

Segments I - VII: tergites and sternites present on all segments; tergites represented by a transverse sclerite on or near anterior margin (sometimes interrupted medially); sternites represented by a weak transverse plate in the middle of each segment. Caudal extension of 7th segment small, rounded, not sclerotized. Dorsal setae: f.s. only, usually one each side on the 1st and 5th - 7th segments. Pleural setae consisting of h.s. only, which include dorsopleural setae: usually 2 on each of the 3rd to 6th segments, and ventropleural setae: occasionally one on each of the 3rd - 5th, and usually one on the 6th segment. Segment VII with 1 - 6 (3) h.s. Ventral setae: h.s. only, usually none on the 2nd, one on each side on the 3rd and 4th, and 4 on each of the 5th - 7th segments.

Segment VIII: with transverse tergite and sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about twice as

long as the section within the pouch. No 9th tergite observed. Ante - anal setae: usually 2 (range 1 - 4) h.s. Posterior margin with 3 - 4 (3.5) h.s. on each side.

Genital segment: Penial sheath of medium length, about 1/5 total body length (ratio 1: 4.97 - 5.57, av. 5.27) 285 - 304 (294)μ long and 46 - 49 (48)μ wide; narrowly joined anterior to anus; length of basal rod about ¾ that of aedeagus, the rod extending anteriorly from the base of the latter to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 11 - 19 (15) small setae; a cluster of small sensilla occuring ventrally near apex of sheath. Aedeagus of medium length (118 - 137, av. 127μ), penial sheath and basisternum longer, the ratios being 1: 2.2 - 2.6 (2.3) and 1: 1.11 - 1.29 (1.19) respectively.

Material examined: 8 specimens, collected by J. Řeháček on Vaccinium myrtillus L. in Czechoslovakia on 6.7. 1953 (remounted from Liquid of Swann).

GEN. FILIPPIA

7. FILIPPIA VIBURNI (SIGN.) (Figs. 8 and 31)

A moderately long and robust species, with comparatively long antennae and moderately long legs; with numerous setae on the appendages, but few on the body itself. When mounted, total body length 1940 - 2080 (2004) μ; width at mesothorax 440 - 490 (469)μ. Wing expanse 3630 - 3940 (3798)μ.

Head: subconical in dorsal view, in lateral view obliquely dorsoventrally elongated, with anterodorsal bulge not pronounced; length from apex to pronotal ridge 262 - 285 (277)μ, width across genae 289 - 312 (297)μ. Median crest sclerotized and striated posteriorly, but usually without polygonal reticulation; with 7 - 12 (9.3) hair-like dorsal head setae. Midcranial ridge dorsally absent; ventrally narrow but well defined, reaching postocular sclerite posteriorly, surrounding area with polygonal reticulation. Genae large, sclerotized; polygonal reticulation enclosing weaker irregular reticulation; without setae. Eyes: five pairs; dorsal and ventral pairs large, subequal; lateral eyes smaller, especially the middle one which is about half as big as the other two; corneae of dorsal eyes 27 - 30 (29) μ in diameter and 3.0 - 4.3 (3.6) times as much apart; those of the ventral

eyes 29 - 33 (30)μ in diameter and 1.2 - 1.7 (1.4) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge with ventral part almost reaching midcranial ridge. Postocular ridge tapering dorsally, well developed latero-ventrally, and narrow but well defined postero-medially; below the ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae absent; ventral head setae: 2 - 10 (6.3) h.s. situated medially just behind the preocular ridges. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis of medium length; apex bifurcate, not reaching the level of anterior margin of ventral eyes. Mouth opening irregular, Anterior tentorial pits absent.

Antennae: 10 - segmented; filiform; 1129 - 1379 (1284)μ long, i.e. longer than half body length (ratio 1: 1.47 - 1.75, av. 1.58), longer than posterior leg (ratio 1: 1.06 - 1.18, av. 1.13) and longer than penial sheath (ratio 1: 3.38 - 3.94, av. 3.74). Scape: 59 - 65 (62)μ long and 46 - 51 (48)u wide, with 3 - 4 (3.3) h.s. Pedicel: with distinct, polygonal, dorsal reticulation; 57 - 65 (62)μ long and 49 - 59 (54)μ wide, with 2 - 6 (3.6) f.s., 7 - 11 (8.4) h.s. and a sensillum

placodeum. Segment III bulging in the middle, 1.9 - 2.6 (2.1) times longer than wide (76 - 87, av. 80μ long and 34 - 39 av. 35μ wide); with 4 - 9 (7.1) h.s. and 4 - 12 (7.9) f.s., the latter of medium length, 0.9 - 1.2 (1.1) times as long as width of segment; with 1 - 3 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 194 - 220 (205), 182 - 247 (223), 171 - 224 (204), 129 - 186 (165), 87 - 118 (108) and 72 - 99 (86) respectively, all of about the same width, varying from 21 to 29 μ; with 33 - 45 (38), 37 - 44 (41), 30 - 49 (41), 28 - 39 (33) 7 - 22 (16) and 10 - 19 (14) f.s., and 2 - 4 (3.0), 3 - 9 (5.1), 2 - 7 (4.0), 3 - 6 (4.2), 1 - 4 (2.9) and 0 - 5 (2.3) h.s. respectively, antennal bristles on 8th and 9th segments dinstinctly larger than f.s. Segment X: terminal part not constricted; 86 - 99 (92)μ long and 23 - 26 (24)μ wide; carrying 6 - 12 (9.0)f.s., 0 - 3 (1.1) h.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are up to half as long as the segment and the 2 shorter ones somewhat shorter, but distinctly thicker than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 733 - 794 (766)μ long.

Prothorax: Pronotal ridge strong but medially interrupted by weak sclerotization. Lateral pronotal

sclerites small, without setae. Medial pronotal setae: sometimes one or two (0 - 2, av. 0.7) h.s. Posttergites: narrow, elongated, without striations and without setae. Pleural structures typical for the family. Sternum with a strong transverse ridge, a long median ridge, which is usually weak and interrupted posteriorly, and a narrow triangular sclerite. Anteprosternal setae absent; 1 - 2 (1.7) h.s., usually one on each side.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum more than twice as wide as long (av. 237 and 106μ respectively); anterior margin strongly curved laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially and irregularly reticulated. Scutum: Median membranous area: subrectangular; 120 - 133 (128)μ long and 1.54 - 1.94 (1.68) times as wide (width 201 - 236, av. 213μ): with 11 - 19 (15) h.s. Scutellum: 76 - 86 (82)μ long and 201 - 228 (210)μ wide, the ratio being 1: 2.4 - 2.8 (2.6); tubular, with large ventral foramen; without setae. Postnotum with anterior margin usually regular and exposed; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge

strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum showing weak, irregular reticulation; subepisternal ridge well developed but below membranous cleft indistinct only marked by a band of darker sclerotization. Epimeron small. Lateropleurite anteriorly bounded by an extension from marginal ridge. Basisternum: large, about 293μ wide and 231μ long, i.e. 1.66 - 1.95 (1.81) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae, Furca well developed, Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and 5 - 9 (7.0) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite small, but well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with anterior margin usually weak medially; suspensorial sclerites small, rod-like; a small sclerite present anterior to postnotum. Postnotum consisting of a transverse sclerite on each side. Metatergal setae: one h.s.

on each side. Pleural ridge well developed, though interrupted in middle; with small wing process. Episternum with anterior margin not ridge-like; vestigial precoxal ridge present, epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmesostigmatal setae: 4 - 9 (5.5) f.s. and 0 - 5 (2.5) h.s. Metasternum represented by a weak transverse plate. Anterior and posterior metasternal setae consisting of 0 - 3 (0.8) and 0 - 1 (0.6) h.s. respectively.

Wings: hyaline; long (1650 - 1770, av. 1713μ) and broad (width 750 - 860, av. 818μ), the ratio width to length being 1: 2.04 - 2.25 (2.09); alar lobe present; alar setae absent. Halteres well developed, 106 - 133 (123)μ long and 23 - 33 (26)μ wide, each with one apcially hooked seta which is about 68μ long.

Legs: moderately long, and slender, with the the middle pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1: 1.75 - 1.85 (1.80). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	74-84 (78)	105-118 (113)	258-308 (284)	456-483 (467)	129-139 (133)	23-27 (25)	1062-1144 (1101)
II	91-103 (96)	105-118 (113)	250-277 (266)	418-448 (439)	129-137 (134)	23-26 (25)	1018-1100 (1072)
III	106-118 (113)	110-118 (116)	266-289 (276)	429-479 (451)	127-141 (136)	25-29 (26)	1068-1163 (1119)

Coxae: each with 21 - 32 f.s. and 12 - 23 h.s. fore coxa with 1 - 3 (2) pointed coxal bristles which are about half as long as the segment; apical seta about half as long as the trochanter. Trochanters: 34 - 38μ wide; with 6 oval sensilla, 13 - 20 f.s. and 7 - 10 h.s., the latter including 2 minute setae near Basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 2.6 - 3.0 (2.7) times as long as width of the trochanter. Femora: of medium width (46 - 49μ), the ratio width to length of hind femur being 1: 5.5 - 6.3 (5.8); with 34 - 45 f.s. and 18 - 34 h.s. Tibiae: 27 - 30u wide, the ratio width to length of hind tibia being 1: 14.1 - 17.3 (15.4); each with 94 - 130 setae, of which 36 - 50 are h.s. and 56 - 80 f.s., the latter about as long as width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 23 - 27μ wide, hind tarsus 5.1 - 5.3 (5.2) times longer than wide; each with 13 - 19 f.s. and 15 - 22 h.s; tarsal digitules subequal, longer than claw. Claws: of medium length about

as long as width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 620 - 710 (669)μ long and 400 - 500 (446)μ wide.

Segments I - VII: tergites on 2nd and 3rd segments represented by 3 small sclerites on anterior margin - one medially and one on each side, and on the 7th by a weak transverse plate in the middle of the segment; sternites present on all segments, represented by a weak transverse plate on the anterior and posterior segments and a small sclerite on each side on the intermediate segments. Caudal extension of 7th segment small, rounded, not sclerotized. Dorsal setae: h.s. only, usually one on each side on each of the 1st and 5th - 7th segments and sometimes one or two on the 4th. Pleural setae consisting of h.s. only which include dorsopleural setae: up to 3 on the 2nd, 2 - 3 on the 3rd and usually 4(range 3 - 5) on each of the 4th - 6th segments, and ventropleural setae: usually one on the 6th segment. Segment VII with 6 - 10 (7.3) h.s. Ventral setae: h.s. only, occasionally one on each side on the 2nd usually one on each side on the 3rd and 4th, and 4 on each of the 5th - 7th segments.

Segment VIII: with transverse tergite and sternite; caudal extension forming a small, simple

lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about twice as long as the section within the pouch. No 9th tergite observed. Ante-anal setae; 2 long h.s. Posterior margin with 3 h.s. on each side.

Genital segment: Penial sheath short, about 1/6th total body length (ratio 1: 5.49 - 6.00, av. 5.86), 327 - 357 (342)μ long and 56 - 63 (60)μ wide; lateral sclerotizations not joined anterior to anus; length of basal rod about half that of aedeagus, the rod extending anteriorly from the base of the aedeagus to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 28 - 42 (33) small setae; a cluster of small sensilla occuring ventrally near apex of sheath. Aedeagus long (160 - 186, av. 174μ), penial sheath and basisternum longer, the ratios being 1: 1.8 - 2.1 (2.0) and 1: 1.23 - 1.39 (1.34) respectively.

Material examined: 10 specimens, collected by J.M. Cherret on Hedera helix L.(ivy) in Bangor, Wales during May, 1962. Two specimens collected by N.S. Borchsenius in the Crimea U.S.S.R. on 24.5.54 agreed well with the above description, but were somewhat smaller, measuring 1680 and 1720μ. The same is true for 4 specimens collected by J. Rehacek on Hedera helix L. during May, 1953 in Czechoslovakia; they measured 1660, 1680, 1760 & 1830u.

GEN. CTENOCHITON

8. CTENOCHITON SP. (Figs. 9 and 32)

A moderately small and slender species, with comparatively long antennae and moderately long legs; with numerous setae on the appendages but few on the body itself. When mounted, total body length 1601 - 1929 (1754) μ; width at mesothorax 240 - 280 (256)μ. Wing expanse 3052 - 3265 (3178)μ.

Head: subconical in dorsal view; in lateral view obliquely dorsoventrally elongated, with anterodorsal bulge not pronounced; length from apex to pronotal ridge 220 - 258 (237)μ, width across genae 240 - 280 (256)μ. Median crest sclerotized and striated posteriorly, but not polygonally reticulated; with 9 - 15 (12) hair-like dorsal head setae. Mid ranial ridge dorsally absent; ventrally narrow but well defined, reaching postocular ridge posteriorly, surrounding area not reticulated. Genae large, sclerotized; polygonal reticulation enclosing weaker, irregular reticulation; without setae. Eyes: four pairs; dorsal and ventral pairs large, subequal; lateral pairs smaller, subequal; corneae of dorsal eyes 19 - 27 (23)μ in diameter and 3.1 - 5.8 (4.6) times as much apart; those of the ventral eyes 20 - 27 (23)μ in diameter and 1.2 - 1.6 (1.5) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally

reticulated throughout. Preocular ridge with ventral part reaching or almost reaching midcranial ridge. Postocular ridge thin and tapering dorsally, well developed lateroventrally, and narrow but well defined posteromedially; below the ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae: 1 - 4 (2.2) h.s. on each side; ventral head setae: 3 - 5 (4.5) h.s., 2 of which are usually situated anterior to preocular ridge and 2 - 3 posterior. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis short; apex bifurcate with a central lobe, not reaching level of posterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10 - segmented; filiform; 1024 - 1144 (1070)μ long, ie. longer than half body length (ratio 1: 1.51 - 1.69, av. 1.63), longer than posterior leg (ratio 1: 1.01 - 1.05, av. 1.04) and longer than penial sheath (ratio 1: 3.30 - 3.69, av. 3.48). Scape: 52 - 60 (58)μ long and 40 - 48 (46)μ wide, with 3 h.s. Pedicel: with weak polygonal, dorsal reticulation; 44 - 52 (46)μ long and 40 - 48 (45)μ wide; with 8 - 14 (10) f.s. 4 - 8 (6.3) h.s. and sensillum placodeum. Segment III bulging in the middle, 2.0 - 2.4 (2.2) times longer than wide (52 - 68, av. 61μ long and 26 - 32, av. 29μ wide);

with 2 - 4 (3.1) h.s. and 6 - 10 (8.3) f.s., the latter of medium length, 1.1 - 1.4 (1.3) times as long as width of segment; with 2 - 4 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 152 - 180 (166), 148 - 164 (155), 148 - 180 (166), 124 - 164 (147), 100 - 124 (111) and 72 - 94 (80) respectively, all of about the same width, varying from 19 to 25 μ; with 27 - 38 (33), 26 - 32 (28), 26 - 36 (30), 21 - 33 (27), 18 - 26 (22) and 11 - 21 (17) f.s., and 1 - 4 (2.3), 1 - 4 (2.2), 1 - 3 (2.3), 1 - 3 (2.1), 0 - 2 (0.6) and 0 - 2 (1.0) h.s. respectively; antennal bristles on 8th and 9th segments disintctly larger than fleshy setae. Segment X: terminal part not constricted; 76 - 84 (80)μ long and 22 - 26 (24)μ wide; carrying 6 - 12 (10) f.s., 3 capitate subapical setae and 5 antennal bristles of which the3 long ones are about half as long as the segment and the 2 shorter ones somewhat shorter than most fleshy setae, but distinctly thicker; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 584 - 664 (619)μ long.

Prothorax: Pronotal ridge strong, though medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae absent; 3 - 7 (6.1) circular pores present on each side posterior to pronotal sclerite. Posttergites

small, without striations, and without setae. Pleural structures typical for the family. Sternum with a strong transverse ridge, narrow triangular sclerite. Anteprosternal setae absent; prosternal setae: occasionally one h.s.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum about twice as wide as long (av. 201 and 98μ respectively); anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture ; weakly, irregularly reticulated; slightly more heavily sclerotized medially. Scutum: Median membranous area: subrectangular; 108 - 128 (116)μ long and 1.28 - 1.78 (1.49) times as wide (width 152 - 192 av. 173u ; with 7 - 13 (10) h.s. Scutellum : 61 - 87 (72)μ long and 160 - 192 (175)μ wide, the ratio being 1: 2.2 - 2.8 (2.4); tubular with ventral foramen of medium size; without setae. Postnotum with anterior margin usually regular and exposed; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with shallow emargination.

Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum showing weak

irregular reticulation; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 253μ wide and 207μ long, i.e. 1.60 - 1.89 (1.74) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and 4 - 7 (5.0) h.s. Third axillary wing sclerite with a pronounced ventral prejection at its base. Additional sclerite small, but well defined. Antemetastingmatal setae absent. Metathorax: Metanetum with anterior margin usually strong medially; suspensorial sclerites small, spot-like; a small sclerite usually present anterior to postnotum. Postnotum consisting of a transverse sclerite on each side. Metatergal setae: one h.s. on each side, 3 - 11 (6.3) circular pores occuring near each seta. Pleural ridge: well developed, though interrupted in middle; with small wing process. Episternum with anterior margin net ridge-like; vestigial precoxal ridge present, epimeron posteriorly directed. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent.

Postmetaspiracular setae: 2 - 6 (3.5) f.s. and 1 - 7 (4.0) h.s. Metasternum represented by a weak transverse plate. Anterior metasternal setae: 1 - 3 (1.9) medially situated h.s.; posterior metasternal setae: occasionally one h.s.

Wings: hyaline; long (1357 - 1465, av. 1427μ) and of medium width (530 - 615, av. 578μ), the ratio width to length being 1: 2.36 - 2.56 (2.46); alar lobe present; alar setae: one, occassionally two h.s. on each wing. Halteres well developed, 104 - 120 (iii) μ long and 20 - 28 (24)μ wide, each with one apically hooked seta which is about 64μ long.

Legs: moderately long and slender, with the middle or fore pairs shortest and the hind pair longest; the ratio length of hind leg to body length is 1: 1.68 - 1.73 (1.71). Length of segments (in μ)

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	68-76 (71)	92-106 (100)	198-222 (211)	359-422 (391)	110-128 (119)	23-26 (24)	903-1013 (964)
II	72-84 (81)	92-106 (99)	178-207 (193)	331-414 (377)	115-133 (124)	24-27 (25)	859-1010 (947)
III	80-91 (85)	95-116 (104)	190-218 (204)	361-426 (293)	112-135 (125)	24-27 (25)	906-1053 (985)

Coxae: with 13 - 25 f.s. and 13 - 19 h.s. on each coxa; fore coxa with 2 - 5 (3.8) pointed coxal bristles, the latter about half as long as the segment;

apical seta about half as long as trochanter. Trochanters: 26 - 30μ wide; with 6 or 7 sensilla, 10 - 16 f.s. and 7 - 10 h.s. the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1.4 - 1.7 (1.5) times as long as width of trochanter. Femora: of medium width (38 - 42μ), the ratio width to length of hind femur being 1: 4.7 - 5.4 (5.1); with 22 - 34 f.s. and 13 - 26 h.s. Tibiae: 19 - 25μ wide, the ratio width to length of hind tibia being 1: 16.7 - 20.0 (18.4); with 79 - 102 setae, of which 30 - 48 are h.s. and 44 - 60 f.s. the latter about as long as width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 18 - 21 (19.0)μ wide, hind tarsus 5.7 - 7.0 (6.3) times longer than wide; with 9-15 f.s. and 19 - 32 h.s. tarsal digitules subequal, about as long as claw. Claws: of medium length, somewhat longer than width of tarsus; slightly curved, with a small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 551 - 721 (613)μ long and 371 - 477 (441) μ wide. Segments I - VII: tergites represented by a small sclerite on each side on the anterior margin of the 2nd and 3rd segments and a weak transverse plate on the 7th; sternites present on all segments, represented by a weak transverse plate on the anterior and posterior segments and a sclerite on each side.

on the intermediate segments. Caudal extension of 7th segment small, somewhat pointed, not sclerotized. Dorsal setae: h.s. only, usually one on each side on the 1st and 3rd - 7th segments; 1 - 7 (4.1) circular pores occur near each seta on the 1st segment. Pleural setae consisting of h.s. only, which include 2 - 5 (3.3), 3 - 5 (4.1), 3 - 6 (4.6) and 3 - 5 (4.3) dorsopleural setae; ventropleural setae absent or incorporated into the dorsopleural group. Segment VII with 5 - 8 (6.0) h.s. of which the posterior ones are usually longer than the rest. Ventral setae: h.s. only, usually one on each side on the 3rd and 4th and 4 on each of the 5th - 7th segments.

Segment VIII: with transverse tergite and sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long setae, each with a small apical knob, the protruding part of these setae being about 3 - 4 times as long as the section within the pouch. No 9th tergite observed. Ante-anal setae: 2 long and occasionally one small h.s.; 9 - 17 (14) circular pores present anterior to ante-anal setae. Posterior margin with 3 - 4 (3.3) h.s. on each side.

Genital segment: Penial sheath short, about 1/6th total body length (ratio 1: 5.20 - 6.12, av. 5.75), 285 - 323 (304)μ long and 42 - 49 (46)μ wide;

lateral sclerotizations narrowly joined anterior to anus; length of basal rod 2/3 - 4/5 as long as aedeagus and extending anteriorly from the base of the aedeagus for about 2/3 of the length to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 17 - 26 (20) small setae; a cluster of small sensilla occuring ventrally near apex of sheath. Aedeagus of medium length (101 - 120, av. 114μ), penial sheath and basisternum longer, the ratios being 1: 2.6 - 3.0 (2.7) and 1: 1.74 - 1.92 (1.85) respectively.

Material examined: 10 specimens, collected by myself on Antizoma capensis in Stellenbosch, South Africa during August 1961; identified by G De Lotto.

GEN ERICERUS

9. ERICERUS PELA (CHAV.) (Figs 10 and 33)

A very large and moderately robust species with comparatively long antennae and legs; with numerous long setae on the appendages, but few on the body itself. When mounted, total body length 2500 - 3100 (2864)μ; width at mesothorax 570 - 740 (680)μ. Wing expanse 5330 - 5700 (5563)μ.

Head: subconical in dorsal view, in lateral view dorsoventrally elongated; long and narrow, length from apex to pronotal ridge 357 - 456 (420)μ and width across genae 285 - 342 (315)μ. Median crest sclerotized and densely polygonally reticulated; with 5 - 7 (5.7) hair-like dorsal head setae anteriorly. Midcranial ridge dorsally absent; ventrally narrow but well defined, reaching postocular sclerite posteriorly, surrounding area polygonally reticulated. Genae large, sclerotized; polygonal reticulation enclosing weaker, irregular reticulation; without setae. Eyes: five pairs; dorsal and ventral pairs large, subequal; lateral pairs smaller, subequal; corneae of dorsal eyes 40 - 47 (43)μ in diameter and 1.4 - 2.1 (1.7) times as much apart, those of the ventral eyes 42 - 49 (46)μ in diameter and 0.9 - 1.1 (1.0) times as much apart. Ocellus small. Ocular sclerite well

sclerotized and densely polygonally reticulated throughout. Preocular ridge with ventral part reaching or almost reaching midcranial ridge. Postocular ridge weak dorsally, well developed lateroventrally, and narrow but well defined posteromedially, below ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae: 3 - 5 (4.4) h.s. situated anterior to ocular sclerite on or near midcranial ridge. Prooral ridge present. Tendon-like apodeme long. Cranial apophysis short; apex truncate, not reaching level of anterior margin of ventral eyes. Mouth opening irregular.

Anterior tentorial pits situated anterolateral to mouth opening.

Antennae: 10 - segmented; filiform: 1691 - 2120 (1922)μ long, i.e. longer than half body length (ratio 1: 1.46 - 1.55, av. 1.50), longer than penial sheath (ratio 1: 3.50 - 4.04, av. 3.89). Scape: 80 - 99 (93)μ long and 76 - 95 (86) μ wide, with 3 h.s. and 2 - 4 (2.6) f.s. Pedicel: with distinct, polygonal dorsal reticulation; small, 61 - 84 (73)μ long and 57 - 68 (64)μ wide; with 1 - 3 (2.1) f.s., 2 - 4 (2.6) h.s. and a sensillum placodeum. Segment III: long, cylindrical, 4.6 - 6.3 (5.3) times longer than wide (209 - 258, av. 228 μ long and 38 - 48, av. 43 μ wide); with 6 - 11

(8.3) h.s. and 15 - 26 (21) f.s., the latter, as on the other antennal segments, are very long, 4.0 - 5.0 (4.5) times that of the width of the 3rd segment; with 1 - 3 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 213 - 274 (248), 235 - 281 (264), 232 - 312 (277), 194 - 274 (235), 156 - 205 (186) and 118 - 156 (145) respectively, all of about the same width, varying from 27 to 38μ, and with 15 - 28 (21), 17 - 26 (23), 18 - 31 (24), 18 - 26 (22), 12 - 18 (15) and 9 - 14 (12) f.s. respectively, but no h.s.: antennal bristles on 8th and 9th segments distinctly thicker than f.s.; one or two f.s. near apex of each segment short, shorter than width of segment. Segment X: terminal part not constricted; 125 - 213 (172) μ long, and 29 - 34 (31)μ wide; carrying 6 - 11 (8.2) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about ⅔ as long as the segment and the 2 short ones thin and shorter than the f.s. (one shorter than the other, about as long as width of segment); with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 832 - 1113 (1015)μ long

Prothorax: Pronotal ridge strong, but narrowly constricted medially. Lateral pronotal

sclerites small, without setae. Medial pronotal setae absent. Posttergites elongated with wavy striations and without setae. Pleural structures typical for the family. Sternum with transverse ridge strong, median ridge reduced to a short basal stalk and triangular sclerite well sclerotized. Antepros-ternal setae absent; prosternal setae: 0 - 4 (1.8) h.s.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum less than twice as wide as long (av. 287 and 185 μ respectively); anterior margin curved; laterally and posteriorly bounded by the prescutal ridges and posteriorly by the prescutal suture; with weak, irregular reticulation slightly more heavily sclerotized medially. Scutum: Median membranous area: trapezium - shaped; 108 - 186 (156)μ long and 1.57 - 2.40 (1.95) times as wide (width 247 - 334, av. 298μ) without setae. Scutellum : large, 76 - 114 (96)μ long and 209 - 293 (250)μ wide, the ratio being 1: 1.4 - 1.8 (1.6); not tubular; without setae. Postnotum with anterior margin irregular and partly overlapped by meta-thoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural

apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 430μ wide and 356μ long, i.e. 2.08 - 2.81 (2.31) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a weak sclerite posteriorly and 2 - 7 (4.7) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite elongated, well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with anterior margin usually strong medially; suspensorial sclerites small, spot-like; a small sclerite present anterior to postnotum. Postnotum consisting of a narrow, transverse sclerite on each side. Metatergal setae absent. Pleural ridge well developed, though interrupted in middle; with small wing process. Episternum with anterior margin not ridge-like

precoxal ridge absent; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one Dorsostigmatal setae absent. Postmetastigmatal setae: 0 - 3 (1.0) f.s. and 4 - 8 (5.6) h.s.; of the latter 3 - 7 are situated dorsally and one or two more ventrally. Metasternum represented by a weak transverse plate. Anterior and posterior metasternal setae absent.

Wings: hyaline; long (2350 - 2530, av. 2490μ) and of medium width (890 - 950, av, 911μ), the ratio width to length being 1: 2.64 - 2.77 (2.68); alar lobe present; alar setae absent. Halteres well developed, 163 - 228 (202)μ long and 42 - 61 (52)μ wide, each with 1 - 4 (2.3) apically hooked setae which are about 97μ long.

Legs: long and slender, with the middle pair shortest and the hind pair longest; the ratio length of hind leg to body is 1: 1.54 - 1.73 (1.65). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	106-137 (119)	114-186 (171)	334-426 (389)	562-760 (678)	194-266 (242)	34-48 (45)	1379-1804 (1643)
II	106-141 (124)	114-186 (164)	308-388 (353)	543-749 (669)	179-251 (227)	40-49 (46)	1321-1763 (1584)
III	114-156 (136)	160-198 (176)	334-418 (384)	608-798 (734)	188-304 (249)	40-49 (47)	1444-1908 (1726)

Coxae: with 14 - 22 f.s. on the fore and middle coxa and 17 - 32 (25) on the hind coxa, and with

12 - 23 (18) h.s. on the fore coxa and 8 - 15 on the middle and hind coxa, fore coxa without coxal bristles; apical setae about half as long as the trochanter. Trochanters: 42 - 68μ wide, with 6 - 8 oval sensilla, 7 - 12 f.s. and 7 - 9 f.s. and 7 - 9 h.s. the latter including 2 minute setae near basal ridge, one small seta on the outer margin and a long apical seta which, on the fore trochanter, is 1.5 - 1.9 (1.7) times as long as width of trochanter. Femora: of medium width (60-87μ) the ratio width to length of hind femur being 1: 4.7 - 5.5 (5.1) each with 25 - 43 f.s., with 16 - 21 (18) h.s. on the fore and 10 - 16 on the middle and hind legs. Tibiae: 34 - 49μ wide, the ratio width to length of hind tibia being 1: 16.2 - 18.2 (17.1); with 72 - 99 setae of which 17 - 29 are h.s. and 53 - 72 f.s.; the latter, as on the other segments, very long, about 4 - 5 times as long as width of tibia; with a number of spurs near apex, apical spur of about the same size on all tibiae. Tarsi: 29 - 38μ wide, hind tarsus 6.2 - 8.9 (7.3) times longer than wide; each with 12 - 19 f.s. and 8 - 15 h.s. tarsal digitules subequal, longer than claw. Claws: of medium length, somewhat longer than width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 800 - 1060 (982)μ long and 600 - 780

(681)μ wide.

Segments I - VII: tergites on the 2nd and 3rd segments represented by a small sclerite on each side, and on the 7th by a weak transverse plate; sternites on the 5th - 7th segments represented by a weak transverse plate. Caudal extension of 7th segment small, somewhat pointed, not sclerotized. Dorsal setae: h.s. only, sometimes one on each side on the 4th segment and usually so on the 5th - 7th. Pleural setae: 1, 1-2 (1.2), 1 - 3 (1.7) and 3 on the 3rd to 6th segments respectively, and ventropleural setae: usually one on each of the 4th - 6th segments. Segment VII with 4 h.s. Ventral setae: h.s. only, usually one on each side on each of the 2nd - 4th segments, and 3 - 5 on the 5th - 7th.

Segment VIII: with a transverse tergite and sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long setae, each with a small apical knob; the protruding part of these setae being about 1 - 1½ times as long as the section within the pouch. No 9th tergite observed. Ante-anal setae: 2 long h.s. Posterior margin with 3 h.s. on each side.

Genital segment: Penial sheath short, about 1/6th total body length (ratio 1: 5.26 - 6.20, av. 5.81), 441 - 536 (492)μ long and 61 - 68 (65)μ wide; lateral sclerotizations not joined anterior

to anus; length of basal rod about equal that of aedeagus, extending anteriorly from the base of the aedeagus to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 26 - 41 (34) small setae; a cluster of small sensilla occuring ventrally near apex of sheath. Aedeagus short (length 137 - 171, av. 162μ), penial sheath and basisternum longer, the ratios being 1: 2.8 - 3.2 (3.0) and 1: 1.81 - 2.44 (2.17) respectively.

Material examined: 10 specimens, collected by N.S. Borchsenius on Ligustrum sp. in China on 14.9.54.

10. GEN. A (Figs 11 and 84)

A medium-sized, robust species with comparatively long antennae and moderately long legs; with numerous short, thick setae on the appendages but with only a few h.s. on the body itself. When mounted, total body length 1630 - 1830 (1757)μ; width at mesothorax 455 - 500 (477)μ. Wing expanse 3140 - 3220 μ.

Head: subconical in dorsal view; rounded in lateral view, with anterodorsal bulge not pronounced; length from apex to pronotal ridge 213 - 236 (218)μ, width across genae 277 - 304 (286)μ. Median crest well sclerotized, especially anteriorly and around the posterior margin; central part polygonally reticulated; with 7 - 10 (8.5) hair-like dorsal head setae. Midcranial ridge dorsally absent; ventrally narrow but well defined, reaching postocular sclerite posteriorly, surrounding area sometimes weakly sclerotized near ridge, but not reticulated. Genae large, sclerotized not reticulated, without setae. Eyes: four pairs; dorsal and ventral pairs large, subequal; lateral pairs smaller, subequal; corneae of dorsal eyes 21 - 23 (22)μ in diameter and 6.8 - 7.8 (7.2) times as much apart; those of the ventral eyes 19 - 23 (21) μ in diameter and 2.8 - 3.3 (3.1) times as much apart. Ocellus small.

Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge with ventral part reaching midcranial ridge. Postocular ridge weak dorsally, well developed laterventrally and narrow but well defined posteromedially; below the ocellus the ridge splits up, with the posterior part weak or lost entirely and the anterior part strong, extending anterior to ocellus. Interocular ridge usually present narrow, connecting pre- and postocular ridges between lateral eyes (ridge sometimes absent on one side and occasionally on both sides) Dorsal ocular setae absent; ventral head setae: 3 - 5 (4,0) h.s., situated on or just anterior to preocular ridge, a pair of these being considerably longer than the others. Preoral ridge absent. Tendon-like apodeme long, arising from the anterior part of an elongated ventral plate. Cranial apophysis very short, apex truncate with a large, irregular central lobe. Mouth opening irregular. Anterior tentorial pits situated antero-lateral to mouth opening.

Antennae: 10 - segmented; filiform. 1003 - 1144 (1101)μ long, i.e. longer than half body length (ratio 1: 1.62 - 1.74, av. 1.68), longer than posterior leg (ratio 1: 1.16 - 1.19, av. 1.17) and longer than penial sheath (1: 3.06 - 3.40, av. 3.18).

Scape: 61 - 72 (66)μ long and 57 - 63 (60)μ wide, with 3 - 6 (4.1) h.s. Pedicel: with distinct polygonal dorsal reticulation; 57 - 68 (64) μ long and 53 - 63 (59), wide; with 7 - 14 (10.4) f.s., 8 - 15 (10.9) h.s. and a sensillum placodeum. Segment III bulging in middle; 1.7 - 2.1 (1.9) times longer than wide (76 - 95, av. 84 μ long and 38 - 46, av. 43μ wide); with 6 - 8 (7.0) h.s. and 21 - 31 (24) f.s., the latter, as on the other antennal segments, very short, about 0.4 - 0.6 (0.5) times as long as width of 3rd segment; with 1 - 3 usual sensilla basiconica. Segments IV-IX: cylindrical; lengths of these segments (in μ) 137 - 164 (149), 141 - 175 (155), 156 - 175 (165), 118 - 148 (135), 95 - 122 (113) and 76 - 91 (85) respectively, all of about the same width, varying from 29 to 38 μ; with 35 - 48 (42), 40 - 51 (47), 46 - 53 (48), 36 - 48 (42), 30 - 41 (33) and 20 - 28 (25) f.s. and 5 - 10 (8.0), 5 - 8 (6.7) 5 - 12 (7.7), 4 - 6 (4.6), 3 - 5 (4.0) and 0 - 4 (2.3) h.s. respectively; antennal bristles on 8th and 9th segments not distinctly different from the f.s. Segment X: terminal part not constricted; 84 - 91 (86)μ long and 57 - 68 (63)μ wide; carrying 5 - 10 (7.3) f.s., 0 - 2 (1.5) h.s. 4 - 6 (5) capitate subapical setae and 5 antennal bristles of which the 3 long ones are less than half as long as the segment and the 2 short ones about as long as

the f.s. though thinner; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 593 - 665 (637)μ long.

Prothorax: Pronotal ridges strong, though medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae absent. Postterga ites small, without striations and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge a median ridge, which is occasionally interrupted in the middle and a well sclerotized triangular sclerite. Anteprosternal setae absent; prosternal setae: occasionally one h.s. on each side.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum more than twice as wide as long (av. 228 and 90μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; with polygonal reticulation; slightly more heavily sclerotized medially. Scutum: Median membranous area: subrectangular: 96 - 114 (100)μ long and 2.00 - 2.82 (2.38) times as wide. Width 205 - 236, av. 221μ; with 9 - 13 (11.9) h.s., usually with one on each side situated posterolaterally immediately outside the membranous area. Scutellum large, 110 125 (115)μ long and 201 - 235 (220)μ wide, the ratio

being 1: 1.8 - 2.1 (1.9); not tubular; with 0 - 2 (1.6) h.s. Postnotum with anterior margin irregular and partly overlapped by metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with deep emargination.

Mesopleuron: Mesopleural ridge strong, but interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected to episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 262μ wide and 183μ long, i.e. 1.57 - 2.49 (1.92) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a weak sclerite posteriorly and 7 - 11 (8.8) h.s. Third axillary wing sclerite with a large ventral projection at its base. Additional sclerite elongated, well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with anterior margin usually strong medially; suspensorial sclerites small, spot-like, a small sclerite occasionally present anterior to postnotum. Postnotum consisting of a transverse sclerite, which is narrow medially but usually not interrupted. Metatergal setae: one or two h.s. on each side. Pleural ridge well developed, but usually interrupted in the middle; with a small wing process.
Precoxal ridge absent. Episternum ventrally interrupted so that a small, separate sclerite is formed, anterior margin not ridge-like. Epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: occasionally one or two h.s. Metasternum represented by a transverse plate. Anterior and posterior metasternal setae: usually one median h.s. each.

Wings: hyaline; of medium length (1370 - 1420) av. 1394μ) and broad (610 - 655, av. 630μ), the ratio width to length being 1: 2.17 - 2.26 (2.21). Alar lobe present; alar setae absent. Halteres well developed, 125 - 144, (136)μ long and 30 - 36 (34)μ wide, each with one apically hooked seta which is about 70μ long.

Legs: moderately long and slender, with the fore pair shortest and the middle or hind pair

longest; the ratio length of hind leg to body length is 1: 1.82 - 2.01 (1.89). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	76-87 (82)	87-103 (99)	209-224 (217)	338-384 (364)	91-103 (100)	25-27 (26)	842-920 (888)
II	76-91 (87)	93-106 (102)	191-231 (209)	376-440 (395)	103-110 (108)	25-29 (27)	865-954 (928)
III	76-91 (87)	91-114 (106)	192-227 (215)	357-418 (390)	108-112 (390)	25-27 (26)	859-969 (927)

Coxae: with 10 - 13 (11), 11 - 19 (15) and 14 - 25 (18) f.s. on the fore, middle and hind coxa respectively, and with 11 - 21 h.s. each: fore coxa with 2 - 4 (3) coxal bristles; apical seta about half as long as trochanter. Trochanters: 30 - 40 μ wide; with 6 oval sensilla, 5 - 10 f.s. and 6 - 11 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1.2 - 1.5 (1.4) times as long as width of trochanter. Femora: very broad (46-65μ), the ratio width to length of hind femur being 1: 3.2 - 3.8 (3.5); each with 32 - 54 f.s. and 15 - 31 h.s. Tibiae: 30 - 34μ wide, the ratio width to length of hind tibia being 1: 10.4 - 12.2 (11.5) Setae: 83 - 135 of which 35 - 59 are h.s. and 40 - 81 f.s. the latter, as on the other segments, very short and thick, about $\frac{2}{3}$ as long as width of tibia; apical spur

of about the same size on all tibiae. Tarsi: 25 - 30μ wide, hind tarsus 3.6 - 4.1 (3.7) times longer than wide; each with 0 - 5 (1.[illegible]) f.s. on the fore and none on the middle and hind tarsi; with 21 - 40 h.s. tarsal digitules subequal, longer than claw. Claws: of medium length, about as long as width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 540 - 620 (577)μ long and 430 - 510 (459) μ wide.

Segments I-VII: tergites represented by a transverse sclerite on the anterior margin of the 2nd, 3rd and sometimes 4th segment; sternites represented by a weak transverse plate on the 2nd, 3rd and 5th - 7th segments. Caudal extension of the segment small, somewhat pointed, not sclerotized. Dorsal setae: h.s. only, usually one on each segment. Pleural setae: consisting of h.s. only, which include dorsopleural setae: 0 - 2 (1.6), 1 - 4 (2.1), 2 - 4 (3.3) and 0 - 4 (2.9) on the 3rd - 6th segments respectively, and ventropleural setae: sometimes one on each of the 4th - 6th segments. Segment VII with 3 - 9 (5.4) h.s. Ventral setae: h.s. only, usually one on each side on each of the 3rd - 5th segments, 4 on the 6th and 4 - 6 (5.6) on the 7th, two of the median setae considerably longer than the rest.

Segment VIII with small tergite and transverse sternite; glandular pouch with 2 long setae, each with a small apical knob; the protruding part of these setae about 2-2½ times as long as the section within the pouch. No 9th tergite observed. Ante-anal setae absent. Posterior margin with 3 h.s. on each side.

Genital segment: Penial sheath of medium length about 1/5th total body length (ratio 1: 4.80 - 5.32 av. 5.04), 315 - 369 (349)μ long and 53 - 61 (57)μ wide; lateral sclerotizations narrowly joined anterior to anus; length of basal rod about 5/8 to equal that of aedeagus and extending anteriorly from the base of the latter to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 36 - 46 (40) small setae: a cluster of small sensilla occuring ventrally near apex of sheath. Aedeagus long (125 - 148, av. 140μ) and broad, penial sheath and basisternum longer, the ratios being 1: 2.4 - 2.6 (2.5) and 1: 1.21 - 1.42 (1.31) respectively.

Material examined: 7 specimens, collected by C.J. Joubert on "katdoring" during August 1956 at Stanford, South Africa (received from J.G. Theron).

GEN SPHAEROLECANIUM

11. SPHAEROLECANIUM PRUNASTRI (FONSC.)

(Figs 12 and 35)

A medium-sized, robust species with comparatively short antennae and legs; with many setae on the appendages, but few on the body itself. When mounted, total body length, 1640 - 1810 (1739)μ; width at mesothorax 360 - 430 (408)μ. Wing expanse 1200 - 1280 (1231)μ.

Head: subconical in dorsal view; in lateral view obliquely elongated dorsoventrally, with antero-dorsal bulge somewhat pronounced; length from apex to pronotal ridge 205 - 247 (222)μ; width across genae 243 - 266 (253)μ. Median crest sclerotized and distinctly polygonally reticulated; with 9 - 12 (10) hair-like dorsal head setae, arranged in a group of 3 - 5 near anterior margin of head and a group of 5 - 7 very short setae more posteriorly. Midcranial ridge dorsally absent; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area with polygonal reticulation. Genae large, sclerotized, polygonally reticulated without setae. Eyes: two pairs; subequal; corneae of dorsal eyes 19 - 27 (25)μ in diameter and 3.4 - 4.2 (3.9) times as much apart; those of the ventral eyes 19 - 27 (26)μ in diameter and 1.2 - 1.6 (1.3) times as much apart.

Ocellus small bulging. Ocular sclerite well sclerotized and polygonally reticulated throughout Preocular ridge short, not extending far below articular process. Postocular ridge well developed dorsally and latereventrally, but weak posteromedially, below the ocellus the ridge splits up, with anterior branch partly surrounding ocellus. Interocular ridge absent, but sometimes indicated by a line of darker sclerotization. Dorsal ocular setae absent.

Ventral head setae: 4 - 6 (5.0) h.s., situated on the anterior margin or just anterior to the ocular sclerite; with one pair of setae distinctly longer than others. Preoral ridge present. Tendon-like apodeme long; cranial apophysis of medium length; apex bifurcate with a central lobe, not reaching level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits apparently present anterolateral to mouth opening. Antennae: 10 - segmented; filiform; 671 - 809 (770)μ long i.e. shorter than half body length (ratio 1: 2.13 - 2.45 av. 2.28), longer than posterior leg (ratio 1: 0.95 - 0.96) and longer than penial sheath (ratio 1: 1.55 - 1.73, av. 1.62). Scape: 45 - 53 (47)μ long and 46 - 49 (47)μ wide, with 3 - 4 (3.4) h.s. Pedicel: with weak, polygonal, dorsal reticulation; 55 - 68 (63)μ long and

32 - 42 (38)μ wide, with 0 - 3 (1.2) f.s., 4 - 9 (6.8) h.s. and a sensillum placodeum. Segment III club-shaped, 2.7 - 3.7 (3.1) times longer than wide (68 - 86, av. 78μ long and 23 - 29, av. 26μ wide), with 4 - 7 (6) f.s. of medium length, 1.1 - 1.3 (1.2) times as long as width of segment; with 1 - 3 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 106 - 133 (121), 76 - 133 (95), 72 - 91 (84), 70 - 95 (83), 61 - 76 (69) and 53 - 72 (66μ) respectively, widths varying from 21 to 27μ, with distal segments wider than proximal ones; with 18 - 27 (21), 13 - 24 (16), 13 - 23 (17), 12- 18 (16), 12 - 19 (15) and 10 - 17 (15) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments not distinctly different from the f.s., sometimes slightly thicker. Segment X: terminal part not constricted; 57 - 72 (65)μ long and 21 - 27 (23)μ wide; carrying 9 - 15 (12) f.s. & capitate subapical setae and 5 antennal bristles of which the 3 long ones are about half as long as the segment and the 2 shorter ones not distinctly different from the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 513 - 597 (566) μ long.

Prothorax: Pronotal ridge strong, though medially interrupted by weak sclerotization.

Lateral pronotal sclerites medium-sized, without setae. Medial pronotal setae: usually 2 h.s. Posttergites: very small and weakly sclerotized, without striations and without setae. Pleural structures typical for the family. Sternum with transverse ridge strong, median ridge absent (occasionally a small basal stalk may be present) and triangular sclerite with lines arching latero-anteriorly. Anteprosternal setae absent; prosternal setae: 7 - 16 (10.6) f.s. and 0 - 2 (0.7) h.s., scattered over the sternal area but not occuring anterior to the spiracles.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum more than twice as wide as long (av. 181, and 82 μ respectively); anterior margin curved; laterally bounded by the presental ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially but not reticulated. Scutum: Median membranous area: subrectangular; 72 - 91 (83)μ long and 1.92 - 2.48 (2.11) times as wide (width 152 - 220, av. 175μ); with 2 - 4 (2.8) h.s. Scutellum 65 - 80 (74)μ long and 141 - 182 (163)μ wide, the ratio being 1: 2.0 - 2.3 (2.2); tubular, with a large ventral foramen; occasionally with one or two h.s. Postnotum with anterior margin irregular and partly overlapped by the meta-thoracic fold; postnotal apophysis and postalare

well developed, the latter densely reticulated distally. Mesopostphragma with moderately deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed but below membranous cleft indistinct and only marked by a band of darker sclerotization.

Epimeron small. Lateropleurite not bounded by an extension from marginal ridge. Basisternum: large, about 236μ wide and 170μ long, i.e. 1.8 - 2.2 (?.1) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and 4 - 10 (?.3) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Additional sclerite well defined. Antemetastigmatal setae absent.

Metathorax: Metanotum with anterior margin desclerotized medially; suspensorial sclerites absent. Postnotum consisting of a transverse sclerite on each side. Metatergal setae: usually one h.s.

on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Dorsostigmatal setae absent. Postmetastigmatal setae: 0 - 15 (7.5) f.s. and 1 - 3 (1.2) h.s. Metasternum represented by two small, irregular sclerites. Anterior metasternal setae: 11 - 18 (14) f.s. and occasionally one h.s.; posterior metasternal setae: 0 - 3 (1.6) f.s.

Wings: hyaline; short (length 1200 - 1280, av. 1231μ) and of medium width (500 - 530, av. 516μ), the ratio width to length being 1: 2.34 - 2.42 (2.38); alar lobe and alar setae absent. Halteres absent.

Legs: short and moderately slender, with the fore pair usually shortest and the hind pair longest; the ratio length of hind leg to body length is 1: 2.02 - 2.34 (2.17). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	59-72 (67)	72-95 (87)	175-209 (197)	239-293 (280)	19-110 (103)	26-28 (27)	667-803 (759)
II	62-76 (70)	84-103 (95)	160-190 (179)	251-304 (281)	106-118 (113)	27-30 (28)	690-813 (766)
III	65-83 (76)	84-106 (100)	171-201 (189)	255-317 (295)	101-125 (116)	27-32 (30)	701-851 (805)

Coxae: 3 - 6 (4.6) f.s. on the fore and 10 - 20 on the middle and hind coxa, and 10 - 20 h.s. on each; fore coxa with 3 - 6 (4) pointed coxal bristles (about as long as segment): apical seta about ⅔ as long as trochanter. Trochanters: 30 - 34 μ wide; with 6 oval sensilla, 6 - 10 f.s. and 5 - 9 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 2.1 - 2.9 (2.4) times as long as the width of the trochanter. Femora: very wide (46 - 57μ) the ratio width to length of hind femur being 1: 3.3 - 3.8 (3.5); each with 8 - 16 f.s. and 17 - 28 h.s. Tibiae: 23 - 30μ wide, the ratio width to length of hind ~~femur~~ tibia being 1: 10.3 - 11.5 (10.9); each with 47 - 75 setae of which 31 - 49 are h.s. and 10 - 26 f.s., the latter about as long as width of tibia; with apical spur of about the same size on all tibiae. Tarsi 21 - 25μ wide, hind tarsus 4.8 - 5.5 (5.2) times longer than wide; each with 1 - 6 f.s. and 15 - 27 h.s.; tarsal digitules subequal, longer than claw. Claws: of medium length, longer than width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 470 - 530 (498) μ long and 320 - 420 (375)μ wide.

Segments I - VII: tergites represented by a small sclerite on each side on the anterior margin of the 2nd and 3rd segments and by a weak plate on the 6th and 7th; sternites represented by a small sclerite on each side on the 2nd and 3rd segment and a transverse plate on the 6th. Caudal extension of 7th segment small, pointed, not sclerotized. Dorsal setae: h.s. only, usually one on each side on the 1st and each of the 5th - 7th segments. Pleural setae on the 3rd - 6th segments consisting of 0 - 1 (0.1), 0 - 1 (0.1) 0 - 2 (0.5) and 0 - 2 (0.9) f.s., and 0 - 2 (0.7), 0 - 3 (1.8), 1 - 3 (2.1) and 1 - 4 (1.9) hair-like dorsopleural setae respectively; ventropleural setae absent or incorporated into the dorsopleural group. Segment VII with 0 - 2 (1.1) f.s. and 3 - 5 (3.4) h.s. Ventral setae: 1 - 5 (2.3) f.s. on the 2nd and occasionally one on the 3rd segment; and usually one h.s. on each side on the 2nd - 4th and 4 on each of the 5th - 7th segments.

Segment VIII: with transverse tergite and sternite; caudal extension forming a large, cylindrical lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being $2\frac{1}{3}$ - 3 times as long as the section within the pouch. No 9th tergite observed. Ante-anal setae: 2 long h.s. posterior margin with 3 h.s. on each

side.

Genital segment: Penial sheath long, about 2/7th total body length (ratio 1: 3.42 - 3.85, av. 3.68), 433 - 517 (473)μ long and 46 - 51 (48)μ wide; lateral sclerotizations narrowly joined anterior to annus; length of basal rod 1¾ - 2 times that of aedeagus and extending anteriorly from the base of the latter to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 27 - 39 (32) small setae; a cluster of small sensilla occuring ventrally near apex of sheath Aedeagus of medium length (114 - 152, av. 140)μ, penial sheath and basisternum longer, the ratios being 1: 3.1 - 3.8 (3.4) and 1: 1.15 - 1.32 (1.23) respectively.

Material examined: 10 specimens, collected by B. Ogaza on Prunus spinosa in Cracow Poland during March 1962; received from Z. Kawecki.
A number of specimens, received from N.S. Borchsenius (collected by A. Kiritchenko in the Odessa district, U.S.S.R. in 1928) agreed well with the above description, but the medial pronotal setae were not observed in any of the 10 specimens examined. These specimens were generally in a poor condition (they were kept dry on cotton wool); with many setae broken off.

ERIOPELTIS GROUP

GEN. ERIOPELTIS

12. ERIOPELTIS ?FESTUCAE (FONSC.) (Figs 13 and 36)

Living specimens light reddish brown; short, slender, with comparatively long antennae and short legs; with many setae on body and appendages. When mounted, total body length 1360 - 1570 (1486)μ ; width at mesothorax 280 - 310 (293)μ. Wing expanse 2730 - 2920 (2820)μ.

Head: subconical in dorsal view; in lateral view flat, not obliquely elongated dorsoventrally, anterodorsal bulge not pronounced; length from apex to pronotal ridge 175 - 194 (190)μ, width across genae 182 - 201 (195)μ Median crest sclerotized, distinctly polygonally reticulated, with 6 - 9 (7.8) hair-like dorsal head setae. Midcranial ridge dorsally absent; ventrally reduced to a shorter or longer median bar without lateral arms; surrounding area sclerotized and showing distinct polygonal reticulation. Genae large, weakly sclerotized, with distinct polygonal reticulation; without setae. Eyes: two pairs, subequal; cornea of dorsal eyes 17 - 23 (20)μ in diameter and 3.3 - 4.2 (3.7) times as much apart; those of the ventral eyes 19 - 23 (21)μ in diameter and

1.5 - 1.9 (1.7) times as much apart. Ocellus small, situated on a distinct protuberance which overhangs the postocular ridge. Ocular sclerite well sclerotized, distinctly polygonally reticulated throughout. Preocular ridge long, the ridges of each side ventrally meeting or almost meeting each other medially. Postocular ridge well developed and distinct throughout. Interocular ridge broadly joining pre- and postocular ridges below ocellus. Dorsal ocular setae absent. Ventral head setae: 12 - 25 (18) f.s. and 7 - 17 (12) h.s., arranged in a broad band on anterior part of the ocular sclerite, usually also with some (0 - 2, av. 1.0) f.s. and some (0 - 3, av. 1.0) h.s. occuring in the area anterior to this sclerite, but with none between the eyes. Preoral ridge absent. Tendon-like apodeme absent or very short. Cranial apophysis of medium length; apex truncate or rounded, not reaching level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits present, situated anterolateral to mouth opening.

Antennae: 10 - segmented; filiform; 996 - 1060 (1018)μ long, i.e. longer than half body length (ratio 1: 1.37 - 1.52, av. 1.45) longer than posterior leg (ratio 1: 1.38 - 1.45, av. 1.41) and longer than penial sheath (ratio 1: 3.31 - 3.49, av. 3.41). Scape: 42 - 49 (47)μ long and 44 - 48 (46)μ

wide, with 3 h.s. Pedicel: with distinct, polygonal, dorsal reticulation; 49 - 69 (57)μ long and 38 - 42 (39)μ wide; with 2 - 5 (3.4) f.s., 3 - 7 (4.9) h.s. and a sensillum placodeum. Segment III somewhat club-shaped, with a rugose surface; 4.3 - 6.0 (5.0) times longer than wide (99-118, av. 113 μ long and 19 - 25, av. 22μ wide); with 3 - 9 (5.4) f.s. of medium length, 1.2 - 1.7 (1.4) times longer than width of segment, and with 1 - 3 usual sensilla basiconica. Segments IV - IX: cylindrical, rugose; lengths of these segments (in μ) 137 - 156 (148), 133 - 156 (145), 133 - 163 (146), 103 - 118 (III), 84 - 99 (90) and 72 - 87 (82) respectively, all of about the same width, varying from 19 to 23μ and with 13 - 21 (18), 19 - 23 (21), 20 - 32 (26), 18 - 27 (22), 13 - 25 (18) and 11 - 17 (15) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments not markedly different from f.s. Segment X: terminal part not constricted; 72 - 89 (80)μ long and 19 - 22 (20)μ wide; carrying 6 - 12 (9.1) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about $\frac{3}{4}$ as long as the segment and the 2 short ones about half as long as the f.s; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 448 - 502 (473)μ long.

Prothorax: Pronotal ridge strong, though medially interrupted by weak sclerotization. Lateral pronotal sclerites small, with an occasional f.s. occuring on or immediately behind them. Medial pronotal setae rarely present, pores absent. Posttergites small, without wavy striations and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, usually somewhat narrowed medially; median ridge sometimes complete but usually interrupted; triangular sclerite well sclerotized. Anteprosternal setae absent; prosternal setae consisting of 0 - 2 (0.7) f.s. occuring medially around anterior part of sternum.

Mesothorax: Mesoprephragma without emargination, Prescutum about 1½ times as wide as long (av. 125 and 81μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially but not reticulated. Scutum: Median membranous area: without reticulation; subrectangular, 61 - 72 (64)μ long and 1.47 - 2.00 (1.71) times as wide (width 99 - 122 av. 109μ); with 2 - 10 (6.0) h.s. Anterior arms of scutum not reticulated. Scutellum: 42 - 49 (45)μ long and 114 - 129 (122)μ wide, the ratio being 1: 2.5 - 3.0 (2.7) tabular, with ventral foramen of medium

size; setae absent. Postnotum with the anterior margin irregular, weakly sclerotized and not overlapped by metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with shallow emargination. Mesopleuron: Mesopleural ridge strong, but becoming weaker immediately above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum without polygonal reticulation; subepisternal ridge becoming broader ventrally, but below the membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron very small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 171μ wide and 128μ long, i.e. 1.74 - 2.19 (2.01) times longer than membranous area of scutum; median ridge sometimes complete but usually interrupted, the combined length more than half the length of the basisternum; marginal and precoxal ridges well developed. Setae absent. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesospiracular setae absent. Tegula small, its membranous bulge with a small weak sclerite posteriorly and with 2 - 6 (3.6) h.s. Third axillary wing sclerites with small,

rounded ventral projection at its base. Additional sclerite well sclerotized. Antemetastigmatal setae absent.

Metathorax: Metanotum with posterior margin thick and well developed throughout; suspensorial sclerites absent; a small sclerite sometimes present on each side anterior to postnotum. Postnotum consisting of a large, subtriangular sclerite on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: 8 - 11 (9.2) f.s. and 0 - 1 (0.3) h.s. Metasternal plate transverse, irregular; no sclerotization present in the area anterior to sternum. Anterior and posterior metasternal setae: 8 - 17 (12.4) and 7 - 15 (10.4) f.s. respectively.

Wings: hyaline; long (1240 - 1320, av. 1280μ) and narrow (width 400 - 460, av. 422μ) the ratio being 1: 2.87 - 3.15 (3.04); alar lobe and alar setae absent. Halteres absent.

Legs: short and moderately slender, with the fore legs the longest and either middle or hind legs the shortest; the ratio length of hind leg to body length is 1: 1.98 - 2.12 (2.05). Length

of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	53-68 (62)	76-84 (80)	186-194 (190)	258-293 (277)	110-125 (114)	29-34 (32)	726-775 (754)
II	61-68 (62)	72-80 (76)	171-190 (180)	251-274 (262)	106-122 (111)	27-32 (29)	695-751 (720)
III	61-68 (64)	72-78 (75)	167-186 (177)	251-274 (265)	99-108 (104)	30-32 (31)	686-731 (714)

Coxae: 7 - 15 f.s. and 9 - 15 h.s. on each coxa; fore coxa without coxal bristles apical setae long about as long as the trochanter. Trochanters 26 -30μ wide; with 6 oval sensilla, 5 - 12 f.s. and 7 - 11 h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and one long apical seta; the apical seta on the fore trochanter is 3.1 - 5.0 (4.1) times as long as the width of the trochanter Femora of medium width (34-42μ), the ratio width to length of hind femur being 4.0 - 4.9 (4.6) each with 6 - 14 fleshy and 14 - 32 hair-like setae. Tibiae: 21 - 25μ wide, the ratio width to length of hind tibia being 1: 10.3.- 13.1 (11.6) with 48 - 62 setae of which 30 - 52 are h.s. and 9 - 18 f.s. the latter setae about 1½ times as long as width of tibia apical spur of about the same size on all tibiae. Tarsi 19 - 23μ wide, hind tarsus 4.3 - 4.8 (4.6) times longer than wide; each with 0 - 3 f.s. and 21 - 30 h.s.; tarsal digitules subequal, slightly longer than claw.

Claws: long, about 1½ times as long as width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 470 - 600 (563)μ long and 250 - 300 (272)μ wide.

Segments I - VII: tergites absent; sternites consisting of transverse plates on all segments, these usually less well sclerotized medially. Caudal extension of 7th segment small, rounded and weakly sclerotized lateroventrally. Dorsal setae: 0 - 3 (0.8), 0 - 6 (2.5), 7 - 16 (9.7) 3 - 8 (4.9) 2 - 6 (3.4) and 2 - 6 (3.6) f.s. on the 2nd - 7th segments respectively, and usually with one h.s. on each side on the 1st and 4th - 7th segments. Pleural setae absent on 1st - 3rd segments, and on the 4th - 6th represented by h.s. only, which include the dorsopleural setae: sometimes one on the 4th and usually 2 on the 5th and 6th segments, and the ventropleural setae: usually one on each of the 5th and 6th segments. Segment VII with 1 - 8 (3.6) f.s. and 3 - 6 (4.8) h.s., some of the posterior h.s. somewhat longer than rest. Ventral setae: 2nd and 7th segments with 8 - 22 (14.3) 6 - 21 (13.1) 8 - 18 (10.8), 6 - 15 (12.2) and 9 - 15 (12.6) f.s. respectively. Hair-like setae: none on the 2nd, sometimes one on each side on

3rd and 4th, and usually 4 (4 - 5) on each of the 5th - 7th segments.

Segment VIII with irregular tergite and transverse sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about 4 - 6 times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: 1 - 4 (2.7) f.s. and occasionally one short or long h.s. Posterior margin with 3 h.s. on each side.

Genital segment: Penial sheath of medium length, about 1/5th total body length (ratio 1: 4.53 - 5.16 (4.95), 289 - 308 (300)μ long and 30 - 36 (34)μ wide, lateral sclerotizations narrowly joined anterior to anus; basal rod about $1\frac{1}{2}$ - 2 times as long as aedeagus, and extending anteriorly from the base of the latter for about $\frac{1}{2}$ - $\frac{3}{4}$ of the distance to the apex of the basal membranous area; apex of sheath without a membranous extension. The area from the base of the sheath to the tip of aedeagus with 25 - 36 (30.3) small setae; a cluster of small sensilla occuring ventrally near apex of sheath.

Aedeagus short (61 - 69, av, 65μ long) the penial sheath and the basisternum longer, the ratios being 1: 4.3 - 5.1 (4.7) and 1: 1.78 - 2.19 (1.99) respectively.

Material examined: 10 specimens, bred in the laboratory from material collected by myself on leaves of Festuca rubra at Imperial College Field Station, Silwood Park, Sunninghill, Berks; males emerged during September 1963; the species was found to be bivoltine in the field.

13. ERIOPELTIS SP. (Figs. 14 and 36)

Living specimens light reddish brown; short, slender with comparatively long antennae and short legs; with many setae on the body and appendages. When mounted, total body length 1510-1590 (1550) μ; width at mesothorax 260-290 (281) μ. Wing expanse 2730-2930 (2839) μ.

Head: subconical, in dorsal view; in lateral view flat, not obliquely elongated dorsoventrally, anterodorsal bulge not pronounced; length from apex to pronotal ridge 185-205 (199) μ, width across genae 182-198 (190) μ. Median crest sclerotized, distinctly polygonally reticulated, with 7-11 (9) hair-like dorsal headsetae. Midcranial ridge dorsally absent; ventrally reduced to a shorter or longer median bar with lateral arms, surrounding area sclerotized and showing distinct polygonal reticulation. Genae large weakly sclerotized, with distinct polygonal reticulation; without setae. Eyes: two pairs, subequal; corneae of dorsal eyes 19-25 (22) μ in diameter and 2.7-3.4 (3.0) times as much apart; those of the ventral eyes 19-25 (22) μ in diameter and 1.2-1.8 (1.4) times as much apart. Ocellus small, situated on a distinct protuberance which overhangs the post-ocular ridge. Ocular sclerite well sclerotized, distinctly polygonally reticulated throughout.

Preocular ridge long, the ridges of each side ventrally meeting or almost meeting each other medially. Postocular ridge well developed throughout. Interocular ridge broadly joining pre- and postocular ridges below ocellus. Dorsal ocular setae absent. Ventral head setae: 9-16 (13.1) f.s. and 5-9 (6.9) h.s. arranged in a broad band on anterior part of ocular sclerite, occasionally with some (0-3, Av. 0.7) f.s. and some (0-1, av. 0.5) h.s. occurring in the area anterior to this sclerite, but with none between the eyes. Preoral ridge absent. Tendon-like apodeme variable, occasionally fully developed, but usually reduced or absent. Cranial apophysis of medium length; apex trifurcate, extending to around the margin of the posterior level of the ventral eyes. Mouth opening irregular. Anterior tentorial pits present, situated anterolateral to mouth opening.

Antennae: 10-segmented; filiform; 10 30-1284 (1125) μ long, i.e. longer than half body length (ratio 1:1.23-1.51, av. 1.38), longer than posterior leg (ratio 1:1.42-1.52, av. 1.46) and longer than penial sheath)ratio 1:3.04-3.86, av.3.39), Scape: 44-53 (48) μ long and 45-50 (46) μ wide, with 3 h.s. Pedicel with distinct, polygonal, dorsal reticulation; 49-61 (55) μ long and 34-42 (37) μ wide; with 3-6 (4.2)

f.s, 1-5 (2.9) h.s. and a sensillum placodeum.

Segment III: somewhat clubshaped with a rugose surface; 4.0-4.9 (4.6) times longer than wide (99-125, av.114 μ long and 23-27, av.25μ wide); with 5-11 (7.7) f.s. of medium length, 1.3-1.7 (1.5) times longer than width of segment; with one or two usual sensilla basicona.

Segments IV - IX: cylindrical, rugose; lengths of these segments (in μ) 141-198 (162), 152-205 (171), 141-194 (159), 114-171 (135) 95-118 (106) and 84-95 (90) respectively, all of about the same width, varying from 19 to 23 μ, and with 14-23 (20), 20-30 (24), 19-28 (23), 14-23 (20), 14-20 (18) and 13-19 (16) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segment not distinctly different from the f.s.

Segment X: terminal part not constricted; 80-95 (86) μ long and 19-21 (19) μ wide; carrying 10-14 (11.5) f.s. 3 capitate subapical setae and 5 antennal bristles of which the three long ones are nearly half as long as the segment and the 2 short ones less than half as long as the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 448-486 (469) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, with an occasional fleshy lateral pronotal seta occurring immediately behind it. Medial

pronotal setae and pores absent. Posttergites very small, if present, derm irregularly striated, without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, usually narrowed medially; median ridge, only represented on anterior part of well sclerotized triangular sclerite. Anteprosternal setae absent; prosternal setae: 1-7 (4.2) f.s., occurring medially around anterior part of the sternum.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum about twice as wide as long (av.128 and 68 μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially but not reticulated. Scutum: Median membranous area: weakly polygonally reticulated; subrectangular, 65-76 (73) μ long and 1.47-1.79 (1.62) times as wide (width 106-129, av. 117 μ); with 4-10 (7.0) h.s. Anterior arms of scutum irregularly reticulated. Scutellum: 38-46 (41) μ long and 114-137 (127) μ wide, the ratio being 2.8-3.5 (3.1) tubular, with a small ventral foramen; without setae. Postnotum with anterior margin irregular, weakly sclerotized and not overlapped by metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma short, with

shallow emargination. Mesopleuron: Mesopleural ridge strong, but becoming weaker immediately above coxal articulation; pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum without polygonal reticulation; subepisternal ridge becoming broader ventrally, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron very small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 176 μ wide and 130 μ long, i.e. 1.68-1.96 (1.79) times longer than membranous area of scutum; median ridge reduced to a few vestiges of which the combined length is less than half the length of the basisternum; marginal and precoxal ridges well developed; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 1-5 (2.8) h.s. Third axillary wing sclerite with small, rounded ventral projection at its base. Additional sclerite well sclerotized. Ante metastigmatal setae absent.

Metathorax: Metanotum with posterior margin thickened throughout; suspensorial sclerite absent. Postnotum consisting of a large, subtriangular sclerite on each side. Metatergal setae: usually one h.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Episternum reduced to a small subtriangular plate, epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae: 5-13 (9.1) f.s. and 0-2 (0.4) h.s. Metasternal plate transverse, irregular; weak irregular sclerotization present in the area anterior to the sternum. Anterior metasternal setae: 14-23 (18.2) f.s. and 0-3 (0.5) h.s.; posterior metasternal setae: 8-15 (11.1) f.s.

Wings: hyaline; long (1255-1340, av.1303 μ) and narrow (width 395-430, av. 413 μ), the ratio width to length being 1: 3.02 - 3.29 (3.16): Alar lobe and alar setae absent. Halteres absent.

Legs: short and moderately slender, with the fore legs usually the longest and the middle pair shortest; the ratio length of the third leg to body length is 1:1.96-2.09 (2.04). Length of segments (in μ)

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	59-68 (61)	76-84 (79)	186-198 (191)	272-319 (292)	110-122 (116)	30-34 (33)	736-806 (772)
II	57-67 (60)	72-80 (75)	175-198 (183)	270-315 (291)	103-114 (109)	28-31 (29)	711-789 (748)
III	61-68 (66)	72-84 (76)	177-217 (183)	277-323 (296)	99-114 (106)	30-34 (32)	722-809 (758)

Coxae: with 6-9 (7.6), 10-13(12) and 13-18(16) f.s. on the fore, middle and hind coxa respectively, and each with 5-12 h.s; fore coxa without coxal bristles; apical seta long, about as long as the trochanter. Trochanters: 25-30 μ wide with 6 oval sensilla; 5-10 f.s. and 7-10 h.s., the latter including 2 minute setae near basal ridge, one small seta which, on the fore trochanter, is 3.0-3.6 (3.3) times as long as the width of the trochantter. Femora: of medium width 34-42 μ) the ratio width to length of hind femur being 4.4-4.7 (4.6); with 14-22 (18) f.s. and 17-20 (19) h.s. on the fore, 10-18 (14) f.s. and 13-15 (14) h.s. on the middle, and 11-15 (12) f.s. and 11-17(15) h.s. on the hind femur. Tibiae: 19-23 μ wide, the ratio width to length of hind femur being 1:12.2-14.2 (13.2) each with 42-58 setae of which 22-34 are h.s. and 17-33 f.s., the latter about 1½ times longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsus: 19-23

μ wide, hind tarsus 4.5-5.5 (4.9) times longer than wide; each with 2-8 f.s. and 13-25 h.s.; tarsal digitules subequal, somewhat longer than claw. Claws long, about 1½ times as long as width of tarsus; slightly curved, with a small denticle near tip; unequal digitules subequal, about as long as claw.

Abdomen: 520-600 (572) μ long, 240-300 (270) μ wide.

Segments I - III: a small tergite occasionally present on each side on anterior margin of the 2nd segment; sternites consisting of transverse plates on all segments, these usually less well sclerotized medially. Caudal extension of 7th segment small, rounded, weakly sclerotized lateroventrally. Dorsal setae: 0-2 (0.4), 0-3 (1.1), 3-10 (6.3), 3-10 (5.9), 2-5 (3.2) and 0-4 (2.5) f.s. on the 2nd - 7th segments respectively, and usually with one h.s. on each side on the 1st and each of the 4th - 7th segments. Pleural setae: absent on the 1st -3rd segments and on the 4th - 6th represented by h.s. only, which include the dorsopleural setae: usually one on 4th and 2 on the 5th and 6th segments, and ventropleural setae: occasionally one on the 5th and usually one on the 6th segment. Segment VII with 0-6 (2.8) f.s. and 5-7 (5.8) h.s., some of the posterior h.s. somewhat longer than rest. Ventral setae: 2nd - 7th segments with 10-18 (15), 7-16 (12), 7-13 (10), 7-14 (11), 7-12

(9) and 8-14 (11) f.s. respectively. Hair-like setae: none on the 2nd, usually one on each side of the 3rd and 4th, and usually 4 (range 3-5) on each of the 5th - 7th segments.

Segment VIII: with irregular tergite and transverse sternite; caudal extension forming a small, simple lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about 4-6 times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: 4-9 (5.8) f.s. and an occasional h.s. Posterior margin with 3-4 (3.1) h.s. on each side.

Genital segment: Penial sheath of medium length, about 2/9 - 1/5 total body length (ratio 1:4.5-4.9, Av. 4.7), 314-342 (332) μ long and 29-36 (32) μ wide; lateral sclerotizations narrowly joined anterior to amis; basal rod about 1½ times as long as aedeagus, extending anteriorly from base of aedeagus to between ½ and ⅔ of the length from the base of the latter to the apex of the basal membranous area; apex of sheath without membranous extensions. The area from base of sheath to tip of aedeagus with 27-37 (32) small setae; a cluster of small sensilla occurring ventrally near apex of sheath. Aedeagus short (68-80, av.75 μ long), penial sheath and basisternum longer, the ratios being 1:4.1-4.9 (4.5) and 1:1.57-1.94(1.74 respectively.

Material examined: 10 specimens, bred in the laboratory from material collected by myself on leaves of Agrostis tenuis Sibth. at Imperial College Field Station, Silwood Park, Sunninghill, Berks; males emerged during September, 1962; the species was found to be bivoltine in the field.

Comparative notes: This species can readily be separated from Eriopeltis festucae by the trifurcate apex of the cranial apophysis, the presence of lateral arms of the mid cranial ridge and the less developed median ridge of the mesosternum. In addition, the posttergital region, and the anterior arms and membranous area of the mesoscutum are weakly reticulated.

GEN. LUZULASPIS (Figs. 15 and 37)

14. LUZULASPIS LUZULAE (DUFOUR)

Living specimens light reddish brown; short, slender with comparatively long antennae and short legs; with many setae on the body and appendages. When mounted, total body length 1020-1290 (1141) μ; width at mesothorax 240-270 (255) μ. Wing expanse 2090-2350 (2213) μ.

Head: subconical in dorsal view, in lateral view flat, not obliquely elongated dorsoventrally, antero-dorsal bulge not pronounced; length from apex to pronotal ridge 148-179 (164) μ, width across genae 167-182 (175) μ. Median crest sclerotized, distinctly polygonally reticulated, with 7-10 (8.7) hair-like dorsal head setae. Midcranial ridge dorsally absent; ventrally reduced to a shorter or longer median bar with lateral arms, surrounding area not sclerotized, but showing distinct polygonal reticulation. Genae large, weakly sclerotized, with distinct polygonal reticulation, without setae. Eyes: two pairs, small, subequal; corneae of dorsal eyes 14-17 (15) μ in diameter and 4.0-4.5 (4.2) times as much apart; those of the ventral eyes 15-20 (16) μ in diameter and 2.2-2.5 (2.3) times as much apart. Ocellus small. Ocular sclerite well sclerotized, distinctly polygonally

reticulated throughout. Preocular ridges long, the ridges of each side ventrally meeting or almost meeting each other medially. Postocular ridge well developed, but tapering dorsally. Interocular ridge broadly joining pre- and postocular ridges below ocellus. Dorsal ocular setae absent. Ventral head setae: 11-30 (25) f.s. and 6-16 (10) h.s. arranged in a broad band on anterior part of ocular sclerite, frequently with some (0-6, av 2.6) f.s. occurring in the area anterior to the sclerite and occasionally with a seta just behind anterior level of eyes; a pair of median h.s. in the middle of the band distinctly longer than the rest. Preoral ridge absent. Tendon-like apodeme short. Cranial apophysis long; apex truncate, occasionally bifurcate, extending to around the level of the anterior margin of the ventral eyes. Mouth opening irregular. Anterior tentorial pits present, situated anterolateral to mouth opening.

Antennae: 10-segmented; filiform; 729-901 (822) μ long, i.e. longer than half body length (ratio 1:1.28-1.56, av. 1.39), longer than posterior leg (ratio 1:1.36-1.40, av. 1.38), and longer than penial sheath (ratio 1:4.36-5.02, av. 4.87). Scape: 36-46 (41) μ long and 36-40 (38) μ wide, with 3 h.s. and occasionally one f.s.

Pedicel: with weak, polygonal reticulation: 42-49 (45) μ long and 31-34 (33) μ wide; with 5-10 f.s., 1-5 (3.6) h.s., and a sensillum placodeum. Segment III: somewhat club-shaped, 3.0-3.7 (3.3) times longer than wide (68-84, av. 75 μ long and 23 μ wide); with 0-2 (0.7) h.s. and 1-6 (3.3) f.s., the latter of medium length, 1.2-1.6 (1.4) times longer than width of segment; with 1 or 2 usual basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 114-158 (131), 105-137 (122), 95-137 (118), 82-106 (97), 67-82 (74) and 57-72 (63) respectively, widths varying from 15 to 23 μ, with 9th segment somewhat wider than proximal ones; with 11-24 (18), 13-25 (20), 20-30 (23), 18-28 (22), 13-19 (16) and 12-20 (16) f.s., respectively, but no h.s.; antennal bristles on 8th and 9th segment not always distinctly different from the f.s. Segment X: terminal part not constricted; 46-61 (54) μ long and 19-23 (20) μ wide; carrying 4-14 (8) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about ¾ as long as the segment and the 2 short ones shorter than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 357-424 (387) μ long.

Prothorax: Pronotal ridge strong, though medially

interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae and pores absent. Posttergites small, weakly sclerotized, with irregular wavy strictions, without setae. Pleural structures typical for family. Sternum with transverse ridge narrowed medially, median ridge represented by a short basal stalk, and triangular sclerite weakly sclerotized, with lines arching latero-anteriorly from basal stalk; a small apophysis sometimes present anterior to this sclerite. Anteprosternal setae frequently absent, but sometimes up to 2 present on each side; prosternal setae 0-25 (14.4) but usually 12-21 f.s. and 0-1 (0.5) h.s. none of these occurring anterior to spiracles.

Mesothorax: Mesoprephragma short, with shallow emargination. Prescutum about twice as wide as long (av. 116 and 60 μ respectively); anterior margin curved; laterally bounded by strong prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially; polygonally reticulated. Scutum: Median membranous area: subrectangular: 48-72 (60) μ long and 1.42-1.92 (1.70) times as wide (width 97-114, av. 102 μ) with 3-8 (4.7) h.s. Anterior arms of scutum irregularly reticulated. Scutellum 29-34 (32) μ long and 95-114 (102) μ wide, the ratio

being 1:3.6-3.8 (3.4): tubular, with small ventral foramen; usually without setae. Postnotum with anterior margin irregular, weakly sclerotized, and partly overlapped by the metathoracic fold: postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma short with shallow emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed, the latter joined with episternum by a narrow basalare. Subalare small. Episternum without polygonal reticulation; subepisternal ridge broadening ventrally, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron very small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 163 μ wide and 91 μ long, i.e. 1.26-1.72 (1.52) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges. Setae absent. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae absent. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 1-5 (2.8) h.s. Third axillary wing sclerite with a small, rounded ventral projection at its base. Additional sclerite weak, but distinct. Antemetastigmatal

setae absent.

Metathorax: Metanotum with posterior margin thickened throughout; suspensorial sclerites absent. Postnotum large, transverse, weak or interrupted medially. Metatergal setae: one h.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae absent. Postmetastigmatal setae 6-14 (10) f.s. and 0-2 (0.7) h.s. Metasternal plate weak, but more heavily sclerotized around anterior margin. Anterior metasternal setae: 16-23 (19) f.s. and no h.s.; posterior metasternal setae: 7-19 (13) f.s.

Wings: hyaline; long (910-1050, av.969 μ) and narrow (295-360, av. 336 μ wide), the ratio width to length being 1:2.80-3.01 (2.90); alar lobe and alar setae absent. Halteres absent.

Legs: short and moderately slender, all 3 pairs subequal in size, the fore legs being only slightly shorter; the ratio length of hind leg to body length is 1:1.89-2.01 (1.98). Length of segments of leg (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	43-57 (49)	61-7[illegible] (65)	125-152 (140)	186-217 (203)	76-91 (82)	26-28 (27)	518-599 (566)
II	49-60 (54)	62-72 (69)	129-148 (139)	186-219 (206)	84-89 (86)	26-28 (27)	540-616 (578)
III	46-57 (52)	61-68 (65)	125-152 (140)	190-224 (209)	80-87 (84)	25-27 (26)	536-613 (577)

Coxae: with 10-17 f.s. and 10-18 h.s.; fore coxa without coxal bristles; apical seta long, about as long as trochanter. Trochanters: 21-24 μ wide; with 6 oval sensilla, 7-12 (9) f.s. and 7-9 (7.6) h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and a long apical seta which, on the fore trochanter, is 1.7-2.2 (1.9) times as long as width of trochanter. Femora: of medium width (30-34)μ the ratio width to length of hind femur being 1:4.1-5.0 (4.5): each with 8-16 f.s. and 9-17 h.s. Tibiae: 17-23 μ wide, the ratio width to length of hind tibia being 1:9.1-11.6 (10.5); each with 20-39 h.s. and 8-22 f.s., the latter about 1½ times longer than width of tibia: with apical spur of about the same size on all tibiae. Tarsi: 19-21 μ wide, hind tarsus 4.0-4.3 (4.2) times longer than wide; each with 2-6 f.s. and 17-23 h.s.; tarsal digitules subequal, slightly longer than claw. Claws distinctly longer than width of tarsus, slightly curved, with a small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 350-505 (430) μ long and 200-260 (227) μ wide.

Segments I - VII: tergites represented by a weak sclerite on or near anterior margin of each segment; sternites consisting of a weak transverse sclerite on the 2nd and 3rd segments, a small sclerite on each side of the 5th and 6th, and a transverse plate on the 7th segment. Caudal extension of 7th segment small, rounded and weakly sclerotized latero-ventrally. Dorsal setae: f.s. occasionally present on the 1st (0 - 2, av. 0.6) and 5th - 7th segments (up to 3); usually one h.s. on the 1st and on each of the 4th - 7th segments. Pleural setae: absent on the 1st, 2nd and usually on the 3rd segments, on the 4th to 6th segments consisting of dorsopleural setae: usually 2 h.s. on each of the 4th - 6th segments, and ventropleural setae: usually one h.s. and occasionally one f.s. on the 5th and 6th segments. Segment VII with 4-11 (8) f.s. and 3-5 (4) h.s., some of the posterior h.s. somewhat longer than rest. Ventral setae: 3-14 (9), 3-14 (9), 0-9 (3.7) 0-7 (2.6), 0-6 (3.3) and 1-9 (4.9) f.s. respectively; h.s.: none on the 2nd, usually one on each side on the 3rd and 4th, and usually 4 on each of the 5th - 7th segments.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a small simple lobe; glandular pouch absent, replaced by a shallow depression and one long pointed seta. No 9th tergite observed. Ante-anal setae absent, but 2-6 (3.9) small, circular pores. Posterior margin with 2-4 (3.0) h.s. on each side, one of these situated more laterally on convex bulge.

Genital segment: Penial sheath short, about 1/6th to 1/7th total body length (ratio 1:6.1-7.3, av. 6.7) 152-186 (173) μ long and 30-38 (34) μ wide; lateral sclerotizations narrowly joined anterior to anus; basal rod about as long as aedeagus, extending anteriorly from the base of the aedeagus to between ½ and ¾ of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 18-26 (22) small setae; a cluster of small sensilla occurring ventrally near apex of sheath; Aedeagus short (40-53, av. 46 μ long), penial sheath and basisternum longer, the ratios being 1:3.2-4.3 (3.8) and 1:1.57-2.29 (1.97) respectively.

Material examined: 10 specimens, bred in the laboratory from material collected by myself on Luzula

campestris (L.) at the Imperial College Field Station, Silwood Park, Sunninghill, Berks., males emerged during May, 1962; the species was found to be bivoltine in the field.

INGLISIA GROUP

GEN. INGLISIA

15. INGLISIA THEOBROMAE NEWST. (Figs. 16 and 38)

A medium-sized and moderately robust species, with comparatively long antennae and moderately long legs; with numerous setae on the body and appendages. When mounted, total body length 1610-1790 (1710) μ; width at mesothorax 370-420 (399) μ. Wing expanse 2870-3270/3032) μ.

Head: subconical in dorsal view; in lateral view obliquely elongated, with the anterodorsal bulge somewhat pronounced; length from apex to pronotal ridge 209-262 (245) μ, width across genae 251-277 (266) μ. Median crest well sclerotized, especially around the posterior margin which is obtuse; weakly polygonally reticulated; with 4-11 (7.2) fleshy and 10-14 (13) hair-like dorsal head setae. Midcranial ridge: dorsally absent; ventral part with median bar reduced posteriorly, the lateral arms widely diverging, and the surrounding area weakly sclerotized and reticulated. Genae large sclerotized, not reticulated; each with 5-11 (7.0) fleshy and 0-4 (1.2) hair-like genal setae. Eyes: four pairs; dorsal and ventral pairs large, subequal; lateral pairs large, only slightly smaller than dorsal and ventral

eyes, subequal; corneae of dorsal eyes 32-37 (35) μ in diameter and 1.6-2.1 (1.8) times as much apart; those of the ventral eyes 30-36 (34) μ in diameter and 0.6-0.8 (0.7) times as much apart. Ocellus small. Ocular sclerite weakly sclerotized; reticulated only dorsally and between and anterior to the ventral eyes. Preocular ridge with ventral part not extending far below articular process. Postocular ridge well developed throughout; below the ocellus the ridge splits up, completely enclosing the ocellus. Inter-ocular ridge absent, apparently represented by a small posteriorly directed process below the articular process of the preocular ridge. Dorsal ocular setae: on each side 0-3 (1.7) f.s. and occasionally one h.s; ventral head setae: 18-27 (23) f.s. and 7-11 (9) h.s., of which 1-4 (2.0) f.s. and 0-3(1.1) h.s. occur anteriorly, around the midcranial ridge, and 1-4 (3.0) f.s. and 0-2 (1.0) h.s. between and behind the ventral eyes. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis of medium length; apex bifurcate, not reaching level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 903-1047 (986) μ long, i.e. longer than half body length (ratio 1:1.67 - 1.82, av 1.73), longer than posterior

leg (ratio 1:1.07-1.13, av. 1.10) and longer than penial sheath (ratio 1:2.53-2.78, av. 2.66). Scape: 46-53 (47) μ long and 49-53 (51) μ wide, with 3 h.s. Pedicel not reticulated, 38-48 (43) μ long and 34-38 μ wide, with 1-4 (2.6) f.s., 4-9 (6.3) h.s. and a sensillum placodeum. Segment III somewhat club-shaped, 3.6-4.5 (4.0) times longer than wide ; with 1-4 (2.2) h.s. and 6-12 (10.1) f.s., the latter of medium width, 0.8-1.1 (0.9) times as long as width of segment; with 1-3 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 114-141 (127), 114-137 (127), 125-152 (138), 116-129 (120), 89-122 (105) and 76-95 (82) respectively, all of about the same width, varying from 17 to 25 μ; with 22-25 (24), 22-30 (25), 22-34 (28), 20-28 (24), 17-27 (21) and 15-21 (17) f.s., respectively, and occasionally each with one or two h,s.; postapical setae on 8th and 9th segments distinctly thicker than f.s. Segment X: terminal part not constricted; 76-97 (90) μ long and 42-46 (43) μ wide; carrying 9-16 (12.5) f.s., 2 capitate subapical setae and 5 antennal bristles of which the 3 long ones are less than half as long as the segment and the 2 shorter ones not distinctly different from the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 562-635 (600) μ long.

Prothorax: Pronotal ridge strong but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without seta. Medial pronotal setae: occasionally one or two h.s. Posttergites very small, without striations and without setae. Pleural structures typical for the family. Sternum with transverse ridge strong, median ridge reduced to a short basal stalk and triangular sclerite bearing numerous small projections. Anteprosternal setae absent; prosternal setae: 5-11 (7.8) f.s. and 0-2 (0.9) h.s., the setae not occurring in front of spiracles.

Mesothorax: Mesopostphragma with shallow emargination. Prescutum about twice as wide as long (av. 171 and 90 μ respectively); anterior margin almost straight; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially but not reticulated. Scutum: Median membranous area: subrectangular; 61-80 (70) μ long and 2.10-2.88 (2.51) times as wide (width 156-179, av. 171 μ); with 3-15 (6.6) f.s. and 7-15 h.s. Scutellum: 53-80 (70) μ long and 144-175 (163) μ wide, the ratio being 1:2.1-2.9 (2.4); not tubular. Postnotum with anterior margin irregular and usually partly overlapped by

the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation. Pleural apophysis and pleural wing process well developed, the latter connected with episternum by a narrow basalare. Subalare small. Episternum not reticulated; subepisternal ridge well developed but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 253 μ wide and 162 μ long, i.e. 2.00-2.63 (2.33) times longer than membranous area of scutum; median ridge almost completely absent, represented by somewhat darker sclerotization medially which sometimes appears ridge-like over short distances; bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae: 20-28 (24) f.s. and 0-3 (1.0) h.s. arranged in a band behind the spiracles and prosternum. Tegula small, membranous bulge with a weak sclerite posteriorly with 2-6 (4.2) h.s. and occasionally one f.s. Third axillary wing sclerite with a small ventral projection at its base.

Additional sclerite well defined. Antemetastigmatal setae: 1-6 (3.8) f.s.

Metathorax: Metanotum with anterior margin strong medially; suspensorial sclerites absent; a small sclerite occasionally present anterior to postnotum. Postnotum consisting of two narrow, transverse sclerites in a tandem arrangement on each side. Metatergal setae: 0-2 (0.7) f.s. and 0-2 (0.8) h.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a subtriangular plate. Epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 1-8 (3.6) f.s. and 0-2 (0.3) h.s. Postmetastigmatal setae: 6-11 (8.2) f.s. and 0-5 (1.7) h.s. Metasternum represented by a transverse plate. Anterior metasternal setae: 13-24 (19) f.s. and 0-3 h.s. Posterior metasternal setae: 5-16 (8.4) f.s.

Wings: hyaline; of medium length (1270-1370, av. 1333 μ) and width (540-580, av. 561 μ), the ratio width to length being 1:2.33-2.45 (2.38); alar lobe and alar setae absent. Halteres absent.

Legs: moderately long and slender, with the middle pair shortest and the fore or hind pair longest; the ratio length of hind leg to body length is 1:1.87-1.98 (1.91) Length of segments (in μ):

	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57-61 (60)	68-84 (80)	224-255 (239)	308-369 (339)	133-164 (148)	20-25 (22)	821-952 (888)
II	57-67 (64)	65-76 (71)	201-232 (217)	285-338 (315)	150-175 (169)	23-27 (24)	787-901 (860)
III	61-72 (67)	73-84 (79)	201-232 (219)	304-357 (333)	160-179 (173)	25-29 (26)	827-937 (896)

Coxae: inner surface of front coxa with small projections; with 3-7 (5.0) f.s. on the fore and 14-21 on the middle and hind coxa, and both with 6-12 h.s.; fore coxa without coxal bristles; apical seta about ¾ as long as the trochanter. Trochanters: 23-29 μ wide; with 6 oval sensilla, 7-15 f.s. and 6-9 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long epical seta which, on the fore trochanter is 2.0-2.4 (2.3) times as long as width of trochanter. Femora: of medium width (36-44 μ) the ratio width to length of hind femur being 1:4.8-5.4 (5.2); each with 18-33 f.s. and 13-25 h.s. Tibiae: 22-26 μ wide, the ratio width to length of hind tibia being 1: 12.9-15.7 (14.0); with 64-99 setae of which 20-35 are h.s. and 39-68 f.s; the latter about as long as width of tibia; apical spur on fore tibia short, about half as long as on the other tibiae. Tarsi: 19-27 μ wide, and tarsus 6.4-7.8 (7.2) times

longer than wide; each with 12-28 f.s. and as many h.s.; tarsal digitules subequal, about as long as claw. Claws: of medium length, about as long as width of tarsus, ungual digitules subequal, about as long as claw.

Abdomen: 490-610 (558) μ long and 320-420 (380) μ wide.

Segments I - VIII: tergites on the 2nd and 3rd segments represented by three small sclerites on the anterior margin - one medially and one on each side, and on the 4th segment by a small median sclerite. Pluerally a band of sclerotization extends from the 4th - 7th segments, with a separate small sclerite situated ventral to this band on each of the 4th - 7th segments. Sternites on the 2nd - 7th segments represented by a transverse plate, which is weak or interrupted medially. Caudal extension of 7th segment small, rounded. Dorsal setae: sometimes one or two f.s. on the 1st segment; usually one h.s. on each side on the 1st and each of the 5th - 7th segments, occasionally also a single h.s. on the 2nd - 4th segments. Pleural setae consisting of dorsopleural setae: 0-3 (0.5), 0-2 (0.6) and 0-2 (0.8) f.s. on the 3rd and 6th segments and 0-1 (0.7) 1, 1, 1-2 (1.2) 0-2 (1.3) and 1-3 (1.8) h.s. on the 1st - 6th segments respectively, and of ventropleural setae: 0-1 (0.4), 0-3 (1.5) and 0-5

(2.1) f.s. on the 4th - 6th segments and 0-1 (0.4), 0-1 (0.5), 1-2 (1.2), 0-1 (0.9) and 1 h.s. on the 2nd - 6th segments respectively. Segment VII with 3-9 (5.4) f.s. and 1-6 (3.7) h.s. Ventral setae: 2-15 f.s. on each of the 2nd - 7th segments; usually 4 h.s. on each of the 2nd-5th, and 2 median ones on the 6th and 7th segments.

Segment VIII with small tergite and transverse sternite, the latter carrying 7-15 (11) f.s; glandular pouch with 2 very long pointed setae, the protruding part of these being 4 - 6 times as long as the section within the pouch. No 9th tergite observed. Ante-anal setae: occasionally one or two f.s. and 0-4 (1.5) small h.s. present. Posterior margin with 2-3 (2.6) f.s. on each side.

Genital segment: Penial sheath of medium length about 1/5th total body length (ratio 1:4.30-4.86, av. 4.60), 353-380 (371) μ long and 34-40 (37) μ wide; lateral sclerotizations not joined anterior to anus; length of basal rod about 2/5ths of aedeagus and extending anteriorly from the base of the aedeagus for 3/5 - ¾ of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 28-44 (35) small setae; a cluster of small sensilla occurring ventrally near apex of sheath. Aedeagus long (350-38

av. 371 μ), penial sheath longer and basisternum shorter, the ratios being 1:1.9-2.1 (2.0) and 1:0.72-0.93 (0.85), respectively.

Material examined: 10 specimens, collected by G. de Lotto on Pelargonium sp. at Limuru, Kenya on 16.1.63.

Comparative notes: A number of the peculiarities of this species are shared by Ceroplastodes chiton Green, of which 3 imperfect specimens were available. The most striking of these are: the presence of 4 large simple eyes, the numerous projections on the prosternum, the absence of the median ridge of the mesobasi sternum, the presence of a pleural band of sclerotization on the abdomen and the presence of numerous f.s. (about 18 in C.chiton) on the 8th abdominal sternite. In addition, C.chiton also has f.s. on all the regions of the head and prothorax, on the membranous area of the mesoscutum and all the regions of the metathorax and abdomen; the setae of the glandular pouch are also very long, the protruding part being about 4 times as long as the section within the pouch.

C.chiton differs from I.theobromae in the following respects: the midcranial ridge is reduced to a Y shaped sclerotized area ventrally, and sometimes represented dorsally by a short median ridge on the posterior part

of the median crest; the postocular ridge is missing behind the ocellus; a number of f.s. are situated beyond the posterolateral corners of the median membranous area; the anterior margin of the mesopostnotum is exposed; the tegular bulge carries a large number (more than 5) f.s.; the postnotum is represented by a single transverse sclerite; the 8th abdominal segment carries about 10 f.s.; the apical spur of the tibia is about the same size on all 3 tibiae.

The antennae of C.chiton were not available.

The specimens of C.chiton were collected by G. Charles on Carica papava in Port Moresby, New Guinea on 23.7.59, and received from D.J. Williams.

COCCUS GROUP

GEN. COCCUS

16. COCCUS HESPERIDUM L. (Figs. 17 and 39)

A short, slender species with comparatively short antennae and long legs; with numerous setae covering the body and appendages. When mounted, total body length 1380-1520 (1450) μ; width at mesothorax 280-330 (309) μ. Wing expanse 2200-2650 (2446) μ.

Head: subconical in dorsal view; in lateral view obliquely elongated, with anterodorsal bulge pronounced; length from apex to pronotal ridge 198-239 (216) μ, width across genae 186-205 (196) μ. Median crest sclerotized and distinctly polygonally reticulated; with numerous fleshy dorsal head setae and 5-9 (6.8) hair-like ones. Midcranial ridge dorsally absent; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. Genae large, sclerotized, with polygonal reticulation; each with 19-29 (23) fleshy and 3-7 (4.9) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 21-32 (27) μ in diameter and 1.0-2.1 (1.3) times as much apart. Ocellus small. Ocular sclerite well sclerotized dorsally and laterally, but weak ventrally except

for an area around the eyes; polygonally reticulated throughout. Preocular ridge extending only a short distance below articular process. Postocular ridge well developed throughout; dorsal and ventral to the ocellus the ridge usually splits up, with the anterior branch partly surrounding ocellus. Interocular ridge absent, although the area between ocellus and preocular ridge is strongly sclerotized. Dorsal ocular setae: 2-8 (4.9) f.s. and 0-4 (1.6) h.s. on each side. Ventral head setae: 75-98 (83) f.s. and 3-4 (3.8) h.s.; scattered over the ocular sclerite, always with some (9-14, av. 12) f.s. occurring in front of this sclerite and with 8-16 (12) f.s. between and behind the eyes. Preoral ridge present. Tendon-like apodeme long, Cranial apophysis long; apex deeply bifurcate, extending to around anterior level of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 576-732 (663) μ long, i.e. shorter than half body length (ratio 1:2.01-2.63, av. 2.26), shorter than posterior leg (ratio 1:0.58-0.74, av. 0.69) and longer than penial sheath (ratio 1:2.10-2.43, av. 2.27). Scape: 38-46 (43) μ long and 27-31 (30) μ wide, with 3-4 (3.1) h.s. Pedicel with wavy striation dorsally; 46-53 (50) μ long and 27-33 (31) μ wide, with 6-13 (9.7) f.s., 2-7 (4.2) h.s. and with a sensillum placodeum. Segment

III somewhat club-shaped, 3.0-3.7 (3.3) times longer than wide (57-72, av. 60 μ long and 19-21, av. 20 μ wide); with 10-13(11) f.s. of medium length; 1.3-1.8 (1.5) times longer than width of segment; with 1-3 usual sensilla basiconica. Segments IV to IX: cylindrical; lengths of these segments (in μ) 84-103 (95), 68-91 (81), 49-76 (67), 68-84 (75), 53-76 (62) and 55-68 (60) respectively, widths varying from 15 to 21 μ, with distal segments slightly wider than proximal ones; with 20-25 (22), 18-25 (22), 12-23 (18) 19-23 (20), 15-21 (18) and 13-20 (17) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments distinctly larger than the f.s. Segment X: terminal ½ - ⅔ constricted; 57-78 (69) μ long and 49-55 (52) μ wide (near base); carrying 6-9 (7.5) f.s. 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about as long as the segment and the 2 short ones about half as long as the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 448-540 (516) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae:

2 h.s.; widely separated, with 0-1 (0.4) circular pores near each. Posttergites relatively large, with irregular wavy striation and with 4-13 (8.3) fleshy posttergital setae occurring on or behind the sclerite on each side. Pleural structures typical for the family. Sternum with strong transverse and median ridge and a small oval sclerite; the area on each side of the median ridge showing distinct polygonal reticulation. Anteprosternal setae: 1-4 (3.2) f.s. scattered over the sternal area and spreading into the area anterior to the spiracles, and usually with one h.s. (0-2, av.0.9) on each side of median ridge.

Mesothorax: Mesoprephragma with deep emargination. Prescutum about twice as wide as long (av. 159 and 83μrespectively; anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially; with dense irregular reticulation. Scutum: Median membranous area: subrectangular, 99-125 (116) μ long and 1.23-1.37 (1.30) times as wide (width 135-160, av.146 μ); with 16-32 (24) f.s. and 11-15 (13) h.s. Scutellum: 34-42 (38) μ long and 141-160 (154) μ wide, the ratio being 1:3.8-4.2 (4.0); tubular with a small ventral foramen; setae absent. Postnotum with anterior margin weakly

sclerotized, irregular and exposed; postnotal apophysis and postalare well developed, the latter densely reticulated distally and without setae. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare vestigial, incorporated into pleural wing process, not joining the latter with episternum. Subalare small. Episternum showing irregular reticulation dorsally and polygonal reticulation ventrally; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite not bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 182 μ wide and 147 μ long, i.e. 1.20-1.35 (1.27) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae numerous, consisting of 52-75 (61) f.s., arranged in a broad band behind the spiracles and prosternum, and with a few on the episternae. Tegula small, membranous bulge with a small, weak selerite posteriorly and with 2-6 (4.2) h.s. Third axillary wing sclerite with a small, pointed, ventral projection

at its base. Additional sclerite small, well sclerotized: Antemetastigmatal setae: 3-4 (3.6) f.s.

Metathorax: Metanatum with posterior margin strong medially; suspensorial sclerites absent; Postnotum consisting of a small sclerite on each side. Metatergal setae: 1-5 (3.1) f.s., and usually one (0-2, av. 1.0) h.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a small sub-triangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 10-18 (15) f.s. and occasionally one h.s. Postmetastigmatal setae: 8-14 (12) f.s. and usually one h.s.; some f.s. occurring anterior to rest, close behind spiracles. Metasternal plate weak and irregular, but more heavily sclerotized anteriorly. Anterior and posterior metasternal setae: 39-54 (45) and 12-26 (19) f.s. respectively.

Wings: hyaline; of medium length (980-1200, av. 1097 μ), but comparatively broad (width 430-520 av. 481 μ), the ratio width to length being 1:2.19-2.31 (2.27); alar lobe and alar setae absent. Halteres absent.

Legs: long and slender, with the fore pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1:1.58-1.65 (1.62).

Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	38-49 (46)	57-72 (66)	171-200 (190)	291-369 (341)	117-152 (136)	17-18 (17.5)	692-850 (795)
II	69-80 (75)	76-84 (81)	163-190 (180)	293-350 (322)	127-148 (140)	17-19 (18)	749-864 (814)
III	76-84 (81)	76-87 (84)	178-203 (191)	342-395 (369)	141-160 (152)	19-20 (19.5)	834-943 (895)

Coxae: with 10-15 (12) f.s. on the fore and 16-29 on the middle and hind coxa, and each with 7-10 (7.8) h.s.; fore coxa with 2-3 (2.3) knobbed coxal bristles; apical seta about ⅔ as long as trochanter. Trochanters: 19-23 μ wide, with 6 oval sensilla, 9-15 f.s. and 5-7 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and one long apical seta which, on the fore trochanter, is 1.2-1.4 (1.3) times as long as width of trochanter. Femora: very slender, 27-34 μ wide, the ratio width to length of hind femur being 1:6.1-6.7 (6.4); with 27-46 f.s. and 8-14 h.s. Tibiae: 17-21 μ wide, the ratio width to length of hind tibia being 1:18.0-20.8 (19.1); with 89-114 setae of which 17-28 are h.s. and 89-114 f.s., the latter about twice as long as width of tibia:

with apical spur of about the same size on all tibiae. Tarsi: 17-21 μ wide, hind tarsus 7.8-8.4 (8.2) times longer than wide; with 24-42 f.s. and 13-23 h.s.; tarsal digitules subequal, somewhat longer than claw. Claws: of medium length a little longer than width of tarsus; slightly curved, with very small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 400-490 (448) μ long, 230-290 (263) μ wide.

Segments I - VII: tergites present on the 2nd segment only, represented by 3 small sclerites on anterior margin, one medially and one on each side; sternites represented by transverse plates on the 2nd, 3rd, and 5th - 8th segments. Caudal extension of 7th segment large, reaching or extending beyond the level of the posterior margin of the 8th segment, tapering, weakly sclerotized. Dorsal setae: up to 8, 7, 9, 7, 6 and 3 f.s. on the 1st - 6th segments respectively, but none on the 7th; usually one h.s. on each side of the 1st and each of 4th - 7th segments. Pleural setae consisting of dorsopleural setae: 4-12 (8.1), 2-7 (4.4), 6-9 (7.5) 5-9 (6.4), 3-8 (4.8) and 1-6 (3.9) f.s. on the 1st - 6th, and 0-1 (0.5), 0-3 (1.6), 1-3 (2.4), 2-4 (2.4) and 0-3 (1.6) h.s. on

the 2nd to 6th segments respectively, and of ventropleural setae (sometimes difficult to separate from dorsopleural group): usually one f.s. on the 2nd and 3rd and up to 5 on the 4th - 6th segments, and usually one h.s. on the 4th - 6th segments. Segment VII with 16-17 (16) f.s. and 4-6 (5.3) h.s; some of the posterior h.s. usually longer than rest. Ventral setae: 16-21 (17), 14-26 (20), 11-25 (16), 12-23 (16), 8-17 (11) and 5-12 (9) f.s. on the 2nd - 7th segments respectively; usually one h.s. on each side on the 3rd and 4th and 4 on each of the 5th - 7th segments.

Segment VIII: with a weak tergite and transverse sternite; caudal extension forming a sclerotized cylindrical lobe with a large, weakly reticulated membranous cicatrice posteriorly on the lobe; glandular pouch with 2 long, pointed setae, the protruding part of these being about 4¾ - 6 times as long as the concealed section. Small 9th tergite present. Ante-anal setae: usually 2 strong h.s. Posterior margin with 2-3 (2.9) h.s. on each side.

Genital segment: Penial sheath of medium length, about 1/5th total body length (ratio 1:4.8-5.1, av. 4.9), 274-308 (296) μ long and 30-34 (32) μ wide; lateral sclerotizations narrowly joined anterior to anus; length of basal rod about 1¾ times that of

aedeagus for about ⅔ - ¾ of the distance to the apex of the basal membranous area; apex of sheath with a small but distinct membranous extension. The area from base of sheath to tip of aedeagus with 15-23 (20) small setae; a cluster of small sensilla occurring ventrally near apex. Aedeagus short (57-67, av. 62 μ long), penial sheath and basisternum longer, the ratios being 1:4.5-5.3 (4.8) and 1:2.12-280 (2.39) respectively.

Material examined: 9 specimens, 4 from Laurus nobilis, collected in Leningrad, U.S.S.R., on 11.6.60 and 5 from "citrus", collected in Leningrad on 3.11.61; both samples received from N.S. Borchsenius.

17. GEN. B (nr. PULVINARIA) SP. (Figs. 18 and 40)

A moderately long, slender species with comparatively short antennae and long legs; with numerous setae covering the body and appendages. When mounted, total body length 1960-2100 (2044)μ; width at mesothorax 3440-3560 (3515)μ.

Head: subconical in dorsal view; in lateral view dorsoventrally elongated, with anterodorsal bulge pronounced; length from apex to pronotal ridge 289-308 (301)μ; width across genae 353-385(266)μ. Median crest sclerotized and distinctly polygonally reticulated; with numerous (10-22, av.16) fleshy dorsal head setae and 6-9 (7.1) hair-like ones. Midcranial ridge: dorsally absent; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. Genae large, sclerotized, with polygonal reticulation; each with 12-24 (17) fleshy and 3-8 (4.0) hair-like genal setae. Eyes : two pairs, subequal; corneae of dorsal eyes 27-30 (28)μ in diameter and 1.5-2.3 (1.9) times as much apart; those of the ventral eyes 27-30 (29)μ in diameter and 1.0-1.8 (1.4) times as much apart. Ocellus small. Ocular sclerite well sclerotized dorsally and laterally, but weak ventrally; polygonally reticullated throughout. Preocular ridge extending only a very short distance below articular process. Postocular ridge well developed throughout; below ocellus the ridge splits up with the anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae : 1-4 (2.3) f.s. and 1-4 (2.3) h.s. on each side. Ventral head setae

45-78 (62)f.s. and 3-8 (5.4) h.s., scattered over the ocular sclerite, always with some (3-8, av.5.4)f.s. occurring in front of this sclerite and with 1-8 (4.8) between and behind the eyes (when present in small numbers situated well behind the level of the anterior margin of the eyes). Preoral ridge present. Tendon-like apodeme long. Cranial apophysis long; apex deeply bifurcate, extending to around the level of the anterior margin of the ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 979-1094 (1028)μ long; i.e. about half body length (ratio 1: 1.86-2.13, av. 1.99), shorter than posterior leg (ratio 1 : 0.77-0.82, av. 0.79) and longer than penial sheath (ratio 1:2.67-3.13, av. 2.94). Scape: 57-61 (60)μ long and 40-45 (42) μ wide, with 3 h.s. Pedicel: with distinct polygonal dorsal reticulation; 65-72 (70)μ long and 40-45 (42)μ wide, with 9-13 (12)f.s., 3-6 (4.7)h.s. and a sensillum placodeum. Segment III somewhat club-shaped, 2.6-3.1 (2.8) times longer than wide (68-84, av. 78μ long and 27-30, av. 28μ wide), with 11-17 (13) f.s. of medium length, 1.6-2.3 (1.9) times longer than width of segment; with 1-3 usual sensilla basiconica.

Segments IV-IX cylindrical; lengths of these segments (in μ) 205-228 (218), 137-171 (153), 98-129 (113), 95-118 (104), 72-91 (82) and 65-80 (73) respectively, widths varying from 21 to 27 μ, with distal segments slightly wider than proximal ones; with 38-49 (42), 28-35 (32), 24-31 (27), 22-33 (26), 17-25 (21) and 15-19 (17) f.s. respectively, but no h.s. ; antennal bristles on 8th and 9th segments distinctly larger than f.s. Segment X : terminal $\frac{1}{3}$ constricted;

72-95 (81)μ long and 24-27 (25)μ wide (near base); carrying 4-8 (6.1) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about as long as segment and the 2 shorter ones about as long as f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 730-779 (755)μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites medium-sized, without setae. Medial pronotal setae occasionally present, consisting of 0-2 (0.6) f.s. and 0-2 (0.6) h.s.; 2-5 (3.6) circular pores present on each side posterior to pronotal sclerite. Posttergites relatively large, with irregular wavy striation and usually with some (0-3, av. 1.4) fleshy posttergital setae on each side, occurring on or behind the sclerite. Pleural structures typical for the family. Sternum with strong transverse ridge, a strong but interrupted median ridge, and an oval-shaped sclerite. Anteprosternal setae : 1.3 (2.4) f.s. on each side; prosternal setae : 15-28 (21)f.s., scattered over the sternal area and spreading into the area anterior to the spiracles, and usually one (0-2, av. 1.0)h.s. on each side of median ridge.

Mesothorax : Mesoprephragma with deep emargination. Prescutum about 1¾ times as wide as long (av. 219μ and 121μ respectively); anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially; with dense irregular reticulation. Scutum: Median membranous area: subrectangular; 152-169 (157)u long and 1.40-1.53 (1.45) times as wide (width 213-243, av. 227μ); with 7-18

(11)f.s. and 14-22 (18) h.s. Scutellum: 65-72μ long and 220-247 (229)μ wide, the ratio being 1:3.1-3.8 (3.4); tubular, with small ventral foramen; setae absent. Postnotum: with anterior margin weakly sclerotized, and usually regular and exposed; postnotal apophysis and postalare well developed, the latter densely reticulated distally and without setae. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare vestigial, incorporated into pleural wing process, not joining the latter with episternum. Subalare small. Episternum showing irregular reticulation dorsally and polygonal reticulation ventrally; subepisternal ridge well developed, but below membranous cleft in distinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite not bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 268u wide and 228u long, i.e. 1.39-1.53 (1.45) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; with 2-9 (5.4)f.s. posteriorly on or near median ridge. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae numerous, consisting of 50-87 (66) f.s., arranged in a broad band behind the spiracles and prosternum, often with a few on the episternae. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 2-6 (3.1) h.s. Third axillary wing sclerite with a small, pointed, ventral projection at its base. Additional sclerite small, well sclerotized. Antemetastigmatal setae: 2-4 (3.1) f.s.

Metathorax: Metanotum with posterior margin usually strong medially; suspensorial sclerites absent; occasionally a small sclerite visible anterior to postnotum. Postnotum consisting of 2 small sclerites, one on each side. Metatergal setae: usually 2 h.s. on each side, one laterally and one more medially, and usually with one (0-3) f.s. near the lateral h.s. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 9-19 (13) f.s. and in one case 2 h.s. Postmetastigmatal setae: 14-23 (18) f.s. and usually one (0-2) h.s., one or more f.s. occurring anterior to rest, close behind spiracle. Metasternal plate weak and irregular, but more heavily sclerotized anteriorly. Anterior metasternal setae: 47-78 (63) f.s. and occasionally one h.s., posterior metasternal setae: 18-41 (27) f.s.

Wings: hyaline; of medium length (1540-1600, av. 1571 μ, but comparatively broad (720-780, av. 763 μ wide), the ratio width to length being 2.03-2.14 (2.06); alar lobe and alar setae absent. Halteres absent.

Legs: long and slender, with the fore pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1:1.51-1.63 (1.56). Length of segments (in μ):

Legs	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	65-80 (74)	76-89 (84)	304-334 (317)	498-536 (516)	194-217 (203)	25-30 (28)	1180-1286 (1221)
II	99-122 (111)	106-118 (111)	277-300 (289)	490-543 (517)	186-209 (197)	28-30 (29)	1203-1301 (1253)
III	101-114 (111)	114-125 (117)	277-304 (290)	532-597 (560)	200-213 (206)	27-31 (30)	1277-1382 (1314)

Coxae: 16-24 (19) f.s. on the fore and 26-34 on the middle and hind coxa, and each with 6-12 h.s.; fore coxa with 2-4 (2.6) capitate coxal bristles; apical seta about ¾ as long as trochanter. Trochanters: 29-34 μ wide; with 6 oval sensilla; with 8-10 (9) f.s. on the fore and 14-20 on the middle and hind trochanter; with 6-8 h.s. which include 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1.7-1.9 (1.8) times as long as width of trochanter. Femora: slender, 42-49 μ wide, the ratio width to length of hind femur being 1:5.98-6.52 (6.24), with 35-49 f.s., and with 17-28 (22) h.s. on the fore and 10-18 on the middle and hind trochanter. Tibiae: 23-27 μ wide; the ratio width to length of hind tibia being 1:20.6-22.4 (21.2); with 105-141 setae of which 19-37 are h.s. and 80-107 f.s., the latter about twice as long as width of tibia; with apical spur about the same size on all tibiae. Tarsi: 20-25 μ wide, hind tarsus 8.1-9.3 (9.0) times longer than wide; each with 30-46 f.s. and

13-25 h.s.; tarsal digitules subequal, slightly longer than claw. Claws: of medium length, somewhat longer than width of tarsus; slightly curved with a small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 620-700 (676) μ long and 370-500 (405) μ wide.

Segments I-VII: tergites present on anterior margin of 2nd and 3rd segments, represented by 3 small sclerites - one medially ahd one on each side; sternites represented by a transverse plate on the 2nd, 3rd and 5th-7th segments. Caudal extension of 7th segment large, reaching level of posterior margin of 8th segment, tapering, weakly sclerotized. Dorsal setae: usually a few (0-5, av. 2.2) f.s. on the 1st and occasionally one or two on each of the 2nd-5th segments; usually one h.s. on each side on all segments. Pleural setae: consisting of dorsopleural setae: 5-16 (10), 4-9 (5.9), 4-11 (7.2), 4-11 (6.8), 2-9 (5.0) and 1-5 (2.6) f.s. on the 2nd-6th, and 0-1 (0.3), 1-3 (1.9), 2-4 (3.1), 2-4 (3.1) and 2-5 (3.2) h.s. on the 3rd-6th segments respectively, and of ventropleural setae: occasionally one or two f.s. on the 4th, 0-3 (1.5) on the 5th and 0-5 (2.4) on the 6th, with occasionally one h.s. on the 3rd and usually one on each of the 4th-6th segments. Segment VII with 10-16 (14) f.s. and 3-6 (4.7) h.s., some of the posterior h.s. usually longer than rest. Ventral setae: 17-26 (21), 18-28 (24), 10-21 (16), 9-15 (12), 4-10 (6.7) and 3-10 (6.2) f.s. on the 2nd-7th segments respectively; usually one h.s. on each side on the 2nd-4th segments and 4 on each of the 5th-7th.

Segment VIII: with weak tergite and transverse sternite;

caudal extension forming a geniculate lobe, with a large weakly reticulated membranous cicatrix posteriorly; glandular pouch with 2 long, pointed setae, the protruding part of these being about 2-2½ times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: usually 2 strong h.s., with occasionally one or two additional small h.s. and with 1-5 (2.5) small, circular pores. Posterior margin with 2-3 (2.8) h.s. on each side.

Genital segment: Penial sheath short, about $\frac{1}{6}$th total body length (ratio 1:5.6-6.1, av. 5.9), 334-367 (352) μ long and 34-42 (38) μ wide; lateral sclerotizations narrowly joined anterior to anus; length of basal rod 1¾-2 times that of aedeagus, extending anteriorly from the base of the aedeagus for about ¾ of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 23-34 (28) small setae; a cluster of small sensilla occurring ventrally near apex. Aedeagus short (57-72, av. 70 μ long), penial sheath and basisternum longer, the ratios being 1:4.8-6.1 (5.3) and 1:3.11-3.93 (3.43) respectively.

Material examined: 10 specimens; from leaves of unknown plant; collected in Goba, Ethiopia on 6.8.62 by members of Imperial College Expedition; identification by Dr. K. Boratynski.

18. GEN. PULVINARIA (Figs. 19 and 41)

PULVINARIA ?BETULAE (L.)

A moderately long and robust species, with comparatively short antennae and long legs; with numerous setae covering the body and appendages; wings with a faint purplish tinge between anterior margin and 1st wing vein. When mounted, total body length 1800-2010 (1885)μ; width at mesothorax 415-460 (434)μ. Wing expanse 3070-3320 (3170)μ.

Head: subconical in dorsal view; in lateral view dorsoventrally elongated, with anterodorsal bulge pronounced; length from apex to pronotal ridge 247-288 (269)μ, width across genae 247-266-257)μ. Median crest sclerotized and distinctly polygonally reticulated, with numerous (20-34, av. 28) fleshy dorsal head setae and 5-8 (6.7) hair-like ones. Midcranial ridge dorsally weak and irregular; ventrally narrow, but well defined, reaching ocular sclerite posteriorly, area surrounding ventral part showing weak polygonal reticulation. Genae large, weakly sclerotized and without polygonal reticulation; each with 11-28 (20) fleshy and 1-5 (3.0) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 30-34 (32)μ in diameter and 1.1-1.8 (1.5) times as much apart; those of the ventral eyes 30-34 (32)μ in diameter and 0.6-1.0 (0.7) times as much apart. Ocellus small. Ocular sclerite well sclerotized dorsally, but weak ventrally; polygonally reticulated throughout. Preocular ridge extending only a very short distance below articular process. Post-ocular ridge well developed throughout; below ocellus the ridge splits

up, with the anterior branch partly surrounding the ocellus. Inter-ocular ridge absent. Dorsal ocular setae: 0-5 (2.5) f.s. and 0-2 (0.6) h.s. on each side. Ventral head setae: 61-82 (71) f.s. and 4-6 (4.7) h.s. scattered over the ocular sclerite, always with some (2-6, av. 4.0) f.s. occurring in front of this sclerite and with 13-18 (14) f.s. between and behind the eyes. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis long; apex deeply bifurcate, extending to around the level of the anterior margin of the ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 840-901 (871)μ long, i.e. shorter than half body length (ratio 1:2.10-2.23, av. 2.18), shorter than posterior leg (ratio 1:0.87-0.92, av. 0.90) and longer than penial sheath (ratio 1:2.30-2.35, av. 2.33). Scape 46-53 (47)μ long and 38-46 (43)μ wide, with 3 h.s. Pedicel: dorsal reticulation very weak or absent; 51-61 (56)μ long and 42-49 (45) μ wide, with 7-11 f.s., 4-6(5.1)h.s. and a sensillum placodeum. Segment III somewhat barrel-shaped, 1.9-2.4 (2.1) times longer than wide (57-65 av. 60 μ long and 27-30, av. 29 μ wide), with 5-15 (9.3)f.s. of medium length, 1.3-1.5 (1.4) times longer than width of segment, with 2 or 3 usual sensilla basiconica. Segments IV-IX: cylindrical, lengths of these segments (in μ) 106-182 (144), 110-131 (119), 106-129 (118), 87-103 (95), 76-91 (83) and 68-84 (76) respectively, widths varying from 19 to 27μ, with distal segments slightly wider than proximal ones; with 23-44 (31), 25-30 (28), 22-32 (27), 20-30 (24), 15-20 (19) and 16-18 (18)f.s. respectively, but no h.s., antennal bristles on 8th and 9th segments distinctly larger than the f.s. Segment X: terminal part

not constricted; 72-76 (74)μ long and 25-29 (26)μ wide; carrying 6-11 (8.3) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are almost as long as the segment and the 2 shorter ones distinctly larger than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal. Thorax: 650-749 (703) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae and pores absent. Posttergites medium-sized, not striated, with 4-13 (7.8) fleshy posttergital setae occurring on and behind the sclerite on each side. Pleural structures typical for the family. Sternum with strong transverse ridge, irregular median ridge and a small triangular sclerite. Anteprosternal setae: 0-6 (2.9)f.s. on each side; prosternal setae: 10-54 (37)f.s. and 0-2 (1)h.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum about 1¾ times as wide as long (av. 208 and 119μ respectively), anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially, reticulation weak or absent. Scutum: Median membranous area: subrectangular; 118-125 (123)μ long and 1.52-1.67 (1.59) times as wide (width 179-209, av. 196μ); with 15-28 (20) h.s. but no f.s. Scutellum: 65-68 (67)μ long and 179-209 (196)μ wide, the ratio being 1:3.0-3.4 (3.2); tubular, with small ventral foramen; without setae. Postnotum with anterior margin irregular,

weakly sclerotized and either exposed or partly overlapped by the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally and occasionally with a fleshy postalary seta. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare vestigial, incorporated into pleural wing process, not joining the latter with episternum. Subalare small. Episternum without polygonal reticulation; subepisternal ridge becoming broader ventrally, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Latero-pleurite not bounded by an extension from marginal ridge. Basisternum: large, about 244u wide and 212μ long, i.e. 1.67-1.78 (1.73) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae numerous consisting of 58-85 (74)f.s. arranged in a broad band behind the spiracles and prosternum, with a few occurring on the episternae. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 4-8 (6.0)h.s. Third axillary wing sclerite with a small, pointed ventral projection at its base. Additional sclerite small, well sclerotized. Antemetastigmatal setae: 3-7 (4.8)f.s.

Metathorax: Metanotum with thickening of posterior margin usually desclerotized medially; suspensorial sclerites absent; Postnotum consisting of a small subtriangular sclerite on each side. Metatergal

setae: one h.s. and usually one (0-2, av. 0.9) f.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 10-19 (15)f.s. Post-metastigmatal setae: 19-32 (25) f.s. and 0-2 (1.0) h.s. Metasternal plate weak and irregular, but somewhat more heavily sclerotized near anterior margin. Anterior metasternal setae: 50-79 (68) f.s. and 0-4 (1.6) h.s.; posterior metasternal setae: 28-39 (32) f.s. and occasionally one or two h.s.

Wings: hyaline; of medium length (1320-1470, av. 1402μ), but comparatively broad (width 580-700, av. 637μ), the ratio width to length being 2.10-2.27 (2.20); alar lobe and alar setae absent. Halteres absent.

Legs: short and slender, with the middle pair usually shortest and the hind pair longest; the ratio length of hind leg to body length is 1:1.94-2.03 (1.98). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	61-70 (65)	80-101 (90)	201-243 (227)	346-422 (389)	137-152 (144)	27-29 (28)	827-1014 (942)
II	72-89 (83)	91-99 (96)	182-213 (198)	357-410 (383)	133-148 (139)	26-28 (27)	870-977 (926)
III	76-91 (83)	91-112 (103)	198-217 (206)	376-437 (403)	137-160 (149)	27-30 (29)	918-1034 (972)

Coxae: 14-24 (21) f.s. on the fore and 25-36 on the middle and hind coxae, and each with 6-11 h.s.; fore coxa with 2-4 (2.7) knobbed coxal bristles; apical seta about half as long as trochanter. Trochanters: 26-31μ wide, with 6 oval sensilla, 11-22 f.s. and 6-8 h.s., the latter including 24 minute setae near basal ridge, one small seta on outer margin and a long apical seta, which on the fore trochanter is 1.5-2.4) 2.1) times as long as the width of trochanter. Femora: of medium width (39-49μ), the ratio width to length of hind femur being: 1:4.5-4.8 (4.6); with 28-48 f.s. and 7-14 h.s. Tibiae: 21-27μ wide, the ratio width to length of hind tibia being 1:16.5-17.7 (17.0); each with 70-115 setae of which 16-31 are h.s. and 54-89 f.s., the latter about 1¾ to 2 times longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 21-23μ wide, hind tarsus 6-7 (6.5) times longer than wide; each with 23-28 f.s. and 10-18 h.s.; tarsal digitules sub-equal, slightly longer than claw. Claws of medium length, a little longer than width of tarsus; slightly curved with small denticle near tip; ungual digitules subequal, about as long as claw, with small apical knob.

Abdomen: 570-600 (594)μ long and 350-450 (410)μ wide.

Segments I-VII: tergites represented by 3 small sclerites, one medially and one on each side, on the anterior margin of the 2nd and 3rd segments, and a weak transverse plate on the 7th; sternites usually present on all segments, represented by a weak transverse plate on the 2nd, 3rd and 7th segments, and a weak sclerite on each side on the 4th-6th. Caudal extension of 7th segment extending beyond the level of posterior margin of 8th segment, tapering, weakly sclerotized

lateroventrally. Dorsal setae: 0-2 (0.1), 0-7 (0.6), 0-1 (0.3), 0-3 (0.9), 0-1 (0.3) and 0-2 (0.3) f.s. on the 1st-6th segments respectively; one h.s. on each side on the 1st and each of the 4th-7th segments, and very rarely a single seta on the 2nd and 3rd. Pleural setae consisting of dorsopleural setae 10-16 (13), 2-6 (4.1), 2-8 (4.2), 2-6 (4.3), 0-4 (2.7) and 0-4 (2.1) f.s. on the 1st-6th and 0-1 (0.1), 0-3 (1.2), 2-3 (2.6), 2-5 (3.4) and 2-6 (3.5) h.s. on the 2nd-6th segments respectively, and of ventropleural setae: 0-2 (0.6) f.s. on the 6th and usually one h.s. on each of the 3rd-6th segments. Segment VII with 12-24 (20) f.s. and 4-12 (7.3) h.s.; some of the posterior h.s. somewhat longer than the rest. Ventral setae : 26-42 (36), 22-33 (27), 11-18 (15), 9-15 (12), 9-16 (12) and 9-12 (11) f.s. on the 2nd-7th segments respectively; usually one h.s. on each side on each of the 2nd-4th, and 4 (range 3-6) on the 5th-7th segments.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a mammillate lobe, with a small, membranous cicatrix laterally; glandular pouch with 2 long, pointed setae, the protruding part of these being about 2½-3 times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae 2-7 (4.4) f.s. and 2 strong h.s. Posterior margin with 2-3 (2.9) h.s. and an occasional f.s. on each side.

Genital segment. Penial sheath of medium length, about $\frac{1}{5}$ total bodylength (ratio 1:4.9-5.3, av. 5.1), 365-388 (375)μ long and 40-46 (44)μ wide; lateral sclerotizations narrowly joined anterior to anus; length of basal rod about equal to 1¼ times that of aedeagus, extending anteriorly from the base of the aedeagus for ½ to ¾ of the distance to

the apex of the basal membranous area; apex of sheath with a very small membranous extension. The area from base of sheath to tip of aedeagus with 22-31 (25) sensilla. Aedeagus short (72-82, av. 75 μ long), penial sheath and basisternum longer, the ratios being 1:4.9-5.3 (5.0) and 1:2.56-3.08 (2.83) respectively.

Material examined: 7 specimens, collected by D.J. Williams on Salix sp. in Newcastle-on Tyne, England during 1950.

In addition 10 specimens, received from Z. Kawecki (collected on Ribes sp. during August, 1962 in Warsaw, Poland) as Pulvinaria ? ribesiae Sign., were examined.

There are no distinct structural differences between the males of these two samples, and the various measurements, ratios and setal counts all overlapped. The description given above is based on the specimens from England and the characteristics of the specimens from Poland can be summarized as follows:

Total body length 1760-2160 (1963μ). Head: Dorsal head setae 26-51 (34) f.s. and 5-10 (7.9) h.s.; dorsal ocular setae 0-7 (3.6) f.s. and 0-3 (0.9)h.s.; ventral head setae 54-108 (84) f.s. and 5-7 (6.1)h.s. of which 5-9 (6.6)f.s. occur in the area anterior to the ocular sclerite and 17-25 (21) between and behind the ventral eyes; genal setae 18-30 (23) f.s. and 2-9 (4.6) h.s.; antennae 809-999 (887)μ long, length in relation to body length 1:2.08-2.37 (2.23). Thorax: Medial pronotal setae absent; posttergital setae 0-8 (2.3) f.s. and 1-3 (2.1)h.s.; median membranous area of scutum 122-141 (128)μ long and 205-239 (223)μ wide (ratio 1:1.62-1.88, av. 1.74), with 14-30 (21) h.s. setae; fleshy postmesostigmatal setae: 67-84 (76);

antemetastigmatal setae 3-9 (5.2)f.s.; dorsostigmatal setae: 9-19 (13) f.s.; postmetastigmatal setae: 16-28 (23) f.s. and 0-4 (1.8) h.s. ones; anterior and posterior metasternal setae: 53-89 (79) and 37-54 (44) f.s. respectively; wings 1340-1440 (1410)μ long and 610-670 (642) μ wide; front coxa with 2-4 (3.0) knobbed coxal bristles. Abdomen: Pleural setae on segment VII: 13-29 (22) f.s. and 3-8 (5.6) h.s.; fleshy ventral setae on segments II-VII 33-56 (41), 23-49 (35), 18-26 (20), 13-27 (17), 10-17 (14) and 5-16 (11) respectively; penial sheath 353-384 (367)μ long, length in relation to body length 1:5.15-5.63 (5.41); aedeagus 72-82 (77)μ long.

19. PULVINARIA ACERICOLA (WALSH & RILEY) (Figs. 20 and 41)

A moderately long, robust species with comparatively short antennae and legs; with numerous setae covering the body and appendages; wings with a faint purplish tinge between the anterior margin and first wing vein. When mounted, total body length 1670-1890 (1786)μ; width at mesothorax 420-480 (458)μ. Wing expanse 2840-3140 (2978)μ.

Head: subconical in dorsal view; in lateral view obliquely elongated, with anterodorsal bulge pronounced; length from apex to pronotal ridge 228-293 (260)μ, width across genae 251-266 (257)μ. Median crest sclerotized and distinctly polygonally reticulated, with numerous (19-43, av. 30) fleshy dorsal head setae and 1-7 (5.2) hair-like ones. Midcranial ridge: dorsally weak and irregular; ventrally narrow, but well defined, reaching ocular sclerite posteriorly, area surrounding ventral part showing weak polygonal reticulation. Genae large, weakly sclerotized, but showing distinct polygonal reticulation; each with 16-31 (23) fleshy and 1-9 (4.2) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 27-34 (31)μ in diameter and 1.7-2.4 (1.9) times as much apart; those of the ventral eyes 27-34 (30)μ in diameter and 0.9-1.4 (1.1) times as much apart. Ocellus small. Ocular sclerite well sclerotized dorsally, but weak ventrally; polygonally reticulated throughout. Preocular ridges extending only a very short distance below articular process. Postocular ridge well developed throughout; below the ocellus the ridge splits up with the anterior branch partly surrounding the ocellus.

Interocular ridge absent. Dorsal ocular setae: 0-6 (2.3) f.s. and 0-2 (0.5) h.s. on each side. Ventral head setae: 70-90 (80) f.s. and 4-7 (4.8) h.s., scattered over the ocular sclerite, always with some (4-7, av. 4.8) f.s. occurring in front of this sclerite and with 10-15 (12) f.s. between and behind the eyes. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis long; apex deeply bifurcate, extending to around the anterior margin of the ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 733-828 (794)μ long, i.e. shorter than half body length (ratio 1:2.08-2.45, av. 2.24), shorter than posterior leg (ratio 1:0.78-0.81, av. 0.80) and longer than penial sheath (ratio 1:2.14-2.35, av. 2.20). Scape: 46-53 (49)μ long and 34-46 (41)μ wide, with 3 h.s. Pedicel: with distinct polygonal dorsal reticulation; 53-65 (61)μ long and 38-46 (43)μ wide; with 10-15 (12) f.s., 3-5 (4.0)h.s. and a sensillum placodeum. Segment III somewhat barrel-shaped, 2.1-2.3 (2.2) times longer than wide (57-72, av. 64μ long and 23-29, av. 26μ wide); with 9-19 (12) f.s. of medium length, 1.6-1.8 (1.7) times longer than width of segment; with 1 to 3 usual sensilla basiconica. Segments IV - IX: cylindrical; lengths of these segments (in μ) 110-133 (122), 95-133 (114), 87-118 (106), 80-122 (94), 57-72 (66) and 53-65 (59) respectively, widths varying from 21 to 29μ, with distal segments slightly wider than proximal ones; with 19-31 (25), 23-36 (29), 20-35 (27), 21-27 (24), 17-25 (22) and 14-21 (17) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments distinctly larger than f.s. Segment X: terminal part not constricted; 53-68 (59)μ long and 22-29 (23)μ wide; carrying 6-13 (10) f.s., 3

capitate subapical setae and 5 antennal bristles of which the 3 long ones are about ¾ as long as the segment and the 2 shorter ones about ½ as long as the f.s.; with two sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 635-741 (687)μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae and pores absent. Posttergites medium-sized, with irregular wavy striations and usually with some (0-7 av. 3.9) fleshy posttergital setae occurring on or behind the sclerite on each side. Pleural structures typical for the family. Sternum with strong transverse ridge, weak and interrupted median ridge, and a small triangular sclerite. Anteprosternal setae: 2-7 (3.6) f.s. on each side; prosternal setae: 7-19 (14) f.s. and occasionally one h.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum about 1¾ times as wide as long (av. 218 μ and 119 μ respectively); anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially; showing polygonal reticulation, which sometimes tends to be irregular. Scutum: Median membranous area: subrectangular; 99-139 (124)μ long and 1.53-2.04 (1.76) times as wide (width 201-228, av. 212 μ); with 6-20 (14) h.s. and in one case 2 f.s. Scutellum: 65-72 (69) μ long and 213-247 (231) μ wide, the ratio being 3.0-3.8 (3.4); tubular, with moderately large ventral foramen; without setae.

Postnotum with anterior margin irregular, weakly sclerotized and either exposed or partly overlapped by metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally and without setae. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare vestigial, incorporated into pleural wing process, not joining the latter with episternum. Subalare small. Episternum usually showing weak polygonal reticulation dorsally; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite not bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 287μ wide and 214μ long, i.e. 1.45-2.00 (1.74) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges. Setae absent. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae numerous, consisting of 55-79 (66) f.s., arranged in a broad band behind the spiracles and prosternum, with a few occurring on the episternae. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 2-7 (5.0) h.s. Third axillary wing sclerite with a small, pointed ventral projection at its base. Additional sclerite small, well sclerotized. Antemetastigmatal setae: 1-7 (2.9) f.s.

Metathorax: Metanotum with thickening of posterior margin usually desclerotized medially; suspensorial sclerites absent. Postnotum consisting of a small transverse sclerite on each side. Metatergal setae: one h.s. and usually a few (0-6, av. 2.4) f.s. on each side.

Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Episternum reduced to a small sub-triangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 10-23 (16) f.s. Postmetastigmatal setae: 12-25 (16) f.s. and 0-2 (0.8) h.s. Metasternal plate weak and irregular, but more heavily sclerotized anteriorly. Anterior and posterior metasternal setae consisting of 58-94 (7 7) and 34-49 (38) f.s. respectively. Wings: hyaline; of medium length (1230-1350, av. 1292 μ), but comparatively broad width (660-690, av. 670μ); the ratio width to length being 1:86-1.97 (1.93), alar lobe and alar setae absent. Halteres absent.

Legs: moderately long and slender with the fore pair usually shortest and the hind pair longest; the ratio length of hind leg to body length is: 1:1.76-1.85 (1.79). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	61-72	87-99	205-243	369-422	118-133	19-25	864-998
	(65)	(95)	(227)	(391)	(126)	(24)	(928)
II	80-91	99-114	194-220	372-418	118-133	23-25	890-991
	(86)	(108)	(208)	(391)	(125)	(24)	(941)
III	84-91	106-116	193-228	399-456	125-144	25-30	942-1056
	(87)	(112)	(211)	(422)	(135)	(27)	(995)

Coxae: 11-24 (18), 18-29 (23) and 22-30 (26) f.s. on the fore, middle and hind coxa respectively, and each with 7-11 h.s.; fore coxa

with 3-5 (4.0) knobbed coxal bristles; apical seta about half as long as trochanter. Trochanters: 30-38 μ wide; with 6 oval sensilla; with 11-16 (13) f.s. on the fore and 10-22 on the middle and hind trochanters, and each with 5-8 h.s., the latter including 2 or 3 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1.6-1.8 (1.7) times as long as the width of the trochanter. Femora: of medium width (41-53μ), the ratio width to length of hind femur being 1:3.9-4.6 (4.2); with 28-47 f.s. and 8-16 h.s. Tibiae: 24-30μ wide, the ratio width to length of hind tibia being 1:13.5-16.6 (14.9); each with 90-118 setae of which 14-22 are h.s. and 72-100 f.s., the latter about 1½-2 times longer than width of tibia; with apical spur about the same size on all tibiae. Tarsi: 21-27 μ wide, hind tarsus 4.3-5.2 (5.0) times longer than wide; each with 22-32 f.s. and 5-11 h.s.; tarsal digitules subequal, slightly longer than claw. Claws: of medium length, length about equal to width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 450-570 (538)μ long and 400-450 (427)μ wide.

Segments I-VII: tergites on the 2nd and 3rd segments represented by 3 small sclerites on anterior margin - one medially and one on each side, on the 4th segment by a small sclerite on each side, and on the 7th by weak transverse plate; sternites represented by a weak transverse plate on the 2nd, 3rd and 7th segments, and sometimes by a small weak sclerite on each side on the 4th and 6th. Caudal extension of 7th segment large, extending beyond the level of the posterior margin of the 8th segment, tapering, weakly sclerotized lateroventrally.

Dorsal setae: a few (up to 4) f.s. occasionally present; usually one h.s. on each side on the 1st and each of the 4th-7th segments but none on the 2nd and 3rd. Pleural setae consisting of dorsopleural setae: 0-8 (4.4), 1-8 (3.5), 0-9 (3.3), 0-9 (3.6), 4-13 (6.4) and 1-9 (3.9) f.s. on the 1st-7th segments respectively and 0-2 (0.3), 0-2 (1.0), 1-5 (2.8), 0-3 (2.4) and 1-5 (2.6) h.s. on the 2nd-7th, and of ventropleural setae: one or two f.s. occasionally present on the 3rd and 4th segments, and 0-6 (2.0) and 0-6 (2.4) on the 5th and 6th respectively, with usually one h.s. on each of the 4th-6th segments. Segment VII with 9-24 (15) f.s. and 4-6 (4.8) h.s.; some of the posterior h.s. somewhat longer than rest. Ventral setae: 22-42 (33), 20-37 (28), 8-22 (16), 5-19 (12), 5-16 (10), 3-6 (4.6) f.s. on the 2nd-7th segments respectively; usually no h.s. on the 2nd, one on each side on the 3rd and 4th and 4 (range 3-6) on each of the 5th-7th segments.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a mammillate lobe with a small, membranous cicatrix laterally; glandular pouch with 2 long, pointed setae, the protruding part of these being about 2-3 times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: usually a few (0-5, av. 1.2) f.s. and 2 (0-2, av. 1.3) strong h.s. present. Posterior margin with 2-3 (2.7) h.s. on each side.

Genital segment: Penial sheath of medium length, about $\frac{1}{5}$ total body length (ratio 1:4.8-5.2, av. 5.0), 342-369 (357)μ long and 38-53 (44)μ wide; lateral sclerotizations narrowly joined anterior to anus; length of basal rod equal to about 1¼ times that of aedeagus, extending anteriorly from the base of the aedeagus for ½-¾ of the distance to the

apex of the basal membranous area; apex of sheath with a very small membranous extension. The area from base of sheath to tip of aedeagus with 24-35 (28) small setae; a cluster of small sensilla occurring ventrally near apex. Aedeagus short (76-95, av. 85 μ long), penial sheath and basisternum longer, the ratios being 1:3.6-4.8 (4.3) and 1:2.26-2.95 (2.59) respectively.

Material examined: 9 specimens; collected by T.E. Tabor on Acer saccharinum L. in Hillsville, Virginia, U.S.A. on 6.5.63; received from M. Kosztarab, identified by K. Boratynski.

Comparative notes: P. acericola can readily be separated from P. ?betulae by the 2 short antennal bristles on the 10th antennal segment and also by the distinct polygonal reticulation on the pedicel, gena and mesoprescutum.

20. GEN. PARTHENOLECANIUM (Figs. 21 and 42.)

PARTHENOLECANIUM CORNI (BOUCHÉ)

A medium-sized and moderately robust species, with comparatively short antennae and long legs; with numerous setae on the body and appendages. When mounted, total body length 1880-2110 (1980)μ; width at mesothorax 390-500 (446)μ. Wing expanse 3030-3400 (3283)μ.

Head: subconical in dorsal view; in lateral view obliquely elongated dorsoventrally, with anterodorsal bulge pronounced; length from apex to pronotal ridge 239-293 (273)μ, width across genae 258-289 (275)μ. Median crest sclerotized and distinctly polygonally reticulated, with 23-37 (28) fleshy and 16-19 (17) hair-like dorsal head setae. Midcranial ridge: dorsally absent; ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. Genae large sclerotized; polygonally reticulated; each with 17-30 (23) fleshy and 7-13 (9.1) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 34-42 (38)μ in diameter and 1.2-1.7 (1.5) times as much apart; those of the ventral eyes 34-42 (38)μ in diameter and 0.5-0.8 (0.7) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge extending only a short distance below articular process. Postocular ridge usually well developed throughout, usually with a weak anterior branch below ocellus. Interocular ridge absent. Dorsal ocular setae: 1-7 (4.1) f.s. and 0-4 (2.0) h.s. on each side. Ventral head setae: 65-83 (70) f.s. and 7-12 (9.0) h.s.

scattered over the ocular sclerite, occasionally with one or two f.s. occurring in front of the sclerite, and with 12-17 (15) f.s. and 0-2 (0.7) h.s. between and behind the eyes. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis of medium length; apex bifurcate, without central bulge, not reaching the level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits apparently absent.

Antennae: 10-segmented; filiform; 825-998 (895)μ long, i.e. shorter than half body length (ratio 1:2.06-2.41, av. 2.23), shorter than posterior leg (ratio 1:0.77-0.89, av. 0.82) and longer than penial sheath (ratio 1:1.89-2.10, av. 1.95). Scape: 49-61 (55)μ long and 42-53 (48)μ wide, with 3 h.s. Pedicel: with distinct, polygonal, dorsal reticulation; 61-68 (64)μ long and 42-49 (46)μ wide, with 7-11 (9.3) f.s., 5-8 (6.0) h.s. and a sensillum placodeum. Segment III: club-shaped, 2.1-2.4 (2.3) times longer than wide (61-84, av. 66 μ long and 27-34, av. 28 μ wide); with 10-15 (13) f.s. of medium length, 1.1-1.4 (1.2) times longer than width of segment; with 1-4 usual sensilla basiconica. Segment IV-IX: cylindrical; lengths of these segments (in μ) 171-220 (192), 103-141 (114), 99-113 (107), 80-103 (90), 65-84 (73) and 53-68 (59) respectively, all of about the same width, varying from 21 to 29 μ, and with 38-67 (53), 31-46 (36), 32-54 (36), 27-38 (32), 22-30 (25) and 19-25 (20) f.s., but no h.s.; antennal bristles on 8th and 9th segments distinctly larger than the f.s. Segment X: terminal $\frac{1}{3}$ somewhat constricted; carrying 7-13 (9.4) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about $\frac{2}{3}$ as long as the segment and the 2

shorter ones somewhat shorter and thicker than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 669-790 (733) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, occasionally with one fleshy lateral pronotal seta on each side. Medial pronotal setae absent. Posttergites comparatively large, with irregular, wavy striation; posttergital setae absent. Pleural structures typical for the family. Sternum with strong transverse ridge, interrupted median ridge and small triangular sclerite. Anteprosternal setae: 1-3 (2.1) f.s. on each side; prosternal setae 19-30 (26) f.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum less than twice as wide as long (av. 223 and 127 μ respectively) anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially; polygonally reticulated. Scutum: Median membranous area: subrectangular; 118-133 (128) μ long and 1.53-1.82 (1.61) times as wide (width 182-236 av. 206 μ); with 11-26 (20) h.s., but no f.s. Scutellum: 65-87 (74) μ long and 198-247 (220) μ wide, the ratio being 1 : 2.9-3.3 (3.0); tubular, ventral foramen small; its length usually less than half that of scutellum; without setae. Postnotum with anterior margin weakly sclerotized, irregular, and usually not overlapped by the metathoracic fold; polygonally reticulated dorsally; postnotal apophysis and postalare

well developed, the latter densely reticulated distally and without setae. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare vestigial, incorporated into pleural wing process, not joining the latter with episternum. Subalare small. Episternum showing polygonal reticulation dorsally; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite not bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 270 μ wide and 214 μ long, i.e. 1.50-1.82 (1.68) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae numerous, consisting of 71-98 (89) f.s. and 0-2 (0.9) h.s., arranged in a broad band behind the spiracles and prosternum. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 6-8 (7.2) h.s. Third axillary wing sclerite with a small ventral projection at its base. Additional sclerite small, well sclerotized. Antemetastigmatal setae: 4-12 (6.5) f.s.

Metathorax: Metanotum with posterior margin desclerotized medially; suspensorial sclerites absent; small sclerite sometimes present anterior to postnotum. Postnotum consisting of a small transverse sclerite on each side. Metatergal setae: 0-2 (0.8) f.s. and 0-2 (1.0) h.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial

precoxal ridge usually present. Episternum reduced to a small plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 5-14 (10.4) f.s. Postmetastigmatal setae: 21-35 (30) f.s. and 0-2 (0.9) h.s. Metasternal sclerite represented by a weak transverse plate. Anterior and posterior metasternal setae: 76-94 (86) and 31-60 (42) f.s. respectively.

Wings: hyaline; short (length 1330-1510, av. 1439 μ) but comparatively broad (width 620-740, av. 686 μ), the ratio width to length being 1:2.04-2.15 (2.10); alar lobe and alar setae absent. Halteres absent.

Legs: long and slender, with the fore pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1:1.74-1.84 (1.81). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	72-80 (76)	99-118 (108)	247-285 (271)	395-452 (429)	125-141 (132)	24-29 (26)	984-1091 (1042)
II	87-95 (92)	106-118 (112)	224-262 (244)	418-471 (444)	137-143 (140)	27-30 (28)	1003-1112 (1062)
III	95-107 (102)	106-122 (117)	232-266 (251)	441-479 (465)	137-152 (144)	27-32 (29)	1051-1146 (1109)

Coxae: 17-24 (20) f.s. on the fore and 23-43 on the middle and hind coxae, and each with 10-19 h.s.; fore coxa with 3-4 (3.5) capitate coxal bristles; apical seta about $\frac{1}{2}$ - $\frac{2}{3}$ as long as

trochanter. Trochanters: with 6 oval sensilla, 12-21 f.s. and 8-11 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and one long apical seta which, on the fore trochanter, is 2.6-3.4 (3.0) times as long as width of trochanter. Femora: of medium width (42-53 μ), the ratio width to length of hind femur being 1:4.8-5.7 (5.2); with 36-54 f.s. and 15-27 h.s. Tibiae: 23-30 μ wide, the ratio width to length of hind tibia being 1:15.0-19.1 (16.4); with 107-153 setae, of which 30-47 are h.s. and 76-110 f.s., the latter about as long as width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 21-27 μ wide, with 13-28 f.s. and 16-26 h.s.; tarsal digitules subequal, somewhat longer than claw. Claws: of medium length, a little longer than width of tarsus; slightly curved, with a small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 520-600 (570) μ long and 390-500 (425) μ wide.

Segments I-VII: tergites represented by a small sclerite on each side on the anterior margin of the 2nd and 3rd segments and a weak transverse plate on the 7th; sternites represented by a weak transverse sclerite on the 2nd, 3rd, sometimes 6th, and the 7th segments. Caudal extension of the 7th segment large, reaching or extending beyond the level of the posterior margin of the 8th segment, tapering, weakly sclerotized. Dorsal setae: occasionally one f.s. on the 1st and 2nd segments, usually one h.s. on each side on the 1st and each of 4th-7th segments. Pleural setae consisting of dorsopleural setae: 1-7 (3.4), 1-6 (2.5), 1-4 (2.2), 2-6 (3.9), 1-6 (3.1) and 0-3 (1.4) f.s., and 0-2 (0.9), 0-1 (0.1), 0-1 (0.3), 1-4 (1.8),

0-5 (3.3), 3-5 (3.9) and 2-5 (3.9) h.s. on the 1st-6th segments respectively, and of ventropleural setae: 0-3 (1.1) f.s. on the 6th and usually one h.s. on each of the 4th-6th segments. Segment VII with 10-17 (15) f.s. and 5-12 (7.3) h.s.; some of the posterior h.s. usually longer than the rest. Ventral setae: 30-38 (34), 13-23 (20), 8-18 (15), 5-11 (7.6), 5-11 (7.8) and 4-9 (6.5) f.s. on the 2nd-7th segments respectively; usually one h.s. on each side on the 3rd and 4th segments and 4 on each of the 5th-7th.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a small, sclerotized, papilla-shaped lobe, with a small, membranous cicatrix laterally; glandular pouch with 2 long, pointed setae, of which the protruding part is 2½-3 times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: 2 strong h.s. which are sometimes forked. Posterior margin with 3 h.s. on each side.

Genital segment: Penial sheath long, about ¼ total body length (ratio 1:4.19-4.44, av. 4.38), 456-486 (470) μ long and 45-49 (46) μ wide at base of aedeagus; lateral sclerotizations not joined anterior to anus; length of basal rod about $\frac{2}{3}$ or equal that of aedeagus, extending anteriorly from the base of the aedeagus for about $\frac{1}{3}$rd of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath to tip of aedeagus with 20-30 (25) small setae; a cluster of small sensilla occurring near apex. Aedeagus short (106-125, av. 114 μ long), penial sheath and basisternum longer, the ratios being 1:3.9-4.3 (4.1) and 1:1.79-2.67 (1.99) respectively.

Material examined: 8 specimens, collected by Z. Kawecki on Ribes aureum and Ribes sp. in Warsaw, Poland during January 1962.

In addition, ten specimens were examined from Belgrade, Yugoslavia (received from N. Mitic-Muzina, collected on an unknown host during 1961) and two from Alma-Ata, Kazakhstan, U.S.S.R. (received from G. Matesova, collected in fruit orchards on 20.4.51). These specimens were all smaller than the specimens from Warsaw, consequently the measurements of the various structures and the numbers of setae are somewhat reduced; otherwise they are practically identical. On the other hand, the specimens that Habib (1956) described from Cotoneaster microphylla Lindl., collected in Wisely, England, were bigger (2100-2300, av. 2200 μ long) in length. It is worthy of note that the females of this species also show considerable size variation, due mainly to the influence of the host plant (Habib, 1953 and Kawecki, 1958a).

The variation in the specimens from Poland, Yugoslavia and the U.S.S.R. can be summarized as follows (all measurements in μ):

Variation in P. corni from three localities

Characters	Localities		
	Warsaw	Belgrade	Alma-Ata
Total length	1880-2110 (1980)	1470-1770 (1660)	1650-1850 (1750)
Wing expanse	3030-3400 (3283)	2470-3110 (2856)	2950-3130 (2540)
HEAD:			
Width across genae	258-289 (275)	217-274 (250)	251-258 (255)
Dorsal head setae : fleshy	23-37 (28)	19-46 (29)	18-23 (21)
" " " : hair-like	16-19 (17)	10-22 (15)	19-21 (20)
Genal setae : fleshy	17-30 (23)	16-30 (22)	21-25 (23)
" " : hair-like	7-13 (9)	7-12 (9)	10-11
Diameter of dorsal eyes	34-42 (38)	23-34 (28)	30-31
Diameter of ventral eyes	34-42 (38)	23-36 (29)	34
Ventral head setae : fleshy	65-83 (70)	57-92 (72)	69-76 (73)
" " " : hair-like	7-12 (9)	3-7(5)	4
Antennal length	825-998 (895)	659-827 (740)	906
Antennal length in relation to body length	1:2.06-2.41 (2.23)	1:2.12-2.33 (2.24)	1:2.04
THORAX:			
Prosternal setae : fleshy	22-39 (31)	18-40 (28)	13-28 (20)
Median membranous area of scutum:			
length:	118-133 (128)	84-118 (101)	103

THORAX (cont.):			
Median membranous area of scutum: width	182-236 (206)	135-194 (173)	179-190 (184)
scutal setae (hair-like)	11-26 (20)	10-22 (15)	13-16 (15)
Scutellum : length	65-87 (74)	46-65 (57)	65-76 (70)
" : width	198-247 (220	144-205 (184)	182-205 (194)
Basisternum : length	194-236	156-201 (182)	213
" : width	233-304 (270)	194-262 (237)	266-277 (272)
Postmesostigmatal setae : fleshy	71-98 (89)	44-85 (63)	73-80 (77)
Tegular setae (hair-like):	6-8 (7.2)	4-9 (5.7)	7-9 (8.0)
Antemetastigmatal setae (fleshy):	4-12 (6.5)	2-5 (3.1)	5
Dorsostigmatal setae (fleshy)	5-14 (10)	5-15 (10)	7
Postmetastigmatal setae (fleshy)	21-35 (30)	15-34 (19)	18
Anterior metasternal setae: fleshy	76-94 (86)	40-82 (57)	76
Posterior metasternal setae: fleshy	31-60 (42)	18-45 (29)	39-50 (45)
Wing length	1330-1510 (1439)	1100-1380 (1260)	1310-1400 (1355)
" width	620-740 (686)	480-650 (598)	650-710 (680)
Ratio width to length	1:2.04-2.15 (2.10)	1:1.10-2.31 (2.18)	1:1.97-2.02 (2.00)
Hind leg : length	1051-1146 (1109)	832-1098 (973)	1064-1139 (1102)
length in relation to body length	1:1.74-1.84 (1.81)	1:1.72-1.77 (1.75)	1:1.62
Tibial setae	107-153	81-123	101-127

ABDOMEN:			
Pleural setae on segment VII: fleshy	10-17 (14.9)	11-25 (19.9)	11-14 (12.3)
Ventral setae on segment II: fleshy	30-38 (34)	13-42 (25)	26-31 (29)
Penial sheath : length	456-486 (470)	361-410 (394)	410-429 (420)
length in relation to body length	1:4.19-4.44 (4.38)	1:3.91-4.39 (4.23)	1:3.84-4.51 (4.28)
Aedeagus : length	106-125 (114)	91-114 (100)	114

21. PARTHENOLECANIUM POMERANICUM (KAW.) (Figs. 22 and 42)

A medium-sized and moderately robust species, with comparatively short antennae and long legs; with numerous setae on the body and appendages. When mounted, total body length 1610-1800 (1690) μ; width at mesothorax 405-450 (418) μ. Wing expanse 2590-2910 (2750) μ.

Head: subconical in dorsal view; in lateral view obliquely elongated dorsoventrally, with anterodorsal bulge pronounced; length from apex to pronotal ridge 243-277 (261) μ, width across genae 247-281 (265) μ. Median crest well sclerotized and distinctly polygonally reticulated, with 15-32 (24) fleshy and 10-17 (13) hair-like dorsal head setae. Midcranial ridge: dorsally absent, ventrally narrow but well defined, reaching ocular sclerite posteriorly, surrounding area showing distinct polygonal reticulation. Genae large, sclerotized, polygonally reticulated; each with 14-24 (19) fleshy and 6-13 (6.9) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 23-27 (25) μ in diameter and 2.7-3.3 (3.0) times as much apart; those of the ventral eyes 23-30 (26) μ in diameter and 1.1-1.5 (1.3) times as much apart. Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge extending only a short distance below articular process. Postocular ridge well developed dorsally and lateroventrally, but usually weak posteromedially; below the ocellus the ridge usually has a weak anterior branch. Interocular ridge absent. Dorsal ocular setae: 2-8 (4.2) f.s. and 0-4 (1.6) h.s. on each side. Ventral head setae: 44-60 (51) f.s. and 8-15 (9.9) h.s., scattered over the ocular sclerite, occasionally with

a fleshy seta occurring in front of the sclerite, and with 9-16 (13) f.s. and 0-1 (0.6) h.s. between and behind the eyes. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis of medium length; apex bifurcate, sometimes with central bulge, not reaching level of anterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 686-758 (730) μ long, i.e. shorter than half body length (ratio I:2.20-2.54, av. 2.39), shorter than posterior leg (ratio 1:0.72-0.74, av. 0.73) and longer than penial sheath (ratio 1:1.92-2.09, av. 2.01). Scape: 49-57 (53) μ long and 40-44 (42) μ wide, with 3 h.s. Pedicel: with distinct polygonal, dorsal reticulation; 49-57 (53) μ long and 42-46 (43) μ wide, with 3-8 (5.1) f.s., 5-9 (6.9) h.s. and a sensillum placodeum. Segment III club-shaped, 2.0-2.9 (2.3) times longer than wide (53-63, av. 59 μ long and 21-27, av. 26 μ wide); with 8-15 (12.8) f.s. of medium length, 1.0-1.4 (1.2) times longer than width of segment; with 1-4 usual sensilla basiconica. Segments IV-IX: cylindrical; lengths of these segments (in μ) 95-122 (113), 84-114 (97), 93-99 (95), 65-91 (75), 57-78 (66) and 46-57 (52) respectively, all of about the same width, varying from 19 to 27μ, and with 21-33 (30), 22-36 (32), 28-43 (36), 23-37 (27), 19-30 (21) and 16-23 (19) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments distinctly larger than the fleshy setae. Segment X: terminal $\frac{1}{3}$rd somewhat constricted; carrying 10-15 (12.2) f.s., occasionally one h.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are just more than half as long as the segment and the 2 shorter ones somewhat shorter

and thicker than the f.s.; with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 638-688 (660) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, with 0-3 (1.1) fleshy and 0-3 (0.5) hair-like lateral pronotal setae on each side. Medial pronotal setae: usually one h.s. and occasionally one f.s. on each side. Posttergites comparatively large, with irregular wavy striations; posttergital setae absent. Pleural structures typical for the family. Sternum with transverse ridge strong, median ridge weak and only represented anteriorly, and a well sclerotized triangular sclerite. Anteprosternal setae: 0-4 (1.3) f.s. on each side; prosternal setae: 13-21 (15) f.s. and sometimes one h.s., scattered over the sternal area and spreading into the area anterior to the spiracles.

Mesothorax: Mesoprephragma with shallow emargination. Prescutum less than twice as wide as long (av. 115 and 201 μ respectively); anterior margin strongly curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; slightly more heavily sclerotized medially; polygonally reticulated. Scutum: Median membranous area: subrectangular; 103-118 (111) μ long and 1.50-1.78 (1.55) times as wide (width 175-182, av. 178 μ); with 14-22 (19) h.s., but no f.s. Scutellum: 53-61 (58) μ long and 175-182 (178) μ wide, the ratio being 1:2.9-3.8 (3.3); tubular, with a large ventral foramen of which the length is half or more than half that of the scutellum; without setae. Postnotum with anterior margin weakly

sclerotized, irregular, and partly overlapped by the metathoracic fold; postnotal apophysis and postalare well developed, the latter densely reticulated distally and without setae. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare vestigial, incorporated into pleural wing process, not joining the latter with episternum. Subalare small. Episternum showing polygonal reticulation dorsally; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite not bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 240 μ wide and 179 μ long, i.e. 1.48-1.74 times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae numerous, consisting of 54-64 (57) f.s. and 2-5 (3.8) h.s., arranged in a broad band behind the spiracles and prosternum. Tegula small, membranous bulge with a small, weak sclerite posteriorly and with 3-9 (5.4) h.s. Third axillary wing sclerite with a small ventral projection at its base. Additional sclerite small, well sclerotized. Antemetastigmatal setae : 2-8 (5.3) f.s.

Metathorax: Metanotum with posterior margin desclerotized medially; suspensorial sclerites absent; Postnotum consisting of a small transverse sclerite on each side. Metatergal setae: 0-3 (0.6) f.s. and 1-3 (1.3) h.s. on each side. Pleural ridge considerably reduced, extending only a short distance above coxal articulation.

Vestigial precoxal ridge usually present. Episternum reduced to a small plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 3-11 (7.8) f.s. and 0-3 (1.0) h.s. Postmetastigmatal setae: 14-24 (18) f.s. and 1-4 (2.2) h.s. Metasternal sclerite represented by a weak, transverse plate. Anterior and posterior metasternal setae : 56-74 (64) and 20-32 (28) f.s. respectively.

Wings: hyaline; short (length 1130-1290, av. 1210 μ) but comparatively broad (width 520-590, av. 557 μ), the ratio width to length being 1:2.15-2.20 (2.17); alar lobe and alar setae absent. Halteres absent.

Legs: long and slender, with the fore pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1 : 1.69-1.84 (1.77). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	61-72 (67)	76-87 (81)	222-241 (231)	338-372 (355)	118-141 (130)	24-27 (25)	868-918 (890)
II	76-87 (81)	84-91 (87)	201-224 (209)	353-380 (366)	133-148 (140)	25-27 (26)	882-948 (972)
III	76-95 (87)	80-99 (92)	209-228 (216)	372-410 (391)	141-163 (150)	26-29 (27)	934-1017 (963)

Coxae: 12-16 (13) f.s. on the fore and 24-32 on the middle and hind coxa, and each with 13-20 h.s.; fore coxa with 2-5 (3.8) coxal bristles; apical seta about $\frac{2}{3}$ as long as trochanter. Trochanters: 28-32 μ wide, with 6 oval sensilla; with 9-12 (11) f.s. on the fore

and 14-18 on the middle and hind trochanter, and each with 8-14 h.s., the latter including 2 minute ones near basal ridge, one small seta on outer margin and one long apical seta which, on the fore trochanter, is 2.2-2.8 (2.5) times as long as width of trochanter. Femora: of medium width (42-49 μ), the ratio width to length of hind femur being: 1 : 4.5-4.9 (4.6); each with 26-42 f.s. and 20-37 h.s. Tibiae: 23-30 μ wide, the ratio width to length of hind tibia being 1 : 12.3-16.3 (14.2); each with 120-150 setae of which 44-64 are h.s. and 68-92 f.s., the latter about as long as width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 19-25 μ wide, hind tarsus 6.2-8.6 (7.0) times longer than wide; each with 8-19 f.s. and 27-37 h.s.; tarsal digitules subequal, about as long as claw. Claws: of medium length, somewhat longer than width of tarsus; slightly curved, with small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 440-550 (491) μ long and 410-530 (460) μ wide.

Segments I-VII: tergites represented by a small sclerite on each side on the anterior margin of the 2nd and 3rd segments and a weak transverse plate on the 7th; sternites represented by a weak transverse sclerite on the 2nd, 3rd and 7th segments. Caudal extension of the 7th segment large, reaching or extending beyond the level of the posterior margin of the 7th segment, tapering, weakly sclerotized. Dorsal setae: occasionally one or two f.s. on the 1st segment; usually one h.s. on each side on the 1st and each of the 4th-7th segments. Pleural setae consisting of dorsopleural setae: 1-5 (2.1), 0-4 (1.5), 0-5 (1.7), 1-4 (2.6), 0-3 (2.0) and 0-4 (1.4) f.s., and

0-1 (0.2), 0-2 (0.9), 0-3 (1.5), 1-4 (2.8), 1-3 (2.1) and 0-2 (1.6) h.s. on the 1st-6th segments respectively, and ventropleural setae: occasionally one f.s. on the 5th and 6th segment, sometimes one h.s. on the 4th and usually one on each of the 5th and 6th segments. Segment VII with 4-8 (5.4) f.s. and 4-8 (5.9) h.s., some of the posterior h.s. usually longer than the rest. Ventral setae: 9-18 (17), 6-16 (11), 9-14 (11), 5-11 (7.3), 4-11 (7.1) and 1-4 (2.7) f.s. on each side on the 3rd and 4th segments and 4 on each of the 5th-7th.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a large papilla-shaped lobe with a small, membranous cicatrix laterally on the lobe; glandular pouch with 2 long, pointed setae, the protruding part of these about twice as long as the section within the pouch. Small 9th tergite sometimes present. Ante-anal setae: 2 strong h.s., which are sometimes forked. Posterior margin with 2-3 (2.8) h.s. on each side.

Genital segment: Penial sheath of medium-length, about $\frac{1}{5}$th total body length (ratio 1 : 4.40-5.09, av. 4.77), 342-361 (353) μ long and 36-42 (38) μ wide; lateral sclerotizations apparently not joined anterior to anus; basal rod about $\frac{1}{2}$ - $\frac{2}{3}$ as long as aedeagus, extending anteriorly from the base of the aedeagus for about $\frac{1}{4}$ - $\frac{1}{5}$th of the distance to the apex of the basal membranous area; apex of sheath without membranous extension. The area from base of sheath tip of aedeagus with 20-30 (25) sensilla; a cluster of small sensilla occurring ventrally near apex. Aedeagus short (76-95, av. 84 μ long), penial sheath and basisternum longer, the ratios being 1 : 3.8-4.5 (4.2) and 1 : 1.84-2.25 (2.10) respectively.

Material examined: 10 specimens collected by M.S.K. Ghauri on Taxus baccata L. at Imperial College Field Station, Silwood Park, Sunninghill, Berks., on 5.5.57.

Comparative notes: This species is very closely related to P. corni (Bouche). The two species can be separated by the number of fleshy pleural setae on the caudal extension of the 7th segment. In P. pomeranicum these setae vary from 4-8 (5.0) and in P. corni they vary from 11-14 (12), 10-17 (15) and 11-25 (20) in the specimens from Kazakstan, Warsaw and Belgrade respectively. In addition, the pair of hair-like median pronotal setae was absent in only one specimen of P. pomeranicum whereas only one median pronotal seta was present in one specimen of P. corni (from Warsaw); the ventral foramen of the scutellum is large in P. pomeranicum, its length being half or more than half that of the scutellum, while in P. corni it is usually very small, although it was more than half as long as the scutellum in one specimen from Belgrade.

22. GEN. CEROPLASTES (Figs. 23 and 43)

CEROPLASTES BERLINIAE HALL

A short, robust species, with comparatively short antennae and moderately long legs; with numerous setae covering the body and appendages. When mounted, total body length 1450-1610 (1529)μ; width at mesothorax 360-400 (372) μ. Wing expanse 2170-2310 (2277) μ.

Head: subconical in dorsal view; in lateral view dorsoventrally elongated, with anterodorsal bulge not pronounced; length from apex to pronotal ridge 201-232 (217) μ, width across genae 201-224 (213) μ. Median crest sclerotized, showing distinct polygonal reticulation which enclose irregular striations; with numerous (15-27, av. 21) fleshy dorsal head setae and 4-10 (8.1) hair-like ones. Midcranial ridge: dorsally absent; ventrally strong, reaching ocular sclerite posteriorly, surrounding area weakly polygonally reticulated. Genae large, sclerotized, with polygonal reticulation; each with 9-18 (14) fleshy and 2-7 (4.4) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 23-27 (25) μ in diameter and 1.8-2.7 (2.2) times as much apart; those of the ventral eyes 25-27 (26) μ in diameter and 0.6-1.0 (0.7) times as much apart; Ocellus small. Ocular sclerite well sclerotized and polygonally reticulated throughout. Preocular ridge extending only a very short distance below articular process. Postocular ridge well developed throughout; dorsal and ventral to ocellus the ridge usually splits up with the anterior branch partly surrounding ocellus. Interocular ridge absent. Dorsal ocular setae:

0-4 (2.0) f.s. and occasionally one h.s. on each side. Ventral head setae consisting of 47-67 (53) f.s. and 3-8 (4.4) h.s., scattered over the ocular sclerite, always with some (2-7, av. 4.8) f.s. occurring in front of this sclerite and with 5-9 (7.1) between and behind the eyes. Preoral ridge present. Tendon-like apodeme long. Cranial apophysis of medium length; apex deeply bifurcate, extending to around level of posterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 541-673 (622) μ long, i.e. shorter than half body length (ratio 1 : 2.39-2.54, av. 2.46), shorter than posterior leg (ratio 1 : 0.68-0.74, av. 0.71), and longer than penial sheath (ratio 1 : 1.43-1.64, av. 1.55). Scape: 38-42 (40) μ long and 34-40 (37) μ wide, with 3 h.s. Pedicel: with distinct polygonal, dorsal reticulation; 48-53 (50)μ long and 27-30 (29) μ wide, with 6-8 (7.1) f.s., 3-5 (4.3) h.s. and a sensillum placodeum. Segment III: somewhat club-shaped, 2.2-2.8 (2.5) times longer than wide (44-53, av. 49 μ long and 19-23, av. 20 μ wide); with 4-8 (6.2) f.s. of medium length, 1.0-1.4 times longer than width of segment; with 1-4 usual sensilla basiconica. Segments IV-IX: cylindrical; length of these segments (in μ) 80-103 (90), 68-89 (78), 46-65 (57), 60-76 (65), 53-63 (58) and 46-57 (52) respectively, widths varying from 15 to 23 μ, with distal segments slightly wider than proximal ones; with 11-19 (15), 13-22 (17), 9-17 (13), 12-20 (15), 12-14 (13), 11-15 (13) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments distinctly larger than f.s. Segment X: terminal $\frac{1}{3}$ constricted; 74-93 (82) μ long and 20-23 (21) μ wide

(near base); carrying 5-7 (5.8) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about as long as the segment and the 2 shorter ones about as long as the f.s., (but shorter); with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 498-555 (540) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae: occasionally one f.s. present behind pronotal sclerite. Posttergites relatively large, with irregular striations and without setae. Pleural structures typical for the family. Sternum with strong transverse ridge, median ridge represented by a weak basal stalk, and triangular sclerite narrow and very weakly sclerotized. Anteprosternal setae: 2-7 (4.3) f.s. on each side, with usually one f.s. situated dorsal to proepisternum and cervical sclerite; prosternal setae: 27-39 (32) f.s., scattered over the sternal area and often spreading into the area anterior to the spiracles.

Mesothorax : Mesoprephragma with moderately deep emargination. Prescutum more than twice as wide as long (av. 197 and 85 μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; medially with slightly more heavy sclerotization becoming ridge-like anteroventrally; with distinct polygonal reticulation. Scutum: Median membranous area: subrectangular; 99-112 (103) μ long and 1.69-1.94 (1.80) times as wide (width 175-199, av. 188 μ), with 10-20 (14) f.s. and 4-14 (10) h.s. Scutellum: 53-65 (60) μ long and 190-209 (200) μ

wide, the ratio being 1:3.0-3.8 (3.4); tubular, with small ventral foramen; without setae. Postnotum reticulated, with anterior margin irregular and exposed; postnotal apophysis and postalare well developed, the latter densely reticulated distally and with 1-3 (1.7) fleshy postalary setae occurring on or immediately posterior to it. Mesopostphragma with deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare absent. Subalare small. Episternum distinctly polygonally reticulated; subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large, about 223 μ wide and 171 μ long, i.e. 1.48-1.77 (1.65) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae: 18-29 (24) f.s., arranged in a band behind the spiracles and prosternum. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 4-8 (6.3) h.s. Third axillary wing sclerite with a pronounced ventral projection. Additional sclerite small. Antemetastigmatal setae: 1-5 (2.7) f.s.

Metathorax: Metanotum with thickening of posterior margin desclerotized medially; suspensorial sclerites absent. Postnotum consisting of two small sclerites, one on each side. Metatergal setae:

2-7 (3.6) f.s. on each side but no h.s. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to metathoracic one. Dorsostigmatal setae: 3-9 (5.5) f.s. Postmetastigmatal setae: 12-16 (14) f.s. and 0-2 (0.6) h.s. Metasternal plate weak and irregular, but more heavily sclerotized anteriorly. Anterior and posterior metasternal setae: 36-48 (41) and 18-29 (23) f.s. respectively.

Wings: hyaline; short (length 920-980, av. 968 μ) and comparatively broad (width 450-480, av. 465 μ), the ratio width to length being 1:2.00-2.18 (2.08); alar lobe and alar setae absent. Halteres absent.

Legs: moderately long, and slender, with the fore pair shortest and the hind pair longest; the ratio length of hind leg to body length is 1:1.75-1.86 (1.79). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	49-61	68-76	186-205	289-325	106-122	21-23	724-798
	(54)	(73)	(197)	(310)	(113)	(22)	(770)
II	65-74	80-89	158-175	304-338	112-125	20-23	744-813
	(70)	(84)	(166)	(319)	(119)	(22)	(780)
III	76-84	89-95	175-186	338-365	122-133	22-24	825-876
	(80)	(92)	(180)	(352)	(127)	(23)	(854)

Coxae: with 8-13 (11), 13-22 (16) and 20-29 (24) f.s., and

6-10 (8.2), 9-14 (11) and 14-17 (15) h.s. on the fore, middle and hind coxa respectively; fore coxa without coxal bristles; apical seta about $\frac{2}{3}$ as long as trochanter. Trochanters: 23-34 μ wide; with 6 oval sensilla; with 9-14 f.s. on the fore and middle trochanter and 15-24 (19) on the hind one, and each with 6-10 h.s., the latter including 2 minute setae near basal ridge, one small seta on the outer margin and a long apical seta which, on the fore trochanter, is 1.32-1.77 (1.52) times as long as the width of trochanter. Femora: of medium width (37-45 μ), with the ratio width to length of hind femur 1 : 4.1-4.4 (4.2); with 24-35 f.s. and 8-16 h.s. Tibiae: 19-27 μ wide; the ratio width to length of hind tibia 1 : 12.8-15.9 (14.3); with 81-111 setae of which 21-30 are h.s. and 58-83 f.s., the latter about 1½ times longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 17-21 μ wide, hind tarsus 6.4-6.6 (6.5) times longer than wide; with 17-27 f.s. and 6-11 h.s.; tarsal digitules subequal, slightly longer than claw. Claws: of medium length, a little longer than width of tarsus; slightly curved, with a small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 380-450 (409) μ long and 330-380 (345) μ wide.

Segments I-VII: tergites represented by a small transverse sclerite on each side on anterior margin of the 2nd and 3rd segments and a weak transverse plate on the 6th and 7th; sternites represented by a weak transverse plate on the 2nd, 3rd, 6th and 7th segments. Caudal extension of 7th segment large, reaching the level of the posterior margin of the 8th segment, tapering and weakly sclerotized.

Dorsal setae: up to 4, 5, 6, 3, 2 and 1 f.s. on the 1st to 6th segments respectively, but none on the 7th; occasionally a single h.s. present on the 1st-3rd segments, and usually one on each side on each of the 4th-7th segments. Pleural setae consisting of dorsopleural setae: 0-3 (0.7), 0-3 (1.3), 0-3 (1.7), 1-3 (2.0), 0-3 (1.6) and 0-4 (1.0) f.s. on the 1st-6th, and 0-2 (0.9), 2, 0-2 (1.6) and 1-2 (1.7) h.s. on the 3rd-6th segments respectively, and of ventropleural setae: occasionally one (range 0-2) f.s. on the 2nd, usually 2 (range 0-3) on the 3rd, and 3 (range 1-5) on each of the 4th-6th segments, and usually one h.s. on each of the 4th-6th segments. Segment VII with 9-15 (12) f.s. and 3-4 (3.2) h.s.; some of the posterior h.s. usually longer than rest. Ventral setae: 21-28 (25), 17-25 (21), 11-18 (14), 7-12 (10), 5-8 (7) and 1-5 (3) f.s. on the 2nd-7th segments respectively; usually one h.s. on each side on each of the 3rd-6th segments and 4 on the 7th.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a prominent, weakly sclerotized, semicircular lobe with a large cicatrix posterodorsally, the latter weakly sclerotized and reticulated in the middle; glandular pouch with 2 long, pointed setae, the protruding part of these being about 3-4 times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: 0-3 (1.9) f.s. Posterior margin with 2-6 (3.8) f.s. and 2-3 (2.9) h.s. on each side.

Genital segment: Penial sheath long, about $\frac{2}{7}$ - $\frac{1}{4}$ total body length (ratio 1 : 3.6-4.1, av. 3.8), 395-410 (402)μ long and 38-42 (40) μ wide; lateral sclerotizations narrowly joined anterior to

anus; length of basal rod about equal to that of aedeagus, extending anteriorly from the base of the aedeagus for about $\frac{2}{3}$ of the distance to the apex of the basal membranous area; apex of sheath with a distinct, finger-like membranous extension. The area from base of sheath to tip of aedeagus with 17-22 (20) small setae; a cluster of small sensilla occurring ventrally near apex. Aedeagus of medium length (118-137, av. 125 μ long), penial sheath and basisternum longer, the ratios being 1 : 3.0-3.4 (3.1) and 1 : 1.28-1.52 (1.39) respectively.

Material examined: 10 specimens, collected on Brachystegia tamarinoides by R. Boulton in the Salisbury district, Southern Rhodesia on 11.12.62; received from J. Munting; identified by D.J. Williams.

23. CEROPLASTES SP. (Figs. 24 and 43)

A short, robust species, with comparatively short antennae and long legs; with numerous setae covering the body and appendages. When mounted, total body length 1430-1670 (1529) μ; width at mesothorax 370-410 (386) μ. Wing expanse 2320-2500 (2417) μ.

Head: subconical in dorsal view; in lateral view dorsoventrally elongated, with anterodorsal bulge not pronounced; length from apex to pronotal ridge 205-247 (225) μ, width across genae 213-251 (231)μ. Median crest sclerotized, showing distinct, polygonal reticulation which does not enclose irregular striations; with numerous (16-27, av. 22) fleshy dorsal head setae and 7-11 (8.1) hair-like ones. Midcranial ridge : dorsally represented by a short vestigial ridge on anterior margin of head; ventrally strong, reaching ocular sclerite posteriorly, surrounding area weakly polygonally reticulated. Genae large, sclerotized, with polygonal reticulation; each with 11-19 (15) fleshy and 2-7 (4.3) hair-like genal setae. Eyes: two pairs, subequal; corneae of dorsal eyes 27-30 (29) μ in diameter and 1.6-2.6 (2.1) times as much apart; those of the ventral eyes 29-32 (30) μ in diameter and 0.6-1.0 (0.8) times as much apart. Ocellus small. Ocular sclerite well sclerotized, polygonally reticulated throughout. Preocular ridge extending a very short distance below articular process. Postocular ridge well developed throughout; ventral to ocellus the ridge usually splits up, with the anterior branch partly surrounding ocellus. Interocular ridge absent.

Dorsal ocular setae: 1-4 (2.5) f.s. and 1-5 (2.8) h.s. Ventral head setae: 55-84 (71) f.s. and 4-8 (6.3) h.s., scattered over the ocular sclerite, always with some (3-6, av. 2.3) f.s. occurring in front of the sclerite and with 11-21 (16) between and behind the eyes. Pre-oral ridge present. Tendon-like apodeme long. Cranial apophysis of medium length; apex bifurcate, extending to around level of posterior margin of ventral eyes. Mouth opening irregular. Anterior tentorial pits absent.

Antennae: 10-segmented; filiform; 678-770 (727) μ long, i.e. shorter than half body length (ratio 1 : 202-2.24, av. 2.10), shorter than posterior leg (ratio 1 : 0.72-0.78, av. 0.75), and longer than penial sheath (ratio 1 : 1.59-1.80, av. 1.71). Scape: 42-46 (43) μ long and 38-42 (39) μ wide, with 3 h.s. Pedicel: occasionally with polygonal reticulation dorsally, but usually with only wavy striations; 46-53 (50) μ long and 34-47 (38) μ wide; with 8-17 (12) f.s., 4-6 (5.4) h.s. and a sensillum placodeum. Segment III: somewhat club-shaped, 2.6-3.2 (3.0) times longer than wide (59-72, av. 69 μ long and 21-25, av. 23 μ wide); with 8-15 f.s. of medium length, 1.2-1.4 (1.3) times longer than width of segment; with 1-3 usual sensilla basiconica. Segments IV-IX: cylindrical; lengths of these segments (in μ) 106-137 (120), 91-105 (98), 68-80 (74), 68-87 (79), 49-65 (58) and 53-65 (59) respectively, widths varying from 15 to 23 μ, with distal segments slightly wider than proximal ones; with 23-29 (26), 20-27 (23), 13-24 (19), 17-23 (21), 14-20 (17) and 12-17 (15) f.s. respectively, but no h.s.; antennal bristles on 8th and 9th segments distinctly larger than f.s. Segment X: terminal $\frac{1}{3}$ constricted;

65-84 (78)μ long and 19-23 (21)μ wide (near base); carrying 2-11 (7.8) f.s., 3 capitate subapical setae and 5 antennal bristles of which the 3 long ones are about $\frac{4}{5}$ as long as the segment and the 2 shorter ones about as long as the f.s. (but stouter); with 2 sensilla basiconica ventrally, one near apex and the other more proximal.

Thorax: 498-593 (531) μ long.

Prothorax: Pronotal ridge strong, but medially interrupted by weak sclerotization. Lateral pronotal sclerites small, without setae. Medial pronotal setae: occasionally one f.s. may be present behind pronotal sclerites. Posttergites relatively large, with irregular striations, without setae. Pleural structures typical for the family. Sternum with transverse ridge strong, median ridge represented by a weak basal stalk, and triangular sclerite narrow, weakly sclerotized. Anteprosternal setae: 2-5 (3.5) f.s. on each side, with no setae occurring dorsal to proepisternum + cervical sclerite; prosternal setae: 14-24 (19) f.s. and occasionally one h.s., scattered over the sternal area but not spreading into the area anterior to the spiracles.

Mesothorax: Mesoprephragma with moderately deep emargination. Prescutum about twice as wide as long (av. 196 and 96 μ respectively); anterior margin curved; laterally bounded by the prescutal ridges and posteriorly by the prescutal suture; medially with somewhat more heavy sclerotization becoming ridge-like anteroventrally; with distinct polygonal reticulation. Scutum: Median membranous area: subrectangular; 80-99 (91) μ long and 1.75-2.14 (1.99) times as wide

(width 160-209, av. 180 μ), with 2-11 (6.7) f.s. and 9-12 (11) h.s. Scutellum: 46-65 (55) μ long and 175-198 (188) μ wide, the ratio being 1 : 3.1-4.1 (3.5); tubular, with small ventral foramen; without setae. Postnotum reticulated, with anterior margin irregular and exposed; postnotal apophysis and postalare well developed, the latter densely reticulated distally and with 1-6 (3.3) fleshy postalary setae, occurring on or immediately posterior to it. Mesopostphragma with moderately deep emargination. Mesopleuron: Mesopleural ridge strong, not interrupted above coxal articulation; pleural apophysis and pleural wing process well developed. Basalare absent. Subalare small. Episternum distinctly polygonally reticulated, subepisternal ridge well developed, but below membranous cleft indistinct and only marked by a band of darker sclerotization. Epimeron small. Lateropleurite partly bounded anteriorly by an extension from marginal ridge. Basisternum: large about 232 μ wide and 158 μ long, i.e. 1.60-1.88 (1.74) times longer than membranous area of scutum; with strong median ridge and bounded by strong marginal and precoxal ridges; without setae. Furca well developed. Mesothoracic spiracle with well developed peritreme; postmesostigmatal setae: 14-29 (21) f.s. and occasionally one h.s., arranged in a group behind each spiracle and a small number posterior to prosternum. Tegula small, membranous bulge with a small weak sclerite posteriorly and with 3-10 (5.7) h.s. Third axillary wing sclerite with a pronounced ventral projection at its base. Antemetastigmatal setae: 2-7 (4.1) f.s.

Metathorax: Metanotum with thickening of posterior margin

desclerotized medially; suspensorial sclerites absent. Postnotum consisting of two small sclerites, one on each side. Metatergal setae: 1-6 (2.9) f.s. and sometimes up to 3 (0-3, av. 0.8) h.s. of which one is occasionally situated more medially than the others. Pleural ridge considerably reduced, extending only a short distance above coxal articulation. Vestigial precoxal ridge present. Episternum reduced to a small subtriangular plate; epimeron produced posteriorly. Metathoracic spiracle similar to mesothoracic one. Dorsostigmatal setae: 9-18 (15) f.s. Postmetastigmatal setae: 13-19 (16) f.s. and 1-3 (1.6) h.s. Metasternal plate weak and irregular, but more heavily sclerotized anteriorly. Anterior and posterior metasternal setae: 41-66 (54) and 20-46 (33) f.s. respectively.

Wings: hyaline; short and comparatively broad: 970-1060 (1018) μ long and 445-500 (483) μ wide, the ratio width to length being 1 : 2.04-2.18 (2.11); alar lobe and alar setae absent. Halteres absent.

Legs: long and slender, with the fore pair usually shortest and the hind pair longest; the ratio length of hind leg to body length is 1 : 1.54-1.69 (1.61). Length of segments (in μ):

Leg	Coxa	Trochanter	Femur	Tibia	Tarsus	Claw	Total
I	57-65 (62)	70-78 (76)	220-247 (231)	323-376 (347)	124-131 (129)	24-27 (25)	827-928 (870)
II	68-78 (75)	84-95 (89)	194-209 (201)	346-380 (363)	125-137 (132)	25-28 (27)	849-927 (885)
III	80-87 (83)	91-101 (98)	201-220 (213)	365-418 (394)	133-137 (136)	25-27 (26)	903-989 (950)

Coxae: with 14-16 (15), 22-30 (26) and 30-41 (37) f.s. and 7-9 (8), 7-11 (9) and 12-17 (13) h.s. on the fore, middle and hind coxa respectively; fore coxa with 2-4 (3.2) knobbed coxal bristles; apical seta about half as long as trochanter. Trochanters: 23-30 μ wide; with 6 oval sensilla, 10-17 f.s. and 6-8 h.s., the latter including 2 minute setae near basal ridge, one small seta on outer margin and a long apical seta which, on the fore trochanter, is 1.69-2.31 (2.01) times as long as the width of the trochanter. Femora: of medium width (38-46 μ) with the ratio width to length of hind femur 1 : 4.6-5.3 (4.9); each with 31-44 f.s. and 12-23 h.s. Tibia: 19-25 μ wide, the ratio width to length of hind tibia being 1 : 16-18 (17); each with 92-120 setae, of which 19-33 are h.s. and 71-88 f.s., the latter about 1½ times longer than width of tibia; with apical spur of about the same size on all tibiae. Tarsi: 19-22 μ wide, hind tarsus 6.0-6.6 (6.4) times longer than wide; with 20-32 f.s. and 8-16 h.s.; tarsal digitules subequal, slightly longer than claw. Claws: of medium length, a little longer than width of tarsus; slightly curved, with a small denticle near tip; ungual digitules subequal, about as long as claw.

Abdomen: 330-460 (399) μ long and 300-360 (333) μ wide.

Segments I-VII: tergites represented by a small sclerite on each side on the anterior margin of the 2nd and 3rd segments, and a weak transverse plate on the 6th and 7th; sternites represented by a weak transverse plate on the 2nd, 3rd and 7th segments. Caudal extension of 7th segment large, tapering, weakly sclerotized. Dorsal setae: 5-14 (9) f.s. on the 1st, 1-5 on the 2nd and 3rd,

and up to 3 on each of the 4th-7th segments; occasionally a single h.s. on the 1st-3rd, and usually one on each side on each of the 4th-7th segments. Pleural setae consisting of dorsopleural setae: 2-10 (4.4), 1-5 (2.9), 1-6 (3.2), 0-6 (3.2), 2-6 (4.1) and 1-4 (2.2) f.s. on the 1st-6th, and 0-1 (0.3), 1-2 (1.6), 1-2 (1.7), 1-3 (2.1) and 0-2 (1.6) h.s. on the 2nd-6th segments respectively, and of ventropleural setae: up to 5 f.s. on each of the 3rd-6th segments, and usually one (range 0-2) h.s. on the 4th-6th. Segment VII with 12-17 (14) f.s. and 3-5 (3.4) h.s.; some of the posterior h.s., usually longer than the rest. Ventral setae: 23-35 (29), 14-31 (23), 12-22 (16), 8-14 (11), 5-12 (9) and 6-11 (9) f.s. on the 2nd-7th segments respectively; usually one h.s. on each side on each of the 3rd-6th segments, and 4 on the 7th.

Segment VIII: with weak tergite and transverse sternite; caudal extension forming a prominent weakly sclerotized, semi-circular lobe, with a large cicatrix posterodorsally, the latter weakly sclerotized and reticulated in the middle; glandular pouch with 2 long, pointed setae, the protruding part of these being about 3-3½ times as long as the section within the pouch. Small 9th tergite present. Ante-anal setae: 2-5 (3.8) f.s., 0-4 (1.6) small h.s. and occasionally one long h.s. Posterior margin with 3-7 (4.2) f.s. and 3-4 (3.2) h.s. on each side.

Genital segment: Penial sheath long, about $\frac{2}{7}$ total body length (ratio 1 : 3.5-3.8, av. 3.6), 407-445 (426) μ long and 38-44 (40) μ wide; lateral sclerotizations narrowly joined anterior to anus; length of basal rod about twice that of aedeagus, extending anteriorly

from the base of the aedeagus for about $\frac{5}{6}$ of the distance to the apex of the basal membranous area; apex of sheath with a distinct, finger-like membranous extension. The area from base of sheath to tip of aedeagus with 23-29 (25) small sensilla; a cluster of small sensilla occurring ventrally near apex. Aedeagus short (87-106, av. 95 μ long), penial sheath and basisternum longer, the ratios being 1 : 4.1-4.9 (4.5) and 1 : 1.53-1.78 (1.66) respectively.

Material examined: 10 specimens, collected by J. Munting on Milletia sp. in Umkomaas, South Africa, on 7.2.62; no adult females present with the males; nearby females of Ceroplastes ?mimosae Hall occurred on Abaris sp.; identification by D.J. Williams.

Comparative notes: This species differs from C. berliniae in having coxal bristles on the fore coxa, and a shorter aedeagus (measured for example against the basal rod or the penial sheath) and also in a number of less striking characters, e.g. in the presence of a vestigial dorsal part of the midcranial ridge, and in the number of f.s. between and behind the eyes, on the 4th antennal segment and ventrally on the 7th abdominal segment.

V. DISCUSSION

The present study of male Coccidae revealed a number of interesting facts concerning the taxonomy of this family, including its relationships with other members of the superfamily Coccoidea. Unlike the other larger families of the Coccoidea, such as the Diaspididae or even Pseudococcidae, our knowledge of the intra family relationship of various forms included in the family Coccidae is very limited. Only very few workers have attempted to classify this large family on the basis of the customary female characters. Steinweden (1929) grouped a small number of genera around each of the three genera Coccus L., Toumeyella Ckll., and Exaerotopus Newst., but left most of the genera studied by him as "ungroupable"; Sulc (1941) formed the tribe Eriopeltini to include the three genera Eriopeltis, Scythia and Mohelnia (the latter is now regarded as being synonomous with Scythia (Borchsenius, 1957). Bodenheimer (1953) divided the Coccidae of Turkey into four subfamilies, i.e. the Coccinae (including Coccus, Eulecanium, Sphaerolecanium, Saissetia, Pulvinaria and Paralecanopsis), Filippiinae (including Filippia and Euphilippia) and the Ceroplastinae and Eriopeltinae which include Ceroplastes and Eriopeltis respectively. The only

relatively comprehensive classification, based on a comparatively large number of genera (37) is that of Borchsenius (1957), who divided the family into three subfamilies, the Filippiinae, Coccinae and Ceroplastinae, the Coccinae being further subdivided into two tribes, the Coccini and Pulvinariini. This classification is mainly based on a few characters of the adult female and particular emphasis is put on the way in which the body and eggs are covered.

The male material, 19 genera (23 species) used in the present investigation included 14 of the 37 genera on which Borchsenius based his classification, representing all his subfamilies and tribes. On an examination of the characters of the males it was immediately apparent that they exhibit entirely different relationships, which do not conform with the division of the family suggested by Borchsenius. A fresh approach was therefore necessary. The large number of characters available (listed in Table I) made some quantitative evaluation of these relationships possible, but detailed statistical analyses such as mentioned by Sneath and Sokal (1962) and fully discussed very recently in their book on numerical taxonomy (Sokal and Sneath, 1963) are beyond the scope of the present work. Therefore

genera which appeared to resemble each other, especially in sharing distinct features such as prominent caudal extensions, an interocular ridge, a head with a pronounced anterodorsal bulge, large numbers of setae, etc., were grouped together. The validity of these groups were then tested by calculating the number of characters shared by the group as a whole, and by pairs of genera from different groups. For the purpose of these calculations all characters were treated as of equal weight and importance. It was found that the family could be divided into four groups of genera which can conveniently be called the Eulecanium group, the Eriopeltis group, the Inglisia group and the Coccus group. In the following discussion the references to suprageneric groups refer to these groups and three aspects will be discussed:

(a) the characters which are of taxonomic importance and the levels at which they appear to be valid,

(b) the classification and interrelationships within the family, and

(c) the relationship of this family with other subdivisions of the Coccoidea. It must be stressed here that only a small number of species were studied. All the statements and conclusions are therefore tentative and some of them are bound to be altered or even abandoned as more information becomes available,

particularly because the grouping suggested from a study of the male does not conform with the suggested classification based on the female.

(a) TAXONOMIC SIGNIFICANCE OF THE CHARACTERS.

All the characters which appear to be of some taxonomic importance are listed in Tables I - IV. The characters which at this stage of research were found useful for separating the groups of genera, genera and species are discussed below and listed in detail in Table I.

The size and general appearance show considerable variation within the family. Broadly speaking the size is characteristic of species or groups of species but the actual size may vary considerably within one species. Thus specimens of P. corni from different localities (Poland, Russia and Yugoslavia) showed large differences e.g. those from Yugoslavia were about ¾ the size of those from Poland, the Russian ones being intermediate. Apart from local climatic conditions this may be due to the effect of the host plant, which has been shown to influence the size of the females of this species (Habib, 1953; Kawecki 1958a); Bustshik (1958) suggested that the effect of the host plant caused size variation in males of some Diaspididae whereas Ghauri (1962),

having found males of distinctly different sizes on the same host plant, mentioned genetic polymorphism as a possible cause. The size is therefore considered to be of rather limited significance. The general "hairy" appearance of the body can be used to separate groups of genera.

The Head:

The shape of the head is characteristic of groups of genera, thus it is flat in the Eriopeltis group (figs. 36, 37) and elongated dorsoventrally in all the other groups except Genus A (fig. 34) where it is rounded. The peculiar condition where the antero-dorsal bulge is pronounced and the medioventral bulge drawn far back, is characteristic of most of the Coccus group (figs. 39 - 42). The conditions of the ventral part of the midcranial ridge separate groups of genera, being reduced to a greater or lesser degree in the Eriopeltis and Inglisia groups, but complete in the Coccus and Eulecanium groups; the absence of the lateral arms separates E.? festucae from all other species. The dorsal part of the mid-cranial ridge is frequently absent or vestigial and in the latter case it can usually only be seen in well stained preparations, thus it is not particularly useful, but apparently operates

on the specific level. The postoccipital ridge, which provided a series of characters in the Diaspididae (Ghauri, 1962), is absent in this family. The absence of reticulation on the median crest is peculiar to two genera of the Eulecanium group. The degree of development of the postocular ridge separates groups of genera, genera and species in so far as it (i) is generally weak and tapering dorsally, but strong in the Coccus group and the genus Eriopeltis, (ii) usually forks below the ocellus, except in the Eriopeltis group and (iii) is reduced posteromedially in some species but not in others. A broad interocular ridge is characteristic of the Eriopeltis group. The preoral ridge is absent in the Eriopeltis group and two genera of the Eulecanium group. The size of the cranial apophysis and the shape of its apex show some variation which can be used at the generic and specific level. The number of simple eyes is a very distinct and useful character. In the Eriopeltis and Coccus groups the number is constant (4), but in the Eulecanium group the number varies from 4 - 10, separating genera. Thus four closely related genera, Eulecanium, Nemolecanium, Physokermes and Rhodococcus can easily be separated in having 10, 6, 4 and 8 eyes respectively. This character was already suggested to be of generic importance by Newstead (1903), and Sulc (1908) when he defined the genus

Eulecanium Ckll. and his two new genera Sphaerolecanium and Palaeolecanium. The large size of the lateral eyes is characteristic of the Inglisia group.

The setae of the head provide a number of important characters and their absence or presence in various regions of the head can be used to separate groups of genera. In the Eulecanium and Eriopeltis groups there are no fleshy dorsal head setae, and no setae at all between and behind the ventral simple eyes nor genal setae; in the Eulecanium group there are also no fleshy ventral head setae. In the Inglisia and Coccus groups there are present fleshy dorsal head setae as well as fleshy ventral head setae, setae between and behind the ventral eyes, and setae on the genae. The number of setae varies individually, but the differences in the ranges of individual variation can be used to separate some species and genera.

The antennae provide a number of characters which can be used at the generic and specific levels. These are (i) the length of the antenna in relation to the length of the body, the posterior leg and the penial sheath, (ii) the width of the 2nd segment relative to that of the 1st, (iii) the length of the 3rd segment in relation to its width, (iv) the relative lengths of the 3rd and 10th segments and (v) the shape of the terminal segment. In addition the relative

length of the fleshy setae and the antennal bristles, and also the number of subapical setae can be used to separate genera.

The Thorax:

Prothorax. The absence or presence of certain groups of setae and pores can be used to separate genera; a reticulated prosternum is characteristic of Coccus hesperidum and a spinose prosternum of the Inglisia group. The condition of the median ridge of the prosternum varies too much to be of practical use as it may be complete or any section of it reduced within the same species.

Mesothorax. The mesothorax provides a number of important characters. The shape of the mesoprephragma, the condition of the reticulation on the prescutum and the size of the membranous area of the scutum can be used as supplementary characters to separate genera and species. A tubular scutellum is characteristic of the Eriopeltis and Coccus groups and the two closely related genera Ctenochiton and Filippia. A basalare joins the pleural wing process to the mesepisternum in all the groups except the Coccus group, where this structure is vestigial or absent. The condition of the median ridge of the basisternum separates groups of genera, genera and species. As is the case with the head, the setae of the mesothorax

(and metathorax) provide a number of very useful characters. The number of fleshy and hair-like scutal setae separates certain genera; the presence of fleshy postmesostigmatal setae separates the Coccus and Inglisia groups from the Eulecanium and Eriopeltis groups; the setae on the postalare and basisternum can be used to distinguish genera.

Metathorax. The condition of the metapleural ridge and suspensorial sclerites is correlated with the absence or presence of the halteres (q.v). When the halteres are absent the metapleuron is reduced and the suspensorial sclerites absent. The presence of antemetastigmatal and dorsostigmatal setae differentiates the Inglisia and Coccus groups, while the variation in the number and type of postmetastigmatal, anterior metasternal and posterior metasternal setae can be used to differentiate groups and genera.

The fore wings vary from being long and narrow in the Eriopeltis group to short and broad in the Coccus group; in the Eulecanium group this variation in shape can be used to separate genera. The halteres are completely absent in the Eriopeltis, Inglisia and Coccus groups and in the genera Phyllostroma and Sphaerolecanium. Sulc (1908) used this characteristic to define genera. The differences in the number of alar and haltere setae can be used to differentiate genera.

The characters provided by the legs seem to operate on all taxonomic levels. Some characters are constant within one or two of the groups, but differentiate genera and species in others, e.g. (i) the length of the hind leg and the length of the body is subequal in the Eriopeltis and Inglisia groups, but differences in the ratio between these two measurements separate genera in the Eulecanium group, and the two species of Pulvinaria in the Coccus group. (ii) The coxal bristles are absent in the Eriopeltis group and some of the genera of the Eulecanium group, but they are present in other genera of the Eulecanium group, in the Inglisia group as well as in the Coccus group (except Ceroplastes berliniae). (iii) the total number of setae on the fore tibia and the preponderance of fleshy setae on the hind tibia separates the Coccus and Inglisia groups from the Eriopeltis group, but only distinguishes genera within the Eulecanium group. Other characters are mainly significant at the generic and specific levels, e.g. (i) the relative lengths of the apical setae on the coxa and trochanter, (ii) the shape of the femur, (iii) the size of the apical spur of the fore tibia in relation to those on the other tibia, (iv) the length of the fleshy setae in relation to the width of the tibia, (v) the number of fleshy setae relative to the number of hair-like setae on the hind tarsus, (vi) the length of the hind tarsus in relation to its width and (vii) the relative length of the hind claw.

The abdomen:

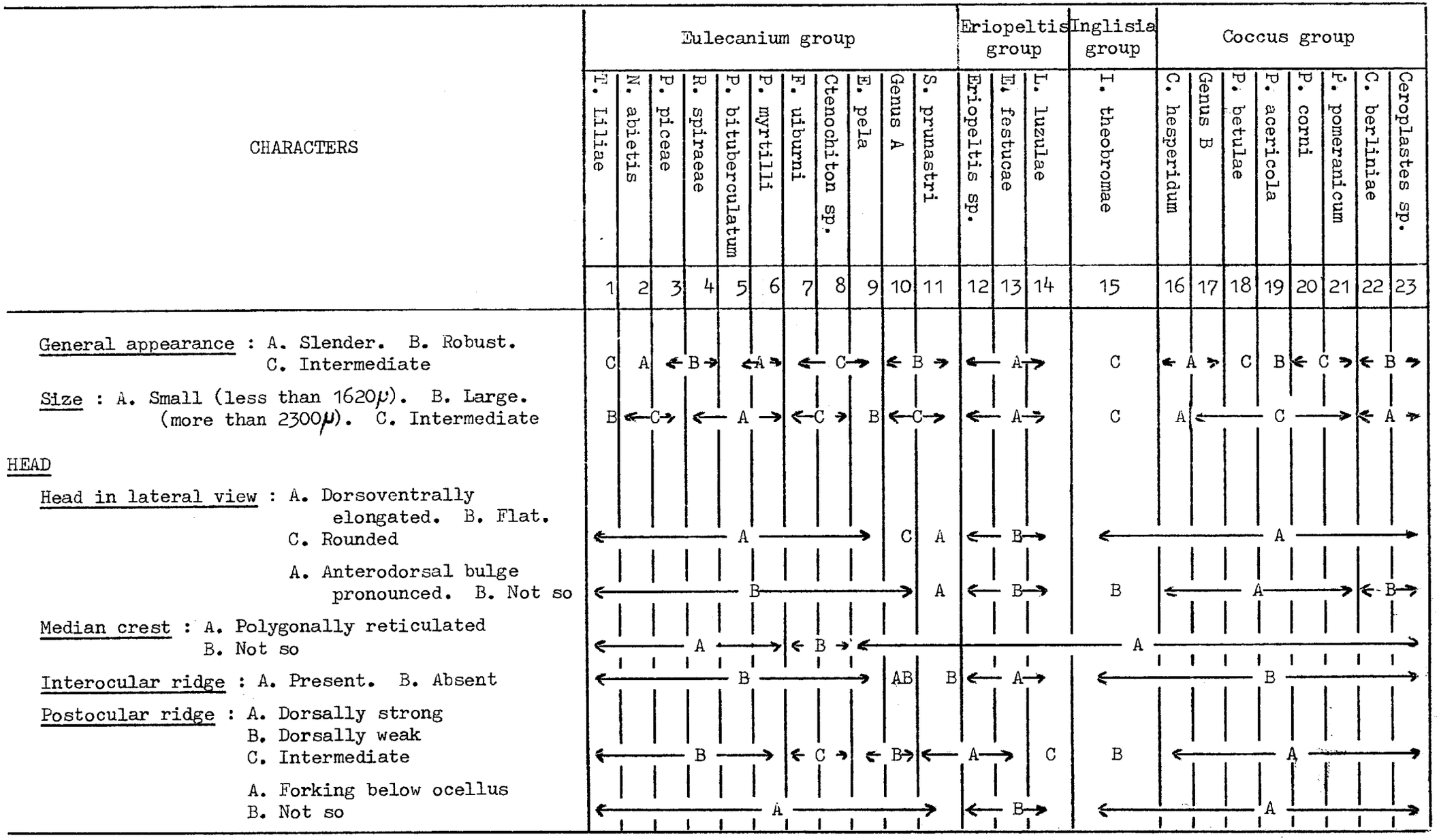
The abdomen and genitalia also provide a series of important characters. The number of tergites and sternites usually vary within the group. The absence or degree of development of the pleural sclerotization, however, remains constant within the groups. A prominent, tapering caudal extension is characteristic of the Coccus group. The shape of the caudal extension of the 8th segment and the position and size of the cicatrix differentiate the genera of the Coccus group. The number of dorsal abdominal setae on certain segments varies somewhat individually, but can be used as a supplementary character to separate genera and species. The length of the setae of the glandular pouch shows considerable differences between species and genera; in Luzulaspis luzulae the pouch itself is absent. The presence of fleshy setae lateral to the glandular pouch is characteristic of the genus Ceroplastes. Fleshy pleural setae occur in the Eriopeltis, Inglisia and Coccus groups and the genus Sphaerolecanium, but only in the Coccus group are they present on the 1st to 3rd segments. Fleshy ventral setae are characteristic of the same genera as the pleural setae, but Sphaerolecanium differs

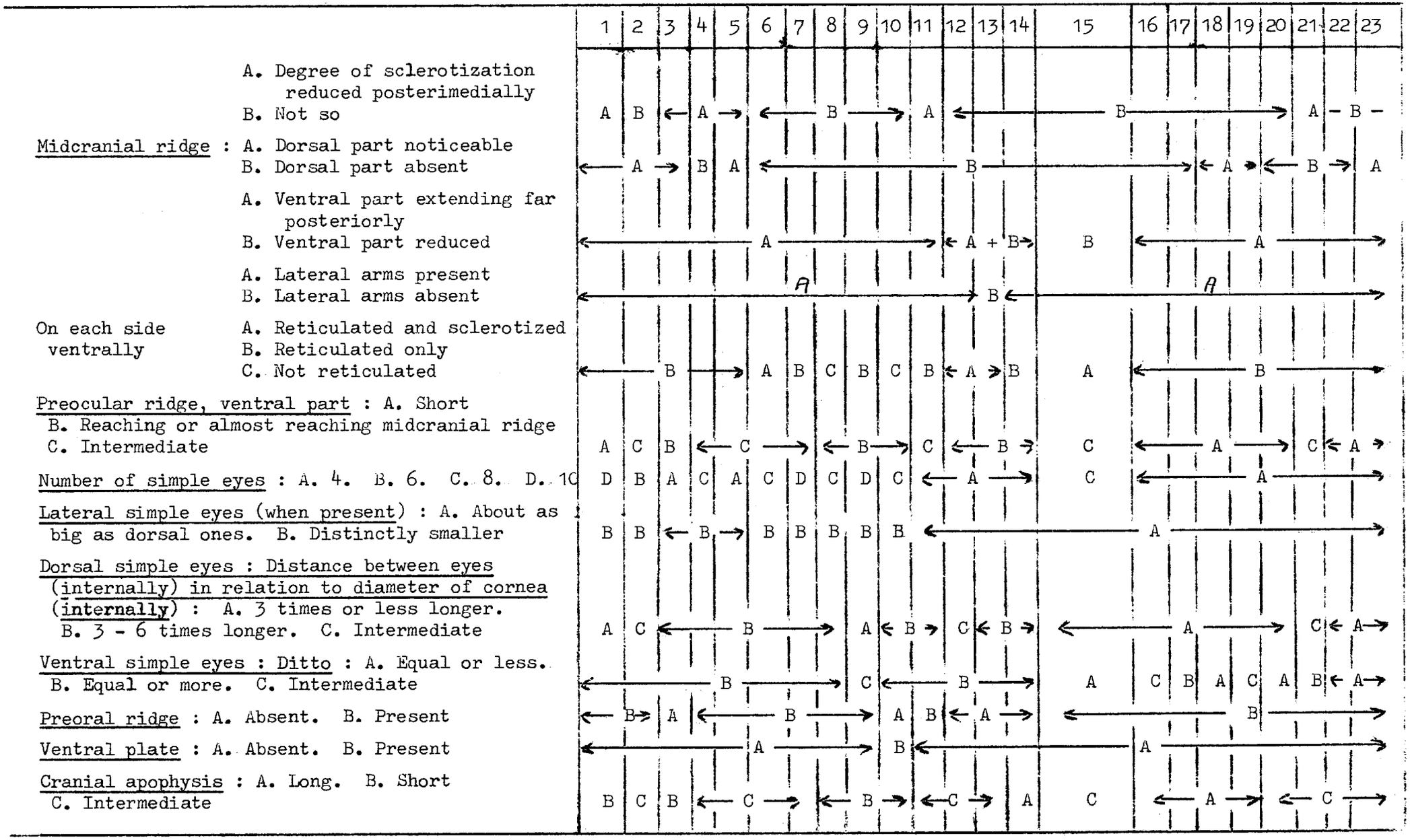
from the others in that the fleshy setae only occur on the 2nd and sometimes 3rd segments; a large number of fleshy setae on the 8th segment is typical of the Inglisia group. The number and arrangement of the hair-like ventral setae can be used as a supporting character to separate genera and species.

The relative lengths of the various structures of the genital segment show considerable differences, usually on the generic, but also on the specific level. The following ratios were found useful: (i) length of penial sheath to body length, (ii) length of basal rod to length of aedeagus, (iii) length of aedeagus to length of penial sheath, (iv) length of aedeagus to length of basisternum. A finger-like membranous extension of the apex of the penial sheath is characteristic of the genus Ceroplastes.

TABLE I

STATEMENT OF CHARACTERS SEPARATING GROUPS, GENERA AND SPECIES




1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
A. Degree of sclerotization reduced posterimedially
B. Not so
Midcranial ridge : A. Dorsal part noticeable
B. Dorsal part absent
A. Ventral part extending far posteriorly
B. Ventral part reduced
A. Lateral arms present
B. Lateral arms absent
On each side ventrally
A. Reticulated and sclerotized
B. Reticulated only
C. Not reticulated
Preocular ridge, ventral part : A. Short
B. Reaching or almost reaching midcranial ridge
C. Intermediate
Number of simple eyes : A. 4. B. 6. C. 8. D. 10
Lateral simple eyes (when present) : A. About as big as dorsal ones. B. Distinctly smaller
Dorsal simple eyes : Distance between eyes (internally) in relation to diameter of cornea (internally) : A. 3 times or less longer.
B. 3 - 6 times longer. C. Intermediate
Ventral simple eyes : Ditto : A. Equal or less.
B. Equal or more. C. Intermediate
Preoral ridge : A. Absent. B. Present
Ventral plate : A. Absent. B. Present
Cranial apophysis : A. Long. B. Short
C. Intermediate

Apex (central lobe excepting) : A. Bifurcate. B. Trifurcate. C. Truncate

Genae : A. Polygonally reticulated. B. Not so

Dorsal head setae : A. Fleshy setae present. B. Fleshy setae absent

Dorsal ocular setae : A. Present on at least one side. B. Absent

Ventral headsetae : A. Fleshy setae present. B. Fleshy setae absent

When present, fleshy setae : A. Less than 35 B. More than 40

A. With a pair of median hair-like setae distinctly longer than rest. B. Not so

A. All the setae situated on or anterior to level of preocular ridge. B. Not so

A. With setae between and behind ventral eyes (when few, these well behind anterior level of eyes). B. Not so

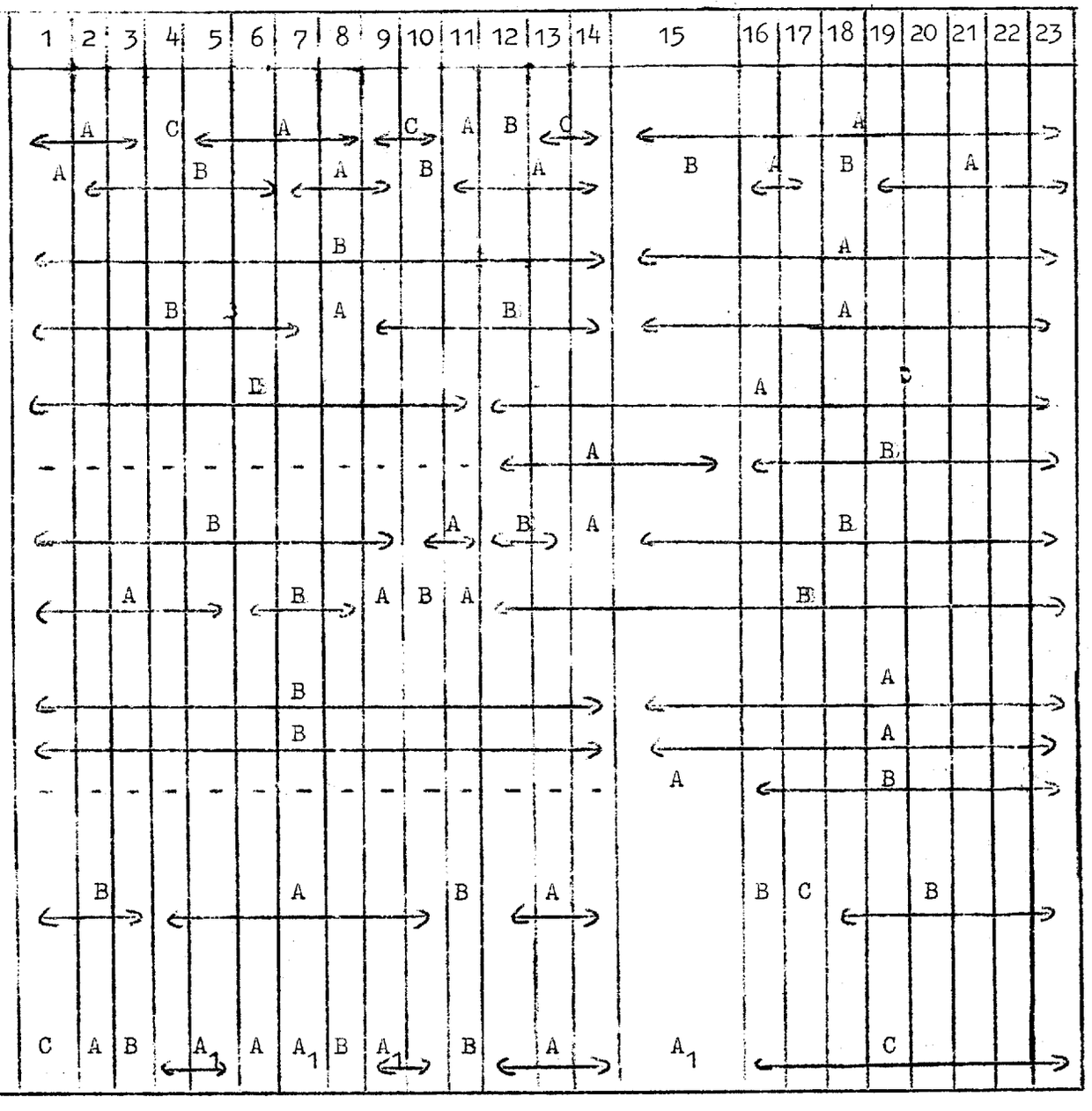
Genal setae : A. Present. B. Absent

When present : A. 11 or less. B. 12 or more

ANTENNAE

Length in relation to bodylength : A. More than half. B. Less than half. C. Intermediate

Length in relation to length of posterior leg :
A. Much longer, ratio 1 : 1.23 - 1.52
A_1 Longer, ratio 1 : 1.05 - 1.22
B. Subequal, ratio 1 : 0.95 - 1.05
C. Shorter, ratio : 1 : 0.58 - 0.93



Length in relation to length of penial sheath :
A. Short, 1.16 - 2.10 times longer. B. Long, 2.10 - 6.10 times longer

Length of 3rd segment in relation to its width :
A. More than 3 times longer. B. Less than 3 times longer. C. Intermediate

Relative widths of 1st and 2nd segments :
A. 2nd wider than 1st. B. 1st wider than 2nd. C. Widths subequal

Fleshy setae on 3rd segment : A. Very short and thick, length less than $\frac{3}{4}$ width of segment. B. Very long, length 4 or more times width of segment. C. Intermediate

Relative lengths of 3rd and 10th segments :
A. 3rd longer than 10th. B. 10th longer than 3rd C. Either condition possible

Hair-like setae on segment III : A. Present. A_1 Usually present. B. Absent

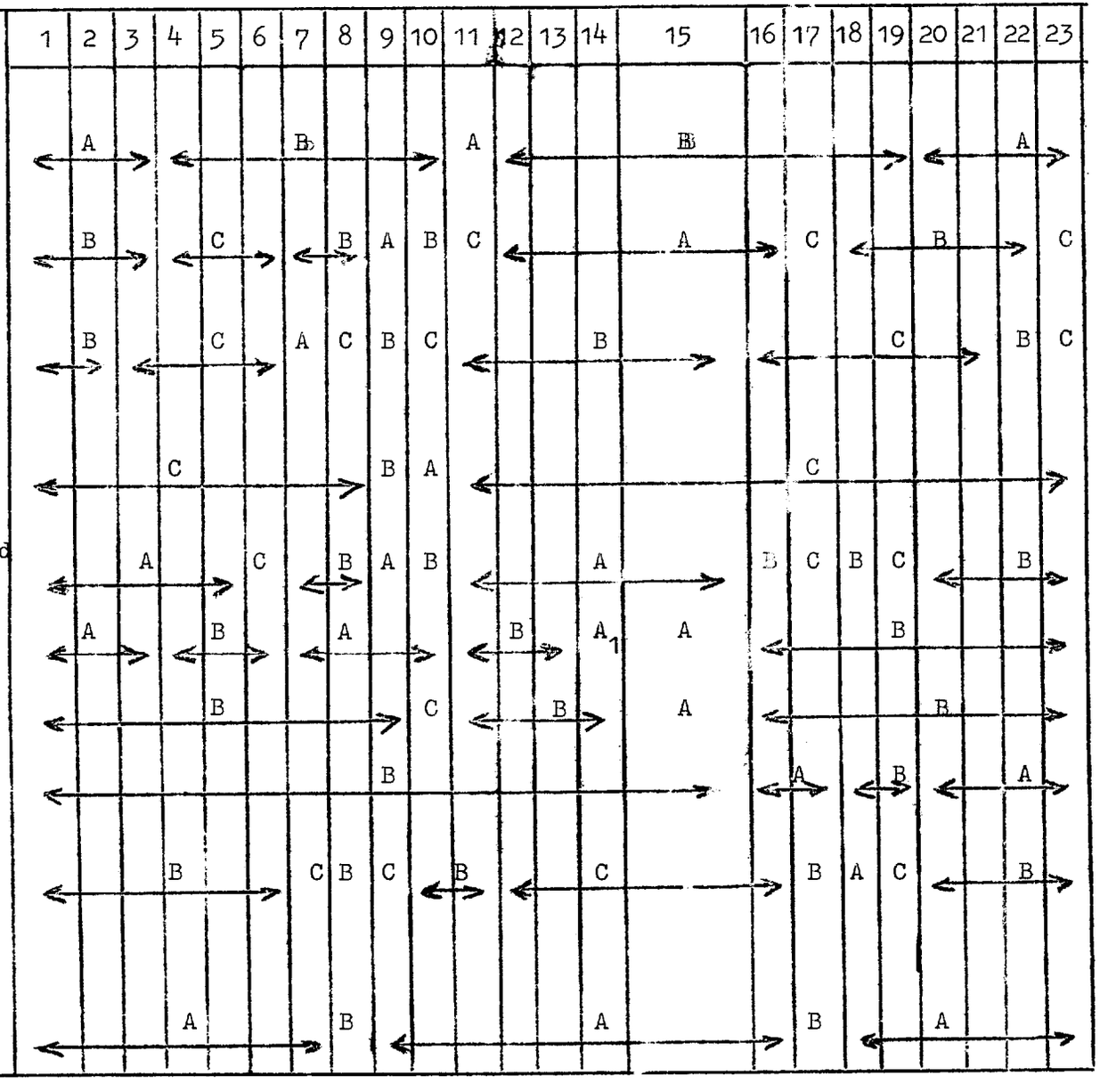
Number of capitate subapical setae on 10th segment : A. 2. B. 3. C. 4 - 6

Shape of 10th segment : A. Distal part constricted. B. Not so

Length of two smallest antennal bristle in relation to length of fleshy setae :
A. Distinctly longer. B. Subequal. C. Shorter

THORAX

Circular pores behind pronotal sclerite :
A. Less than 2 on each side. B. 2 or more on each side



Prosternum : A. Polygonally reticulated. B. Not reticulated. C. Denticulate (spinose)

Medial pronotal hair-like setae : A. Usually 2. B. Intermediate (1 - 2). C. Usually absent

Posttergital setae : A. Present on at least one side. B. Absent

Prosternal setae : A. Fleshy setae present. B. Fleshy setae absent

Mesothorax :

Emargination of mesoprephragma : A. Deep. B. Shallow. C. Absent

Reticulation on prescutum : A. Regular polygonal. B. Irregular. C. Absent or very weak

Length of membranous area of scutum : A. More than twice width. B. Less than twice width. C. Intermediate

Scutellum : A. Not tubular. B. Tubular

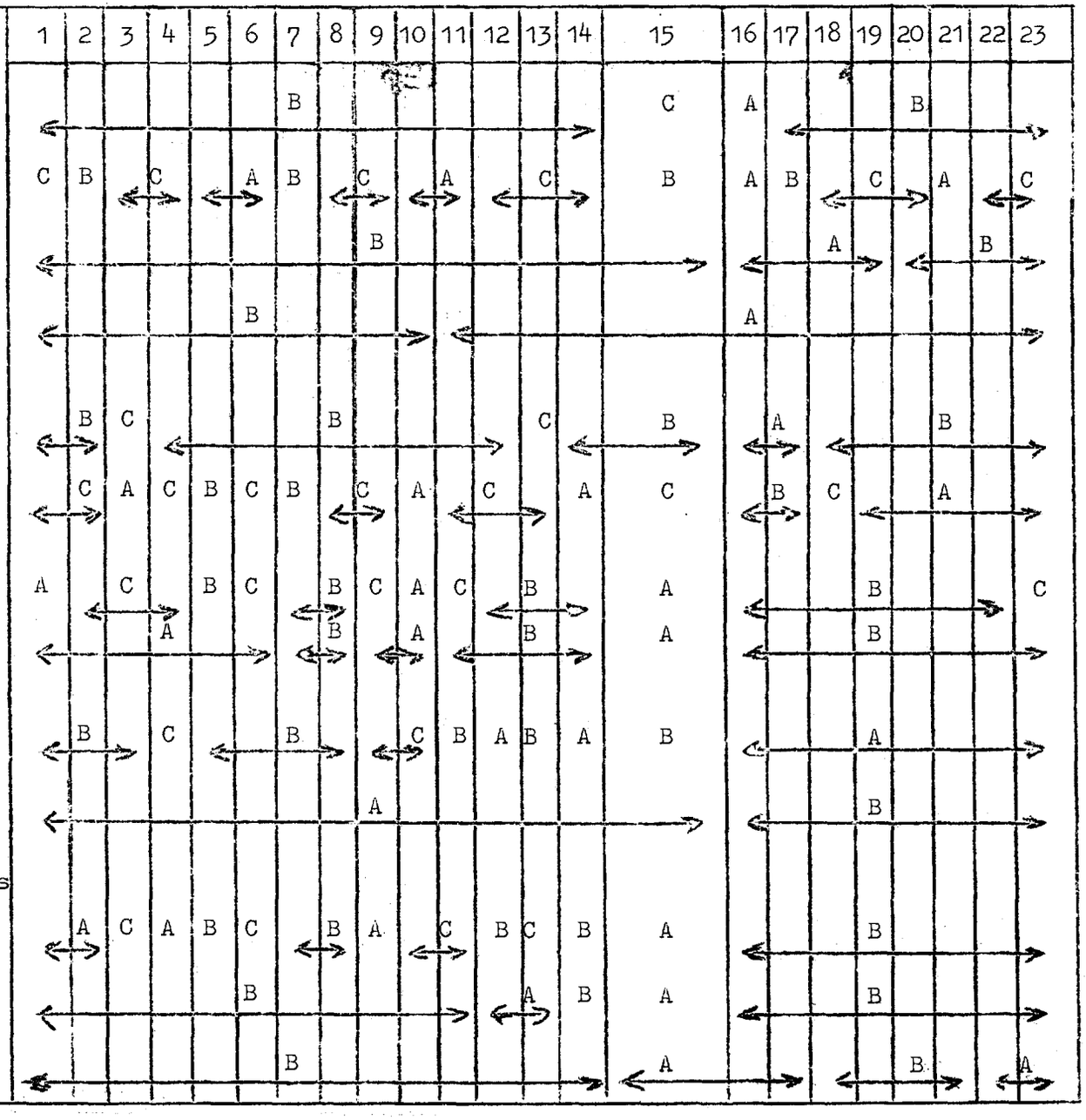
A. 3-4 times wider than long
B. 2-3 times wider than long
C. 1-2 times wider than long

Basalare : A. Joining pleural wing process to mesepisternum. B. Not so

Length of basisternum in relation to length of membranous area of scutum : A. More than twice as long. B. Less than twice as long. C. Intermediate

Median ridge of basisternum : A. Absent or reduced. B. Complete

Scutal setae : A. Fleshy setae present. B. Fleshy setae absent



A. Hair-like setae absent
B. Hair-like setae 1-4
C. Hair-like setae 3-30

Postalary setae : A. Usually present
B. Absent

Postmesostigmatal setae : A. Fleshy setae present
B. Fleshy setae absent

A. Flesh setae 14-32
B. Fleshy setae more than 43

Basisternal setae : A. Fleshy setae present
B. Hair-like setae present
C. Setae absent

Metathorax :

Suspensorial sclerite : A. Present. B. Absent

A. Elongate
B. Not elongate

Metapleural ridge : A. Reduced. B. Not reduced

Dorsostigmatal setae : A. Fleshy setae present
B. Fleshy setae absent

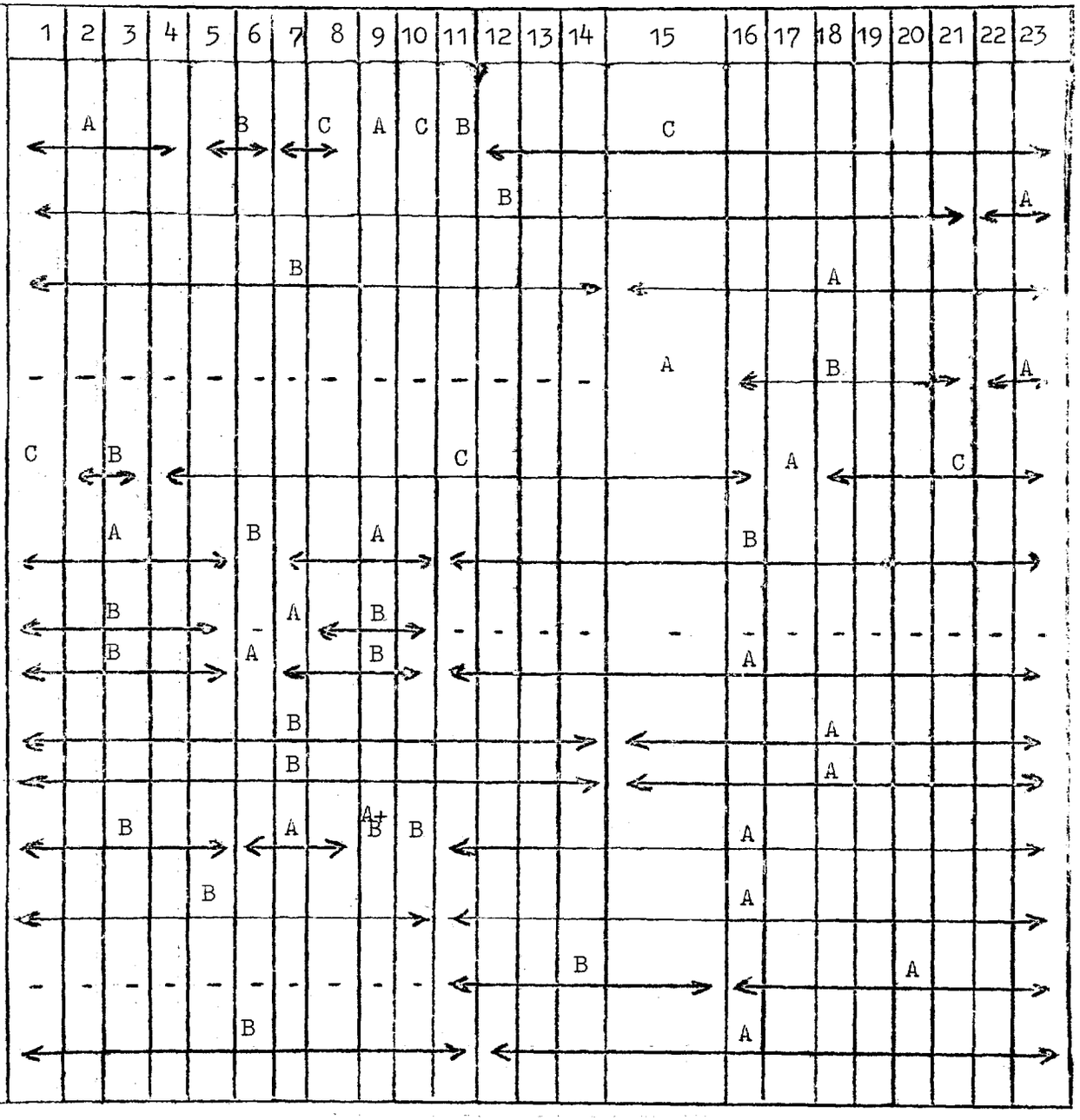
Antemetastigmatal setae : A. Present. B. Absent

Postmetastigmatal setae : A. Fleshy setae present
B. Fleshy setae absent

Anterior metasternal setae : A. Fleshy setae present. B. Fleshy setae absent

A. Fleshy setae numerous (36-94)
B. Fleshy setae less numerous (11-24)

Posterior metasternal setae : A. Fleshy setae more than 4. B. Fleshy setae less than 4



Fore wings : A. Less than $2\frac{1}{4}$ times longer than wide. B. $2\frac{1}{4}$-$2\frac{3}{4}$ times longer than wide. C. More than $2\frac{3}{4}$ times longer than wide

Alar setae : A. Present on at least one side
B. Absent

Halteres : A. Absent. B. Present

Haltere setae : A. One on each side
B. More than one on at least one side

Legs :

Length of hind leg in relation to bodylength :
A. Bodylength 1.85 or more times longer
B. Bodylength less than 1.85 times longer

Front coxa : Coxal bristles : A. Present
B. Absent

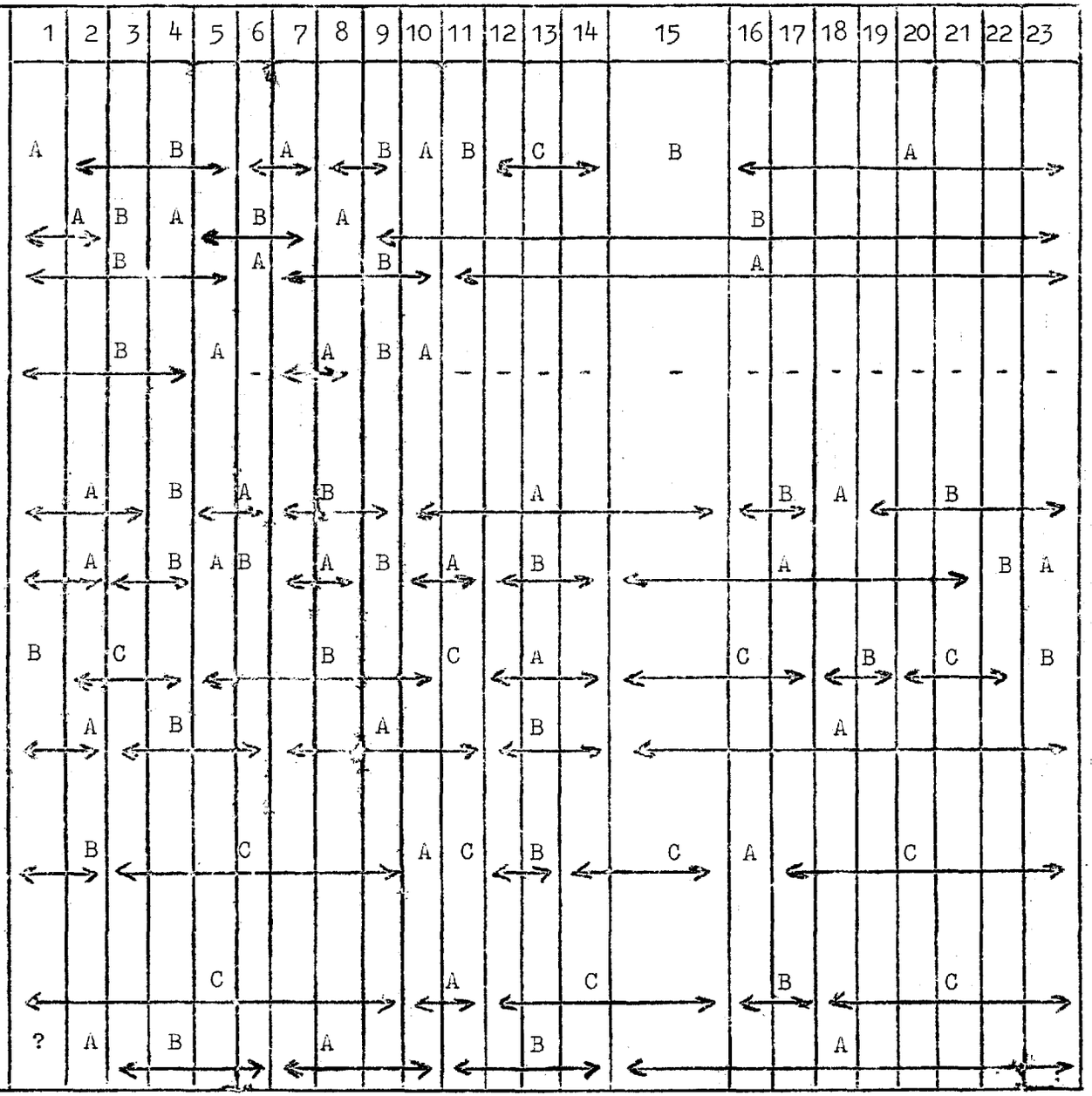
Apical seta : A. Long, about equal to length of trochanter. B. Short, about half length of trochanter. C. Intermediate

Total number of setae on front tibia :
A. More than 60. B. Less than 60

Length of apical seta on front trochanter in relation to width of trochanter : A. Short, less than $1\frac{1}{2}$ times. B. Long, more than 3 times. C. Intermediate

Hind femur : A. Short and wide, less than $3\frac{3}{4}$ times longer than wide. B. Long and narrow, more than 6 times longer than wide. C. Intermediate

Hind tibia : A. With more fleshy than hair-like setae. B. Vice versa



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
A. With apical spur on frong leg much smaller than on middle and leg. B. Spur subequal on all 3 legs	←						B							→	A	←			B				→
Length of fleshy setae in relation to width of tibia : A. At least 3 times longer. B. Shorter. C. Intermediate	←			C				→	A	B	←					C							→
Hind tarsus : A. With more fleshy than hair-like setae. B. With subequal numbers of hairlike and fleshy setae. C. With more hair-like and fleshy setae	?	B	←		C →		B	C	B	←		C		→	B	←	A		→	←	C →	←	A →
A. More than 6 times longer than wide. B. Less than 6 times longer than wide. C. Intermediate	←			B			→	C	A	←		B		→	←	A		→	←	B →	←	A	→
Hind claw : A. About $1\frac{1}{2}$ times longer than width of tarsus. B. Equal to or a little longer than width of tarsus	←	B	→	A	←			B			→	←	A →	←				B					→
ABDOMEN																							
Tergites : A. Present on all the segments B. Absent on one or more of the intermediate segments	←	A	→	←	B →	A	←			B			→	A	←		B						→
Nature of tergites between 1st and 2nd segments : A. Separate sclerite on each side. B. One sclerite on each side with a separate median sclerite. C. Continuous from side to side	←	A		→	B	AC	B	←	A →	C	←		A	→	←		B		→	←	A		→
Pleural sclerotization : A. On segm VII.. B. On segm IV-VII. C. Absent	←					C					→	←	A	→	B	←				A			→
Sternites : A. Present on segm II-VIII. B. Absent on one or more of middle segments. C. Absent on segm II	←	A	→	B	←		A	→	C	←	B →	←		A	→	←	B →	A	←		B		→

Caudal extensions on segm VII : A. Very prominent, tapering. B. Small, broadly rounded or slightly pointed

Caudal extension of segm VIII forming a :
A. Small convex lobe. B. Papilla shaped lobe. C. Large cylindrical lobe. D. Large, semi-circular lobe. E. Large geniculate lobe. E. Mammillate lobe

Cicatrix on caudal extension of segm VIII :
A. Absent. B. Present

Location and size of cicatrix : A. Lateral, small. B. Posterior, large. C. Postero-dorsally, large

Glandular pouch on segm VIII : A. Absent B. Present

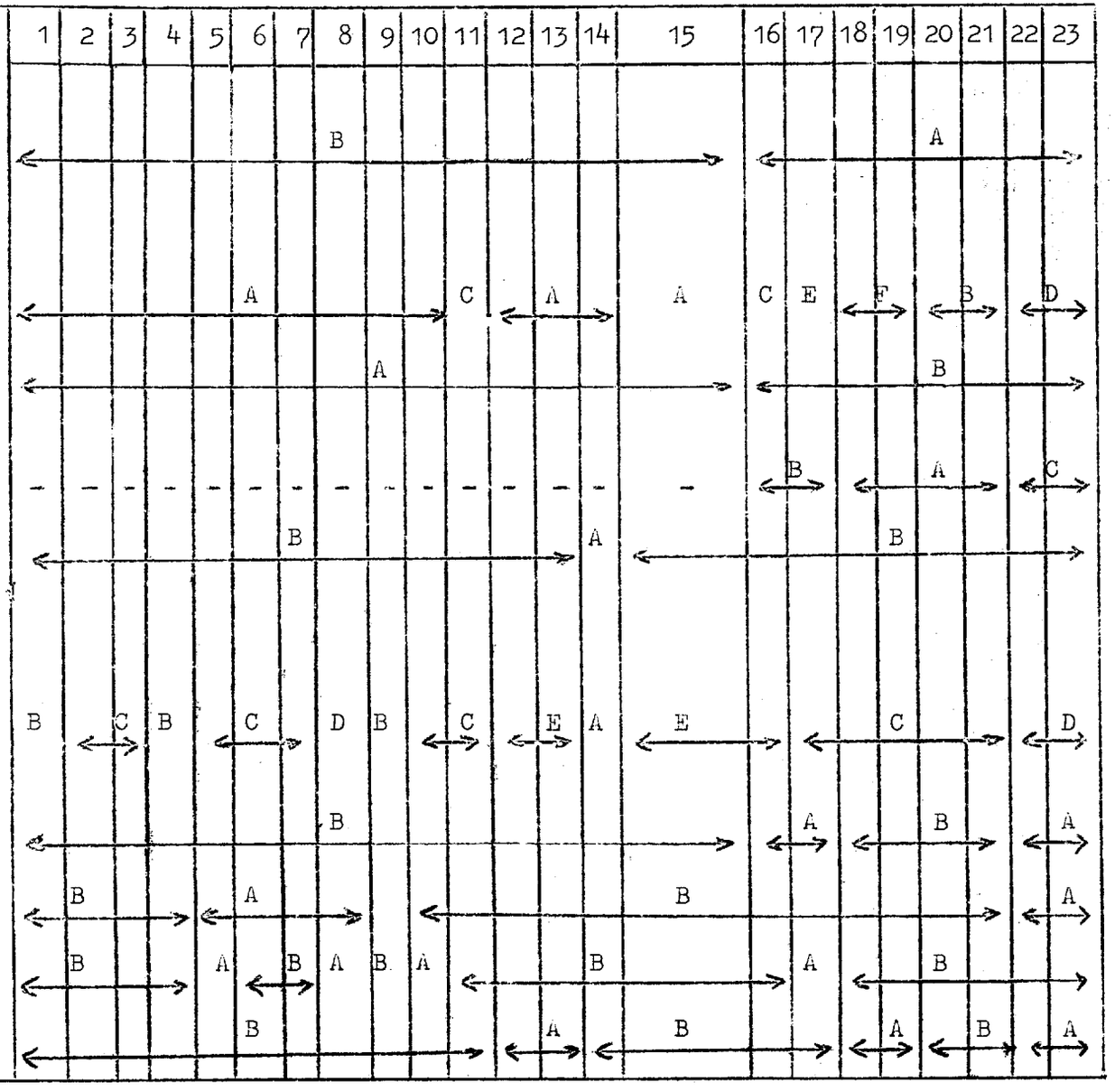
Setae of glandular pouch : A. With no internal part. B. With external part less than twice internal part. C. With external part 2-3 times internal part. D. With external part 3-4 times internal part. E. With external part more than 4 times internal part

Abdominal dorsal setae : Fleshy setae on segm I : A. Usually more than one. B. Usually one or none

Hairlike setae on segm I : A. Usually 2, rarely 1. Usually absent, rarely 1

Hairlike setae on segm III : A. Usually 2, rarely 1. B. Usually absent, rarely 1

Ante-anal setae : A. Fleshy setae usually present. B. Fleshy setae usually absent



A. Usually with 2 long hair-like setae
B. Usually without long hair-like setae

Lateral to glandular pouch : A. Fleshy setae 2-7. B. Fleshy setae absent, rarely one

Circular pores in ante-anal region :
A. One or more present. B. Absent

Abdominal pleural setae : A. Fleshy setae present. B. Fleshy setae absent

A. Present on segm I-III
B. Absent on segm I-III

Abdominal ventral setae : Fleshy setae :
A. Present. B. Absent

A. Absent posteriorly beyond segm III
B. Present posteriorly beyond segm III

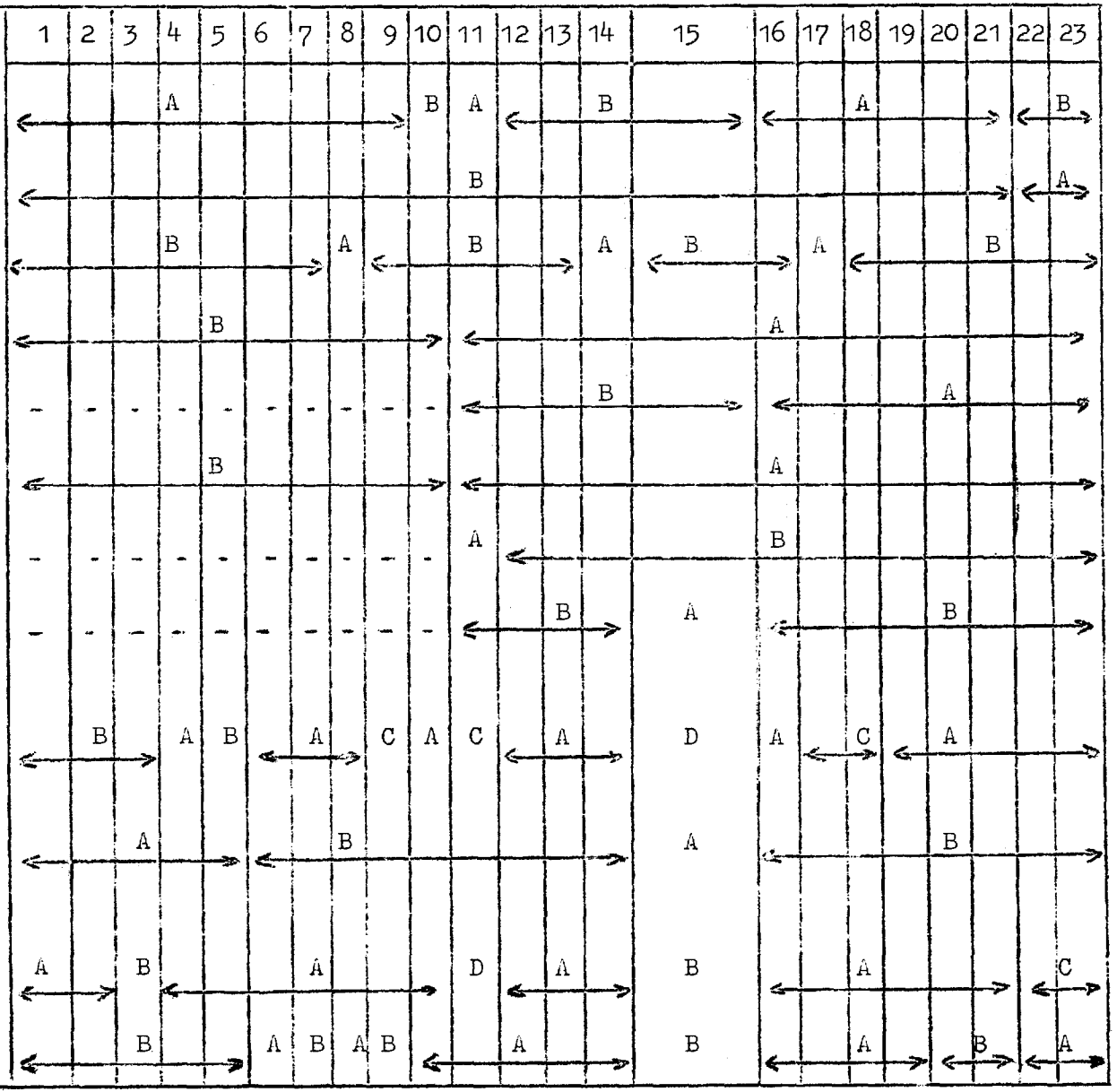
A. Numerous (7-15) on segm VIII
B. Few (3 or less) on segm VIII

Hair-like setae on segm II, usually :
A. Absent. B. Two medially.
C. One on each side. D. Two medially and one on each side

Hair-like setae on segm III, usually :
A. Two medially, rarely one
B. None medially, rarely one

Hair-like setae on segm VI and VII, usually :
A. 4 setae on both segments. B. 2 setae on both segments. C. 2 setae on segm VI and 4 on VII. D. 4 setae on segm VI and 2 on VII

Lateral sclerotizations of penial sheath :
A. Joined anterior to anus. B. Not so



Apex of penial sheath: A. Membranously extended. B. Not membranously extended

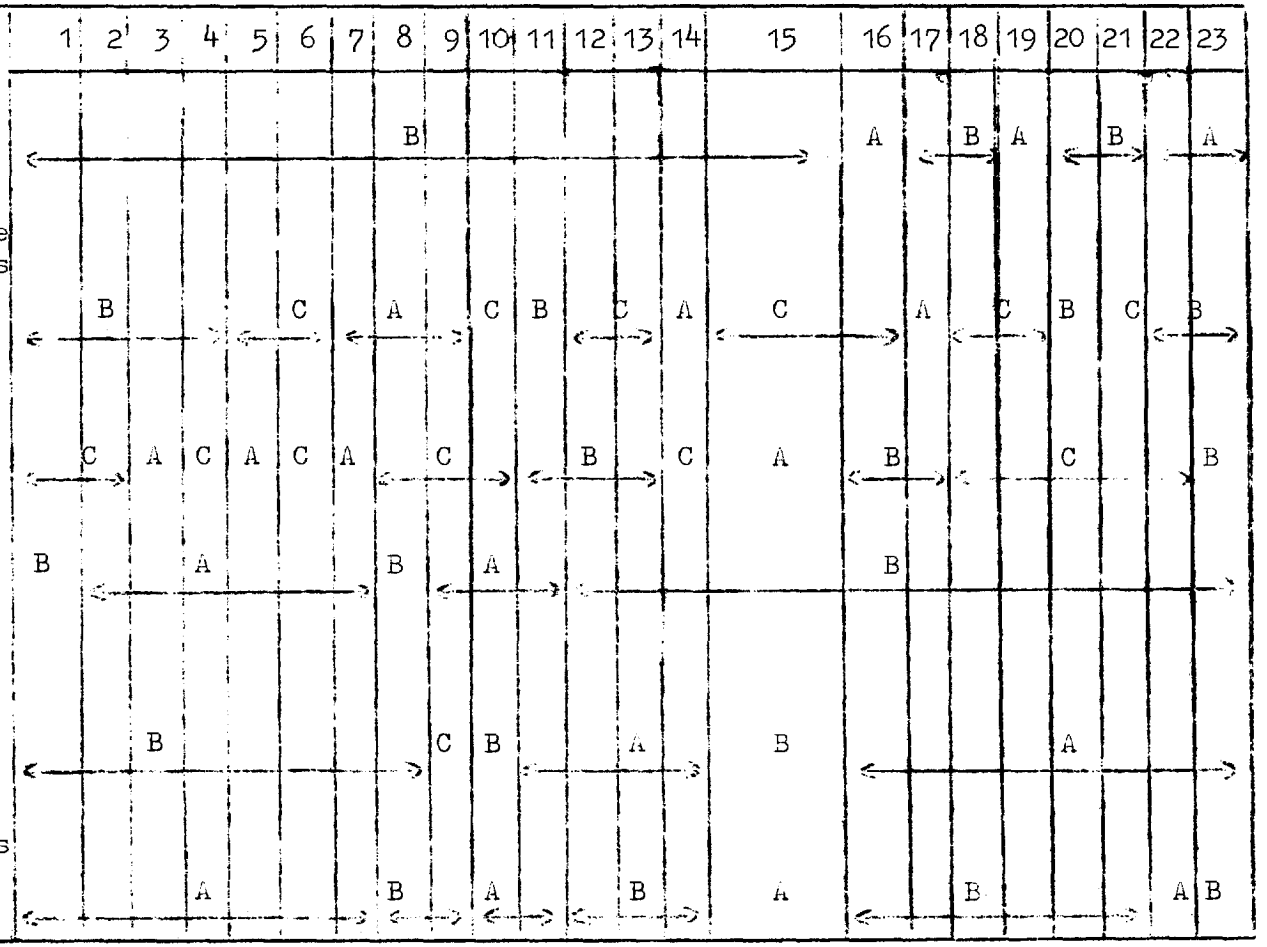
Length of penial sheath in relation to body-length : A. Short, bodylength usually $5\frac{1}{2}$ or more times longer. B. Long, body length usually less than $4\frac{1}{2}$ times longer. C. Intermediate, body length $4\frac{1}{2}$-$5\frac{1}{2}$ times longer

Length of basal rod in relation to length of aedeagus : A. Short, length less than half aedeagal length. B. Long, length more than $1\frac{1}{4}$ times aedeagal length. C. Intermediate

Basal rod : A. Anteriorly reaching or almost reaching basal membranous area. B. Not reaching basal membranous area

Length aedeagus in relation to length of penial sheath : A. Short, penial sheath more than 3 times longer. B. Long, penial sheath less than 3 times longer. C. Intermediate, penial sheath 2.82-3.22 times longer

Length of aedeagus in relation to length of basisternum : A. Long, basisternum $\frac{1}{2}$ to $1\frac{1}{2}$ times as long. B. Short, basisternum $1\frac{1}{2}$-4 times as long



(b) CLASSIFICATION AND INTERRELATIONSHIPS OF THE COCCIDAE BASED ON THE MALES.

(i) Groups of Genera:

A. The characters which were found from an examination of Table I to separate groups of genera are listed in Table II. The table contains 84 characters and shows their distribution among the studied material. It will be noticed that a few characters are included of which the alternate conditions occur within the same group (thus only separating genera), but which are of significance in separating other groups. The characters which are exclusive to any particular group are underlined in the table and their total number is given at the end of the table. The number of these characters may no doubt be reduced as more information about other members of the family becomes available and it must be stressed here that because of the limited number of species studied the diagnosis and discussion of relationships are very tentative.

To investigate the relationship between groups the method of analysis was extended in the way done by Ghauri (1962), and the following were calculated: (a) the number of characters shared by any two groups, (b) the number of characters exclusive to these two

Table II.

List of characters which separate major Groups of Genera.

CHARACTERS	Eule-canium	Erio-peltis	Ingi-sia	Coccus
HEAD:				
1. In lateral view: A. Flat. B. Dorsoventrally elongated or rounded.	B	A	B	B
2. Length of antenna in relation to length of posterior leg: A. 1.05 or more times longer. B. Subequal or shorter	AB	A	A	B
3. Interocular ridge: A. Present. B. Absent	AB	A	A	B
4. Postocular ridge: A. Forking below ocellus B. Not so.	A	B	A	A
5. Midcranial ridge, ventrally: A. Reduced, B. Not so.	B	AB	A	B
6. Number of simple eyes: A. 4, B. more than 4.	AB	A	B	A
7. Lateral simple eyes (when present): A. About as large as dorsal ones. B. Distinctly smaller	-B	-	A	-
8. Pre-oral ridge: A. Absent, B. Present.	AB	A	B	B
9. Fleshy dorsal head setae: A. Present, B. Absent.	B	B	A	A
10. Dorsal ocular setae: A. Present on at least one side, B. Absent.	AB	B	A	A
11. Fleshy ventral head setae: A. Present, B. Absent.	B	A	A	A

CHARACTERS	Eulecanium	Eriopeltis	Inglisia	Coccus
12. Setae between and behind ventral eyes. A. Present, B. Absent.	B	B	A	A
13. Genal setae. A. Present, B. Absent	B	B	A	A
THORAX:				
14. Prosternum: A. Spinose. B. Not so	B	B	A	B
15. Scutellum: A. Tubular. B. Not so.	AB	A	B	A
16. Scutellum: A. 3-4 times as wide as long. B. 1-3 times as wide as long.	B	AB	B	A
17. Fleshy scutal setae: A. Present, B. Absent.	B	B	A	AB
18. Basalare: A. Joining pleural wing process to mesepisternum. B. Vestigial.	A	A	A	B
19. Median ridge of basisternum: A. Complete B. Reduced or absent.	A	AB	B	A
20. Fleshy postmesostigmatal setae: A. Present, B. Absent.	B	B	A	A
21. Antemetastigmatal setae: A. Present, B. Absent.	B	B	A	A
22. Fleshy dorsostigmatal setae: A. Present. B. Absent.	B	B	A	A
23. Fleshy anterior metasternal setae: A. More than 36, B. 0 - 24.	B	B	B	A

CHARACTERS	Eulecanium	Eriopeltis	Inglisia	Coccus
24. Posterior metasternal setae: A. More than 4. B. Less than 4.	B	A	A	A
25. Wings: A. Less than 2¼ times longer than wide. B. 2¼-2¾ times longer than wide. C. More than 2¾ times longer than wide.	AB	C	B	A
26. Total number of setae on front tibia: A. More than 60. B. Less than 60.	AB	B	A	A
27. Hind tibia: A. With more fleshy than hair-like setae. B. With more hair-like setae.	AB	B	A	A
ABDOMEN:				
28. Pleural sclerotization: A. on segment VII, B. on segments IV-VII, C. Absent.	C	A	B	A
29. Caudal extensions of segment VII: A. Very prominent, tapering. B. Small, broadly rounded or somewhat pointed.	B	B	B	A
30. Cicatrix on caudal extension of segment VIII. A. Absent, B. Present.	A	A	A	B
31. Fleshy pleural setae on segments I - III: A. Present, B. Absent.	B	B	B	A
32. Fleshy ventral setae: A. Absent posteriorly beyond segment III, B. Present posteriorly beyond segment III.	A	B	B	B

CHARACTERS	Eulecanium	Eriopeltis	Inglisia	Coccus
33. Fleshy setae on 8th sternite: A. More than 6. B. Not more than 3.	B	B	A	B
34. Ventral hair-like setae on segment III, usually: A. Two setae medially. B. No setae medially.	AB	B	A	B
Total number of exclusive characters	4	3	4	5

TABLE II A

Pairs of Groups	Number of Characters (a) shared	(b) of which exclusive	(c) differentiating
Eulecanium-Eriopeltis	14	6	6
Eulecanium-Inglisia	8	1	15
Eulecanium-Coccus	6	1	16
Eriopeltis-Inglisia	9	1	21
Eriopeltis-Coccus	9	2	17
Inglisia-Coccus	16	6	16

groups, and (c) the number of characters by which the two groups differ from each other. The results are given in Table II A. The characterization of each group is implicit in Table II and given fully in the keys which follow later.

1. The Coccus group: To this group have been assigned five genera which appear to be very closely related. They are Fulvinaria, Genus B, Coccus, Parthenolecanium and Ceroplastes. Pairs of genera share from 75 to 85 characters and the group as a whole has about 60 characters in common. The exclusive characters of this group are (i) the basalare vestigial or absent, (ii) the caudal extensions of the 7th abdominal segment very prominent and tapering, (iii) the presence of a membranous or weakly sclerotized cicatrix on the caudal extension of the 7th abdominal segment, (iv) fleshy anterior metasternal setae more than 36 (v) the presence of fleshy pleural setae on the first three abdominal segments. In all the genera, except Ceroplastes the shape of the head is rather peculiar in having a pronounced anterodorsal bulge and the mediodorsal bulge sharply drawn back. Except for this and some other small differences the males of genus Ceroplastes is very similar to those of the other members of this group. This is rather interesting because the females of the genus Ceroplastes are

considered to be quite distinct and different from the other Coccidae.

The Coccus group is probably the most specialized of the Coccidae as a comparatively large number (8) of specialized characters are found in it. They are: (i) the presence of only four simple eyes, (ii) the tubular scutellum, (iii) the reduced metathorax, with the episternum small, the pleural ridge short and the halteres lacking, (iv) a basalare which is vestigial and incorporated into the pleural wing process, (v) considerable desclerotization of the abdomen, (vi) the presence of prominent caudal extensions on the 7th abdominal segment (although reminiscent of the "fleshy tassels" of the Monophlebidae), (vii) the presence on the 8th abdominal segment of caudal extensions of various shapes which bear a membranous or weakly sclerotized cicatrix, and (viii) the presence of pleural sclerotization of the 7th and 8th abdominal segments. (This does not occur in the more primitive Coccoidea, nor in what is regarded as the more primitive members of this family).

From a study of limited material of Akermes andersoni Newst., the drawings and descriptions of Chloropulvinaria aurantii (Ckll.) by Borchsenius (1957) and Neopulvinaria imeretina Hadz. by Hadzibejli (1955), and the drawing of the posterior part of the abdomen of

Saissetia nigra (Nietner) by Green (1904-1909) it seems certain that the genera Akermes, Chloropulvinaria, Neopulvinaria and Saissetia should also be included in this group.

2. The Inglisia group comprises only the genus Inglisia which, however, shows distinctive characters, justifying its separation from all other groups. A brief study of a species of Ceroplastodes (C.chiton Green) showed that this genus also belongs to the Inglisia group. The exclusive characters of the group are the following: (i) lateral eyes about as large as the dorsal and ventral ones, (ii) prosternum spinose, (iii) pleural sclerotization extending from the 4th - 7th abdominal segments, (iv) more than 6 fleshy setae on the 8th abdominal sternite.

The group features a number of primitive and specialized characters. The specialized ones are: (i) the considerably reduced midcranial ridge, (ii) the small spines present on the prosternum and on the front coxae, (iii) the reduced median ridge of the basisternum, (iv) the reduced metathorax which lacks halteres, suspensorial sclerites and a complete pleural ridge, and (v) the extensive pleural sclerotization which, as discussed earlier, is probably of secondary development and therefore a specialised

feature. The primitive features include: (i) eight simple eyes, which is probably a primitive condition as it more closely resembles the compound eye of the margaroid ancestors, (ii) sternal plates on all the abdominal segments, (iii) a scutellum which is not tubular, (iv) a basalare connecting the pleural wing process with the episternum, and (v) the absence of prominent caudal extensions on the 7th abdominal segment, or caudal extensions with a cicatrix on the 8th.

3. The Eriopeltis group: This group consist of the two closely related genera Eriopeltis and Luzulaspis, which share about 9[illegible] characters between them. Three characters are exclusive to this group: (i) the head comparatively flat dorsoventrally, (ii) the postocular ridge not forking below ocellus, and finally, (iii) the long and narrow wings which are more than 2¾ times longer than wide. Another characteristic of this group is the presence of an interocular ridge, but this is sometimes shared by Genus A of the Eulecanium group.

The Eriopeltis group exhibits both primitive and specialized features. The two genera share the following specialized characters: (i) an interocular ridge, connecting the pre- and postocular ridges, (ii) a more or less reduced midcranial ridge, (iii) four simple eyes, (iv) the absence of the preoral ridge, (v) a tubular scutellum, (vi) a reduced metathorax with a

small episternal plate, short pleural ridge and no halteres or suspensorial sclerites, and (vii) the presence of pleural sclerotization on the 7th abdominal segment. In each of the two genera an additional specialized feature is found: in Luzulaspis the cluster of pores (and the pouch) on the 8th abdominal segment has secondarily been lost (the pores are present in the more primitive margaroid Coccoidea (Morrison, 1928: Theron 1958, 1962) the Pseudococcidae (Giliomee, 1961) and all the other species studied here); in Eriopeltis the median ridge of the basisternum is reduced.

The prevailing primitive features in this group are: (i) the presence of distinct anterior tentorial pits, (ii) the presence of a basalare connecting the episternum and the pleural wing process, (iii) the absence of prominent caudal extensions on the 7th abdominal segment or caudal extensions with a cicatrix on the 8th. In addition, in Eriopeltis the ventromedial part of the epicranium is well sclerotized, and tergites and sternites are present on all the abdominal segments.

The Eriopeltis group can be regarded as being more specialized than the next group, the Eulecanium group. This conclusion is at variance with the views

of Borchsenius (1957), who held that they were the most primitive Coccidae.

It is perhaps interesting to note that Eriopeltis and Luzulaspis are the only two amongst the material studied that are found on grass.

4. The Eulecanium group: In this group the rest of the genera studied have been included, i.e. Eulecanium Nemolecanium, Physokermes, Rhodococcus, Parthenolecanium, Phyllostroma, Filippia, Ctenochiton, Ericerus, Genus A, Sphaerolecanium. There is little doubt that this group is a temporary assembly of genera, related to each other to a greater degree than to the other three groups already discussed. The relationships between these genera are very complex and until more representative material has been studied in detail it seems best to treat them together, although further subdivision appears to be inevitable. The heterogeneity of this group of genera is reflected in the comparatively small number of characters (about 25) that are common to all of them. Four of these are exclusive to this group, namely (i) pleural sclerotization on the abdomen absent (ii) fleshy ventral head setae absent (iii) posterior metasternal setae less than 4 (iv) fleshy setae absent posteriorly beyond the 3rd abdominal segment.

All the genera included in the Eulecanium group appear to be more primitive than those of the other groups, especially the genera genera Eulecanium, Nemolecanium, Physokermes, Rhodococcus, Palaeolecanium, Ericerus and Genus A. They have in common the following characters which can be regarded as being primitive: (i) a scutellum which is not tubular, (ii) a basalare connecting the pleural wing process with the episternum, (iii) a comparatively less specialized metathorax with the episternum and metapleural ridge well developed, the latter with a vestigial pleural wing process which supports the haltere, which is in turn connected to a small suspensorial sclerite, (iv) the absence of prominent caudal extensions on the 7th abdominal segment, (v) the absence of prominent caudal extensions with a cicatrix on the 8th abdominal segment. Furthermore, three of these genera namely Eulecanium, Nemolecanium and Physokermes share a 6th primitive character in possessing small tergites and sternites on all abdominal segments (this is also shared by Phyllostroma). The other four genera share some of the above-mentioned characters, though not all of them. All the genera except Physokermes, Palaeolecanium and Sphaerolecanium share an additional feature which is probably primitive, i.e. having more than 4 simple eyes.

Of the genera in this group Sphaerolecanium appears to be the most specialized. In this genus the scutellum is tubular (though the ventral foramen is large), the halteres are absent and the metathorax reduced, the caudal extension of the 8th abdominal segment forms a prominent cyclindrical lobe, and only 4 eyes are present. This genus might be regarded as linking the Eulecanium group with the Eriopeltis or Coccus groups.

If relationships are estimated by calculating the total number of characters shared by pairs of genera it appears that the genera Eulecanium, Nemolecanium, Physokermes, Rhodococcus and Palaeolecanium are very closely related, with pairs of genera sharing between 75 and 85 characters. Phyllostroma also comes close to this group, especially to Palaeolecanium. The two genera Filippia and Ctenochiton, while not very close to these share between themselves a large number of characters (about 80). The three remaining genera, i.e. Ericerus, Genus A and Sphaerolecanium are not very close to each other or to any of the other above-mentioned subgroups (although Ericerus comes close to Rhodococcus). It is therefore clear that the Eulecanium group, in which 11 out of 19 genera studied have been included, is very heterogeneous and as more material becomes available it will undoubtedly be further subdivided.

5. From Tables II and IIA it can be seen that the Eriopeltis and Eulecanium groups agree in a large number of characters (14), of which 6 are common to them alone (i.e. exclusive). Conversely in the Coccus and Inglisia groups the alternative condition of these 6 characters obtains and they share 15 characters amongst themselves. Any other way of coupling pairs of groups results in a comparatively small number of characters being shared or exclusive. It would appear therefore that there are two major groups, Eriopeltis and Eulecanium on the one hand and Inglisia and Coccus on the other, which can be separated mainly by the absence or presence of setae in various regions of the body, as follows:

Inglisia and Coccus groups	Eriopeltis and Eulecanium Groups
1. Fleshy dorsal head setae present.	Fleshy dorsal head setae absent; eyes absent.
2. Setae between and behind ventral eyes present.	Setae between and behind ventral eyes absent.
3. Genal setae present.	Genal setae absent.
4. Fleshy postmesostigmatal setae present.	Fleshy postmesostigmatal setae absent.
5. Antemetastigmatal setae present.	Antemetastigmatal setae absent.
6. Fleshy dorsospiracle setae present.	Fleshy dorsospiracle setae absent.

The fact that these two groups can only be separated by differences in the chaetotaxy indicates that this family consists of a morphologically rather homogeneous group of species. This is particularly true in comparison with the Diaspididae where Ghauri (1962) found sharp and very distinct morphological differences between major groups.

At present no rank is suggested for these groups of genera indicated by male characters, but they may be considered to be equivalent to each other and representing subfamilies, while the further subdivisions in the Eulecanium group, and possibly the Coccus group could represent tribes.

The diagnostic characters of each group can be found in the detailed key which follows later.

C. The classification proposed above unfortunately differs considerably from the existing classification suggested by Borchsenius (1957) and a few examples are discussed as an illustration of these differences.

It will be remembered that Borchsenius based his classification on a few characters of the adult female with considerable emphasis on the way in which the body and the eggs are protected. In his subfamily Filippiinae, Borchsenius included the three genera Luzulaspis, Eriopeltis and Filippia. From the male

characters it is clear that whereas Luzulaspis and Eriopeltis are very closely related (sharing about 90 characters) they differ from Filippia in a number of striking features (and share only about 50 characters), e.g. the shape of the head, the number of eyes, the presence or absence of the interocular and preocular ridges, the shape of the wing, and in the presence or absence of fleshy ventral head setae and fleshy abdominal setae. On the other hand, Filippia shares up to 80 characters with some of the other genera of the Eulecanium group, e.g. Ctenochitin sp. and P. bituberculatum. It is therefore clear that Filippia and Eriopeltis are not closely related, a conclusion which supports the views of Bodenheimer (1953) who put them into different subfamilies.

In his tribe Pulvinariini Borchsenius included, among others, the two genera Pulvinaria and Phyllostroma. The males of these two genera, however, are widely different and have only a comparatively small number of characters (about 50) in common. Some of the more striking differences are found in the number of eyes, the condition of the scutellum and basalare, the development of the metathorax, the condition of the caudal extensions of the 7th and 8th abdominal segments, and in the chaetotaxy of the head and abdomen. Phyllostroma shares about 80 characters

with some members of the Eulecanium group (e.g. P. bituberculatum) and Pulvinaria about 90 characters with the genera of the Coccus group.

On the other hand males of some genera which were widely separated by Borchsenius indicate close relationships. Thus Borchsenius considered the genera Pulvinaria and Coccus to represent two tribes of one subfamily and Ceroplastes a different subfamily altogether. As discussed earlier the males of these three genera are very similar and belong to the same group. The close relationship between Pulvinaria and Coccus has also been indicated by Steinweden (1959) and Bodenheimer (1953) who grouped them together into the same taxon. Both workers however, considered Ceroplastes to be distinctly different from Coccus and Pulvinaria.

Further detailed studies are needed on both males and females to show if these differences in classification on the two sexes illustrate the dependance of the grouping on the stage (or selection of characters) as found by Morrison (1928) in his studies of various stages of the Margarodidae, or reflect the inadequate knowledge of the females of the family, and finally which, if any, of the two classifications reflects the true relationships and not convergence.

(ii) Genera:

In Table III the characters are tabulated which separate genera in at least one of the three groups for which more than one genus were available. These characters are marked "G" in the columns where they operate; where they only operate at the specific level in any of the remaining groups they are denoted with an "S", while the symbols "GS" are used where the characters can apparently be used to separate both genera and species within the same group; a dash (-) signifies that the character does not operate in that particular group. The table contains about 96 characters. This very high number is due to the fact that in most cases only one species per genus was available and many may eventually be shown to be of specific value only.

Coccus group: All the genera of this group are very closely related but each has a characteristically shaped caudal extension on the 8th abdominal segment. Ceroplastes also differs from the others in the shape of the head.

Inglisia group: Only one genus was studied and generic differences can therefore not be discussed.

Eriopeltis group: The two genera Eriopeltis and Luzulaspis are very closely related but Luzulaspis is distinct in lacking the glandular pouch and pores.

TABLE III

List of characters which mainly separate Genera.

Characters:	Eulecanium	Eriopeltis	Coccus
HEAD:			
1. Shape of the head	G	-	G
2. Absence or presence of polygonal reticulation on median crest	G	-	-
3. Presence of interocular ridge	G	-	-
4. Nature of postocular ridge, dorsally.	G	G	-
omit [5. Postocular ridge forking below ocellus or not	G	-	G]
6. Nature of postocular ridge, posteromedially	G	-	S
7. Midcranial ridge dorsally represented or not	G	-	G
8. Nature of sclerotization and reticulation around ventral part of midcranial ridge	G	G	G
9. Nature of preocular ridge	G	-	-
10. Number of simple eyes	G	-	-
11. Distance between dorsal eyes in relation to diameter of cornea	G	G	G
12. Distance between ventral eyes in relation to diameter of cornea.	G	-	G
13. Presence of preoral ridge	G	-	-
14. Presence of ventral sclerite near mouth opening	G	-	-

Characters:	Eulecanium	Eriopeltis	Coccus
15. Length of cranial apophysis	G	G	G
16. Nature of apex of cranial apophysis	G	GS	-
17. Presence of polygonal reticulation on genae	G	-	S
18. Presence of a pair of long, median, hair-like, ventral head setae	G	G	-
19. Location of ventral head setae	G	-	-
ANTENNA:			
20. Relative length	G	-	G
21. Length in relation to length of posterior leg	G	-	-
22. Length in relation to length of penial sheath	G	-	G
23. Length of 3rd segment in relation to its width	G	-	G
24. Relative widths of 1st and 2nd segments	G	-	-
25. Length of fleshy setae on 3rd segment	G	-	-
26. Presence of hair-like setae on 3rd segment	G	-	-
27. Number of knobbed subapical setae on 10th segment.	G	-	-
28. 10th segment distally constricted or not	-	-	G
29. Length of two smallest antennal bristles in relation to length of fleshy setae	G	-	GS

Characters:	Eulecanium	Eriopeltis	Coccus
THORAX:			
30. Number of circular pores behind pronotal sclerite	G	-	G
31. Prosternum reticulated or not.	-	-	G
32. Number of medial pronotal setae	G	-	GS
33. Presence of posttergital setae	-	-	G
34. Presence of fleshy prosternal setae	G	-	-
35. Nature of emargination of mesoprephragma	G	S	G
36. Nature of reticulation on prescutum	G	G	GS
37. Length of membranous area of scutum in relation to its width	G	-	-
38. Scutellum tubular or not	G	-	-
39. Width of scutellum in relation to its length	G	-	-
40. Length of basisternum in relation to length of membranous area of scutum	G	-	-
41. Presence of fleshy scutal setae	-	-	G
42. Number of hair-like scutal setae	G	-	-
43. Number of fleshy postmesostigmatal setae	-	-	G
44. Presence and type of basisternal setae	G	-	G
45. Presence of suspensorial sclerite	G	-	-

Characters:	Eulecanium	Eriopeltis	Coccus
46. Nature of metapleural ridge	G	-	-
47. Presence of setae on postalare	-	-	G
48. Number of fleshy anterior metasternal setae	G	-	-
49. Length of wing in relation to its width	G	-	-
50. Presence of alar setae	G	-	-
51. Presence of halteres	G	-	-
52. Number of haltere setae	G	-	-
53. Length of hind leg in relation to body length.	G	-	S
54. Presence of coxal bristles on front coxa	G	-	S
55. Total number of setae on front tibia	G	-	-
56. Length of apical seta on front trochanter in relation to width of trochanter	G	G	G
57. Shape of hind femur (length/width)	G	-	G
58. Relative number of fleshy and hair-like setae on hind tibia	G	-	-
59. Relative length of fleshy setae on front tibia	G	-	-
60. Relative numbers of fleshy and hair-like setae on hind tarsus.	G	-	-
61. Length of hind tarsus in relation to its width	G	-	GS
62. Relative length of hind claw	G	G	-

Characters:	Eulecanium	Eriopeltis	Coccus
ABDOMEN:			
63. Number of tergites	G	G	-
64. Nature of tergite between segment I and II	G	-	G
65. Number of sternites	G	-	G
66. Absence or presence of glandular pouch on segment VIII	-	G	-
67. Shape of caudal extension of segment VIII	G	-	G
68. Location of cicatrix on segment VIII	-	-	G
69. Length of external in relation to "internal" part of setae of glandular pouch	G	G	G
70. Number of fleshy dorsal setae	-	-	G
71. Number of hair-like dorsal setae on Segment I	G	-	G
72. Number of hair-like dorsal setae on segment III	G	-	G
73. Presence of fleshy ante-anal setae	G	G	G
74. Presence of 2 long hair-like ante-anal setae	G	-	G
75. Number of fleshy setae around glandular pouch	-	-	G

Characters:	Eulecanium	Eriopeltis	Coccus
76. Presence of circular pores in ante-anal region	G	G	-
77. Presence of fleshy pleural setae	G	-	-
78. Presence of fleshy ventral setae	G	-	-
79. Number and arrangement of hair-like setae on segment II	G	-	G
80. Number of hair-like ventral setae on segments VI and VII	G	-	G
81. Lateral sclerotization of penial sheath fused anterior to anus or not	G	-	G
82. Presence and size of membranous extension of penial sheath	-	-	G
83. Length of penial sheath in relation to body length	G	G	G
84. Length of basal ridge in relation to length of aedeagus	G	G	GS
85. Basal rod reaching basal membranous area or not	G	-	-
86. Length of aedeagus in relation to length of penial sheath	G	-	-
87. Length of aedeagus in relation to length of basisternum.	G	-	S

Eulecanium group: The genera Eulecanium, Hemolecanium, Physokermes and Rhodococcus are very closely related, but can easily be separated by the number of eyes. Palaeolecanium differs from these genera in possessing a comparatively short penial sheath. Phyllostroma is also rather closely related to these genera but is characterized in lacking halteres and in having the metapleuron reduced. The two genera Ctenochiton and Filippia form a distinct subgroup that can be separated from the aforementioned in having a tubular scutellum and from each other by the number of eyes and the development of the basal rod of the aedeagus. The three remaining genera of the group are all very distinct. Ericerus is characterized by the long, narrow head and the extremely long fleshy setae on the appendages, Genus A by the exceptionally short and thick fleshy setae on the appendages and the possession of a ventral plate, whereas Sphaerolecanium is the only genus in this group with a prominent caudal extension on the 8th abdominal segment, a basal rod longer than the aedeagus and fleshy prosternal, anterior metasternal and abdominal setae.

TABLE IV.

List of Characters which Separate Species.

Characters	Eriopeltis	Pulvinaria	Parthenolecanium	Ceroplastes
1. Degree of sclerotization of posteromedian part of postoccipatal ridge.			+	
2. Presence of lateral arms of midcranial ridge	+			
3. Shape of apex of cranial apophysis	+			
4. Presence of reticulation on gena		+		
5. Presence of reticulation on pedicel.		+		
6. No. of fleshy setae between and behind ventral eyes.				+
7. No. of fleshy setae on 4th antennal segment				+
8. Size of two shortest antennal bristles		+		
9. Presence of reticulation on the posttergital region.	+			
10. Nature of emargination of mesoprephragma.	+			
11. Presence of reticulation on mesoprescutum.		+		
12. Presence of reticulation on anterior arms of mesoscutum	+			
13. Presence of reticulation on membranous area of scutum.	+			

Characters	Eriopeltis	Pulvinaria	Parthenolecanium	Coroplastes
14. Size of ventral foramen of scutellum			+	
15. Development of median ridge of mesosternum	+			
16. Length of hind leg in relation to body length.		+		
17. Length of hind tarsus in relation to its width		+		
18. Presence of median pronotal setae			+	
19. Presence of coxal bristles				+
20. No. of fleshy pleural setae on 7th abdominal segment.				+
22. Size of aedeagus (e.g. in relation to basal rod or aedeagus).				+

(iii) Species:

In Table IV the characters are listed which separate species in the four genera in which more than one species were available; a "+" sign indicates the genus in which the character operates. From the Table it can be seen that differences between species are indicated by differences in the chaetotaxy and reticulation in various regions of the body, but also by differences in the development of certain ridges such as the midcranial ridge, the postoccipital ridge and the median ridge of the mesobasisternum.

(c) RELATIONSHIPS OF THE COCCIDAE WITH OTHER SUBDIVISIONS OF THE COCCOIDEA.

I. The division of the Coccoidea into the margaroid, lecanoid and diaspidoid types by Balachowsky (1937, 1942) has been generally supported by the results of more detailed investigations of the adult males (Theron, 1958), as well as by cytological studies (Hughes-Schrader, 1942; Brown, 1959). Of the families of which the males have been studied intensively, the margaroid type includes the Margarodidae and Phenacoleachidae (Theron, 1958, 1962), the lecanoid type, the Pseudococcidae and Coccidae, and the diaspidoid type the Diaspididae (Theron, 1958).

Theron showed that the Pseudococcidae and Coccidae were very closely related and that their closest relatives were found in the margarodid Steingelia on the one hand and the Diaspididae on the other. He regarded the diaspidoids as being more closely related to the lecanoids than the latter to the margaroids and this view was supported by Ghauri (1962).

Theron's conclusions regarding the affinities of the Coccidae was based mainly on the one species P.pomeranicum studied in detail. The results of the present investigation, in which a fairly representative sample of the Coccidae was studied, generally confirms, but also supplements Theron's observations. A few structures of morphological importance and which were either overlooked or absent in the species studied by Theron, can be recorded here:

1. Vestigial dorsal part of the midcranial ridge. This short median ridge is present in some members of the Eulecanium and Coccus groups, though not in the species studied by Theron. It is more fully developed in the Pseudococcidae (Theron 1958; Giliomee, 1961), but absent in the Diaspididae (Ghauri, 1962). The greater reduction or absence of the dorsal section of the midcranial ridge (considered to be primary) is a specialization in the Coccidae.

2. Intercocular ridge: This ridge, which connects the pre- and postocular ridges below the ocellus is present and always well developed in the Eriopeltis group and also occurs, although in a more or less reduced condition in most specimens of Genus A. One is tempted to suggest that this condition was the forerunner of the situation in the Pseudococcidae where the pre- and postocular ridges are fused, but the fact that both the Eriopeltis group and Genus A are comparatively specialized, though with little affinity between them, makes this seem unlikely. Presumably the ridge evolved independently to support the preocular ridge and its articulation with the antenna, which is exceptionally long in Eriopeltis and fairly long in Genus A.

3. Anterior tentorial pits. These structures can be seen in the Eriopeltis group and in some members of the Eulecanium group (e.g. Ericerus and Phyllostroma). They are absent in the Pseudococcidae, where the anterior tentorial arms are fused with each other and with the cranial apophysis. In the Diaspididae the tentorium is absent altogether but vestigial anterior and posterior tentorial pits remain in some species. (Ghauri, 1962)

4. Lateral pronotal sclerite: A small lateral pronotal sclerite is present in all Coccidae. Homologous structures are found in the Pseudococcidae (Giliomee, 1961) and Diaspididae (Ghauri, 1962).

5. Posttergite: The absence of this sclerite in the Coccidae is listed as a specialized character by Theron (1958). It was observed, however, in all the species studied here, including Parthenolecanium pomeranicum. It is present in all the other Coccoidea, except Steingelia (Theron 1958).

6. Metapleural apophyses. Vestigial metapleural apophyses, of the same nature as found in Pseudococcus (Giliomee, 1961) i.e. rudimentary, are present.

7. Basalare: This structure is vestigial or absent in P.pomeranicum (and the other members of the Coccus group) and this was accordingly regarded by Theron as a specialized feature of the Coccidae. It was found, however in all the members of the Eulecanium, Priopeltis and Inglisia groups, where the condition is very similar to that in the Pseudococcidae (Theron, 1958) and the Diaspididae (Ghauri, 1962).

8. Metasternal sclerite. A distinct metasternal plate was found in most of the species studied, including P. pomeranicum. This is a primitive character, present in all the Coccoidea except the Pseudococcidae. The Pseudococcidae, on the other hand, have metasternal apophyses (Giliomee, 1961), which are absent in the Coccidae.

9. Sclerotization of the abdomen. In P.pomeranicum and the Pseudococcidae studied by Theron and Giliomee the abdomen is considerably desclerotized and this is regarded as a specialized condition which the lecanoids share with the diaspidoids (Ghauri, 1962). However, it was found that in some of the genera of the Coccidae, like Luzulaspis, Nemolecanium, Eulecanium, Physokermes and Phyllostroma both tergal and sternal plates (although reduced) were present. This is undoubtedly primitive.

II. This study has shown therefore that, as far as the relationship with the margaroid type is concerned, only minor alterations are necessary in the list of characters given by Theron (1958) that separate the lecanoid type from the basic margaroid type. That is in so far as metasternal plates and abdominal sclerites are not absent in the Coccidae.

The relationships with the basic margaroid male and the diaspidoid male, as expressed by the characters shared with the lecanoid male, is shown in Table V.

Table V. Showing Relationships of Lecanoid Male with the Margaroid and Diaspidoid Types.

	Margaroid	Lecanoid	Diaspidoid
A. Primitive characters:			
1. Head well sclerotized	+	+	-
2. Tentorium present	+	+	-
3. Distinct Propleural apophyses present	+	+	-
B. Specialized characters:			
1. Compound eyes absent	-	+	+
2. Lateral branches of midcranial ridge present	-	+	+
3. Cranial apophysis long	-	+	+
4. Pronotal ridges present	-	+	+
5. Posttergites small	-	+	+
6. Prescutal ridges shifted medially	-	+	+
7. Prealare differentiated into a triangular sclerite	-	+	+
8. Subepisternal ridge detached from marginal ridge	-	+	+
9. Abdominal spiracles absent	-	+	+

From Table V it can be seen that the lecanoids and diaspidoids have a large number (9) of specialized characters in common, whereas 3 primitive ones are shared with the margaroids. It can therefore be stated that the lecanoids are more closely related to the diaspidoids than to the margaroids and also that they are more specialized than the margaroids but less than the diaspidoids. This conclusion confirms the views of Theron (1958) and Ghauri (1962).

III. Two genera of which the males were studied by Theron (1958, 1962) i.e. Steingelia and Phenacoleachia, were regarded by him as occupying an intermediate position between the more primitive margaroids (Margarodes and Pseudaspidoproctus) on the one hand and the lecanoids (Coccidae and Pseudococcidae) on the other. He showed that Steingelia and Phenacoleachia were closely related, but that they differ in a number of striking features. When one investigates whether these differences throw any light on the relationships of the two genera with the two lecanoid families, rather interesting results are found, as shown in Table VI. In this Table the characters known to differentiate male Steingelia and Phenacoleachia are listed and compared with conditions in the Coccidae and Pseudococciddae.

Table VI CHARACTERS DIFFERENTIATING MALE STEINGELIA AND PHENACOLEACHIA COMPARED WITH CONDITIONS IN COCCIDAE AND PSEUDOCOCCIDAE.

	Coccidae	Steingelia	Phenacoleachia	Pseudococcidae
1. Postoccipital ridge completely absent	+	+	-	-
2. Postocular ridge present	+	-	+	+
3. Cranial apophysis extended	+	+	-	-
4. Membranous area of scutum present	+	+	-	-
5. Scutellum short, transverse	+	+	-	-
6. Median ridge of basisternum present	+	+	-	-

From the Table it can be seen that in 5 out of 6 cases similar conditions obtain in Steingelia and the Coccidae whereas, of the opposite conditions, all 6 characters are shared between Phenacoleachia and the Pseudococcidae. These results indicate that the Coccidae are more similar to Steingelia than to Phenacoleachia, and the Pseudococcidae more to Phenacoleachia than to Steingelia. At this stage of research it is difficult to determine, however, whether the similarities have any phylogenetic significance or whether they are merely due to convergence.

IV. In a number of characters male Coccidae differ from male Pseudococcidae, the only other lecanoid family of which the male has so far been studied in detail (Theron 1958; Giliomee 1961). These characters are listed in Table VII and compared with conditions obtaining in the basic margaroid (i.e. excluding Steingelia and Phenacoleachia) and diaspidoid types.

TABLE VII CHARACTERS DIFFERENTIATING MALE COCCIDAE AND PSEUDOCOCCIDAE COMPARED WITH CONDITIONS IN MARGAROID AND LECANOID TYPES.

	Margaroid	Pseudococcidae	Coccidae	Diaspidoid
A. Primitive characters:				
1. Anterior tentorial pits/arms separate	+	-	+	+
2. Membranous area of scutum present	±	-	+	-
3. Median ridge of basisternum present	+	-	+	+
4. Metasternal sclerite present	+	-	+	+
5. Ostiole absent	+	-	+	+
B. Specialized characters:				
1. Postoccipital ridge absent	-	-	+	-
2. Scutellum short, transverse	-	-	+	+
3. Metasternal apophyses absent	-	-	+	+
4. Penial sheath elongated	-	-	+	+
5. Disc pores on body (other than glandular pouch) absent	-	-	+	+

The interpretation of the phylogenetic significance of the membranous area of the scutum (character A2) is very speculative. In the primitive margaroid type it is absent in Margarodes (Theron, 1958) and also in Phenacoleachia (Theron, 1962) but developed to some extent in Pseudaspidoproctus, Steingelia (Theron, 1958) and Icerya (Balachowsky, 1937); in the spedalized diaspidoid type it is absent (Theron, 1958; Ghauri, 1962). Similar considerations make the interpretation of the median ridge of the basisternum difficult. The occurrence of both these structures over a wide range within the superfamily, including decidedly more primitive forms, does suggest that as far as the Coccidae and Pseudococcidae are concerned their presence signifies a primitive condition. For the opposite to be true it would mean that these structures were absent in their common ancestor and have been evolved independently in the Coccidae, which seems unlikely. As mentioned earlier, two of the specializations that Theron (1958) recorded, i.e. the absence of a posttergite and basalare are not valid as they were found to be present in this family.

From Table VII it can be seen that the two families share an equal number of primitive and specialized features and on the basis of these facts alone it is

difficult to decide which of the two families are more specialized. However, it is clear from the table that the Coccidae show an overall affinity with the more specialized Diaspididae, sharing 8 out of 10 characters with that family, whereas the Pseudococcidae have only 2 out of 10 characters with the Diaspididae in common. It can therefore be said that the Coccidae are possibly more specialized than the Pseudococcidae. It will also be remembered that the membranous area of the scutum and the median ridge of the basisternum have rather speculatively been interpreted as being primitive features. Should the opposite be true, it would prove decisively (by 7 specialized characters to 3 primitive) that the Coccidae were more specialized than the Pseudococcidae. The conclusion that the Pseudococcidae are more primitive than the Coccidae supports the opinions based on the evidence of female characters (Morrison, 1928; Balachowsky, 1942; Borchsenius, 1958), cytological studies (Hughes-Schrader, 1942) and earlier, less comprehensive studies of the male (Theron, 1958; Giliomee, 1961).

V. From the existing literature on the males of other families of the lecanoid type, scanty as it is, a few tentative conclusions can be reached regarding their relationships to the Coccidae. Thus the illustrations

and descriptions by Green (1904-1909), Russel (1941) and Borchsenius (1960) indicate that the males of the Asterolecaniidae have a large membranous area of the scutum, a transverse scutellum and an elongated penial sheath. In these respects they resemble the Coccidae and at the same time differ from the Pseudococcidae. It can therefore be suggested that the Asterolecaniidae and Coccidae are closely related, as has also been advocated by Balachowsky (1948) and Ferris (1955) from studies of the female.

From the description of the male of Kermococcus quercus (L.) by Borchsennius (1960) it appears that the Kermococcidae are more closely related to the Coccidae than to any of the other Coccoidea of which the males have been studied in detail. K. quercus possesses: 5 pairs of simple eyes; separate pre- and postocular ridges; a large membranous area of the scutum; a comparatively short, transverse and possibly tubular scutellum; a deeply invaginated glandular pouch; an elongated penial sheath, long penis and a ridge-like basal rod. In all these respects it differs from the Pseudococcidae. The character which at present appears to be exclusive to the Kermococcidae and Pseudococcidae is the two-segmented tarsus. The males of the Kermococcidae therefore appear to show different relationships from those assigned to

these forms by various workers on female characters. Balachowsky (1942, 1948) grouped them together with the pseudococcids and eriococcids into one family; Ferris (1957) regarded them as a subfamily of the Eriococcidae and grouped them with the Pseudococcidae, amongst others, into the ramus Eriococci whereas the Coccidae and Asterolecaniidae were assigned to the ramus Cocci. Obviously, more detailed studies are necessary before any firm conclusions can be reached regarding the true relationships of these groups.

VI KEYS

As is the case with the preceding descriptions of the species studied, the following keys contain many more characters than would eventually be necessary for the purposes of identification. However, it is considered wise to follow Ghauri (1962) and compile detailed keys because (i) they constitute provisional definitions of the supraspecific categories and (ii) because there is little doubt that some of the characters will eventually prove to be insignificant at the taxonomic levels at which they are employed here. It is clear from the following keys that both higher and lower taxa can easily be separated.

(a) Key to the Groups of Genera

1. With fleshy dorsal head setae, setae between and behind the ventral simple eyes, genal setae, fleshy postmesostigmatal setae, antemetastigmatal setae and fleshy dorsostigmatal setae all present 2

With fleshy dorsal head setae, setae between and behind the ventral simple eyes, genal setae, fleshy postmesostigmatal setae, antemetastigmatal setae and fleshy dorsostigmatal setae all absent 3

2. Antenna shorter than posterior leg; midcranial ridge ventrally complete; with 4 simple eyes; prosternum not spinose; scutellum tubular, usually more than 3 times (range 2.8-4.1) as wide as long; basalare not joining pleural wing process to mesepisternum; median ridge of basisternum complete; antemetastigmatal setae more than 36; wings usually less than 2¼ times (range 1.9-2.4) longer than wide; with pleural sclerotization only on 7th abdominal segment, caudal extensions very prominent, tapering; with a cicatrix on posterolateral part of 8th abdominal segment; ... with fleshy pleural setae on the 1st to 3rd abdominal segments; fleshy setae on 8th sternite not more than 3, if present ..... Coccus group.

Antenna 1.07-1.15 (av. 1.10) times longer than posterior leg; midcranial ridge ventrally reduced; with 8 simple eyes; prosternum spinose; scutellum not tubular, 2.11-2.86 (av. 2.36) times as wide as long; basalare joining pleural wing process to mese pisternum; median ridge of basisternum reduced or absent; antemetasternal setae 13-24 (av.18); wings 2.33-2.45 (av. 2.38) times longer than wide; with a band of pleural sclerotization stretching from the 4th to 7th abdominal segment; caudal extensions small, broadly rounded; cicatrix on posterolateral

part of 8th abdominal segment absent; fleshy pleural setae on 1st to 3rd abdominal segments absent; fleshy setae on 8th sternite more than 5 ..... Inglisia group

3. Head (in lateral view) flat; fleshy ventral head setae present; broad interocular ridge present; postocular ridge not forking below ocellus; posterior metasternal setae present, minimum 7; wings more than 2¾ times longer than wide; 7th abdominal segment with pleural sclerotization; with fleshy ventral setae occurring posteriorly beyond 4th abdominal segment ..... Eriopeltis group

Head (in lateral view) dorsoventrally elongated or rounded; fleshy ventral head setae absent; interocular ridge absent or (in Genus A) very narrow; postocular ridge forking below ocellus; posterior metasternal setae usually absent, maximum 3; wings less than 2¾ times longer than wide; abdomen without pleural sclerotization; fleshy ventral setae not occurring posteriorly beyond 4th abdominal segment .....Eulecanium group

(b) Keys to Genera and Species.

(i) Key to the Eulecanium group of Genera:

1. Head with anterodorsal bulge somewhat pronounced; fleshy prosternal setae present; fleshy anterior metasternal setae 11-18 (13.7); lateral margin of 8th abdominal segment forming a large cylindrical tube; fleshy pleural setae present on posterior abdominal segments; fleshy setae present on 2nd and sometimes 3rd abdominal segments; 6th and 7th abdominal segments usually with 4 and 2 setae respectively; length of basal rod 1¾ - 2 times length of aedeagus ..... Sphaerolecanium (S.prunastri (Fonsc.))

Head with anterodorsal bulge not pronounced; fleshy prosternal setae absent; fleshy anterior metasternal setae absent; lateral margin of 8th abdominal segment forming a small convex lobe; fleshy abdominal setae absent; 6th and 7th abdominal setae with either 4 or 2 setae on both segments; length basal rod equal to or less than that of aedeagus 2

2. Head (in lateral view) rounded; ventral sclerite near mouth opening present; fleshy setae very short and thick being less than 0.50 times as long as width of 3rd

antennal segment and shorter than width of hind tibia; 10th antennal segment with 4-6 (av. 5.0) capitate subapical setae .....Genus A.

Head (in lateral view) dorsoventrally elongated; ventral sclerite absent; fleshy setae medium sized or long being 0.67-5.00 times as long as width of 3rd antennal segment and as long, to 3 times as long as width of tibia: 10th antennal segment with 2 or 3 capitate subapical setae 3

3. Third antennal segment more than 4 times (range 4.6-6.3, av. 5.3) longer than wide; fleshy setae very long, 4 - 5 times as long as width of 3rd antennal segment and tibia; sternites on 2nd abdominal segment absent; 2nd abdominal segment with one hair-like seta on each side ..... Ericerus (E. pela (Chav.))

Third antennal segment less than 4 times (range 1.8-3.6) longer than wide; fleshy setae medium-sized, less than twice as long as width of 3rd antennal segment and femur; sternite(s) on 2nd abdominal segment present; 2nd abdominal segment with 2 medially situated hair-like setae 4

4. Median crest not polygonally reticulated; scutellum tubular; with more than 6 hair-like scutal setae 5

Median crest polygonally reticulated; scutellum not tubular; with less than 5 hair-like scutal setae 6

5. With 8 simple eyes; with 1-4 (2.2) dorsal ocular setae; with small circular pores behind pronotal sclerites, around metatergal setae, on 1st abdominal segment and in the ante-anal region; suspensorial sclerite spot-like; fore wings 2.36-2.56 (av. 2.46) times longer than wide, with 1-2 (av. 1.1) alar setae on each side; hind tarsus 5.6-7.0 (6.3) times longer than wide; without a separate median tergite between 1st and 2nd abdominal segments; setae of glandular pouch with external part 3 - 4 times as long as the internal; lateral sclerotizations of penial sheath narrowly joined anterior to anus; length of basal rod ⅔ to equal that of eadeagus, basal rod not reaching apex of basal membranous area; aedeagus short, the basis-ternum being 1.74-1.92 (1.85) times longer ..... Ctenochiton (Ctenochiton sp.)

With 16 single eyes; with no dorsal ocular setae; circular pores absent; suspensorial sclerite elongate; fore wings 2.04-2.25 (av. 2.09) times longer than wide, with no alar setae; hind tarsus 5.1-5.3 (av. 5.2) times longer than wide; with a separate median tergite between 1st and 2nd abdominal segments; setae of glandular pouch with external part about twice as long as the internal part; lateral sclerotizations of penial sheath not joined anterior to anus; basal rod less than half as long as aedeagus, reaching apex of basal membranous area; aedeagus long, the basisternum being only 1.23-1.39 (1.34) times longer .....Filippia (F. viburni (Sign.))

6. Halteres and suspensorial sclerites absent, metapleural ridge reduced; fleshy postmetastigmatal setae present; 3rd abdominal segment with no hair-like setae medially; pleural sclerotizations of penial sheath narrowly joined anterior to anus ..... Phyllostroma (P.myrtilli (Kalt))

Halteres and suspensorial sclerites present, metapleural ridge complete; fleshy postmetastigmatal setae absent; 3rd abdominal segment usually with 2 setae medially, rarely one; pleural sclerotizations not joined anterior to anus 7

7. With 1-4 (av. 2.7) scutal setae; with only one haltere seta on each side; with 2 hair-like setae dorsally on the 1st abdominal segment; penial sheath medium-sized, the ratio of its length in relation to body length being 1:5.09-5.63 (av. 5.39).

.....Palaeolecanium (P.bituberculatum (Targ.))

With no scutal setae; with more than one haltere seta on at least one side (usually 2, range 1-4); usually with no hair-like setae dorsally on 1st abdominal segment, occasionally with one; penial sheath very long, the ratio of its length in relation to body length being 1:3.15-4.15 8

8. Dorsal part of midcranial ridge absent; with 8 simple eyes; apex of cranial apophysis truncate; antenna longer than half body length, the ratio of its length in relation to body length being 1:1.52-1.61 (av. 1.57); antenna also 2.4-2.6 (av. 2.5) times longer than penial sheath; 3rd antennal segment without hair-like setae; scutellum 1.5-1.7 (av. 1.6) times wider than long; legs moderately long, the ratio length of hind leg to body length being 1:1.72-1.83 (av. 1.78): claws long, hind claw about

1½ times as long as width of tarsus; abdominal tergites and sternites absent on 4th and 5th segments; 2nd abdominal segment usually with none, but occasionally with one median hair-like seta ventrally.

..... Rhodococcus (R.spiraeae (Borchs.))

Vestigial dorsal part of midcranial ridge present; with 4, 6 or 10 simple eyes; apex of cranial apophysis bifurcate; antenna shorter than half body length, the ratio of its length in relation to body length being 1:2.02-2.92; antenna only 1.3-2.1 times longer than penial sheath; 3rd antennal segment with one or more hair-like setae; scutellum 1.8-2.3 times wider than long; legs short, the ratio length of hind leg to body length being 1:2.07-2.47; claws medium-sized, as long or a little longer than width of tarsus; tergites and sternites present on all abdominal segments; 2nd abdominal segment with 2 median hair-like setae ventrally 9

9. With 4 simple eyes; preoral ridge absent; mesoprephragma without an emargination; prescutum with distinct polygonal reticulation; basisternum 1.7-2.4 (av. 2.1) times longer than membranous area of scutum; alar setae absent; coxal bristles absent; apical seta on trochanter 2.1-2.6 (av. 2.4) times as

long as width of trochanter; 6th and 7th abdominal segments usually with 2 setae on both segments; basal rod short, length 1/7th-1/5th that of aedeagus .....Physokermes (P.piceae (Schr.))

With 6 or 10 simple eyes; preoral ridge present; mesoprephragma with shallow emargination; prescutum with weak or no reticulation; basisternum 2.5-3.6 times longer than membranous area of scutum; alar setae present on at least one side (range 0-3); coxal bristles present; apical seta on trochanter 3-4 times as long as width of trochanter; 6th and 7th abdominal segments usually with 4 setae on both segments; basal ridge medium-sized, length 2/5ths -⅔ that of aedeagus 10

10. Degree of sclerotization of postocular ridge not reduced posteromedially; with 6 simple eyes; genae not reticulated; antenna longer than posterior leg ratio 1:1.04-1.14 (av. 1.07); 3rd antennal segment 2.5-3.0 (av. 2.8) times longer than wide; basisternum usually with 1 or 2 hair-like setae; setae of glandular pouch with external part about twice as long as the internal part; basal rod extending 9/10ths of the length from eadeagus to apex of basal membranous area .....Nemolecanium (N.abietis Borchs.)

Degree of sclerotization of postocular ridge reduced posteromedially; with 10 simple eyes; genae weakly polygonally reticulated; antennae shorter than posterior leg, ratio 1:0.73-0.87 (av. 0.80); 3rd antennal segment 1.8-3.2 (av.2.0) times longer than wide; basisternum without setae; setae of glandular pouch with external part about 1½ times as long as the internal part; basal rod extending ⅔ or ¾ of the length from aedeagus to apex of basal membranous area ..... Eulecanium (E. tiliae (L.))

(ii) Key to the Genera and Species of the Eriopeltis Group.

1. With a pair of median, hair-like ventral head setae distinctly longer than the rest; 3rd antennal segment 3.0-3.7 (av. 3.3) times longer than wide; prescutum distinctly polygonally reticulated; median ridge of basisternum complete; tergites present on all the abdominal segments; glandular pouch absent, represented by a slight depression and one long seta; ante-anal region with no fleshy setae, but 2-6 circular pores; penial sheath short, the ratio of its length in relation to body length being 1:6.06-7.28 (6.66) .....Luzulaspis (L.luzulae (Dufour)).

Without a pair of long, median, hair-like ventral head setae; 3rd antennal segment 4 - 6 times longer than wide; prescutum not distinctly reticulated; median ridge of basisternum to a greater or lesser degree reduced; tergites absent on 3rd to 6th abdominal segments; glandular pouch present, containing 2 long setae; ante-anal region with 1 - 9 fleshy setae but no pores; penial sheath medium-sized, the ratio of its length in relation to body length being 1:4.46-4.92 ..... Eriopeltis 2

2. Lateral arms of midcranial ridge absent; apex of cranial apophysis bifurcate; median ridge of basisternum interrupted - combined length of separate parts more than half the length of the basisternum; posttergital region, and anterior arms and membranous area of scutum not reticulated .... Eriopeltis festucae (Fonsc.)

Lateral arms of midcranial ridge present; apex of cranial apophysis trifurcate; median ridge of basisternum reduced to a few vestiges of which the combined length is less than half the length of the basisternum; posttergital region, and anterior arms and membranous area of scutum weakly reticulated ....Eriopeltis sp.

(iii) Key to the Genera and Species of the Coccus Group

1. Head with anterodorsal bulge not pronounced; with 14-32 fleshy postmesostigmatal setae; with 1-6 postalary setae; 8th abdominal segment laterally with a large semicircular lobe, which carries a large cicatrix posterodorsally; without 2 long, hair-like ante-anal setae; with 2-7 fleshy setae lateral to glandular pouch; 6th abdominal segment ventrally with 2 or less hair-like setae, usually one on each side; apex of penial sheath with a large finger-like membranous extension at the apex ..... Ceroplastes. 2

Head with anterodorsal bulge pronounced; with more than 43 fleshy postmesostigmatal setae, usually without postalary setae; 8th abdominal segment laterally with a geniculate, mammillate or papilla-shaped lobe which carries a small lateral or large posterior cicatrix; with 2 long hair-like ante-anal setae; without fleshy setae lateral to glandular pouch; 6th abdominal segment ventrally with 3 or more hair-like setae, usually 2 laterally and 2 medially 3

2. Vestigial dorsal part of midcranial ridge present on anterior margin of head; with 11-21 (av. 16) fleshy setae between and behind ventral simple eyes; 4th antennal segment with 23-29 (av. 26) fleshy setae; with 2-4 (av. 3.2) coxal bristles; 7th abdominal segment ventrally with 6-11 (av. 9.2) fleshy setae; aedeagus short - basal rod about 2 times longer and penial sheath 4.1-4.9 (av. 4.5) times longer ..... Ceroplastes sp.

Dorsal part of midcranial ridge absent; with 5-9 (av. 7.1) fleshy setae between and behind ventral simple eyes; 4th antennal segment with 11-19 (av. 15) fleshy setae; coxal bristles absent; 7th abdominal segment with 1-5 (av. 3.0) fleshy setae; aedeagus medium-sized - about as long as basal rod, and penial sheath 3.0-3.4 (3.2) times longer .....C.berliniae Hall

3. Posttergital setae absent; hind tarsus usually with more hair-like than fleshy setae; tergites between 1st and 2nd abdominal segments consisting of a small sclerite on each side; 8th abdominal segment laterally with a papilla-shaped lobe, which carries a small cicatrix laterally .....Parthenolecanium 4

Posttergital setae present on at least one side; hind tarsus with more fleshy than hair-like setae; tergites between 1st and 2nd abdominal segments consisting of a small sclerite on each side and a separate median sclerite; 8th abdominal segment with a geniculate or mammillate lobe which carries a large posterior or small lateral cicatrix respectively 5

4. Usually with a pair of hair-like median pronotal setae; ventral foramen of scutellum large, length usually more than half that of scutellum; caudal extension (7th abdominal segment) with 4-8 (av. 5.0) fleshy setae ..... P. pomeranicum (Kaw.)

Usually without hair-like median pronotal setae; ventral foramen of scutellum small, length usually less than half that of scutellum; caudal extension with 11-25 fleshy setae ..... P. corni (Bouche)

5. Vestigial dorsal part of midcranial ridge present; distal part of terminal antennal segment not constricted; mesoprephragma with a shallow emargination; fleshy scutal setae absent; femora of medium length; hind femur 3.86-4.75 times longer than wide; lateral

margin of 8th abdominal segment with a mammillate lobe which carries a very small cicatrix laterally; a few fleshy ante-anal setae usually present (range 0-7) length of basal rod about equal to 1¼ times that of aedeagus ..... Pulvinaria 6

Dorsal part of midcranial ridge absent; distal part of terminal antennal segment somewhat constricted; mesoprephragma with deep emargination; with 7-32 fleshy scutal setae; femora long and narrow, hind femur 5.98-6.71 times longer than wide; lateral margin of 8th abdominal segment with a geniculate or cylindrical lobe which carries a large cicatrix posteriorly; fleshy ante-anal setae absent, length of basal rod more than 1¼ times that of aedeagus 7

6. The two shortest antennal bristles on the terminal antennal segment about half as long as the fleshy setae; pedicel, gena and mesoprescutum distinctly polygonally reticulated; 2nd abdominal segment usually with one or more hair-like setae (range 0-6)
.....P. betulae (L.)

The two shortest antennal bristles on the terminal antennal segment longer and thicker than the fleshy setae; reticulation on pedicel, gena and mesoprescutum

absent or very weak, 2nd abdominal segment without hair-like setae .....P. acericola Walsh & Riley

7. With 16-22 (av. 18) fleshy dorsal head setae; 4th antennal segment 9-11 (av. 10) times longer than wide; length of 2 shortest antennal bristles about equal that of the fleshy setae; prosternum not reticulated; lateral margin of 8th abdominal segment with a geniculate lobe; with 2-9 (av. 5.4) fleshy basisternal setae; setae of glandular pouch with external part about 2-2½ times as long as the internal; 2nd and 3rd abdominal segments usually with 2 hair-like setae dorsally; 2nd abdominal segment usually with 2 (range 1-2, av. 1.7) hair-like setae ventrally, one on each side; ante-anal region with 1-5 (av. 2.5) small, circular pores

.....Genus B (nr. Pulvinaria)

With 29-42 (av. 35) fleshy dorsal head setae; 4th antennal segment 5-7 (av. 6) times longer than wide; length of two shortest antennal bristles about half that of the fleshy setae; prosternum reticulated; without basisternal setae; lateral margin of 8th abdominal segment with a cylindrical lobe; setae of glandular pouch with the external part about 4¾-5 times as long as the

omit
[absent or very weak, 2nd abdominal segment without hair-like setae ..... P. acericola Walsh & Riley

7. With 10-22 (av. 16) fleshy dorsal head setae; 4th antennal segment 9-11 (av. 10) times longer than wide; length of 2 shortest antennal bristles about equal that of the fleshy setae; prosternum not reticulated; lateral margin of 8th abdominal segment with a geniculate lobe; with 2-9 (av. 5-4) fleshy basisternal setae; setae of glandular pouch with external part about 2-2½ times as long as the internal; 2nd and 3rd abdominal segments usually with 2 hair-like setae dorsally; 2nd abdominal segment usually with 2 (range 1-2 , av. 1.7) hair-like setae ventrally, one on each side; ante-anal region with 1-5 (av. 2.5) small, circular pores .....Genus B (nr.Pulvinaria)

With 26-42 (av. 35) fleshy dorsal head setae; 4th antennal segment 5-7 (av. 6) times longer than wide; length of two short antennal bristles about half that of the fleshy setae; prosternum reticulated; without basisternal setae; lateral margin of 8th abdominal segment; with a cylindrical lobe; setae of glandular pouch with the external part about 4¾ - 6 times as long as the]

internal; 2nd and 3rd abdominal segments usually without hair-like setae dorsally; 2nd abdominal segment usually without hair-like setae ventrally; ante-anal region without pores .....*Coccus* (*C.hesperidum* L.)

VII. SUMMARY

1. In the past only scant attention has been paid to male as opposed to female Coccoidea, but recent studies showed that the characters of the male reveal important information regarding the interrelationships of the group on both higher and lower taxonomic levels.

2. The males of 23 species (representing 19 genera) of the family Coccidae have been described and illustrated, most of them for the first time and all in far more detail than before.

3. Based on these species a detailed account of the external morphology of the male of the family is given and the observations compared critically with those of other workers.

4. A number of structures present in the other male Coccoidea, but not previously observed in this family, have been recorded for some or all species, i.e. a detached dorsal part of the midcranial ridge, anterior tentorial pits, lateral pronotal sclerites, posttergites, vestigial metapleural apophyses, basalares, a metasternal sclerite and sclerites on the intermediate segments of the abdomen.

5. A large number of male characters were shown to be of taxonomic importance and male characters were found useful for classifying the family at all taxonomic levels, thus confirming the conclusion of Ghauri (1962)

from work on male Diaspididae.

6. Evidence is supplied which clearly indicates that the lecanoid type of male is more closely related to the diaspidoid than to the margaroid type and furthermore that they are more specialized than the margaroids but less than the diaspidoids.

7. When compared with the males of the more specialized margaroid genera Steingelia and Phenacoleachia, the male of the Coccidae is shown to be more similar to that of Steingelia and the male of the Pseudococcidae to that of Phenacoleachia.

8. From an examination of the males of the Asterolecaniidae and Kermococcidae described in the literature it appears that these two families are very closely related to the Coccidae.

9. The males of the two lecanoid families Coccidae and Pseudococcidae were found to share an equal number of primitive and specialized features, but on account of the former's closer affinity to the Diaspididae they are considered to be more specialized than the Pseudococcidae.

10. Within the family the males were found in many cases to reveal different relationships from the female, consequently the classification suggested differs substantially from the existing classifications based on female characters.

11. It is suggested that the 19 genera studied in detail should be divided into four groups of genera:

(i) The Coccus group, including the five closely related genera Coccus, Genus B (near Pulvinaria), Pulvinaria, Parthenolecanium and Ceroplastes, with the latter somewhat distinct from the rest. From a study of the existing literature or limited material it is suggested that the genera Chloropulvinaria, Neopulvinaria, Saissetia and Physokermes should also be included in this group. The group is considered to be the most specialized of the four groups studied.

(ii) The Inglisia group, including only the genus Inglisia which is very distinct from all the other genera studied. A brief study of Ceroplastodes indicated that the latter should be included in this group.

(iii) The Eriopeltis group, consisting of two closely related genera Eriopeltis and Luzulaspis.

(iv) The Eulecanium group, a rather heterogeneous assembly of genera, which includes Eulecanium, Nemolecanium, Physokermes, Rhodococcus, Palaeolecanium, Phyllostroma, Filippia, Ctenochiton, Ericerus, Genus A, and Sphaerolecanium. Of these the first five genera are very closely related to each other, and so are Filippia and Ctenochiton, but the other three are not very closely related to each other or any of the first

two subgroups. The Eulecanium group includes the most primitive genera of the family.

12. The Eulecanium and Eriopeltis groups on the one hand and the Inglisia and Coccus groups on the other, are considered to be more closely related.

13. Keys are provided for the identification of the groups of genera, genera and species studied.

VIII. REFERENCES

BAKER, A.C. 1920. Generic classification of the hemipterous family Aphididae. Bull. U.S. Dept. Agric. 825: 109 pp.

BALACHOWSKY, A. 1937. Les cochenilles de France, d' Europe, du Nord de l'Afrique et du Bassin méditerranéen. I Caractères généraux des cochenilles, morphologie externe. Actual. scient. ind. 526: 68 pp.

BALACHOWSKY, A. 1942. Essai sur la classification des cochenilles (Homoptera-Coccoidea). Annls Ec. natn. Agric. Gignon, 3: 34-48.

BALACHOWSKY, A. 1948. Les cochenilles de France, d' Europe, du Nord de 'l Afrique et du bassin méditerranéen. iV. Monographie des Coccoidea, classification - Diaspidinae (Première partie). Actual. scient. ind. 1054: 243-394.

BEARDSLEY, J.W. 1960. A preliminary study of the males of some Hawaiian mealybugs (Homoptera: Pseudococcidae). Proc. Hawaii. ent. Soc. 17: 199-243

BEARDSLEY, J.W. 1962. Descriptions and notes on male mealybugs (Homoptera: Pseudococcidae). Ibid. 18: 81-98.

BERLESE, A. 1893. Le Cocciniglie Italiane viventi sugli agrumi. Parte I. I Dactylopius. Riv. Patol. veg. 2: 70-109, 129-193.

BERLESE, A. 1896. Le Cocciniglie Italiane viventi sugli agrumi. Parte III. I Diaspiti. Ibid. 4: 195-292; 5: 3-73.

BODENHEIMER, F.S. 1953. The Coccoidea of Turkey. III. Rev. Fac. Sci. Istanbul, 18 (Ser. B): 91-164

BORCHSENIUS, N.S. 1957: Fauna U.S.S.R: Homoptera 9. Suborder mealybugs and scales (Coccoidea), family Coccidae. (In Russian.) Zool. Inst. Akad. Nauk SSSR. no. 66: 494 pp.

BORCHSENIUS, N.S. 1958. On the evolution and phylogenic interrelations of Coccoidea (Insecta, Homoptera). (In Russian.) Zool. Zhurn. 37: 765-780.

BORCHSENIUS, N.S. 1960. Fauna USSR: Homoptera 8. Suborder mealybugs and scales (Coccoidea), families Kermococcidae, Asterolecaniidae, Lecanoidiaspididae, Aclerdidae. (In Russian.) Zod. Inst. Akad. Nauk SSSR no. 77: 283 pp.

BROWN, J.W. 1959. Lecanoid chromosome behavior in three more families of the Coccoidea (Homoptera). Chromosoma 10: 278-300

BUSTSHIK, T.N. 1958. A contribution to the comparative morphology of the males of the scale insects (Homoptera, Coccoidea, Diaspididae). (In Russian.) Horae Soc. ent. ross. 46: 152-269.

BUSTSHIK, T.N. & SHAKJAN-BARANOVA, A.A. 1962. On males of Coccus hesperidum L. (In Russian.) (Homoptera, Coccoidea). Ent. Obozr. 41: 334-349.

CRAMPTON, G.C. 1926. A comparison of the neck and prothoracic sclerites throughout the orders of insects from the standpoint of phylogeny. Trans. Amer. ent. Soc. 52: 199-248.

CUSCIANA, M. 1931. La cocciniglia del susino (Eulecanium corni) in provincia di Trieste. Boll. Lab. zool. Portici, 24: 279-298.

DURR, H.J.R. 1954. The male of Lecanium pumilum Brain (Hempitera: Coccidae). J. ent. Soc. S. Afr. 17: 90-92.

EZZAT, Y.M. 1956. The thoracic sclerotization of coccid adult males as a promising taxonomic character. Bull. Soc. ent. Egypte. 40: 357-363.

FERRIS, G.F. 1937. Atlas of the Scale Insects of North America. Series I. Stanford University Press, Stanford. 8 pp + Serial numbers 1 - 136.

FERRIS, G.F. 1942. Ibid. Series IV. Stanford University Press, Stanford. Serial numbers 385-448.

FERRIS, G.F. 1950. Ibid. Series V. The Pseudococcidae (Part 1). Stanford University Press, Stanford. 278 pp.

FERRIS, G.F. 1957. Notes on some little known genera of the Coccoidea (Homoptera). Microentomology. 22: 59-79.

FERRIS, G.F. 1957. A brief history of the study of the Coccoidea, Microentomology, 22: 39-57.

GHAURI, M.S.K. 1962. The morphology and taxonomy of male scale insects (Homoptera: Coccoidea). British Museum (Nat. Hist.), London. 221 pp.

GILLIOMEE, J.H. 1961. Morphological and taxonomic studies on the males of three species of the genus Pseudococcus (Hemiptera: Coccoidea). Annale Univ. Stellenbosch, 36 (A): 241-296.

GREEN, E.E. 1904-1909. Coccidae of Ceylon. III-IV: 171-344. Dulau & Co., London.

HABIB, A. 1953. The bionomics of Lecanium corni group and its relation to host plants. Ph. D. thesis, University of London.

HABIB, A. 1956. The male Eulecanium corni Bouché (Hemiptera-Homoptera: Coccoidea-Coccidae) Bull.Soc.ent. Egypte. 40: 119-126.

KADZIBEJLI, Z.K. 1955. A new genus and species of the family Lecaniidae (Homoptera, Coccoidea) from Georgia. (In Russian). Ent. Obozr. 34: 231-239.

HUGHES-SCHRADER, S. 1948. Cytology of coccids (Coccoidea-Homoptera). Adv. Genet. 2: 127-203.

HUSSEINY, M.M. & MADSEN, H.F. 1962. The life history of Lecanium kunoensis Kuwana (Homoptera: Coccidae). Hilgardia, 33: 179-203.

JANCKE, G.D. 1955. Zur Morphologie der mannlichen Cocciden. Z. angew. Ent. 37: 265-314.

KAWECKI, Z. 1958a. Studies on the Genus Lecanium Burm. IV. Materials to a Monograph of the Brown Scale, Lecanium corni Bouché, Marchal (♀ nec ♂) (Homoptera, Coccoidea, Lecaniidae). (In Polish.) Annls. zool., Warsz. 4: 135-230.

KAWECKI, Z. 1958 b. Ibid. Part V. The Nut or Thorn Scale - Lecanium coryli (L.) sensu Marchal nec Sulc (Homoptera, Coccoidea, Lecaniidae). (In Polish.) Bull. ent. Pologne, 27: 40-69.

LEONARDI, G. 1920. Monografia delle cocciniglie Italiane. Stab. Tip. Ernesto della Torre, Portice. 555 pp.

MATSUDA, R. 1960. Morphology of the pleurosternal region of the pterothorax in insects. Ann. ent. Soc. Am. 53: 712-731.

McCONNELL, H.S. 1953. A classification of the coccid family Aclerdidae. Bull. Md agric. Exp. Stn. A-75) (Tech.): 121 pp.

MORRISON, H. 1928. A classification of the higher groups and genera of the coccid family Margarodidae. Tech. Bull. U.S. Dep. Agric. 52: 240 pp.

MOULTON, D. 1907. The monterey pine scale, Physokermes insignicola (Craw). Proc. Davenport Acad. Sci. 12: 1-26.

NEWSTEAD, R. 1901. Monograph of the Coccidae of the British Isles. I. Ray Soc. Publ. 220 pp.

NEWSTEAD, R. 1903. Monograph of the Coccidae of the British Isles. II. Ray Soc. Publ. 270 pp.

PESSON, P. 1941. Description du mâle de Pulvinaria mesembryanthemi Vallot et observations biologigues sur cette espèce (Hemipt. Coccidae). Ann. Soc. ent. Fr. 110: 71-77.

PFLUGFELDER, O. 1936. Bau und morphologische Bedeutung der sog. Ocellen der Schildlaus-Männchen (Lecanium corni March.) Zool. Anz. 114: 49-55.

PFLUGFELDER, O. 1939. Arthropoda, Insecta. Coccina. Bronn's Klassen, 5, Abt. 3, Buch 8, Teil b.e. 121 pp.

PUTNAM, J.D. 1879. Biological and other notes on Coccidae. I. Pulvinaria innumerabilis. Proc. Davenport Acad. Sci: 2: 293-346.

ROBERTI, D. 1946. Monografia dell' Aphis (Doralis) frangulae Koch. Parte 1. Morfologia, Anatomia, Istologia. Boll. Lab. Ent. agr. Portici, 6: 127-312.

RUSSEL, L.M. 1941. A classification of the scale insect genus Asterolecanium. Misc. Publ. U.S. Dep. Agric. 424: 319 pp.

SILVESTRI, F. 1919 a. Contribuzioni alla conoscenza degli insetti dannosi e dei loro simbionti. IV. La cocciniglia del prugno (Sphaerolecanium prunastri Fonsc.) Boll. R. Lab. Ent. agr. R. Scuola sup. Agric. Portici, 13: 70-126.

SILVESTRI, F. 1919 b. Contribuzioni alla conoscenza degli insetti dannos; e dei loro simbionti. V. La cocciniglia del nocciuolo (Eulecanium coryli L.) Ibid 13: 127-192.

SILVESTRI, F, 1926. Descrizione e notizie del Ceroplastes sinensis D. Guerc. (Hemiptera, Coccidae) Ibid 14: 3-17.

SNEATH, P.H.A. & SOKAL, R.R. 1962. Numerical Taxonomy. Nature, 193: 855-860.

SNODGRASS, R.E. 1935. Principles of insect morphology. McGraw-Hill Book Co., Inc. New York and London. 667 pp.

SOKAL, R.R. & SNEATH, P.H.A. 1963. Principles of numerical taxonomy. W.H. Freeman and Company, San Francisco and London.

STEINWEDEN, J.B. 1929. Bases for the generic classification of the coccoid family Coccidae. Ann. ent. Soc. Am. 22: 197-245.

STICKNEY, F.S. 1934 a. The external anatomy of the red date scale Phoenicococcus marlatti Cockerell, and its allies. Tech. Bull. U.S. Dep. Agric. 404: 162 pp.

STICKNEY, F.S. 1934 b. The external anatomy of the Parlatoria date scale, Parlatoria blanchardi Targioni Tozzetti, with studies of the head skeleton and associated parts. Tech. Bull. U.S. Dep. Agric. 421: 67pp.

SULC, K. 1908. Towards the better knowledge of the genus Lecanium. Entomologist's Mon. Mag., 44: 36.

SULC, K. 1931. O skladbe voskovych steto a jejich prislusnych zlaz u samcu puklic (Lecanium, Coccidae). Prirod. Spolec v. Morav. Ostrave Sborn. 1930-1931: 85-96.

SULC, K. 1932. Ceskoslovenske druhy rodu puklice (gn. Lecanium, Coccidae, Homoptera) Acta Soc. Sci. nat. Morav., 7: 1-134.

SULC, K. 1941. Mohelnia festuceti n. gn., n. sp. Lecaniidae, Eriopeltini, Coccoidea, Hemiptera). (In Czech.) Acta Soc. Sci. nat. Morav. 13: 1-17.

SULC, K. 1943. Zevni morfologie, metamortosa a beh zivota cervse Phenacoccus aceris Sign. Acta. Soc. Sci. nat. Morav. 15: 1-52.

TARGIONI TOZETTI, A. 1867. Studii sulle Coccinigliе Mem. Soc. ital Sci. nat. 3: 1-87.

THERON, J.G. 1958. Comparative studies on the morphology of scale insects (Hemiptera: Coccoidea). Annale Univ. Stellenbosch, 34 (A): 71 pp.

THERON, J.G. 1962. Structure and relationships of the male of Phenacoleachia zealandica (Maskell) (Hemiptera: Coccoidea) Proc. R. ent. Soc. Lond. (A) 37: 145-153.

WEBER, H. 1928. Skelett, Muskulatur and Darm der schwarzen Blattlaus Aphis fabae Scop. Zoologica, Stuttgart, 28, Heft 76, 120 pp.

WEBER, H. 1935. Der Bau der Imago der Aleurodinen. Zoologica, Stuttgart, 33, Heft 89, 71 pp.

WILKEY, R.F. & McKENZIE, H.L. 1961. Systematic status of the Pseudococcus maritimus-malacearum complex of mealybugs. (Homoptera: Coccoidea: Pseudococcidae). Bull. Calif. Dep. Agric. 50: 245-249.

IX. LIST OF FIGURES

Fig.

1. Generalized drawing of the male of the Coccidae.
2. Eulecanium tiliae (L.) dorsal and ventral view.
3. Nemolecanium abietis Borchs., dorsal and ventral view.
4. Physokermes piceae (Schr.), dorsal and ventral view.
5. Rhodococcus spiraeae (Borchs.), dorsal and ventral view.
6. Palaeolecanium bituberculatum (T.T.) dorsal and ventral view.
7. Phyllostroma myrtilli (Kalt.) dorsal and ventral view.
8. Filippia viburni (Sign.) dorsal and ventral view.
9. Ctenochiton sp., dorsal and ventral view.
10. Ericerus pela (Chav.), dorsal and ventral view.
11. Genus A., dorsal and ventral view.
12. Sphaerolecanium prunastri (Fonsc.) dorsal and ventral view.
13. Eriopeltis sp., dorsal and ventral view.
14. Eriopeltis ? festucae (Fonsc.), dorsal and ventral view.
15. Luzulaspis luzulae (Dufour), dorsal and ventral view.
16. Inglisia theobromae (Newst.)
17. Coccus hesperidum L., dorsal and ventral view.
18. Genus B., dorsal and ventral view.
19. Pulvinaria ? betulae (L.) dorsal and veltral view.
20. Pulvinaria acericola (Walsh & Riley) dorsal and ventral view.
21. Parthenolecanium corni (Bouche) dorsal and ventral view.
22. Parthenolecanium pomeranicum (Kaw.) dorsal and ventral view.
23. Ceroplastes berliniae Hall dorsal and ventral view.
24. Ceroplastes sp., dorsal and ventral view.
25. Eulecanium tiliae L., lateral view.
26. Nemolecanium abietis Borchs., lateral view.
27. Physokermes piceae (Schr.), lateral view.
28. Rhodococcus spiraeae (Borchs.), lateral view.
29. Palaeolecanium bituberculatum (T.T.) lateral view.
30. Phyllostroma myrtilli (Kalt.) lateral view.
31. Filippia viburni (Sign.) lateral view.

32. Ctenochiton sp., lateral view.
33. Ericerus pela (Chav.), lateral view.
34. Genus A.
35. Sphaerolecanium prunastri (Fonsc.), lateral view.
36. Eriopeltis sp., lateral view; also referable for lateral view of E. ? festucae (Fonsc.)
37. Luzulaspis luzulae (Dufour), lateral view.
38. Inglisia theobromae (Newst.), lateral view.
39. Coccus hesperidum L., lateral view.
40. Genus B., lateral view.
41. Pulvinaria ? betulae (L.), lateral view; also referable for lateral view of P.acericola (Walsh & Riley).
42. Parthenolecanium pomeranicum (Kaw.), lateral view; also referable for lateral view of P. corni (Bouche).
43. Ceroplastes berliniae Hall, lateral view; also referable for lateral view of Ceroplastes sp.

X. EXPLANATION OF FIGURES.

The lettering of all figures is uniform and is as follows:

A. Dorsal and ventral aspects of body.
A_1. Lateral aspect of body.
B. Head: dorsal view.
C. Head: ventral view.
D. Mesoprephragma: anterior view.
E. Mesopostphragma; posterior view.
F. 3rd segment of left antenna; ventral view.
G. 10th segment of left antenna; ventral view.
H. Membranous area of scutum.
I. 3rd axillary wing sclerite; dorsal view.
J. Fore claw: posterior view.
K. Middle claw; posterior view.
L. Hind claw; posterior view.
M. Part of inner margin of fore coxa, showing setae and coxal bristle(s).
N.. Articulation of fore wing, showing pteralia.
O. 3rd axillary wing sclerite; posterior view.
P. Subalare; dorsal view.
Q. Caudal extension of 8th abdominal segment; dorsal view.
R. Apex of penial sheath, ventral view.
S. Apex of penial sheath, ventral view.
T. Tentorium and cranial apophysis.

XI. LIST OF ABBREVIATIONS

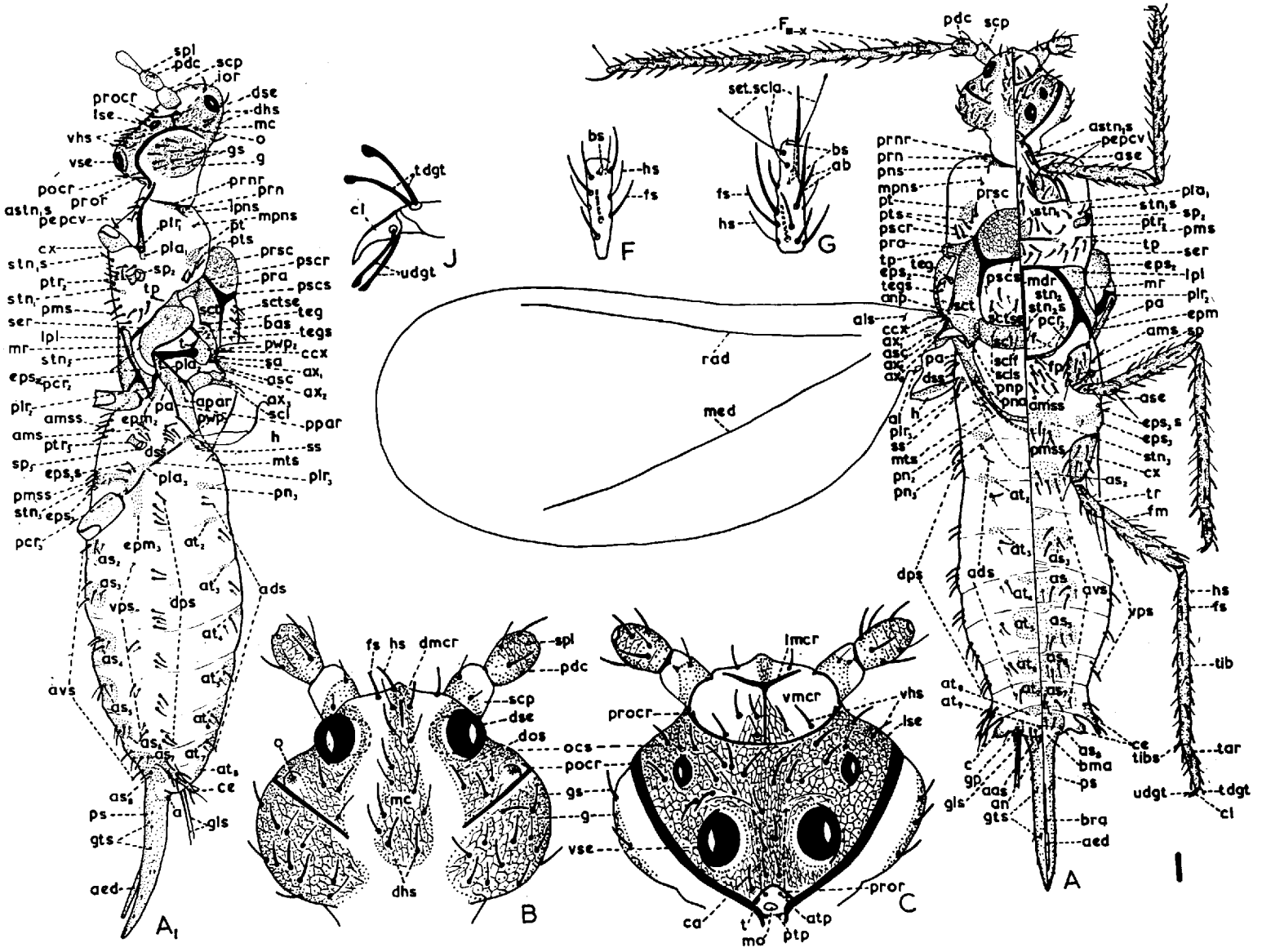
aas	ante-anal setae
ab	antennal bristles
ads	abdominal dorsal setae
aed	aedeagus
al	alar lobe
als	alar seta
ams	antemetastigmatal setae
amss	anterior metasternal setae
an	anus
anp	anterior notal wing process
apar	anterior postalar ridge
as	abdominal sternite
asc	additional sclerite
ase	apical seta
$astn_1s$	anteprosternal setae
at	abdominal tergite
ata	anterior tentorial arm
atp	anterior tentorial pits
avs	abdominal ventral setae
ax_1	first axillary wing sclerite
ax_2	second axillary wing sclerite
ax_3	third axillary wing sclerite
bas	basalare
bma	basal membranous area
bra	basal rod of aedeagus
bs	sensilla basiconica
ca	cranial apophysis
c	cicatrix
cb	coxal bristles
ccx	costal complex of wing veins
ce	caudal extension
cl	claw
cx	coxa
dhs	dorsal head setae
dmcr	dorsomedial part of midcranial ridge
dos	dorsal ocular setae
dps	dorsopleural setae
dse	dorsal simple eye
dss	dorsostigmatal setae
epm_2	mesepimeron
epm_3	metepimeron
eps_2	mesepisternum
eps_3	metepisternum

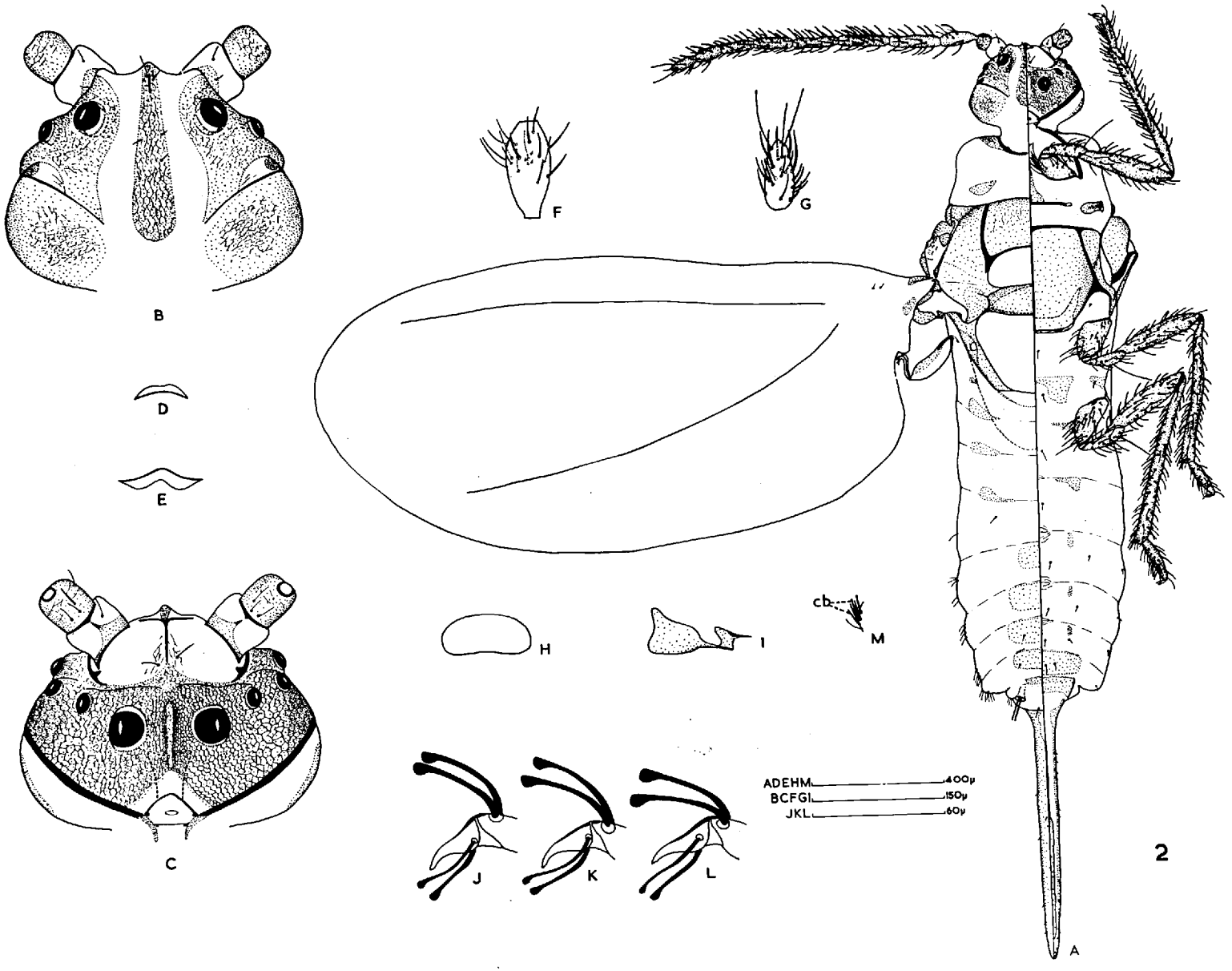
eps_3s	postmetastigmatal setae
f	furca
F_{iii-x}	segments of flagellum 3rd to 10th
fm	femur
fp	furcal pit
fs	fleshy seta
g	gena
gls	seta of glandular pouch
gp	glandular pouch
gs	genal setae
gts	setae of genital segment
h	haltere
hs	hair-like seta
ior	interocular ridge
lmcr	lateral branch of midcranial ridge
lpl	lateropleurite
lse	lateral simple eye
mc	median crest
mdr	median ridge
med	media
mo	mouth opening
mpns	medial pronotal setae
mr	marginal ridge
mts	metatergal setae
o	ocellus
ocs	ocular sclerite
pa	postalare
pcr_2	precoxal ridge of mesothorax
pcr_3	vestigial precoxal ridge of metathorax
pdc	pedicel
pepcv	proepisternum + cervical sclerite
pla_1	propleural apophysis
pla_2	mesopleural apophysis
pla_3	vestigial metapleural apophysis
plr_1	propleural ridge
plr_2	mesopleural ridge
plr_3	metapleural ridge
pms	postmesostigmatal setae
pmss	posterior metasternal setae
pn_2	mesopostnotum
pn_3	metapostnotum
pna	postnotal apophysis
pnp	posterior notal wing process
pnr	pronotal ridge
pocr	postocular ridge
ppar	posterior postalar ridge
pra	prealare

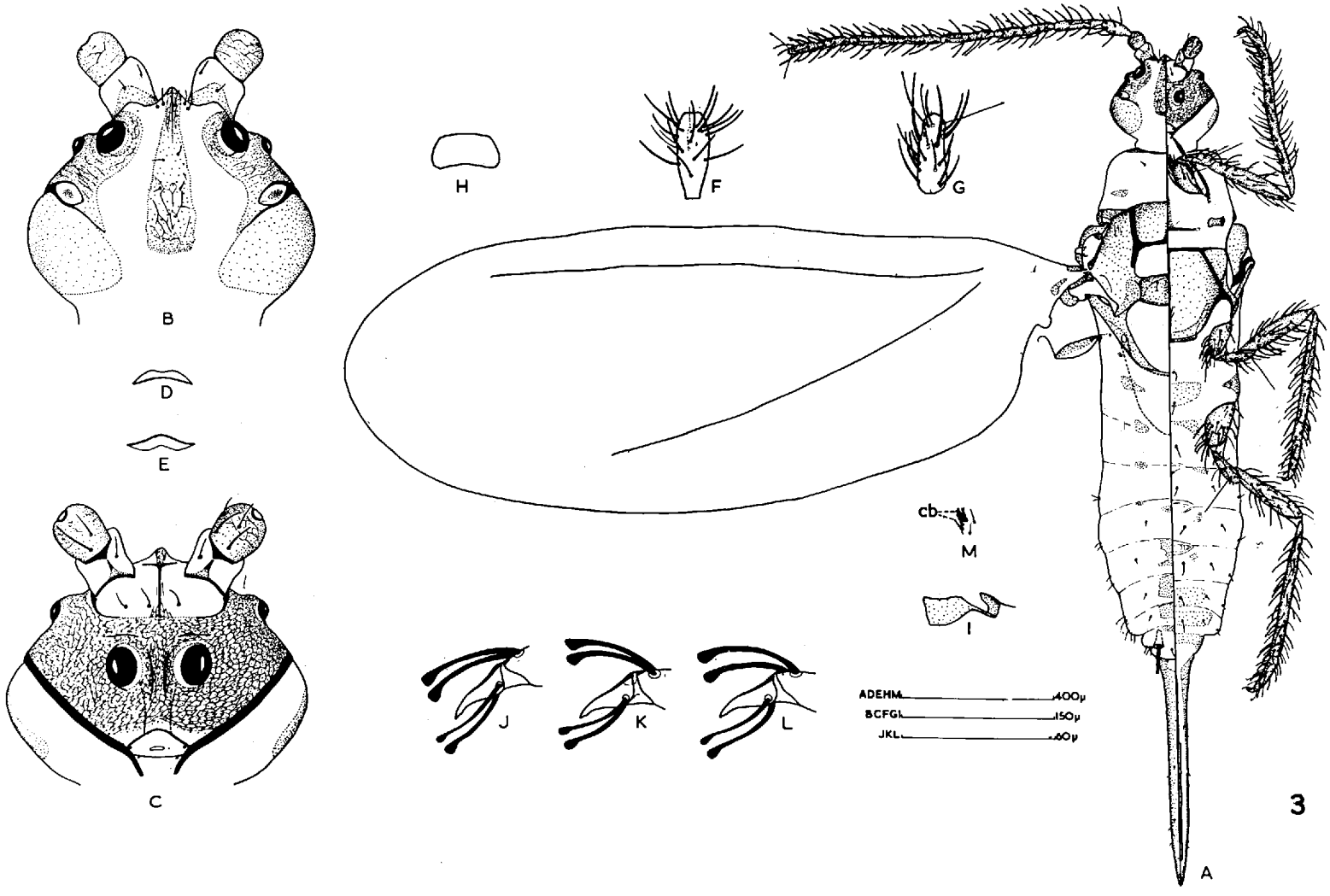
prn	laternal pronotal sclerite
prnr	pronotal ridge
procr	preocular ridge
pror	preoral ridge
prsc	prescutum
ps	penial sheath
pscr	prescutal ridge
pscs	prescutal suture
pt	posttergite
pta	posterior tentorial arm
ptp	posterior tentorial pit
ptr_2	peritreme of meso-thoracic spiracle
ptr_3	peritreme of meta-thoracic spiracle
pts	posttergital setae
pwp_2	mesopleural wing process
pwp_3	vestigial metapleural wing process
rad	radius
sa	subalare
set.scla	subapical seta
scl	scutellum
sclf	scutellar foramen
scls	scutellar setae
scp	scape
sct	scutum
sctse	scutal setae
ser	subepisternal ridge
sp_2	mesothoracic spiracle
sp_3	metathoracic spiracle
spl	sensillum placodeum
ss	suspensorial sclerite
stn_1	prosternum
stn_2	mesosternum
stn_3	metasternum
stn_1 s	prosternal setae
stn_2 s	mesosternal setae
t	tendon-like apodeme
tar	tarsus
tb	tentorial bridge
tdgt	tarsal digitule
teg	tegular
tegs	tegular setae
tib	tibia
tibs	tibial spur
tp	triangular plate
tr	trochanter
udgt	ungual digitule
vhs	ventral head setae

vmcr	ventral part of mid-cranial ridge	vs	ventral sclerite
vps	ventropleural setae	vse	ventral simple eye

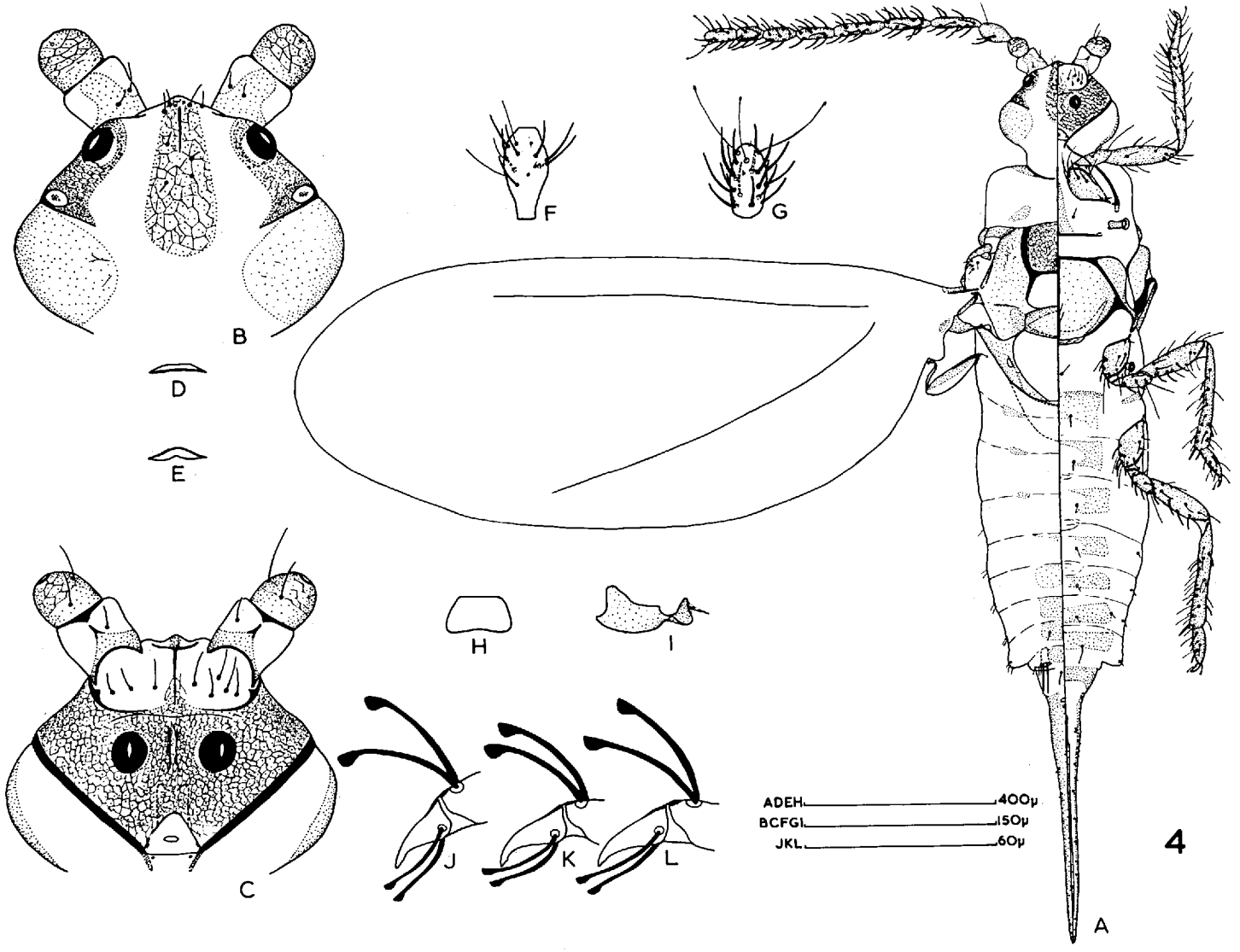
XII FIGURES

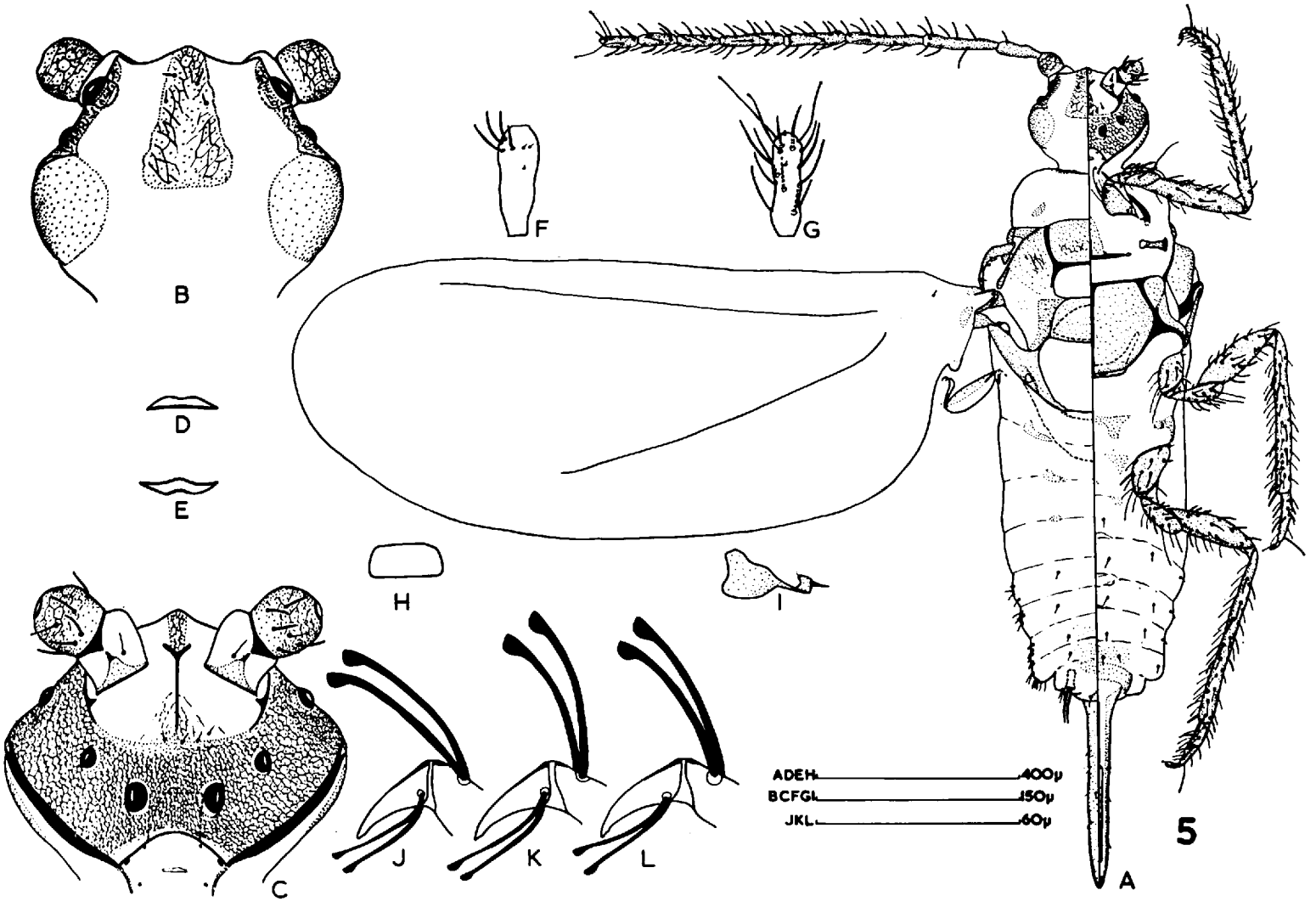

A
A1
B
C
F
G
J
rad
med
spl
pdc
scp
ior
procr
dse
dhs
lse
mc
vhs
o
gs
vse
g
pocr
prnr
prof
prn
astn1s
pepcv
lpns
ptr1
mpns
pt
cx
pla1
pts
stn1s
sp2
prsc
ptr2
tp
pscr
stn1
pra
pms
pscs
ser
sct
sctse
lpl
teg
mr
bas
tegs
stn2
pwp2
ccx
eps2
pla2
sa
pcr2
ax1
plr2
amss
epm2
pa
apar
ax2
pwp1
ax3
scl
ppar
ams
ptr3
dss
h
sp2
eps2s
mts
ss
pla3
plr3
pmss
pn3
stn3
eps3
pcr3
epm3
at2
as2
as3
at3
ads
vps
dps
at4
as4
avs
at5
as5
at6
as6
as7
at7
at8
ce
a
gls
as8
ps
gts
aed
fs
hs
dmcr
spl
pdc
scp
dse
dos
ocs
pocr
gs
g
vse
mc
dhs
lmcr
vmcr
vhs
lse
procr
pror
ca
t
atp
mo
ptp
F1-x
set.scla
bs
ab
hs
fs
tdgt
cl
udgt
astn2s
pepcv
ase
prnr
prn
pns
mpns
pt
pts
pscr
pra
tp
teg
eps1
tegs
anp
als
ccx
ax1
asc
ax2
ax3
pla1
stn1s
sp2
ptr1
pms
tp
ser
eps2
lpl
mr
plr2
pa
epm
ams
sp
ase
eps2s
eps2
stn3
cx
as2
tr
fm
hs
fs
tib
tar
tdgt
cl
tibs
udgt
ce
bma
ps
bra
aed
c
gp
aas
an
gts
gls
pla1
stn1s
sp2
ptr1
pms
tp
ser
eps2
lpl
mr
plr2
pa
epm
ams
sp
ase
eps2s
eps2
stn3
cx
as2
tr
fm
pscs
mdr
stn2
stn2s
pcr1
sct
sctse
scl
scf
scls
pnp
pna
amss
fps
pmss
pa1
dss
al
h
plr3
ss
mts
pn1
pn3
at2
at3
as3
dps
ads
as
at4
avs
vps
at5
as5
at6
as6
at7
at8
as8

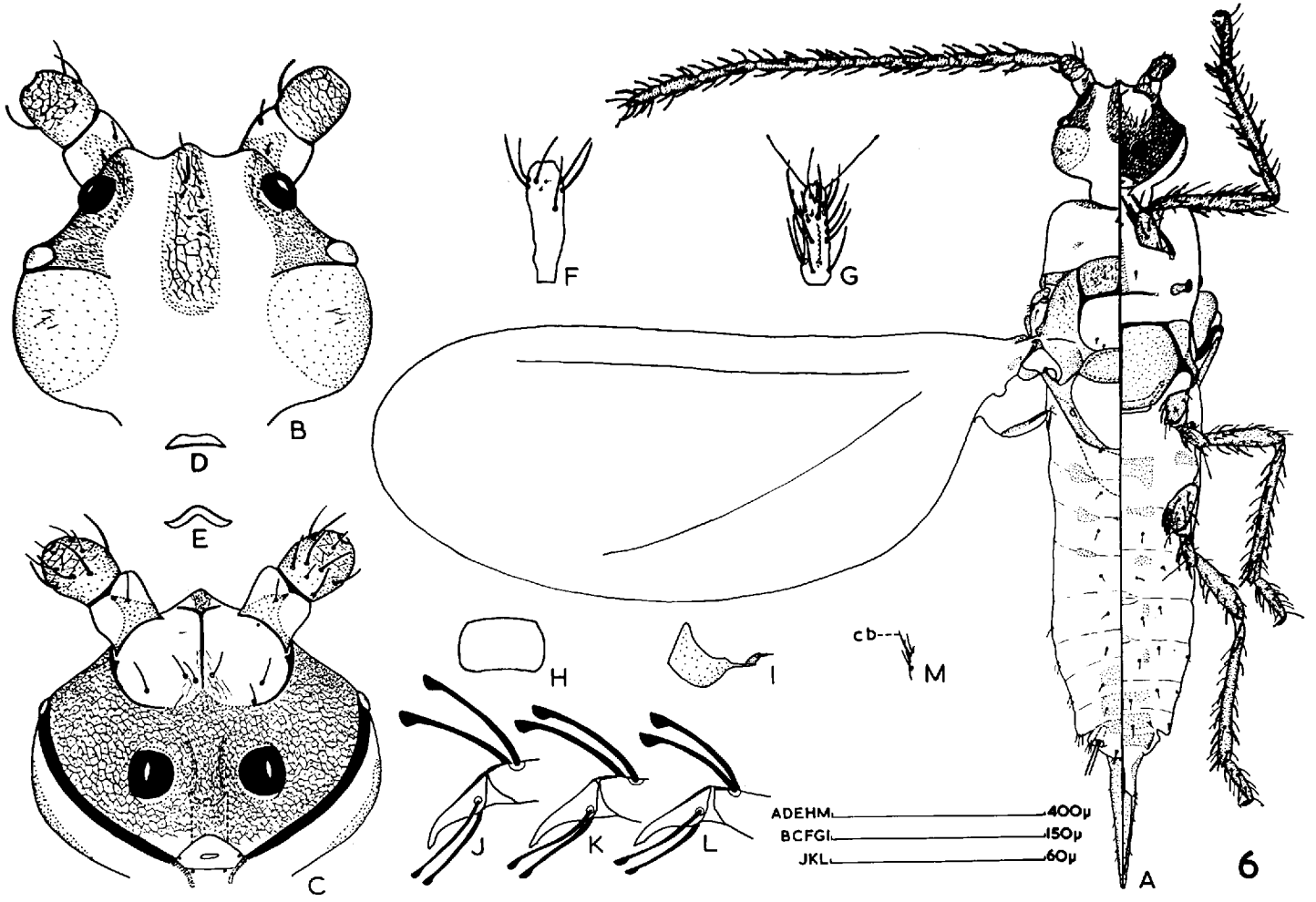

B
D
E
C
F
G
H
I
cb
M
J
K
L
ADEHM 400μ
BCFGI 150μ
JKL 60μ
A
2



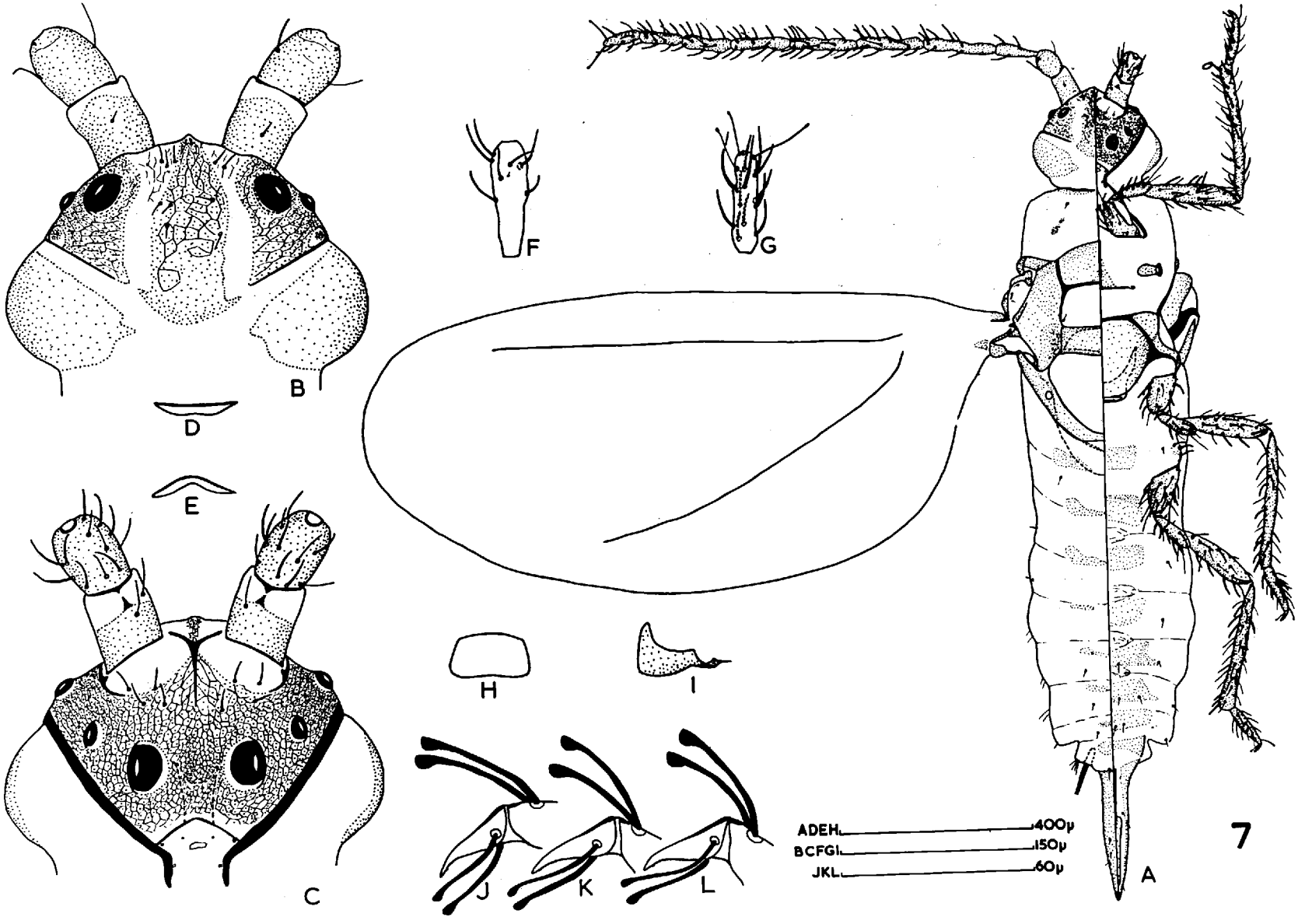
3

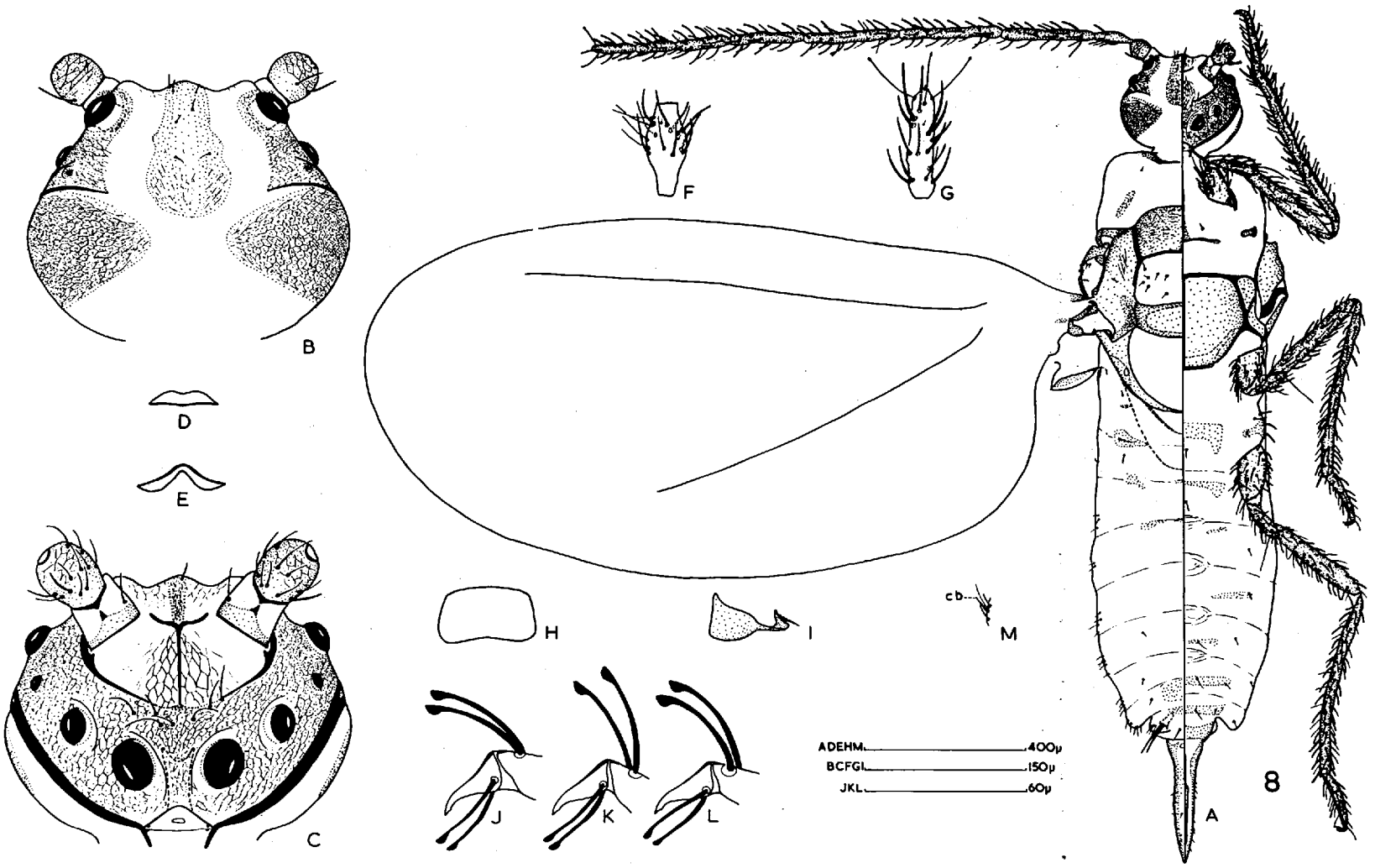

B
D
E
F
G
H
I
C
J
K
L
ADEH 400μ
BCFGI 150μ
JKL 60μ
A
4

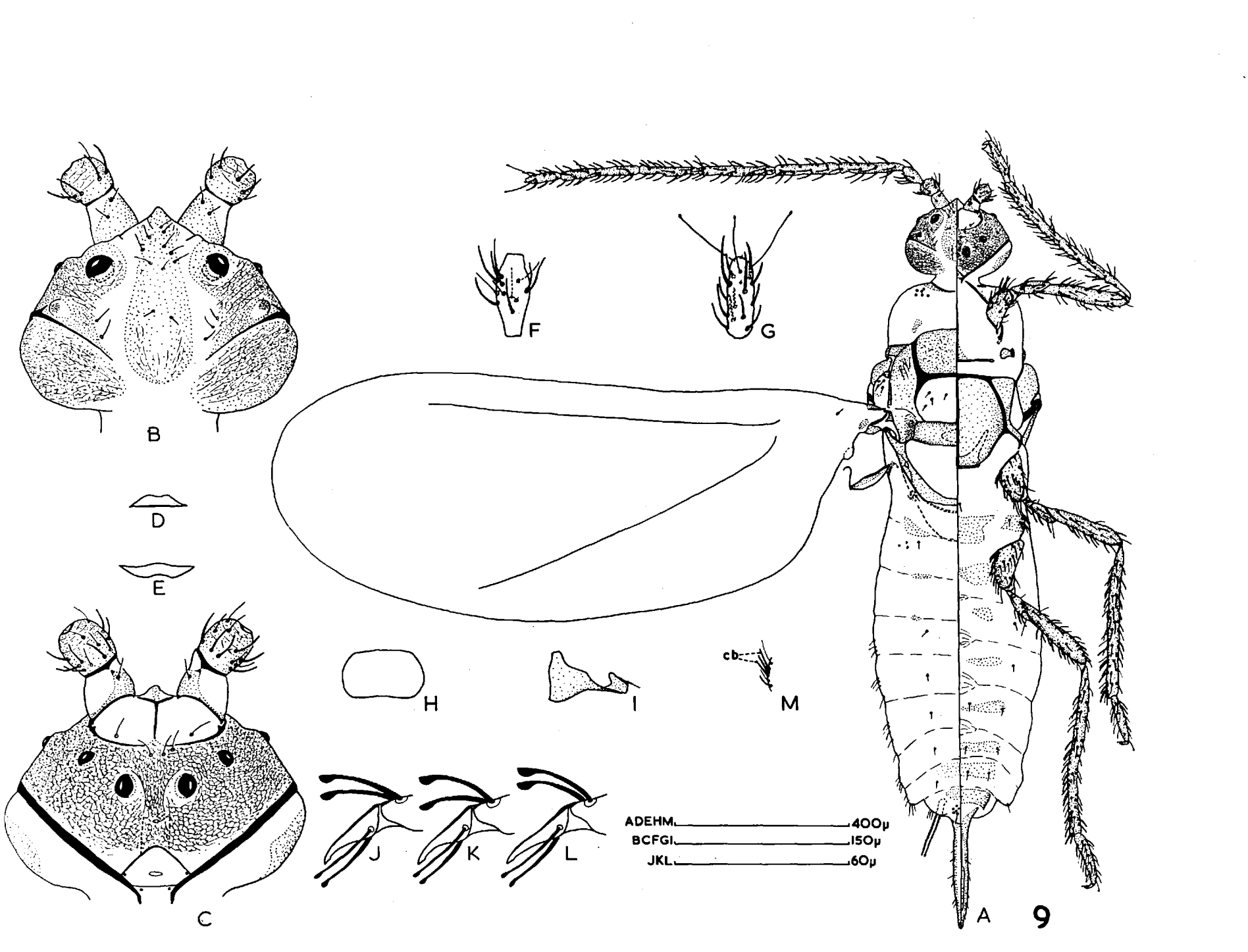

B
F
G
D
E
H
I
C
J
K
L
ADEH 400µ
BCFGI 150µ
JKL 60µ
A
5

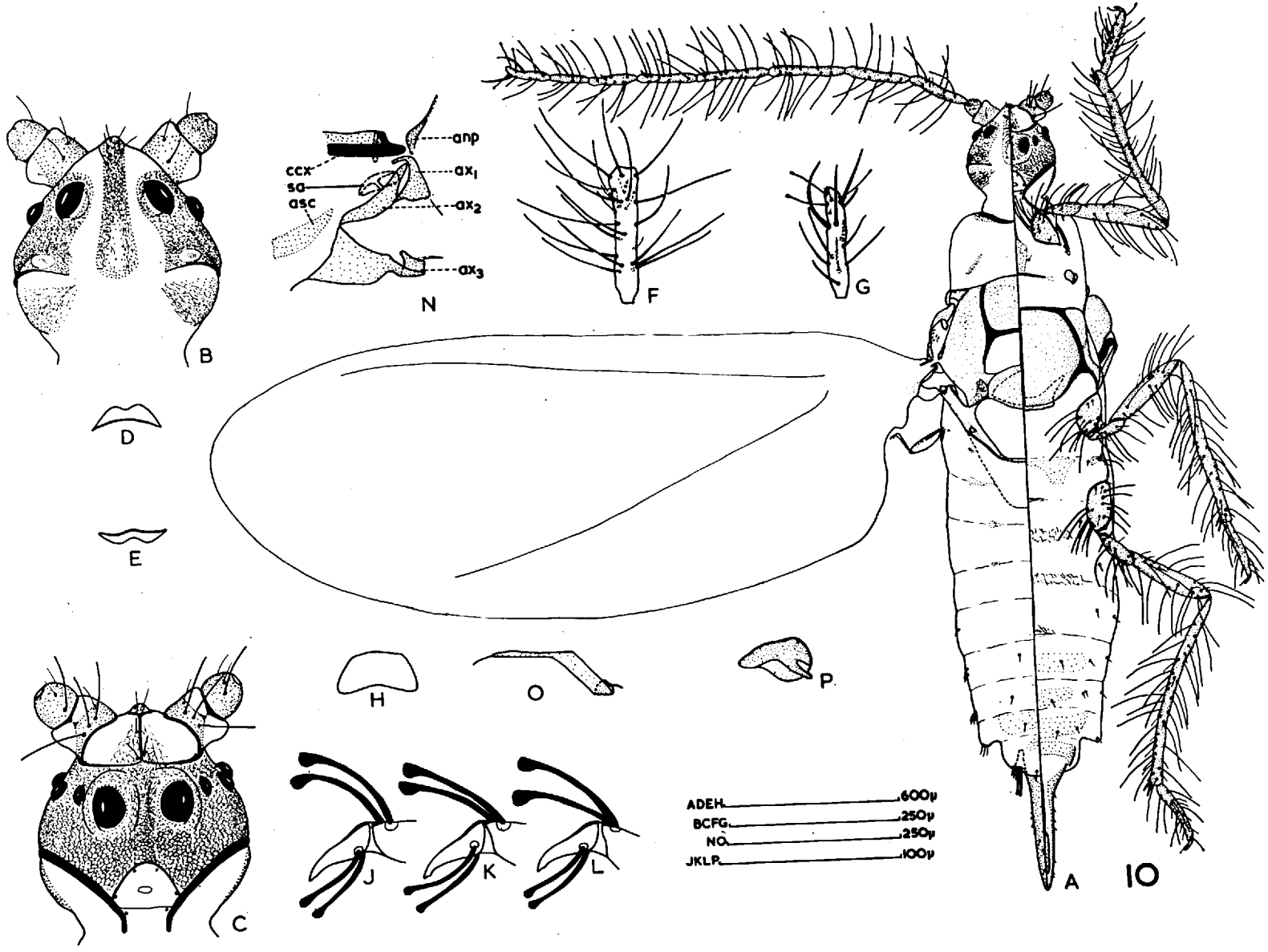


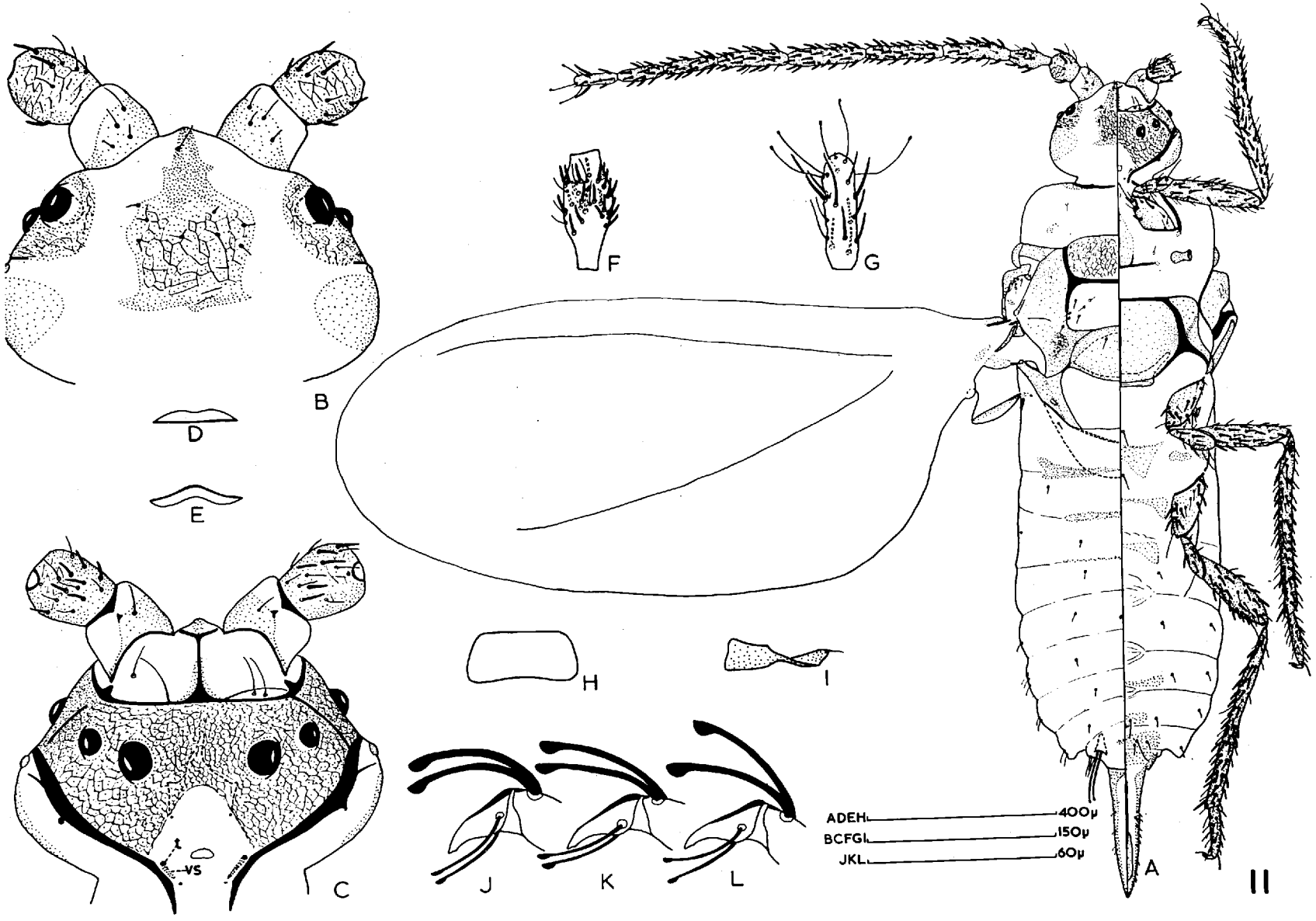
6

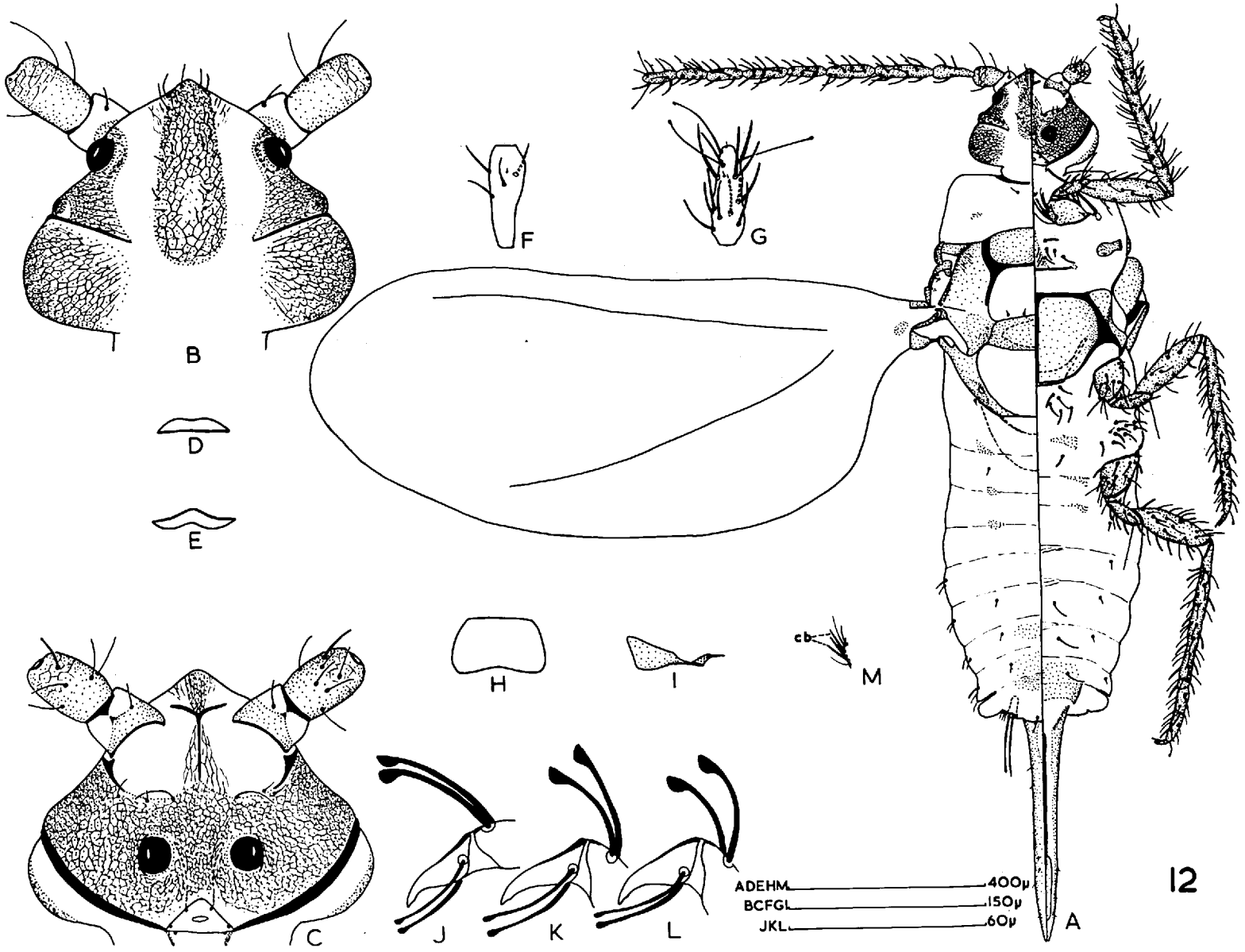

B
D
E
C
F
G
H
I
J
K
L
A
ADEH 400µ
BCFGI 150µ
JKL 60µ
7


B
D
E
C
F
G
H
I
cb
M
J
K
L
ADEHM 400μ
BCFGI 150μ
JKL 60μ
A
8

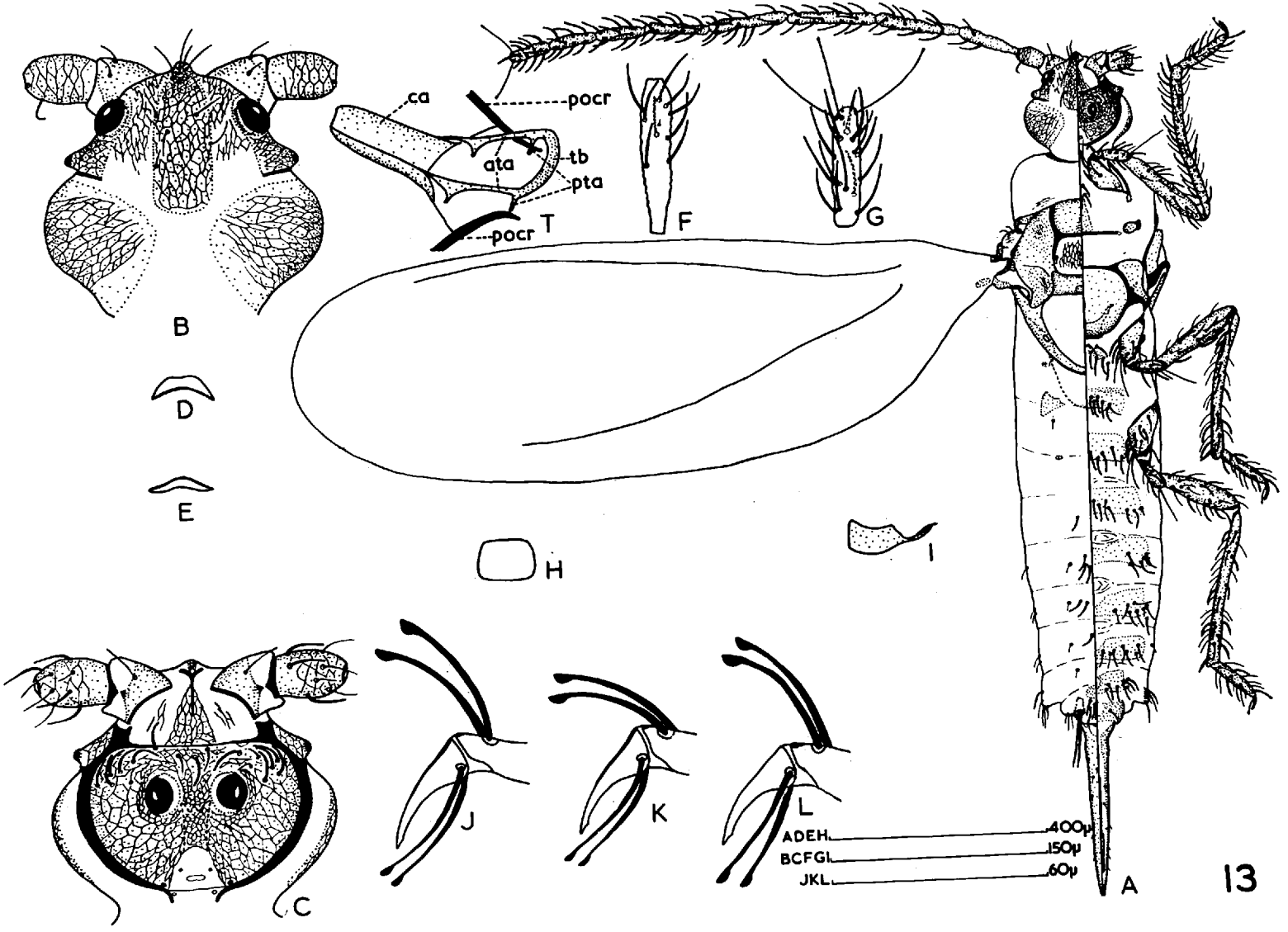

B
D
E
C
F
G
H
I
cb
M
J
K
L
ADEHM 400µ
BCFGI 150µ
JKL 60µ
A

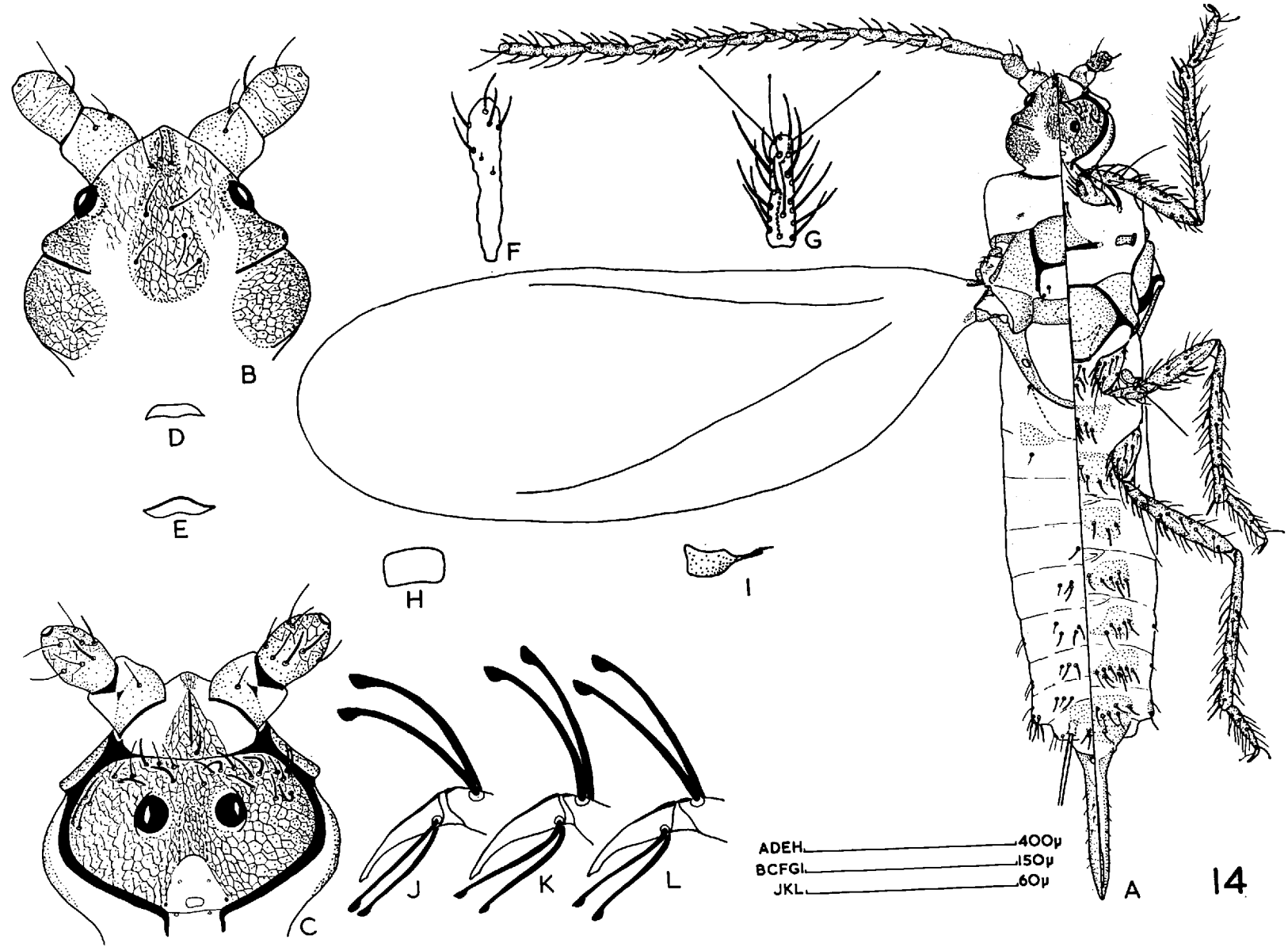

anp
ccx
sa
asc
ax_1
ax_2
ax_3
N
F
G
B
D
E
H
O
P
C
J
K
L
ADEH 600μ
BCFG 250μ
NO 250μ
JKLP 100μ
A
10

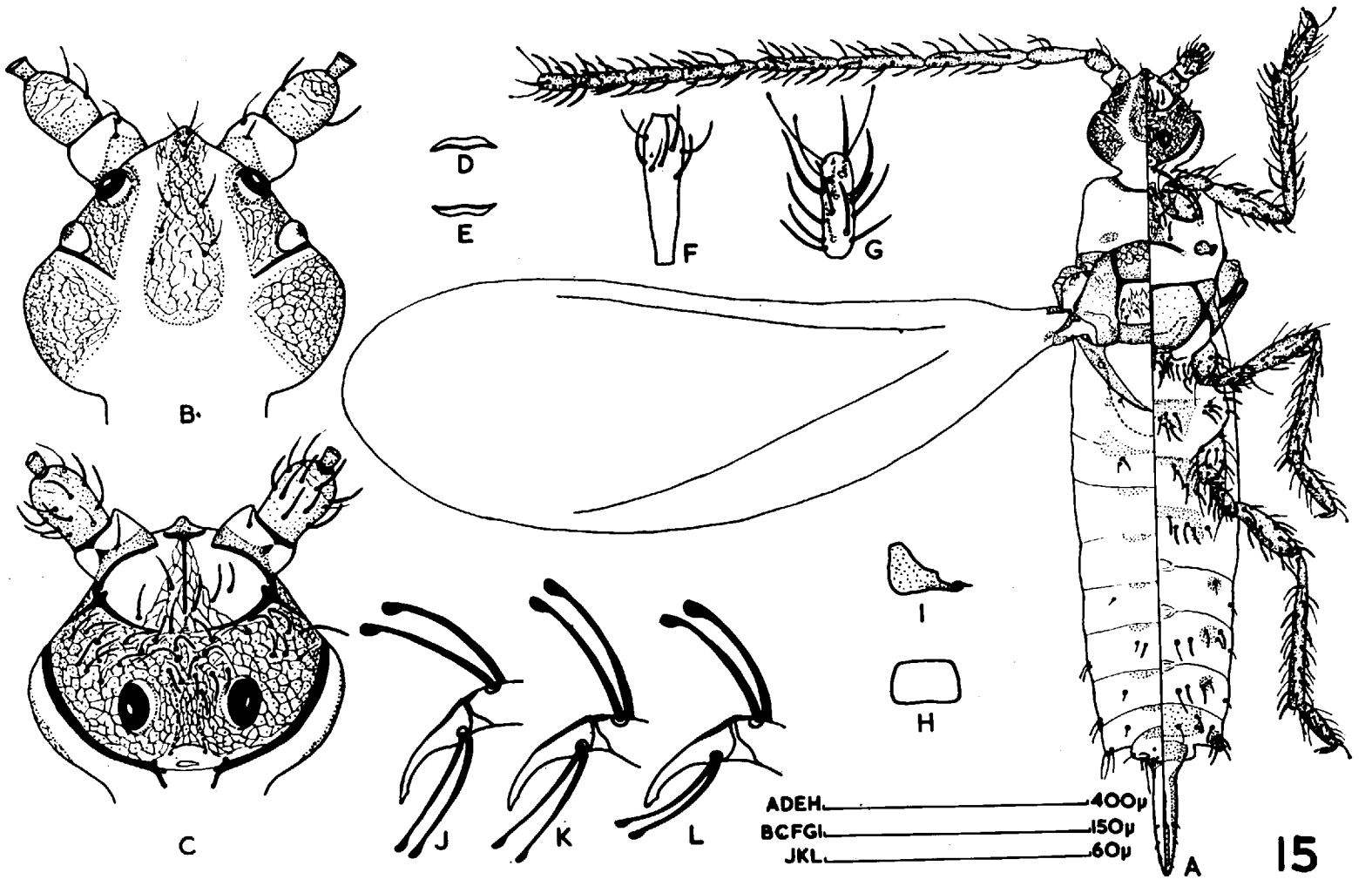

B
D
E
F
G
H
I
C
t
VS
J
K
L
ADEH 400μ
BCFGI 150μ
JKL 60μ
A
II

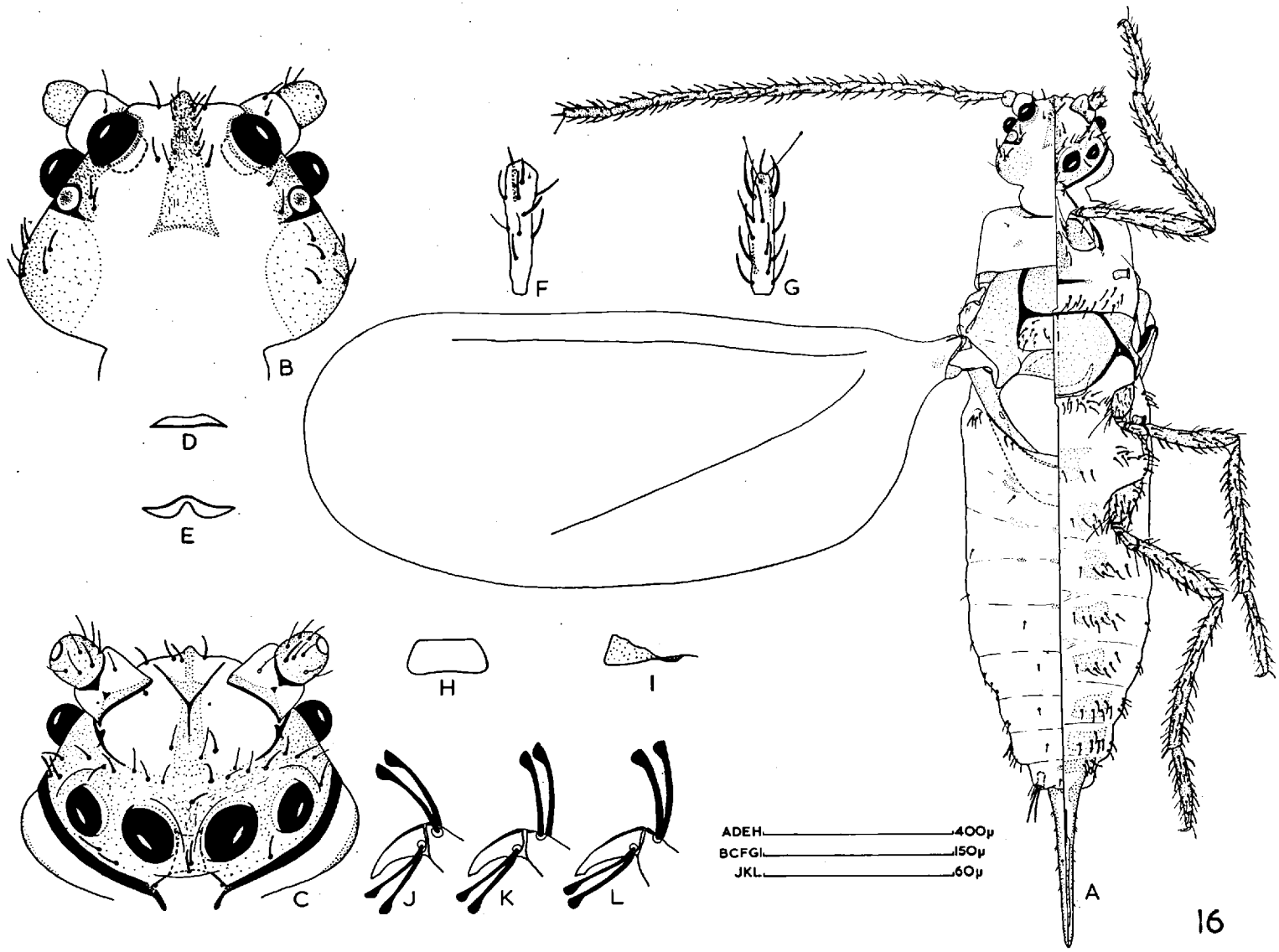


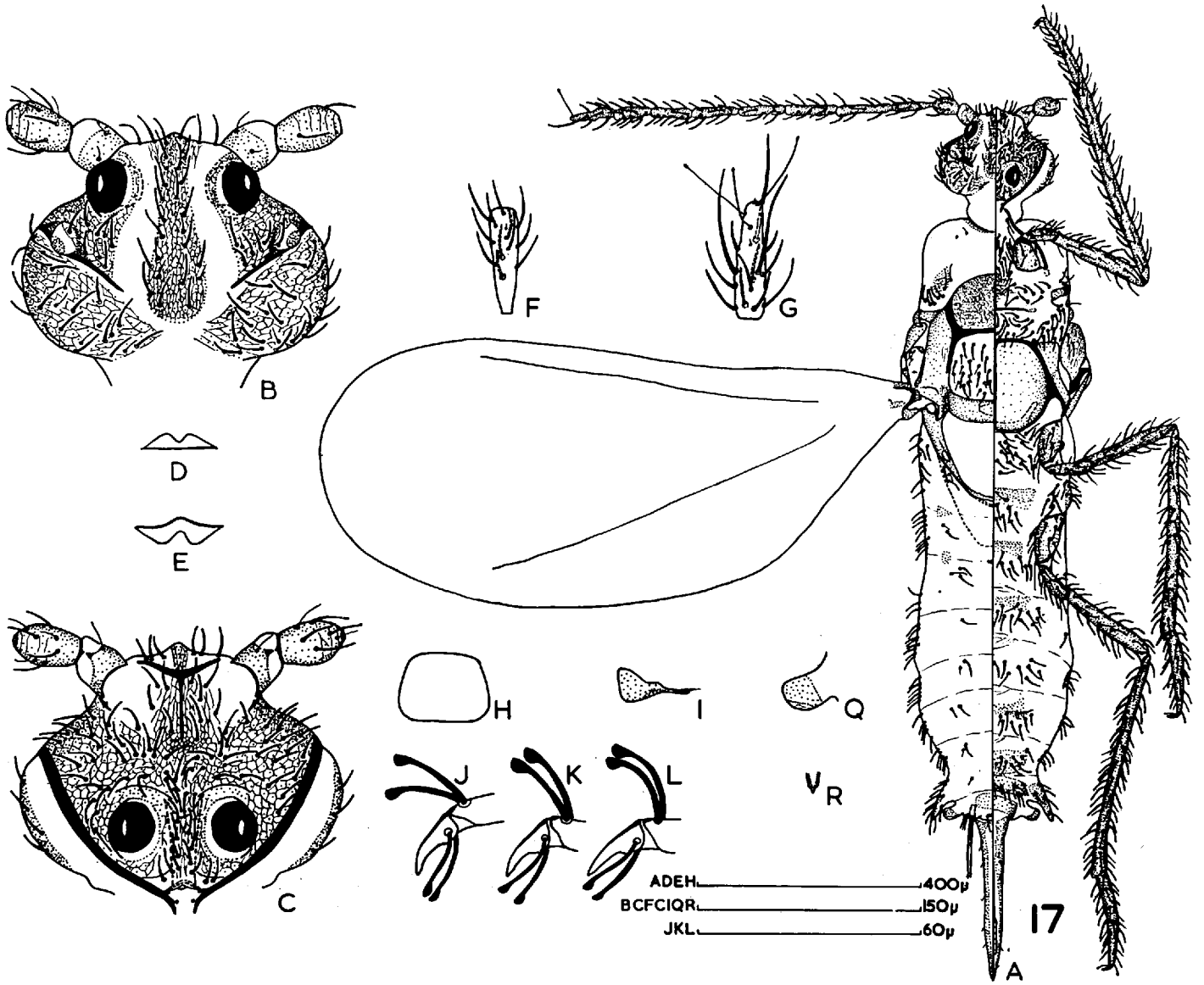
12

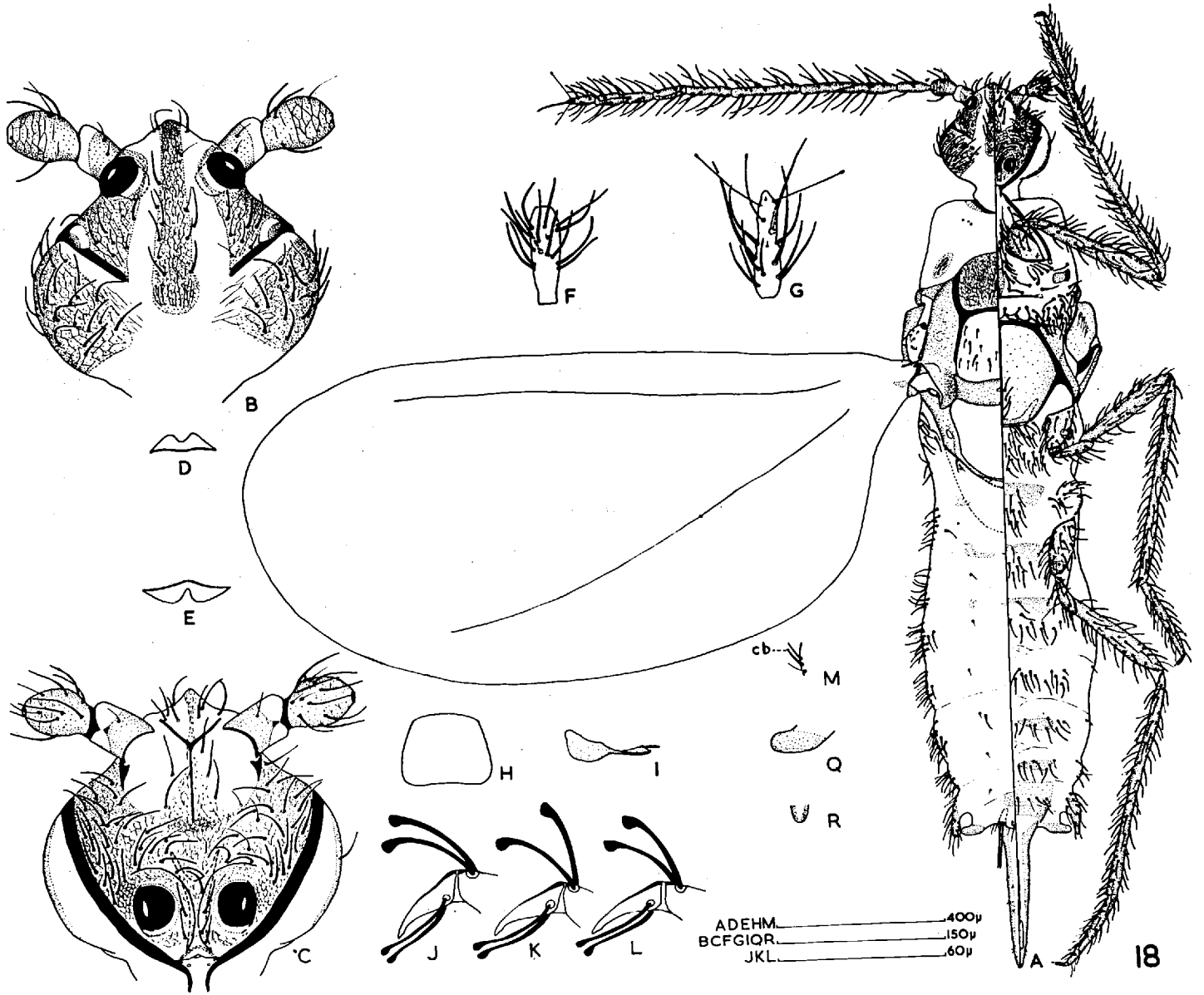

ca
pocr
ata
tb
pta
pocr
T
F
G
B
D
E
H
I
J
K
L
ADEH
BCFGI
JKL
400μ
150μ
60μ
A
C

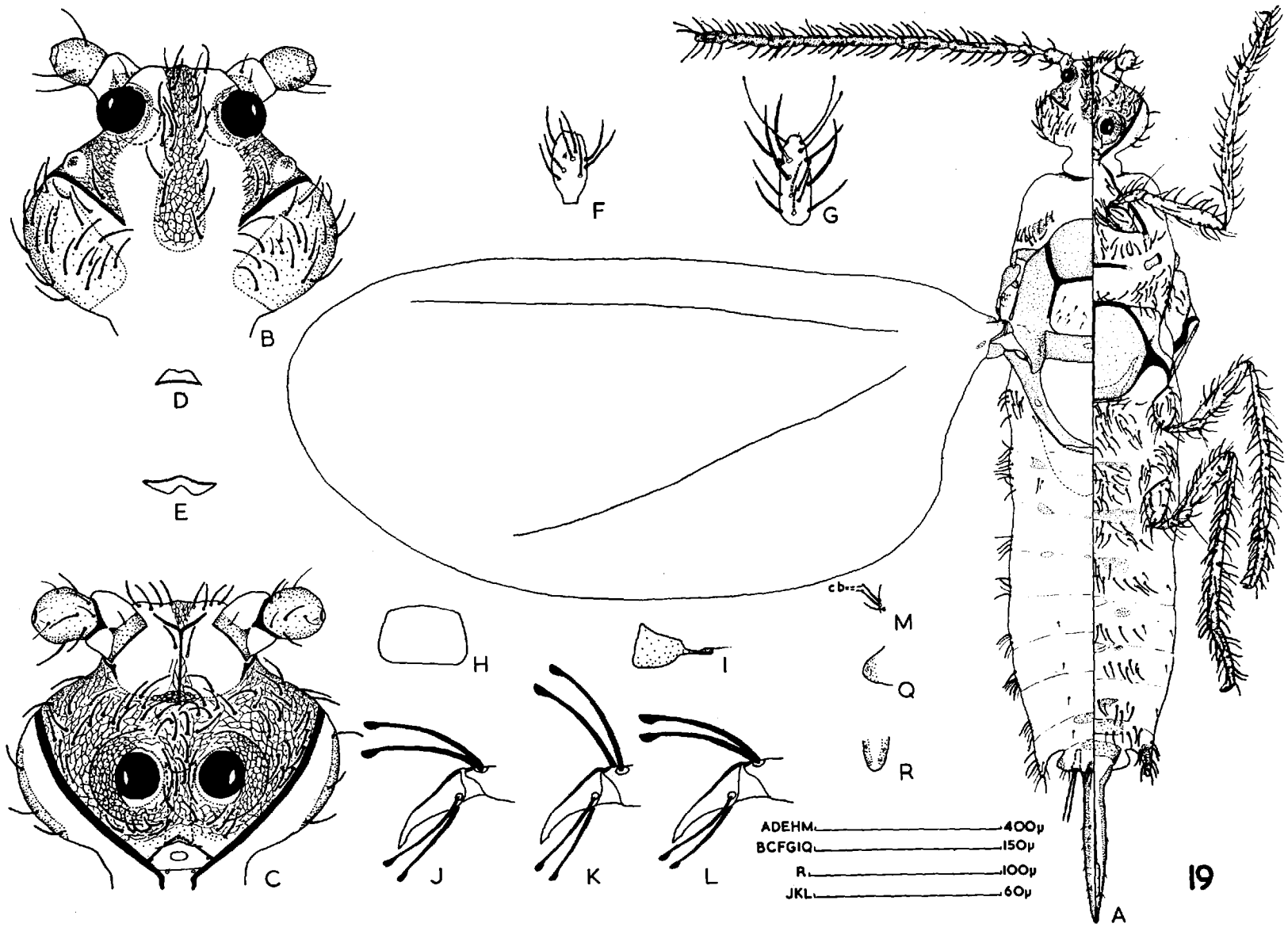

B
D
E
F
G
H
I
C
J
K
L
ADEH 400μ
BCFGI 150μ
JKL 60μ
A

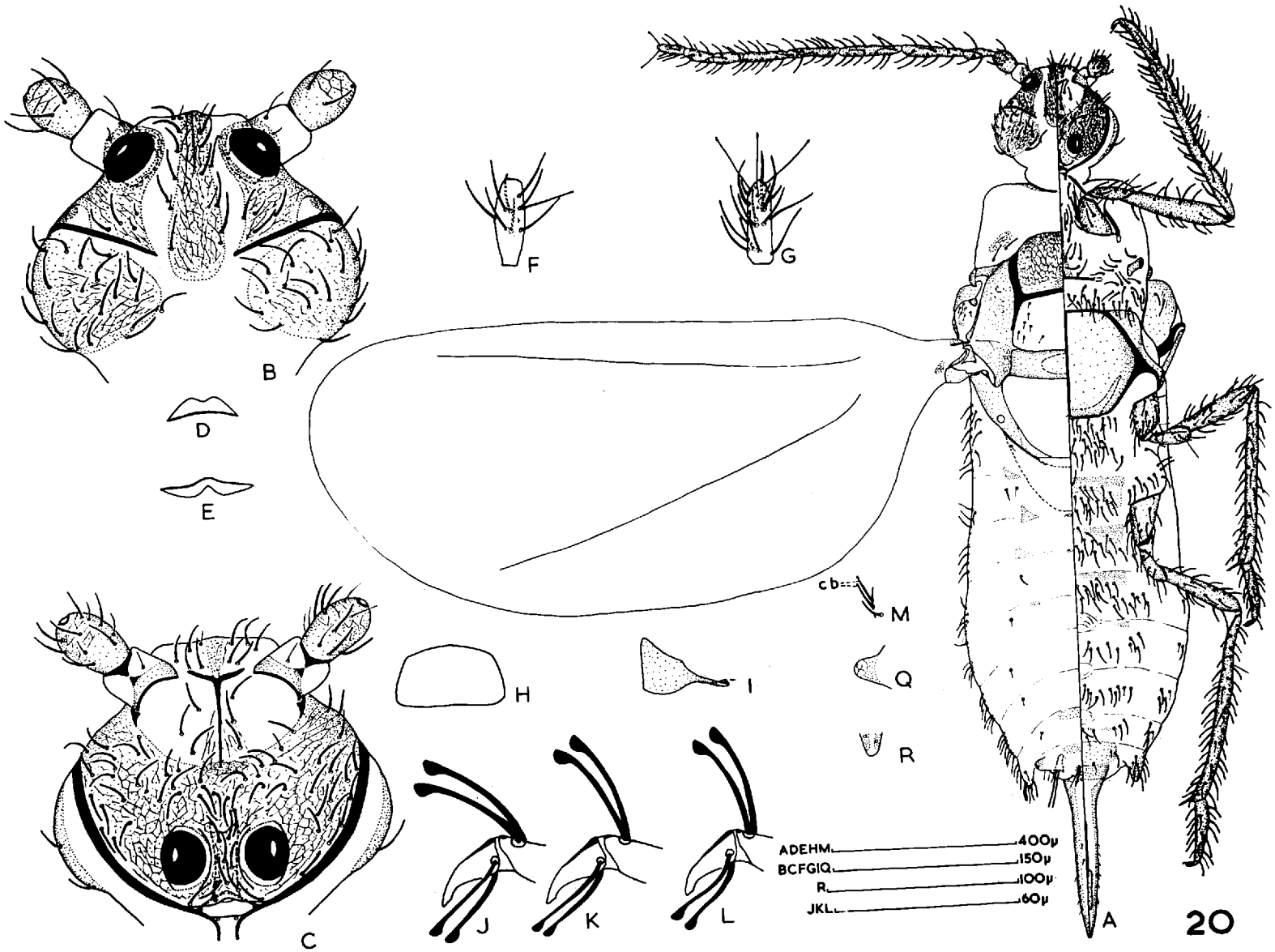

B
C
D
E
F
G
H
I
J
K
L
A
ADEH 400μ
BCFGI 150μ
JKL 60μ

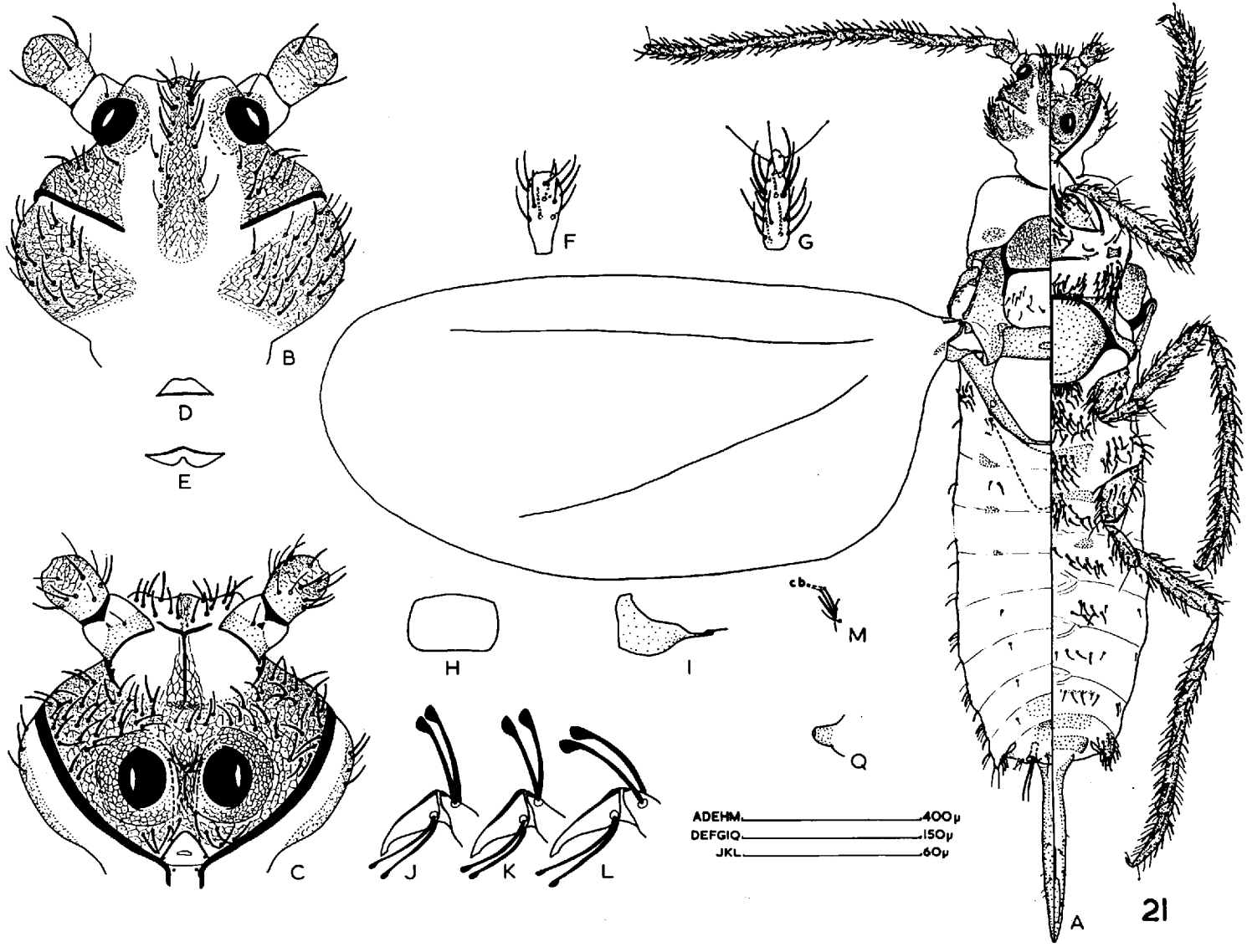

A
B
C
D
E
F
G
H
I
J
K
L
ADEH 400µ
BCFGI 150µ
JKL 60µ

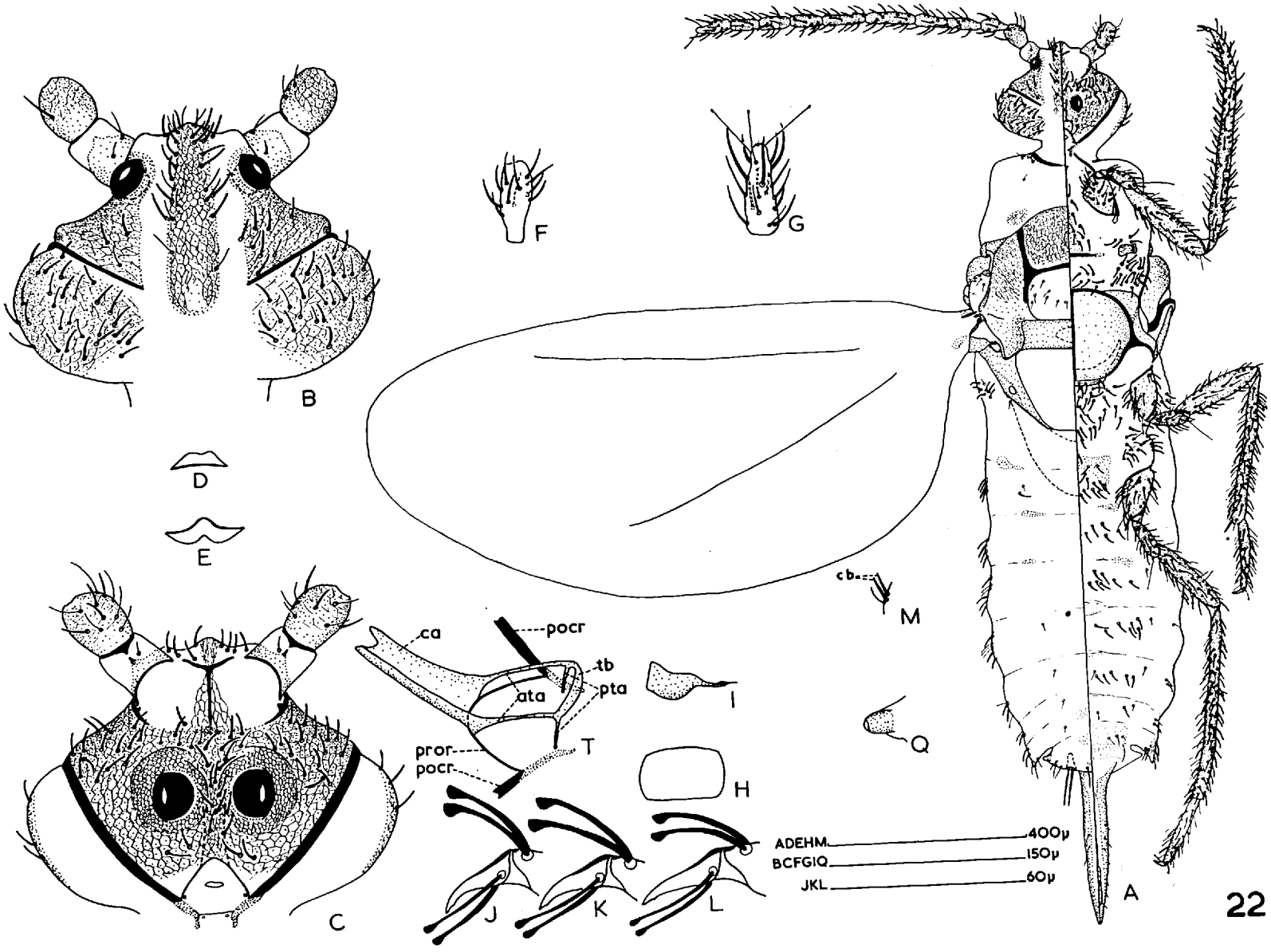

B
F
G
D
E
C
H
I
Q
J
K
L
R
ADEH 400μ
BCFCIQR 150μ
JKL 60μ
17
A

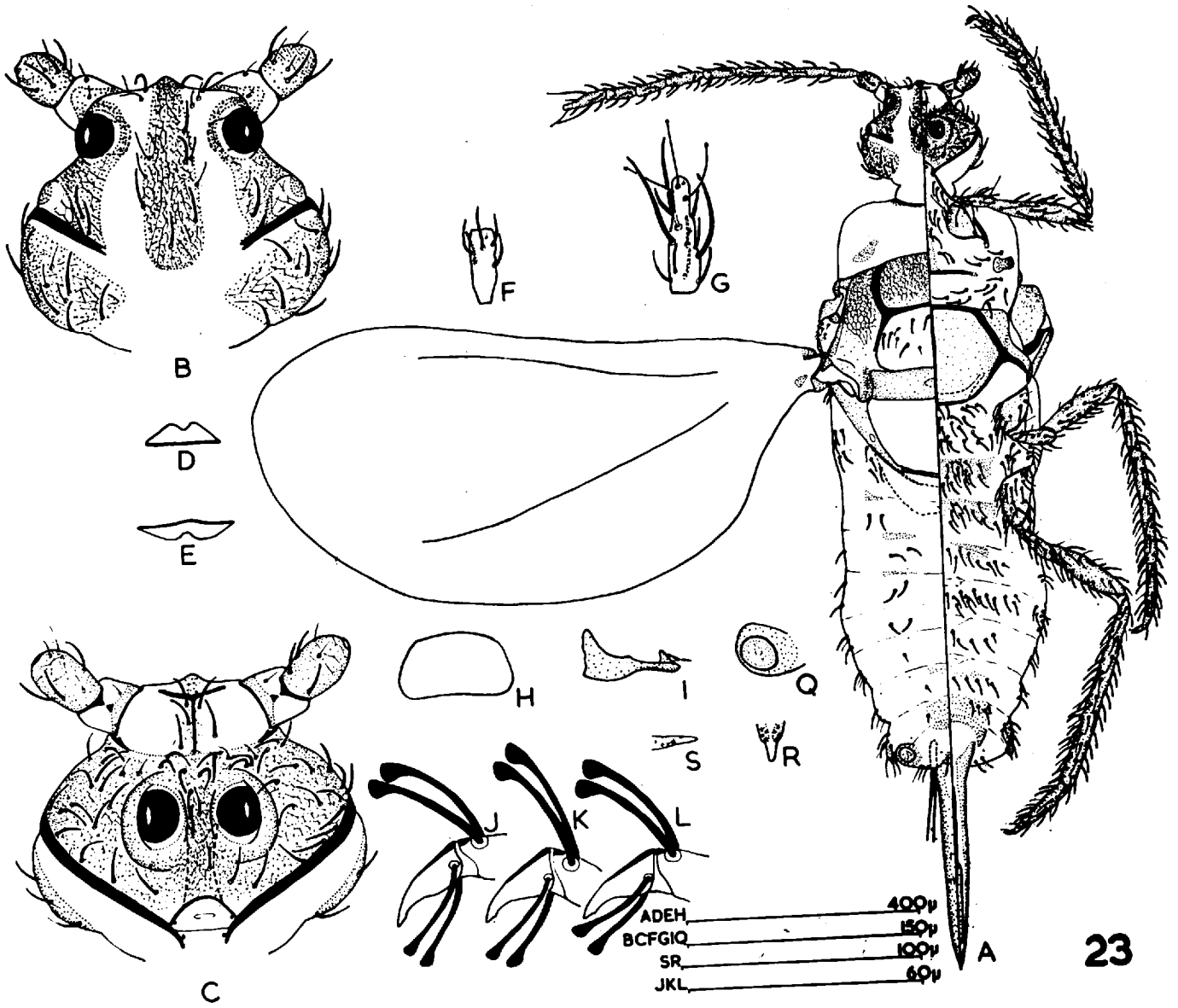

B
F
G
D
E
cb
M
H
I
Q
R
C
J
K
L
ADEHM 400μ
BCFGIQR 150μ
JKL 60μ
A

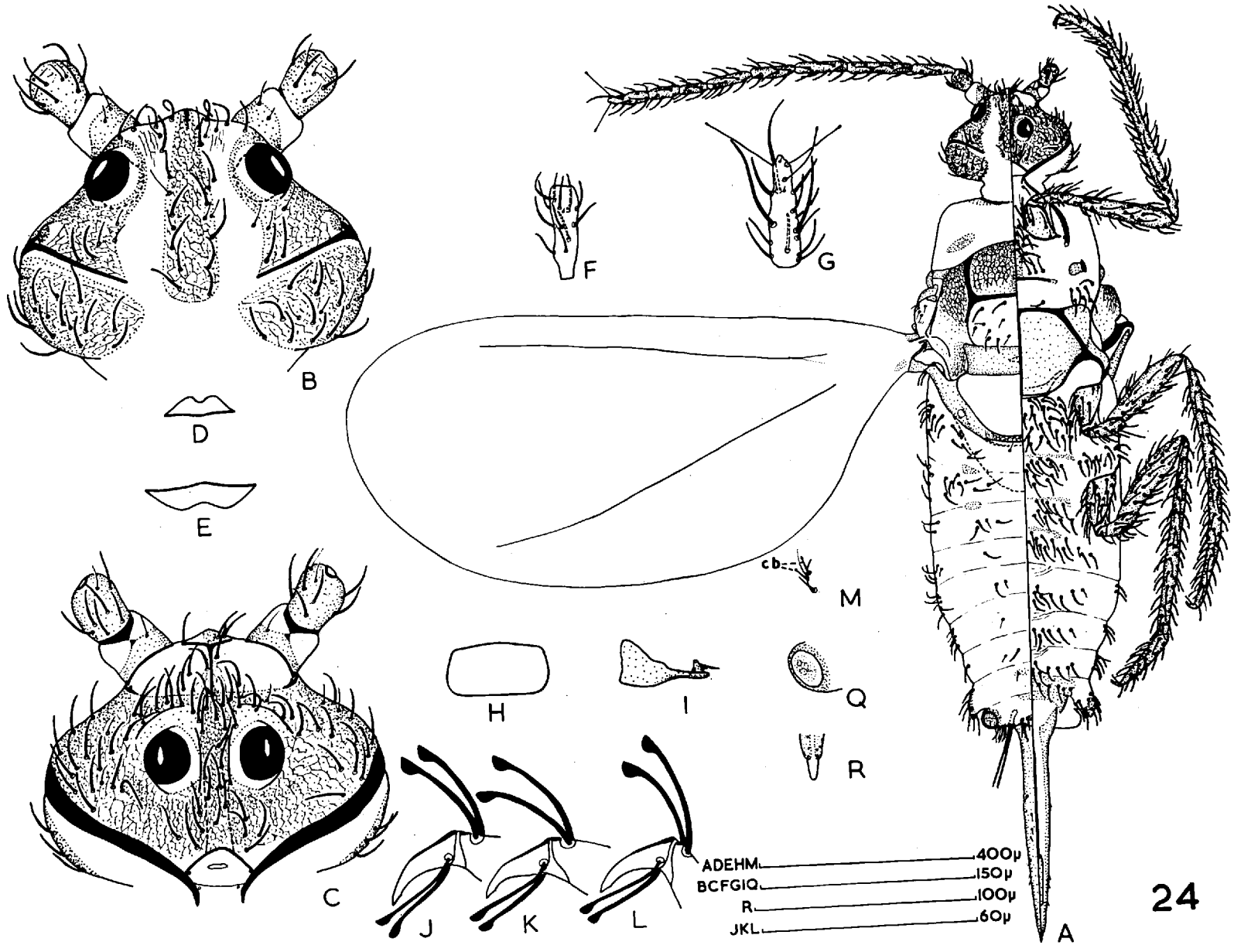

A
B
C
D
E
F
G
H
I
J
K
L
M
Q
R
cb
ADEHM 400μ
BCFGIQ 150μ
R 100μ
JKL 60μ

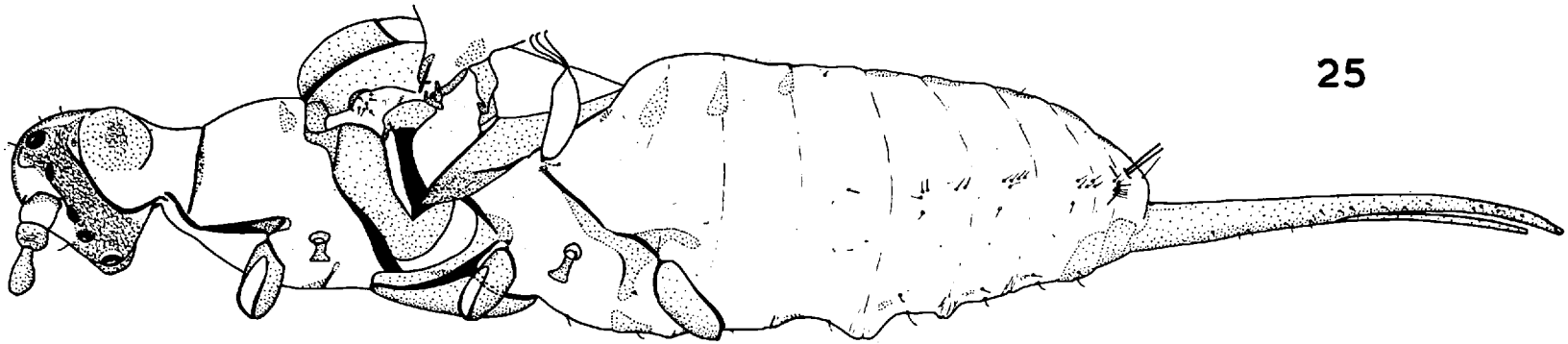

B
F
G
D
E
A
cb
M
Q
R
H
I
J
K
L
C
ADEHM 400µ
BCFGIQ 150µ
R 100µ
JKL 60µ


B
D
E
F
G
H
I
cb.
M
Q
C
J
K
L
ADEHM 400µ
DEFGIQ 150µ
JKL 60µ
A

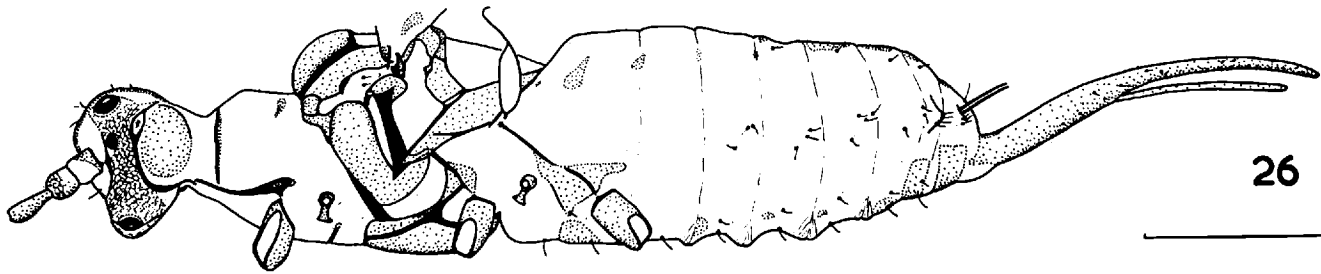

T
B
F
G
D
E
cb
M
ca
pocr
tb
pta
ata
I
Q
pror
pocr
T
H
C
J
K
L
ADEHM 400µ
BCFGIQ 150µ
JKL 60µ
A


B
C
D
E
F
G
H
I
Q
S
R
J
K
L
A
ADEH 400μ
BCFGIQ 150μ
SR 100μ
JKL 60μ


B
D
E
F
G
cb
M
H
I
Q
R
C
J
K
L
ADEHM 400µ
BCFGIQ 150µ
R 100µ
JKL 60µ
A

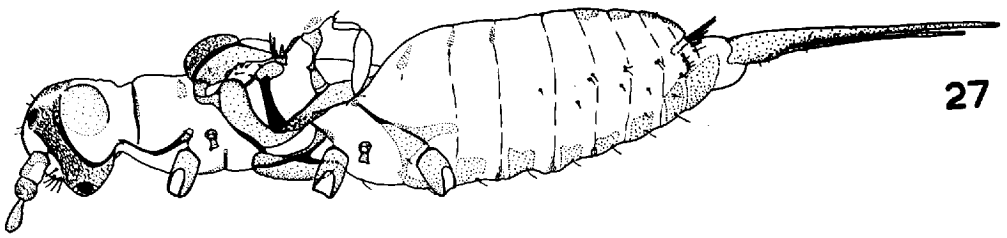


25

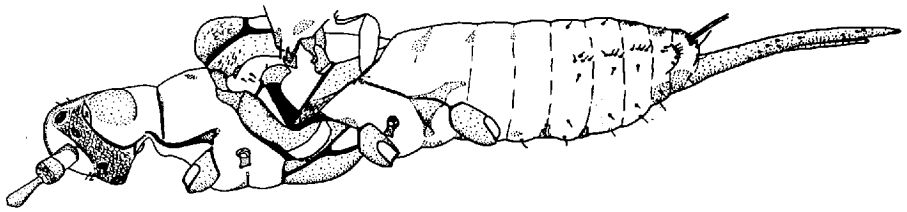


26

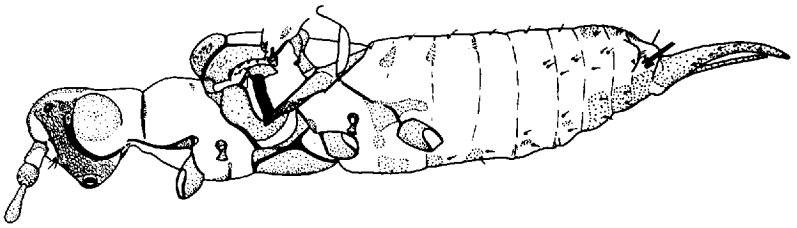
400μ



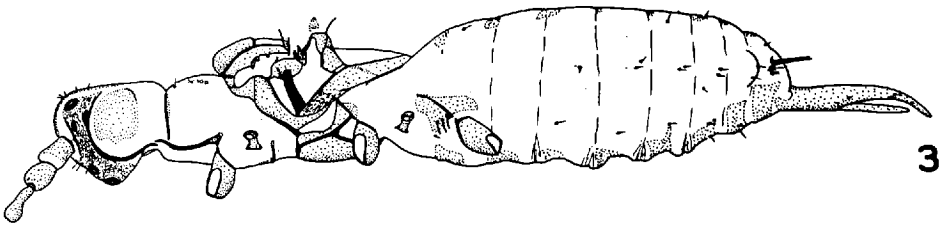
27



28

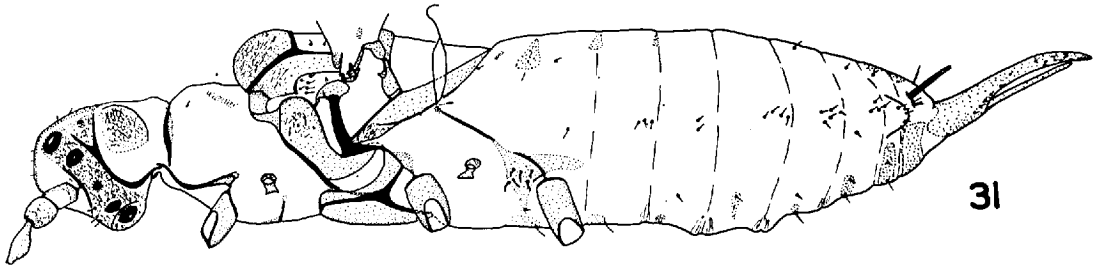


29

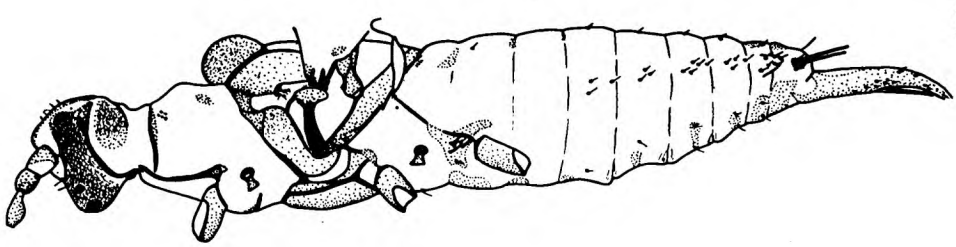


30

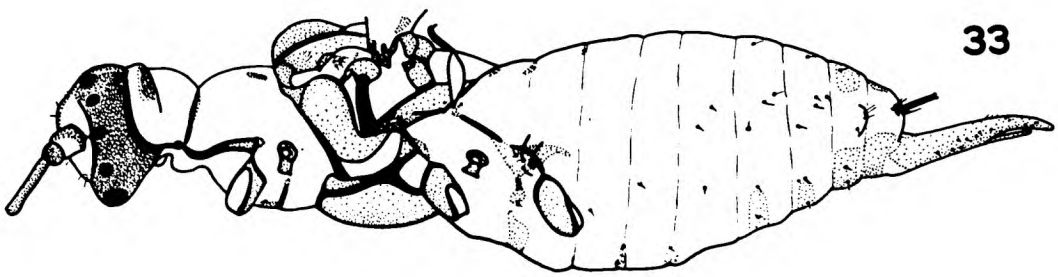
400μ



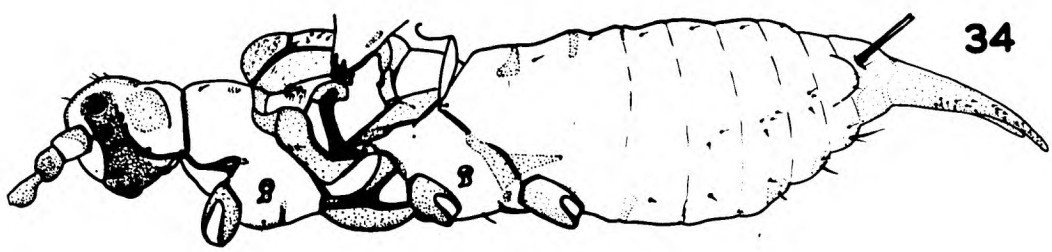
31



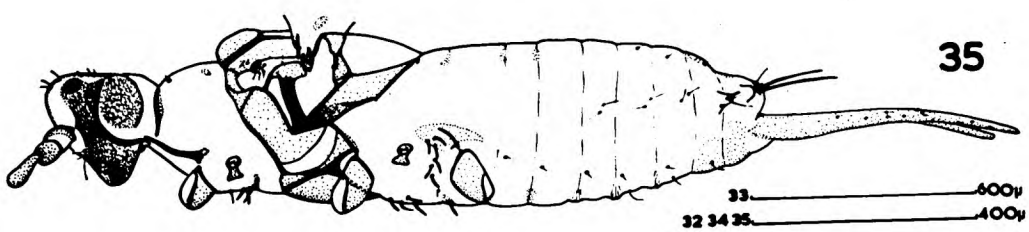
32



33



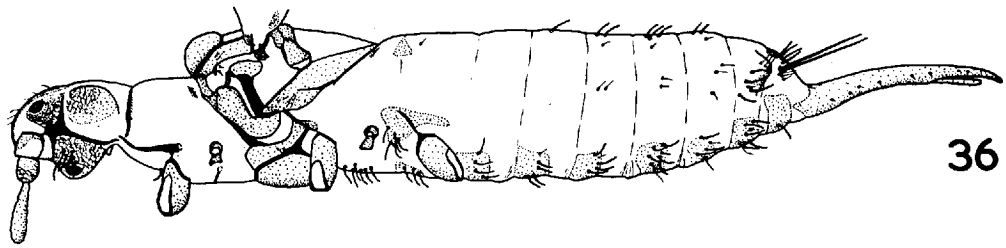
34



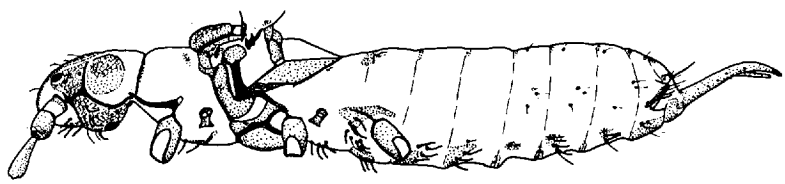
35

33 ——— 600μ

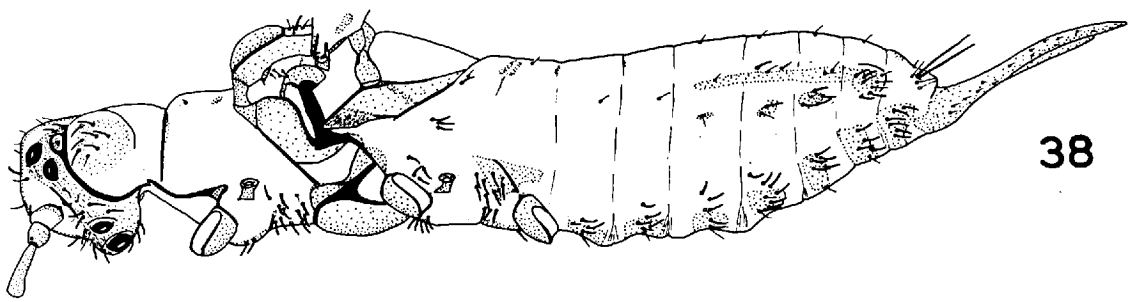
32 34 35 ——— 400μ



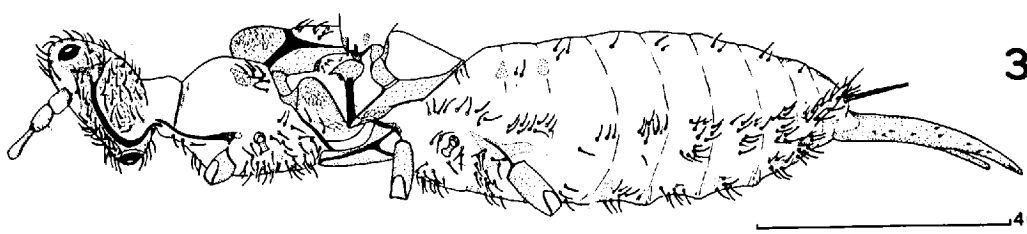
36



37

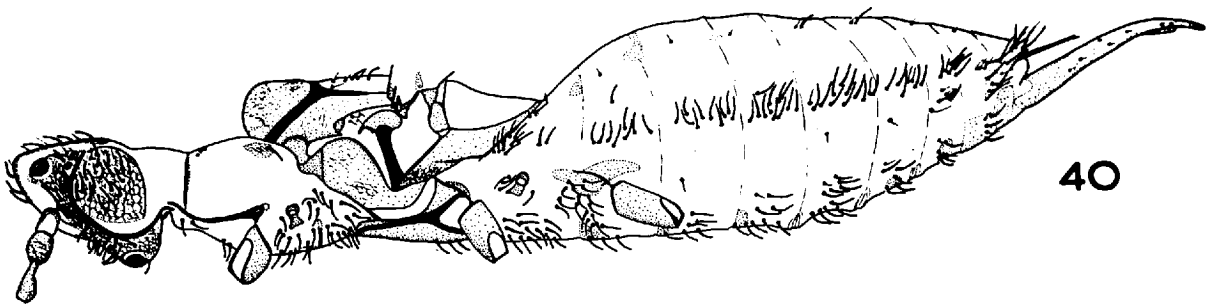


38

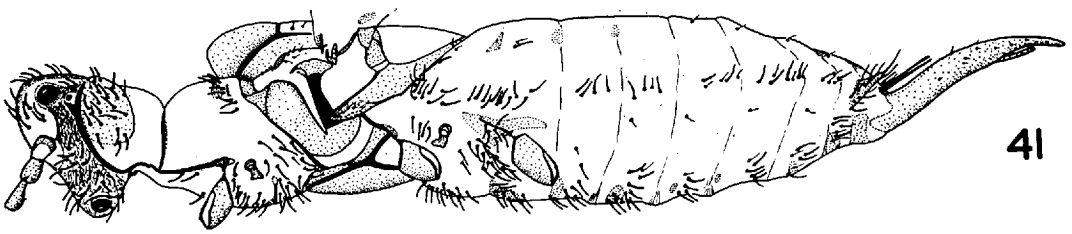


39

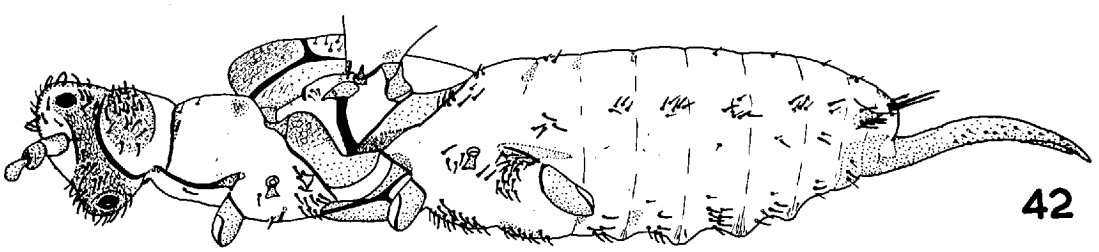
400μ



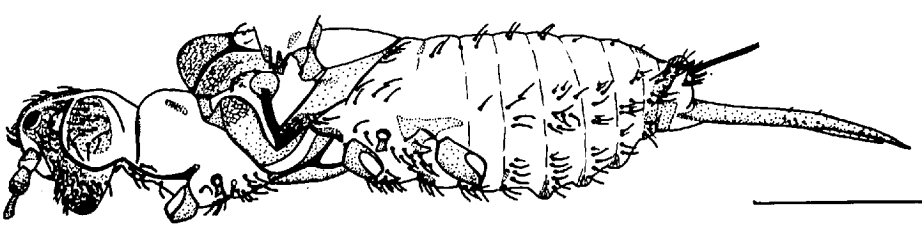
40



41



42



43

400μ