

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

BY

SHERIF AHMED AFIFI, B.Sc., M.Sc.

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

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

January, 1967.

A B S T R A C T

The adult males of 17 pseudococcid species (belonging to 13 genera, and represented by macropterous and apterous forms) and 7 eriococcid species (belonging to 4 genera, and represented by macropterous, brachypterous and apterous forms) were described and illustrated in detail. The study indicated that the two groups, whose taxonomic status was yet controversial, deserve the rank of separate families, and the characters differentiating the males of the two families were given. The general morphology of the males was discussed and a number of new terms introduced. The affinities of the studied species (and 3 others described in detail by Giliomee, 1961) were determined and statistically analysed, and a classification of Pseudococcidae was suggested. The relationships of the lecanoid types of male (Pseudococcidae, Eriococcidae and Coccidae), between each other and with other families of Coccoidea were discussed. The results of this work confirmed earlier conclusions by Ghauri (1962) and Giliomee (1961, 1964) that the males afford significant characters at all the taxonomic levels including the specific. Detailed keys to the families downwards to the species were constructed.

TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGMENTS	7
I. INTRODUCTION AND REVIEW OF LITERATURE	
(a) INTRODUCTION	9
(b) REVIEW OF LITERATURE	14
II. MATERIAL, TECHNIQUE AND ILLUSTRATIONS	18
III. GENERAL MORPHOLOGY	24
((1)) THE MALES OF <u>PSEUDOCOCCIDAE</u>	25
A. GENERAL.....	25
B. THE MACROPTEROUS MALES	27
<u>THE HEAD</u>	
1. THE HEAD CAPSULE	27
2. THE ANTENNAE	33
<u>THE THORAX</u>	35
1. THE PROTHORAX	36
2. THE MESOTHORAX	38
3. THE METATHORAX	44
4. THE WINGS AND THE HAMULOHALTERAE	46
5. THE LEGS	47
<u>THE ABDOMEN</u>	48
1. THE PREGENITAL SEGMENTS	48
2. THE GENITAL SEGMENT AND THE EXTERNAL GENITALIA .	51
C. THE APTEROUS MALES	52

<u>THE HEAD</u>	52
<u>THE THORAX</u>	53
<u>THE ABDOMEN</u>	53
IV (A) DESCRIPTION OF THE SPECIES OF PSEUDOCOCCIDAE	54
<u>PLANOCOCCUS GROUP</u>	54
(1) <u>PLANOCOCCUS CITRI</u> (RISSO)	54
(2) <u>P. KENYAE</u> (LE PELLEY)	65
(3) <u>P. DIOSCOREAE</u> WILLIAMS	74
(4) <u>PLANOCOCCOIDES IRENEUS</u> DE LOTTO	83
(5) <u>NIPAEOCCUS VASTATOR</u> (MASK.)	92
(6) <u>N. NIPAE</u> (MASK.)	100
(7) <u>MACONELICOCCLUS HIRSUTUS</u> (GREEN)	108
(8) <u>FERRISIANA VIRGATA</u> (COCKERELL)	117
(9) <u>TRIONYMUS NEWSTEADI</u> (GREEN)	125
<u>PSEUDOCOCCUS GROUP</u>	134
(10) <u>PSEUDOCOCCUS OBSCURUS</u> (ESSIG)	134
(11) <u>P. CITRICULUS</u> GREEN	143
(12) <u>DYSMICOCCLUS ALAZON</u> WILLIAMS	152
<u>SACCHARICOCCLUS GROUP</u>	161
(13) <u>SACCHARICOCCLUS SACCHARI</u> (COCKERELL)	
a. The macropterous form	161
b. The apterous form	169
<u>OCTOCOCCUS GROUP</u>	177
(14) <u>OCTOCOCCUS AFRICANUS</u> (BRAIN)	177

	<u>Page</u>
<u>CEROPUTO GROUP</u>	185
(15) <u>CEROPUTO PILOSELLAE</u> SULC	185
(16) <u>CENTROCOCCUS INSOLITUS</u> (GREEN)	193
<u>NAIROBIA GROUP</u>	201
(17) <u>NAIROBIA BIFRONS</u> DE LOTTO	201
((2)) THE MALES OF <u>ERIOCOCCIDAE</u>	209
A. GENERAL	209
B. THE MACROPTEROUS MALES	210
<u>THE HEAD</u>	
1. THE HEAD CAPSULE	210
2. THE ANTENNAE	211
<u>THE THORAX</u>	
1. THE PROTHORAX	212
2. THE MESOTHORAX	212
3. THE METATHORAX	213
4. THE WINGS AND THE HAMULOHALTERAE	213
5. THE LEGS	214
<u>THE ABDOMEN</u>	
1. THE PREGENITAL SEGMENT	214
2. THE GENITAL SEGMENT	214
C. THE BRACHYPTEROUS MALES	215
<u>THE HEAD</u>	
<u>THE THORAX</u>	
<u>THE ABDOMEN</u>	
D. THE APTEROUS MALES	216

	<u>Page</u>
(B) DESCRIPTION OF THE SPECIES OF ERIOCOCCIDAE	217
(18) <u>ERIOCOCCUS ARAUCARIAE</u> MASK.	217
(19) <u>E. ORARIENSIS</u> HOY	225
(20) <u>E. BUXI</u> (FONSC.)	233
(21) <u>OVATICOCCUS AGAVIUM</u> DOUGL.	241
(22) <u>GOSSYPARIA SPURIA</u> (MOD.)	
a. The macropterous form	249
b. The apterous form	257
(23) <u>G. SALICICOLA</u> BORCHS. (BRACHYPTEROUS)	265
(24) <u>PSEUDO CHERMES FRAXINI</u> (KALT.), (APTEROUS)	272
V. DISCUSSION	278
(A) STATUS OF PSEUDOCOCCIDAE AND ERIOCOCCIDAE	304
(B) TAXONOMIC SIGNIFICANCE OF THE CHARACTERS	309
(C) CLASSIFICATION	317
(I) FAMILY PSEUDOCOCCIDAE	317
a. GROUPS OF GENERA	325
b. GENERA	336
c. SPECIES	341
(II) FAMILY ERIOCOCCIDAE	345
(D) RELATIONSHIPS OF PSEUDOCOCCIDAE AND ERIOCOCCIDAE WITH OTHER COCCOIDEA	346
VI. KEYS	356
VII. SUMMARY	371
VIII. EXPLANATION OF FIGURES	375
IX. LIST OF ABBREVIATIONS	376
X. REFERENCES	379
XI. APPENDIX	390

ACKNOWLEDGEMENTS

I am greatly indebted to Dr. K. L. Boratynski, who suggested and supervised the present study, and also placed some material from his own collection at my disposal. The writer is grateful to Prof. O. W. Richards, F.R.S., the head of the Department of Zoology and Applied Entomology, Imperial College, for the facilities granted, and to Mr. R. G. Davies for his spontaneous help, reading part of the manuscript, and constructive valuable criticism. The technical remarks and the comments made by Dr. J. H. Gilimee, the earlier Ph.D. student in the department, are highly appreciated. My deep thanks are also due to Dr. D. J. Williams, of the Commonwealth Institute of Entomology, for providing specimens of 4 species, and also to the large number of other workers who kindly furnished material from their collections, or even took the trouble to collect and breed the males specially for the purpose of this study, namely: the late Prof. N. S. Borchsenius, of the Zoological Institute, Academy of Sciences, Leningrad; Dr. G. M. Das, of the Tocklai Experiment Station, Cinnamara, Assam, India; Mr. G. De Lotto, of the Research Institute for Plant Protection, Pretoria; Mgr. A. Dziedzicka, of the Pedagogical Higher School, Krakow, Poland; Mr. A. I. Ezz, of the Department of Entomology, Ministry of Agriculture, Cairo, U.A.R.; Mr. J. M. Hoy, of the Entomology Division, Dept. of Scientific and Industrial Research, New Zealand; Prof. M. Kosztarab, Virginia Polytechnic Institute, Blacksburg, Virginia; Dr. G. Matesova, of the Institute of Zoology, Academy of Sciences, Alma-Ata, Kazakhstan; Mr. D. N. McNutt, of the Agricultural Department, Mbale, Uganda, East Africa; Ing. N. Mitic-Muzina, of the Institute for Plant Protection, Belgrade; Mr. J. Munting, of the Plant Protection Research Institute, Pretoria.

In this opportunity, I would like also to express my gratitude to Prof. Dr. Y. M. Ezzat, the head of the Zoology Department, University of Assiout, U.A.R., for his constant and unfailing encouragement, which has always given me a great deal of confidence.

Finally, the Ministry of Agriculture of the United Arab Republic (Egypt) has the credit of originally awarding me a study leave, which was later elevated to a full mission; a financial support without which this work would have not been accomplished.

I. INTRODUCTION AND REVIEW OF LITERATURE

(a) INTRODUCTION:

This work is the fourth in a series of detailed morphological and taxonomical studies on the males^{of} Coccoidea carried out by the postgraduate students in the Department of Zoology and Applied Entomology, Imperial College, suggested and supervised by Dr. K. Boratynski. Theron (1958) studied the general external morphology of 7 species representing 4 families; Ghauri (1962) described in detail 24 species of the family Diaspididae and suggested intrafamily classification and relationships based on this material; Giliomee (1964, Ph.D. thesis in the press) similarly treated 23 species of the family Coccidae. The present paper deals with 24 species belonging to two groups, the pseudococcids or mealybugs (17 species) and the eriococcids (7 spp.), whose taxonomical status is still controversial.

In general, the taxonomic rank and the classification of coccids has been, and still is, rather precariously established and subject to frequent alterations. In pre-Linnaean times, even in ancient Greece and Rome, they were known in the literature as the "Cocci", but their importance as serious economic pests was not realized; they were then known as producers of commercially valuable substances (fabric dyes, wax, shellac ... etc.) and considered rather as "grains" of plant origin, not insects. According to Blanchard (1883) (see Ferris 1957), the insect nature of "the scarlet grain" occurring on oak (Quercus cocciferae) was not known until the publication of a note by Vallisneri (1714); the detailed and accurate observations on another, "the Polish grain" [Margarodes polonicus (L.)], published by Breyn (1731) was at first disbelieved (Jakubski 1952, page 55).

Status and taxonomic rank of coccids:

Linnaeus (1758) contained the 17 species known to him in a single genus, Coccus. Subsequently, a number of new species and genera were added (e.g. Gray 1828, Guilding 1829, Burmeister 1835); Costa (1828)

divided Linnaeus's genus Coccus into 3 subgenera, some of which have been later raised to the generic rank. The biological peculiarities of the coccids were soon recognized and considered as a distinct group, the "Gallinsectes" (Reaumur 1740 and De Geer 1776), the "Gallinsecta" (Latreille 1825), "Coccina" (Burmeister, l.c.). According to Westwood (1840, synopsis, p.118) Leachⁱⁿ 1817 was the author of the valid family name Coccidae. Westwood (l.c., p.440) placed Coccidae Leach, as the only family, in the section III Monomera Westw. of the order Homoptera. The family status was adopted by the subsequent authors, e.g. Targioni Tozzetti (1868), Signoret (1868) and the subsequent workers (e.g. Comstock 1881, Maskell 1894, Cockerell 1893, Douglas 1885, Newstead 1894, Fernald 1903). Handlirsch (1908, p. 1088)

raised the status of coccids to subordinal rank, but this was not followed except by some authors of general handbooks of entomology (Schröder 1925, p.283; Weber 1930, p.10) and also quite recently by the eminent Russian coccidologist, the late Prof. N. S. Borchsenius (1958). At present, the rank of a superfamily Coccoidea assigned to them by Ferris (1937) is generally accepted.

Classification of coccids:

The classification and relationships of the various groups within Coccoidea has always been subject of considerable difference of opinion, changes, disagreement and confusion, perhaps to a greater degree than in any other group of insects. There are hardly two serious students of coccids, concerned with their classification, who would entirely agree with each other, even regarding the general divisions, not to mention the more detailed classification or interpretations of the relationships of the different groups. These differences can be illustrated by the following examples: Signoret (1868) in a series of detailed and comprehensive papers laid the foundation to the proper study and classification of coccids of the entire world, dividing the family "Cochenilles ou Gallinsectes" into 4 large "sections"; Targioni Tozzetti (1868) proposed 4 "tribes" omitting altogether one of Signoret's sections (the Australian Brachyscelites); Maskell (1894) introduced significant improvements by dividing the Coccidae into 7 subfamilies; Cockerell (1899) recognised

8 subfamilies but only 4 of these in accord with Maskell's classification; Fernald (1903) generally followed Cockerell's conception of the 8 subfamilies but employed different names for two of them. Ferris (1937) divided the superfamily Coccoidea into 11 families; Balachowsky (1942) classified the superfamily into 14 families contained in 3 major "phyla", each with 2, 10 and 2 families respectively; later (1948) however, reduced his phyla to families and the families to subfamilies. Again in 1957, Ferris suggested ^anew arrangement and divided the Coccoidea into 6 "rami" and 13 families, one of which was entirely new (Beesonidae), but left 4 genera unplaced. Borchsenius (1958, 1963) divided the suborder Coccoidea into 2 superfamilies and 17 families. Even among these distinguished coccidologists (Balachowsky 1942, Ferris 1957 and Borchsenius 1958) the suggestions concerning the phylogenetic relationships between the various groups are also at considerable disagreement; the family Conchaspidae for example, is included by Balachowsky in the phylum Lecanoidae, while considered by Ferris as one of the families of the ramus Diaspidi, but regarded by Borchsenius as closely related to Diaspididae; the subfamily Aclerdinae was included in the family Lecaniidae by Balachowsky, recognized as a separate family closely related to Coccidae (Lecaniidae) by Borchsenius, but according to Ferris, the family ought to be transferred altogether from Lecaniidae to the ramus Eriococci.

It should be concluded therefore, that while there is a good agreement as to the status and relationships of some well-defined families, e.g. Diaspididae and Margarodidae, there is a great deal of difference of opinion as to the status, composition and relationships of the other groups. The two above-mentioned families have been subdivided into series of distinct intrafamily taxa, but no such comprehensive subdivision has been even suggested with regard to the other groups including the pseudococcids and the eriococoids here studied.

This disagreement is attributable to two reasons: the first, general and obvious consequence of the increasing volume of the detailed knowledge about the whole group; the second, specific to coccids, and resulting from their biological peculiarities.

(1) The accumulation of knowledge:

The serious economic importance of coccids as pests, resulted in increased interest and the consequent rapid growth of the volume of detailed information about the group; this fact is reflected in the following data of the expanding number of the known species: Linnaeus in the 10th edition of his *systema naturae* (1758) identified 17 species contained in one genus; Signoret (l.c.) ~~accounted~~ ^{recognized} 60 genera and 326 spp.; Fernald (1903) listed 170 genera and 1535 spp.; this figure was approximately doubled a quarter of a century later to over 3000 (Morrison 1928). No further information on the subject has been recently published, but the estimated figure is probably in the range of 7 - 8 thousands spp., estimated from the figures in ^{the} Zoological Record. About 860 new species were recorded in the last decade (1954 - 1963), the numbers per year varying but gradually increasing; over 160 new species were added in 1960 alone. A simultaneous increase in the ^{number} ~~amount~~ of detailed studies leading to fuller understanding of the relationships of various forms, necessitates continuous reshuffling and modification of the existing classification.

(2) The biological peculiarities of Coccoidea:

As already explained by Beardsley (1960), Ghauri (1962) and Giliomee (1961 and 1964), the reason for the disagreements, confusion and altogether the unsatisfactory system of classification of Coccoidea is the fact that it is largely based on one sex only, the neotenic and highly specialized adult females; this classification therefore, represents a system in which only a fraction of the available potentialities are utilized. These neotenic females provide a sufficient number of characters for the recognition and classification of the species but are inadequate for determination of the phylogenetic relationships necessary for satisfactory classification of the whole group. Some of the early workers tried to give equal attention to both sexes (Putnam 1879, Berlese 1893), but the interest in the males soon declined and became sporadic; the descriptions were merely short accounts of the most obvious characters, sometimes supported by diagrammatic and inaccurate drawings if at all. This unbalanced

interest in both sexes is due to the difficulties the study of the males involves. They are comparatively very small, extremely fragile, occurring seasonably and very short-lived (few hours to a maximum life of about 3 days). Many of them are capable of flying and thus almost impossible to collect in the field; to obtain them, it is often necessary to collect and breed the prepupae and the pupae at certain definite time, which requires a knowledge of their life-history, data of their habitats and localities. Their fragility, small size and high degree of desclerotization demands also special techniques for making microscopic preparations suitable for studies.

Morrison (1928) was the first to call for serious study of the stages other than the customary adult females. Balachowsky (1942) used combined general characters of both sexes in his keys separating the phyla and some families. Ferris (1942, 1950, 1957) repeatedly emphasized that "no satisfactory system of classification can be achieved unless more is known about the structure of the male". Balachowsky (1937) and Ferris (1937, 1957) expected the males to provide characters determining the general classification of the higher categories but doubted their usefulness on the specific level. The detailed studies on the males carried out by Ghauri (1962) on Diaspididae and Giliomee (1964) on Coccidae revealed interesting results. Both authors showed that the males are useful at all the taxonomic levels. Ghauri was dealing with a well-defined and already subdivided group, and was able to confirm the existing tribal classification based on the females, with only minor modification regarding the relationship of Parlatoriini with other tribes. Giliomee on the other hand was dealing with a less known group and came to contrary conclusions; he suggested, on the bases of the male characters, a classification of the family that is substantially different from the one based on the females and proposed by Borchsenius (1957).

The species at hand, as already mentioned, belong to two groups, the pseudococcids and the eriococcids, whose taxonomic position is not agreed upon; they have been considered as (1) merely tribes of one subfamily, Pseudococcidae (Cockerell 1899, Balachowsky 1948);

(2) as subfamilies of one family (Balachowsky 1942, Borchsenius 1949) or (3) as separate families, with rather remote connection between them (Ferris 1937, 1957; Borchsenius 1963). Apart from the grouping of certain pseudococcid genera by some authors (the Rhizoecus group including 8 genera by Hambleton 1946, and the tribe Planococcini by Ezzat & McConnel 1956), no comprehensive classification of the pseudococcids or the eriococcids has been hitherto proposed.

The purpose of the present study therefore was: (1) the detailed morphological study of the available male representatives of the two considered groups; (2) evaluate the characters of these males for classificatory purposes; (3) establish and determine the status and relationship of the two groups with each other and with the other families of Coccoidea; and (4) suggest a system of classification within each of these groups.

(b) REVIEW OF THE LITERATURE:

The literature on the males ^{of} Coccoidea has been well covered by Ghauri (1962) and later by Giliomee (1964); therefore, I shall discuss in greater detail, those papers which are particularly relevant to the groups here studied, and enumerate the other papers either omitted by these authors, or published subsequent to their works.

The descriptions of the males by the early workers on scale insects were given in form of generalized accounts usually concerned with the shape, size and colour of the body; frequently, the references to the males were restricted to the puparia, apparently the empty ones only, available to these workers without reference to the male itself at all (e.g. Rutherford 1914, Brain 1920, Hall 1928, Takahashi 1931). Comstock (1881) in his descriptions of many species of the subfamily Diaspinae, discussed the main features of the males; in the same manner, he also treated the males of Rhizococcus araucariae (Maskell).

Newstead (1903) described, in general terms, the males of Dactylopius citri (Risso), D. walkeri (Newstead), Pseudococcus aceris (Sign.) and Apterococcus fraxini (Newstead) of the subfamily Dactylopiinae, giving also some particulars about the antennae, legs and the genital armature. Brain (1915) in even shorter accounts on the males of some species of the subfamily Pseudococcinae, gave only the number of the antennal segments, the measurements of the body, antennae and wings. Leonardi (1920) included Pseudococcus citri and Eriococcus araucaria, in his descriptions of a large number of males; his accounts and diagrams contain no morphological details. Green (1922) made generalized descriptions of the males of some species of the subfamilies Eriococcinae and Dactylopiinae, including 4 of the species here studied (Eriococcus araucariae, Pseudococcus virgatus, Pseudococcus citri and Phenacoccus insolitus). A paper by Kuwana (1923) (mentioned by ^{neither} Ghauri nor Giliomee) includes descriptions and generalized illustrations of the males of 4 scale insects [Prontaspis yanonensis (Kuw.), Ceroplastes rubens (Mask.), C. floridenses Comst. and C. ceriferus (And.)], a mealybug (apterous males of Rhizoecus kondonis Kuw.) and a margarodid (Orthezia yasushii Kuw.); his descriptions are mainly concerned with the colour and the size of the body, the antennae and the legs. MacDougall (1926) gave a generalized description of the males of Pseudococcus comstocki Kuw. Cottier's (1936) account on the apterous males of Pseudococcus cocotis Mask. is also descriptive in general terms. Mäkel (1942) was the first to carry out combined morphological and anatomical studies on 3 spp. of the genus Pseudococcus (i.e. P. adonidum, P. citri and P. longispinus); she was also the first to give adequate attention to the pleural region of the male. Sulc (1943) while studying the different stages of Phenacoccus aceris Sign., gave comparatively detailed descriptions of the males with good, though diagrammatic illustrations of the body, antennae, hind legs and the genital segment; in subsequent papers, he similarly described the males of Peukinococcus piceae (Loew) (1944) and Nipaecoccus nipae (Mask.) (1945). Rao (1943) drew attention to the existence of the apterous males of Trionymus sacchari Ckll., but gave no description of any morphological importance.

The macropterous males of Heterococcus graminicola were described by Morrison (1945); he also provided a generalized illustration of the dorsal view of the body and more detailed drawings of the antenna, posterior leg, abdominal penultimate and genital segments. Reyne (1954) described and figured the males of Puto antennatus Signoret, with a detailed account of the structure of the head and the genital segment; he concluded that the males of Puto and Macrocerococcus are closely related, and included certain characters (e.g. the number of eyes, structure of the penis, number of caudal filaments) widely separating their genotypes (P. antennatus Sign. and M. superbus Leon.) from that of Phenacoccus (P. aceris Sign. described by Sulc, 1943). He also supported ^{the conception of} Borchsenius (1948) regarding the re-establishment of the genus Macrocerococcus. Jancke (1955) studied the main features of a large number of males from different families, including Pseudococcus citri and Eriococcus araucariae. Ezzat (1956), in an attempt to promote the understanding of the thoracic sclerotization of the coccid males, studied the dorsal and the ventral sclerites of six species representing four families (Coccidae, Pseudococcidae, Aclerididae and Diaspididae) and also the pleural sclerites of Pseudococcus vitis (Nied.); his interpretation of several structures somewhat differs from the recent concepts of their homology, but he was able to show that certain characters of the thorax may be significant in coccid taxonomy, e.g. the longitudinal median ridge-like prosternum, called by him "basisternum", the shape of the scutum, the presence of the scutellar foramen "the membranous area"; he pointed out that it was only a step towards better understanding of the thoracic structure of the male. Theron (1958) was the first to carry out a comprehensive morphological study of the males Coccoidea and establish the accurate interpretations of various structures; his study was based on 7 species representing 4 large families (Margarodidae, Coccidae, Pseudococcidae and Diaspididae). In a later paper, Theron (1962) described in detail the males of Phenacoleachia zealandica (Mask.) and discussed its relationships with other groups of Coccoidea. Giliomee (1961) studied comparatively the males of 3 Pseudococcus species, namely P. fragilis Brain, P. adonidum (Linn.) and P. maritimus (Ehrhorn); he described two "types" of the latter species, but as already recognized by him later

(1964) and confirmed by the present writer, these "types" represent in fact two different species (see description of Pseudococcus obscurus). Recently, Giliomee (1964) studied in great detail, the males of 23 spp. of the family Coccidae; he recorded a number of structures not previously observed, suggested a classification of the family based on the males and discussed inter and intra-family relationships within Coccoidea. Beardsley produced a series of papers dealing with the morphology of a large number of pseudococcid males occurring in Hawaii; his illustrations of almost all the species included ventral aspects of the penial sheaths only. In (1960) he studied 30 spp. belonging to 13 genera; the construction of his keys was primarily based on the shape and dimensions of the penial sheath, while the antennae, setae, pores and hind claws formed supporting characters. In (1962), he described 5 additional species, including two of great taxonomic interest [Puto yuccae (Coquillett) and Rhizoecus falcifer Kunckel d'Herculais], both of which exhibit distinct aberration from the other known mealybug males. In (1963), he studied the males, presumably winged, of a new species, Pseudococcus chloris; in (1964) he described the apterous males of Phenacoleachia australis n.sp., the macropterous males of Nipaecoccus longispinus n.sp. and Trionymus danthoniae Morrison, and suggested close relationships between Phenacoleachia and Pseudococcidae, which was also already suggested by Giliomee (1964). In (1965), Beardsley published two other papers similarly dealing with the males of Dysmicoccus brevipes (Ckll.) and Antonina crawii Ckll. respectively, showing that the males of the latter species, unlike their counterpart females, do not exhibit departing features from the usual pseudococcid male type. Dzedzicka (1961) while studying the developmental stages of Gossyparia spuria (Mod.), found and described two forms of the adult males (the brachypterous and the macropterous); her descriptions are rather brief and her interpretation of the abdominal segments is erroneous. Lellakova-Duskova (1965) concisely described the different stages of the males of Quadraspidotus marani Zahradnik, including the adult. Jakubski (1965), in his review of the family Margarodidae, provided short accounts on the ^{males} available to him of this family. In a recent paper, Pesson & Bielenin (1966) re-described the males of Icerya corticalis Vayssiere; they sunk this species as a synonym of I. maxima Newstead, for which they erected the new genus Gigantococcus.

II. MATERIAL, TECHNIQUE AND ILLUSTRATIONS

(A) MATERIAL:

The material for this study was secured from the following three sources: (a) material received from other workers; (b) material bred in the laboratory from pupae collected in the field; and (c) material obtained from colonies reared in the laboratory.

(a) The material received from other workers:

Most of the studied material was acquired through the kind co-operation of many workers from various parts of the world, at the request of Dr. K. Boratynski (see acknowledgement); from these workers, the specimens of 15 spp. were received in 70% alcohol, one species mounted on slides in "B fluid" (Berlese fluid) (Eriococcus orariensis), and one species as dry material (E. buxi). The "B fluid" slides were soaked in warm water to dissolve the ~~mountant~~^{mountant;} the specimens were then washed in distilled water and remounted, using the method here adopted; the dry material was immersed in 10% ~~KOH~~^{caustic potash} for 24 hours and the males were gently dissected from their puparia with a finely pointed quill.

(b) The material collected in pupal stages:

The writer was able to collect and breed the prepupae and pupae of 10 species; these were kept in glass tubes under laboratory conditions (suitable temperature and humidity), and eventually produced adult males; of these, 5 species were collected in London, one at the Imperial College field station, Sunninghill, Berkshire and 4 in Egypt, U.A.R. One of the species collected in London is Dysmicoccus alazon, whose pupae were found on a bunch of banana bought in a fruit shop and imported from the Canary Islands; two others (Pseudococcus fragilis and P. adonidum) presented some problem in the correct identification, which frequently occurs among coccids; they were found in a mixed colony, and since the identification still depends on the females, the actual copulation had to be observed as the only evidence to identify the males. These two species were already described in detail by Giliomee (1961); his descriptions agreed with my specimens and thus are not here repeated, but his data were included in the tables and used in the discussion.

The material of Eriococcus araucariae, collected in Egypt, was secured in a slightly different way; heavily infested branches of the host plant were kept in dark boxes and the males were light trapped through holes drilled at the sides of the boxes where glass tubes were fixed to receive them.

(c) The material obtained from colonies:

Pseudococcus obscurus was bred on potatoes and males collected in the laboratory earlier (by Dr. K. Boratynski); for my studies, cultures of Planococcus citri on potato sprouts and of Chorizococcus lounsburyi on "bulbs" (Amaryllis sp.) were established in the laboratory and the adult males obtained from the pupae transferred at appropriate time into glass tubes.

Attention must be drawn to the following points:

- (1) The material of few species (e.g. P. citri and F. virgata) was duplicated, i.e. obtained from more than one source.
- (2) Two species, namely Chorizococcus lounsburyi and Centrococcus sp., were received too late for a detailed study; a few males of each of these species were mounted and examined under the microscope, but no detailed measurements taken; they are however, included in the discussion.
- (3) The results of the works of other authors, particularly that of Beardsley (1960, 1962, 1963, 1964 and 1965), on a wide variety of pseudococcid species, ~~was~~^{were} made use of; due to Beardsley's different treatment of the species, it was not possible to include them in the tables or discuss them in the same detail as my own and Giliomee's material.

The males of 24 species ⁱⁿ ~~and~~ 17 genera were studied in detail. As will be shown later, the author came to the conclusion that the two considered groups represent two closely related, but well separated families, Pseudococcidae and Eriococcidae. Most of the examined species are known to have macropterous males only, but some were either brachypterous (Gossyparia salicicola) or apterous (Pseudochermes fraxini) and the others had more than one form available (macropterous and apterous in Saccharicoccus sacchari, and macropterous

and brachypterous in Gossyparia spuria). The studied species are:

Family Pseudococcidae:

I. The Planococcus group:

- (1) Planococcus citri (Risso)
- (2) P. Kenyae (Le Pelley)
- (3) P. dioscoreae Williams
- (4) Planococcoides ireneus De Lotto
- (5) Nipaecoccus vastator (Maskell)
- (6) N. nipae (Maskell)
- (7) Maconellicoccus hirsutus (Green)
- (8) Ferrisiana virgata (Cockerell)
- (9) Trionymus newsteadi (Green)

II. The Pseudococcus group:

- (10) Pseudococcus obscurus (Essig)
- (11) P. citriculus Green
- (12) Dysmicoccus alazon Williams

III. The Saccharicoccus group:

- (13) Saccharicoccus saochari (Cockerell)

IV. The Octococcus group:

- (14) Octococcus africanus (Brain)

V. The Ceroputo group:

- (15) Ceroputo pilosellae Sulc
- (16) Centroccoccus insolitus (Green)

VI. The Nairobiia group:

- (17) Nairobiia bifrons De Lotto

Family Eriococcidae:

- (18) Eriococcus araucariae Maskell
- (19) E. orariensis Hoy
- (20) E. buxi (Fonscolombe)

- (21) Ovaticoccus agavium Douglas
- (22) Gossyparia spuria (Mod~~er~~)
- (23) G. salicicola Borchsenius
- (24) Pseudochermes fraxini (Kaltenbach)

(B) PREPARATION AND TECHNIQUE:

Theron (1958) referred to the unsatisfactory old methods in preparing and mounting the coccid males dorso-ventrally, in which the pleural region could not be studied, in addition to the considerable distortion of the specimens. He introduced a method which was basically followed by Giliomee (1961), Ghauri (1962) and herein adopted with slight modifications. The specimens were first cleared in 10% ~~caustic~~ ^{caustic} potash (it was found useful to leave them for about 24 hours at room temperature as a preliminary step), and gently heated at about 55°C, maintained by a 60 Watt electric bulb of a laboratory lamp with box-like shade, on which the solid watch glass containing the specimens was placed; one hour was usually found enough to macerate the internal organs and have the specimens sufficiently clear, but sometimes it was necessary to leave them for two or even three hours. The specimens were then washed in distilled water and gradually dehydrated by passing them through graded series of ethyl alcohol starting from 30 or 50% up to absolute. They were then transferred into a saturated solution of chlorazol black E (in absolute methyl alcohol) and left for 3 - 4 hours; Giliomee (1964) recommended one hour only but it was found inadequate. Excess stain was removed by transferring into fresh absolute ^{ethyl} alcohol and leaving the specimens for a few hours; Ghauri (1962) found that better and quicker results were achieved if a few drops of pyridine were added at this stage, but the writer could not confirm its effect. The specimens were then transferred to terpineol by means of the flotation method: the terpineol is poured into a watch glass, then some absolute alcohol is slowly added, so that the two liquids form two separate layers; the transferred specimens will at first float on the surface of the alcohol, and then will slowly sink to the bottom as the alcohol inside them is gradually replaced by the terpineol. When the specimens were saturated, they

were mounted in pure terpineol on cavity slides and were ready for the microscopic examination. Such mounting is excellent for the studies of the coccid males because it allows changing the position of the specimen thus making examination of the dorsal, ventral and lateral sides possible.

In most cases, 10 specimens of every species were examined, for which the data was taken. The length of the body was measured from the anterior apex of the head to the posterior tip of the genital style; since the postoccipital ridge is well marked in Pseudococcidae and Eriococcidae, the length of the thorax was therefore taken along the median line from that ridge to the posterior margin of the mesopostphragma. The length of the prescutum was topographically measured from the anterior margin to the prescutal suture, and its width taken across from one margin to the other, including the width of the prescutal ridges. Lengths and widths of other structures (scutellum, basisternum ... etc.) also included the widths of the ^{ou}binding ridges. The measurements of the leg segments were taken at their maximum lengths and widths, except for the tibia whose width was taken at about half length; the length of the tarsus is that of the distal segment only (the proximal one is very short and membranous). In Pseudococcidae the length of the abdomen was taken from the mesopostphragma to the anterior margin of the basal ridge of the penial sheath, and the length of the latter taken from that level to the tip of the style; in Eriococcidae, the length of the abdomen was measured from the mesopostphragma to the antero-ventral margin of the genital capsule, and the length of the latter taken from that level to the posterior tip of the style. The width of the penial sheath or the genital capsule was made across their widest distance.

(C) ILLUSTRATIONS:

The drawings were made to scale on graph paper by using a square graticule fitted into the microscopic eye piece; all plates were illustrated to the same scale, to allow comparison between the sizes of the different spp. The condition of the lateral arms of the midcranial ridge and their relationship with the dorsal arm was found ^{to be} of

taxonomic importance; the front view of the head (not illustrated by previous workers), in which the mentioned relationship is best shown, was here given particular consideration. In the dorso-ventral views, the dorsal and the ventral arms of the midcranial ridge were drawn just outside the median line, to show the degree of their development. The black areas in the figures denote the strongly developed ridges; stippling indicates sclerotization. Reticulation is marked by net-like crossed lines representing the actual reticulation as accurately as possible; convex structures are marked vvv and those lying below the surface or invaginated, are drawn in broken lines. Membranous areas are left blank.

The labelling of all the structures in every figure was found ^{almost} ~~practically~~ impossible and rather confusing; thus, reference in the text of the descriptions was made to the labels included in the relevant drawings only.

The material was prepared using a stereoscopic binocular microscope. The detailed study and drawing of the species were made using a standard pattern Leitz microscope with binocular head.

III. GENERAL MORPHOLOGY

Theron (1958) recognized 10 general morphological characters identifying the lecanoid type of male, based on studies of two genera, Eulecanium (=Parthenolecanium-Coccidae) and Pseudococcus (=Planococcus-Pseudococcidae), and indicated that the Pseudococcidae differ from Coccidae by more generalized condition of the genitalia (primitive character), the condition of the anterior tentorial arms and the ocular ridges (specialized characters). Giliomee (1961) found that two of Theron's generalized characters do not apply to Pseudococcidae and this was confirmed by the present study. Later, Giliomee (1964) discussed the relationships between the males of Pseudococcidae and Coccidae, listing 10 morphological characters (5 primitive and 5 specialized) separating the males of the two families. This again was confirmed by the present author.

The problem here was first to find the relationships between the males of Pseudococcidae and Eriococcidae, and determine, on the basis of male characters the controversial question of their status. It was found that the two groups differ by a number of morphological characters (listed later in the discussion), the importance of which is comparable with those separating Pseudococcidae and Coccidae. Accordingly, it has been concluded that Pseudococcidae and Eriococcidae deserve the status of separate families and will be here treated as such. The general characteristics of the male Pseudococcidae will be given first and followed by the description of individual species of this family. In the general description of the male Eriococcidae, the main emphasis will be laid on the differences, on the assumption that the structures not discussed are the same as in Pseudococcidae; this will be followed by the description of individual species of Eriococcidae.

The homologies and terminology of the various structures introduced by Theron (1958), and later supplemented by Ghauri (1962) and Giliomee (1961, 1964) are here adopted; a few additional terms and abbreviations have also been employed.

((1)) THE MALES OF PSEUDOCOCCIDAE:

A. General:

All the studied species were represented by macropterous males (alate or winged), and one species (S. sacchari) was also represented by apterous specimens (wingless). Brachypterous forms (with reduced fore-wings) were reported by earlier authors (Palmicola palmarum, described by Beardsley 1960), but were not available for the present study.

Pupation (prepupal and pupal stages) of the pseudococcid males (at least of the species obtained from pupae by the writer in the laboratory) takes place inside fluffy puparia of waxy threads; the adult male emerges backing through the loosely felted posterior extremity of the puparium.

I. Appearance:

The body of the pseudococcid male, as in all other Coccoidea (Theron 1958 and Ghauri 1962), consists of the well defined head (with non-functional mouth parts), thorax and abdomen. Usually the males are narrow and slender, although those of some of the studied species are moderately robust (O. africanus, C. insolitus and the apterous males of S. sacchari); broadest at the thoracic region and usually round throughout, but sometimes dorso-ventrally flattened (S. sacchari). The head subtriangular in dorsal view with the genae bulging posteriorly. The neck region is neither entirely absent as in Diaspididae (Ghauri 1962), nor distinctly pronounced as in Coccidae (Giliomee 1964), but merely indicated by a distinct constriction. The legs are well developed, usually long and slender. The alate forms with the anterior pair of wings well developed, and the posterior wings modified into hamulohalterae, each normally with one apically hooked seta. The abdomen is largely membranous, becoming gradually narrower posteriorly; with eight well separated pregenital and the terminal genital segments.

II. Size:

The coccid males generally are very small insects and although the actual size varies considerably, they are comparatively large in some families and small in others. The males of Pseudococcidae occupy intermediate position in that respect, i.e. smaller than Margarodidae and some Coccidae, and larger than Diaspididae which are apparently the smallest of all. Among the studied species the smallest was N. nipae (840 - 980, average 896 μ long), and the largest F. virgata (1274 - 1596, av. 1386 μ long).

III. Colour:

Examination of the available living material of a few species indicate that the colour of the males although somewhat variable, is apparently characteristic of each species. The basic colour is always brownish, light (P. citri and S. sacchari), or dark (T. newsteadi), or with yellowish or greenish tinge (M. hirsutus and D. alazon respectively); the eyes usually are also brown but sometimes dark red (D. alazon). In alcohol-preserved material, the colour gradually fades away, becomes indefinible and the differences disappear; unfortunately most of the studied species were alcohol-preserved.

IV. Derm Vestiture:

(a) The body setae: These are of two main types:

- 1 - The fleshy (Giliomee 1961) or "digitiform" (Beardsley 1960), which are comparatively thick and apically obtuse.
- 2 - The hair-like (Giliomee, l.c.) or "filamentous" (Beardsley, l.c.), and are much thinner, with \nearrow very acute tip.

The fleshy setae may occur on any part of the body itself (i.e. on the head, thorax or abdomen), as well as on the antennae and legs (the Pseudococcus group), or their presence may be limited to the appendages only (most species of other groups), occurring both on the antennae and on the legs (P. citri), or on the antennae only (N.

vastator); finally they may be absent altogether (C. pilosellae and N. bifrons). The hair-like setae always occur on the body and on the appendages. Both types of setae usually are easily distinguished, but sometimes the separation is rather difficult. In some species (N. nipae and Ceroputo group) the antennal fleshy and hair-like setae are much longer than the body setae (at least twice as long). Other types of more specialized setae occur on the antennae, on legs, on penultimate abdominal and genital segments; these will be described later, together with the other details of the parts on which they occur.

(b) The disc pores: With the exception of Nairobi group, the males of Pseudococcidae carry a number of disc pores, sometimes on the thorax and the abdomen only (Octococcus and some species of Planococcus groups), or also on the head (Pseudococcus, Saccharicoccus, Ceroputo and most species of Planococcus groups). In the studied material, the pores were usually quadrilocular, occasionally trilocular, quinquilocular or 6-locular, but in some species, Beardsley (1960) observed pores with more than 6 peripheral loculi.

B. THE MACROPTEROUS MALES:

THE HEAD:

1. The head capsule: As already established (Weber 1928, 1935), the typical homopteran head basically consists of the epicranium, the vorderkopf and the labium. The head capsule of the coccid male as discussed by Theron (1958), is almost entirely made up of the epicranium; the absence of the functional mouth parts has resulted in a considerable reduction of the vorderkopf and absence of the labium; the mouth is externally represented by a small opening on the ventro-posterior part of the head wall.

Shape: The head has the form of a somewhat irregular tetrahedron; subtriangular in dorsal, lateral and frontal views; broadest posteriorly across the genae, and becoming gradually narrower anteriorly towards the truncate apex and antero-ventrally towards the cone on which the ventral eyes are situated. Between the apex of the head and the ventral cone, the surface of the head is often depressed; this ventral preocular depression (vprd) may be deep and conspicuous (e.g. P. dioscorcae, F. virgata), or shallow and ill-pronounced (e.g. P. citri and N. vastator); in Sacchariooccus group, the depression is absent.

The head ridges and plates: The head capsule is reinforced by a number of ridges, of variable shape, degree of development, sclerotization ... etc. The midcranial ridge (mcr) with its longitudinal dorsal (dmcr), ventral (vmcr), and the apical transverse lateral arms (lmcr), gives support to the anterior part of the head. The dorsal arm is usually distinct although slender, but sometimes reduced and its position only marked by weak sclerotization (S. sacchari and C. pilosellae), or absent altogether (F. virgata). This arm when present, posteriorly reaches at least the level of the dorsal eyes and then fades away (e.g. P. citri and P. ireneus), or extends further back to meet or almost meet the postoccipital ridge (e.g. P. obscurus and T. newsteadi). Anteriorly, the dorsal arm is detached from the other arms by a very short distance (except in Ceroputo and Nairobi groups of species). The ventral arm anteriorly gives off two branches, the lateral arms, forming a Y, or occasionally T-shaped ridge (N. vastator, Plate V,B) at the apex of the head; posteriorly, the ventral arm disappears before reaching the level of the ventral eyes. In Ceroputo and Nairobi groups, all arms of the midcranial ridge meet at the apex of the head, and a cruciform structure is formed (Plates XVI, XVII and XVIII, figs. B). The lateral arms usually are well developed, but sometimes reduced (N. nipae and C. insolitus). The postoccipital ridge (por) is slender and usually distinct although sometimes only marked by a sclerotized stripe

(C. pilosellae); the ridge is U-shaped and medially continuous in almost all the species, but in S. sacchari it is V-shaped and medially interrupted. Its anterior extremities are either confluent with the preocular ridges (e.g. D. alazon and M. hirsutus), or do not reach the latter (e.g. P. citri and O. africanus). According to Makel (1942), the postoccipital ridge serves for the attachment of the cephalo-thoracic muscles. The area posteriorly bounded by the (por) is the dorsomedial part of the epicranium (dmp), which corresponds to the median crest in Diaspididae (Theron 1958 and Ghauri 1962); this area is slightly raised, well sclerotized, without polygonal reticulation.

Ocular ridges: The preocular (procr) and postocular (pocr) ridges were described as being fused below the lateral ocellus to form the characteristic Y-shaped structure on each side of the head (Theron 1958, Giliomee 1961), and this condition was considered by Theron as "a minor specialization" in Pseudococcidae. The present study showed that indeed this condition obtains in most studied species, but certain differences in details in few of them, as well as the conditions described by Giliomee (1964) in some species of Coccidae indicate that the interpretation of this "fusion" is rather inaccurate. Giliomee (l.c.) found, in Eriopeltis spp. for example, that the well developed pre- and postocular ridges are connected just below the ocellus by a longitudinal interocular ridge (ior), giving support to the preocular ridge and its articulation with the antennae; he suggested that this condition may be a forerunner of the situation in Pseudococcidae where the two ridges are fused. The present author found that most Pseudococcidae with the connecting interocular ridge well developed, and in some species (e.g. P. citri, fig. 2 and T. newsteadi, fig. 17) a short, though well marked lower part of the preocular ridge extends below the point of junction. It appears therefore, that the Y-shaped ridge on the side of the head is a complex structure composed of: (1) the upper part of the preocular ridge, intimately fused with (2) the interocular ridge, which joins (3) the postocular ridge below the ocellus, with simultaneous more or less

considerable reduction of the lower part of the preocular ridge. This condition, although reminiscent of that found in some species of Coccidae, not necessarily evolved from it, but probably developed independently within Pseudococcidae and represent a specialization of this family. It also seems that this Y-shaped fusion of the ocular ridges has the functional significance to render support to the weakly developed preocular ridge and its articulation with the antennae.

In Ceroputo and Nairobiia groups the pre and the postocular ridges are well separated, but a longer (C. pilosellae, fig. 31), or a shorter (N. bifrons, fig. 35) rudiment of the connecting ridge, arising from the anterior edge of the postocular ridge just below the ocellus and extending anteriorly towards the preocular ridge, is present. An aberrant condition was found in C. insolitus (fig. 33), where a ridge anteriorly arising from the postocular ridge and directed towards the preocular ridge is present but above the ocellus, thus it is not strictly homologous with the interocular ridge; nevertheless, it probably serves the same purpose and may represent another independent morphological mean to the same functional end.

The ocular sclerites (ocs) are weakly sclerotized plates on each side of the head; rather large in Ceroputo and Nairobiia groups (where the ocular ridges are separated), but are comparatively smaller and traversed on each side by the interocular ridge, in the remaining groups.

The preoral ridge (pror) is extremely slender and latero-posteriorly connected to both the postocular ridge and the proepisternum + cervical sclerite, by means of a small triangular and weakly sclerotized plate.

EYES:

Two pairs of simple eyes (accessory eyes, Berlese 1893; ocelli, Green 1922) surrounded by a narrow area of polygonal reticulation, and one pair of transparent lateral ocelli (o) (primary eyes, Kreckler 1909; rudimentary eyes, Green 1922) are present in the studied species. Beardsley (1962) recorded 7 pairs of simple eyes and a pair of ocelli in one species, Puto yuccae, and the complete absence of the ocelli in another, Rhizoecus falcifer. The widely separated dorsal eyes (dse) are borne on the dorsal part of the ocular sclerites, between pre- and postocular ridges. The ventral eyes (vse) are much approximated and placed on the ventral protrusion of the head; these are usually somewhat larger than the dorsal eyes, but are sometimes smaller (N. vastator), or both subequal (e.g. C. pilosellae and O. africanus). The ocelli are usually large and well developed; in Planococcus, Pseudococcus, Saccharicoccus and Octococcus groups the ocelli are situated at the base of the fork of the Y-shaped complex of ocular ridges, and are dorsally supported by a slender ocellar ridge (see lateral views); in Ceroputo group, where the Y-shaped complex is absent, they are supported by the postocular ridge and either a rudimentary sclerotized projection (fig. 31), or a ridge-like arm (fig. 33). In Nairobi group, the ocelli are vestigial and merely represented by atrophied spots.

The genae (g) are membranous, laterally bulging behind the postocular ridges and without any reticulation; the genae form the latero-posterior margins of the head.

The ventral cavity (vc) is a longitudinal narrow slit-like invagination in the median line of the head. From the roof of this invagination arises the internal cranial apophysis (ca) which is always apically truncate; according to Theron (1958), the cranial apophysis serves for the attachment of the antennal muscles.

The non-functional mouth opening (mo) is small, situated behind the pre^oral ridge. The "tendon-like apodeme" described in other families (Theron, l.c.) is absent in the species here studied. The posterior tentorial pits (ptp), from which the internal posterior tentorial arms (pta) originate, are minute and placed on the membrane on each side of the mouth opening. The posterior arms are connected with each other by means of the transverse slender tentorial bridge (tb). The anterior tentorial arms (ata) usually fuse just before meeting the cranial apophysis, but in Ceroputo and Nairobiia groups they are well separated; the anterior tentorial pits therefore, are not visible externally.

Cheatotaxy: The hair-like setae are always present on the head, but the fleshy setae may be also present (Pseudococcus group) or absent. The head setae are generally arranged in the following groups:

- (1) The dorsal head setae (dhs): These occur on each side of the median line, anterior to the postoccipital ridge.
- (2) The genal setae (gs), are present dorso-laterally on the genae; sometimes there are 3 setae or less (e.g. P. citri and C. insolitus), 7 or more (Pseudococcus group), or they occur in intermediate numbers (T. newsteadi and M. hirsutus).
- (3) The setae of the ocular sclerites (ocse): These are present in the Pseudococcus group only, and occur in two conditions relative to their topography: (a) the dorsal ocular setae occurring on the dorsal part of the ocular sclerites, were found only in one species, D. alazon; and (b) the ventral ocular setae (vos), which occur on the ventral part of the ocular sclerites.
- (4) The ventral head setae (vhs) are arranged in 3 distinct groups:
 - (a) a group along the longitudinal median line between the ventral eyes; these setae may be always present (Planococcus, Pseudococcus and Saccharicoccus groups), present or absent (Nairobiia group), or entirely absent (Octococcus and Ceroputo groups);
 - (b) a group forming a transverse band across the area of the ventral preocular depression, just anterior to the ventral eyes;
 - (c) a

group of usually a few setae, arranged in a single line on each side of the ventral arm of the midcranial ridge.

Disc pores: 1 - 3 disc pores are usually present dorsally (dhp) on each side of the midcranial ridge, near the base of the antennae (A and B in the figures), but in some species (P. dioscoreae and S. sacchari) 4 or more pores are present. In Ceroputo group, however, there is a ventral pore (vhp) occurring at least on one side of the head, and the dorsal pore may be absent (C. pilosellae, fig. 30,B), or also present (C. insolitus, fig. 32,B); in some other species (F. virgata and O. africanus) the head pores are absent altogether.

2. THE ANTENNAE:

The scape is inserted laterally at the anterior apex of the *head* and articulates with the antennal process of the preocular ridge; the lateral arms of the midcranial ridge, when well developed, also extend towards the base of the scape but with which no articulation takes place. The antennae are typical filiform, normally 10-segmented, and of considerably variable lengths within the family; in Octococcus and Ceroputo groups they are comparatively long (the body usually less than 1.6 times longer); in Pseudococcus and many species of Planococcus groups they are rather short (the body 1.6 - 2.5 times longer); in Nairobi and some species of Planococcus groups (Nipaecoccus spp.) the antennae are intermediate in length; in Saccharicoccus group they are very short (the body being more than 2.5 times longer).

Appearance of the component segments: The antennal segments of the pseudococcid males are always cylindrical and usually conspicuously longer than wide.

The Scape (scp) is the shortest and the widest (at the base) of the antennal segments. It becomes narrower distally, with the dorsal margin usually longer than the ventral; the basal part is sclerotized and laterally articulates with the articular process of the preocular ridge. Distally, the scape articulates with the pedicel by means of a process, into which the ventral sclerotization is produced. Usually 4 hair-like setae are present on the scape, but in Pseudococcus, Saccharicoccus and some species of Planococcus groups (e.g. P. citri and P. dioscoreae), the scape carries more than 4 setae; there are no other types of setae on the scape.

The pedicel (pdc) is narrow at the base and widest near the distal end, thus giving the segment a club-shaped appearance. At the base, the pedicel is ventrally supported by a ridge, which provides a minute process articulating with the scape. At the distal end of the pedicel, a narrow area of polygonal reticulation is present, where a small circular plate, presumably a sensillum placodeum (spl), is dorsally borne. The pedicel carries fleshy and hair-like setae.

The flagellum includes the intermediate (III to IX) and the terminal segments. The surface of these segments is somewhat irregular, and they are usually well separated, although partial fusion between two or more adjacent segments is frequent in some species (e.g. P. ireneus). Segment III is club-shaped, with a short constricted peduncle inserted into the pedicel; this segment is usually the longest; at least subequal in length to the terminal segment (Saccharicoccus, Nairobia and some species of Planococcus groups, e.g. P. citri and N. nipae), or often up to $1\frac{1}{2}$ times longer (Pseudococcus, Octococcus and other species of Planococcus groups), or even more (Ceroputo group). The width of the 3rd segment in relation to its length is also variable; sometimes the length is 2 - 3.3 times the width (Saccharicoccus and many species of Planococcus groups, e.g. P. ireneus and N. vastator), 3.3 - 5.3 times (Pseudococcus, Octococcus, Nairobia and other species of Planococcus groups), or more than 5.3 times (Ceroputo group). Segments IV to X are

relatively long in comparison to their width; the terminal segment with a constricted, rounded or pointed apex.

Antennal setae: The following types of setae occur on the antennal segments:

- (a) The fleshy setae (fs), usually present on segments II to X and represent the majority of the antennal setae, but sometimes the fleshy setae are entirely absent (C. pilosellae and N. bifrons).
- (b) The hair-like setae (hs), which always occur at least on the first three antennal segments.
- (c) The subapical sensory setae (set. scl) are apically knobbed and occur on the terminal segment only, but sometimes are absent altogether (Ceroputo group).
- (d) The capitate sensory setae (set. ca): This group includes setae similar to the latter type but present on the antennal segments III to X; these setae were found in Octococcus and Nairobi groups only.
- (e) The antennal bristles (ab): These are the most stout bristle-like setae, usually longer than the fleshy setae and present on the last three terminal segments; segments VIII and IX always with a single ventral bristle, at about half the length of these segments. The terminal segment (Xth) with at least 3 preapical such bristles, one dorsal and one on each side; in Ceroputo and some species of Planococcus groups (N. vastator and T. newsteadi), two additional and conspicuously smaller bristles are also present latero-ventrally, at a greater distance from the apex of the segment.

THE THORAX:

Makel (1942) was the first to give adequate attention to the pleural region of the thorax; Ezzat (1956) gave more detailed illustrations, but Theron's (1958) identification of the thoracic structures reached incomparably higher standard.

1. THE PROTHORAX:

The prothorax is distinctly separated from the head by the constricted neck; in this respect, Pseudococcidae and Eriococcidae occupy intermediate position between Diaspididae where the neck region is not differentiated due to the close association of the head and the thorax, and Coccidae where the neck is very well pronounced. The prothorax is largely membranous, comparatively long, with a few sclerites and ridges. The pronotum is represented by the following structures: (1) the collar-like transverse pronotal ridges (prnr): These are medially interrupted by a weak sclerotization, and extend laterally on each side; they were called "prothoracic sutures" by Stickney (1934) and Ezzat (1956), and "protergal sclerites" by Habib (1956); (2) two small lateral pronotal sclerites (prn) one on each side, anteriorly bounded by the pronotal ridge; (3) a postero-dorsal pair of small sclerites, the posttergites (pt).

The proepisternum is a distinct, triangular and well sclerotized pleural sclerite, on each side of the prothorax; anteriorly it fuses with the rudiment of the cervical sclerite at a weak point to form one structure, the proepisternum + cervical sclerite (pepcv), which is dorsally approached near its anterior end by the pronotal ridge, and anteriorly articulates with the postocular ridge (see lateral views). Posteriorly, the (pepcv) is fused with a short pleural ridge (plrl) which carries a small invaginated pleural apophysis (plal); the pleural ridge extends downwards and articulates with the basal process of the coxa. The proepimeron which is usually apparent in certain families (Margarodidae and Diaspididae) is entirely indistinguishable in Pseudococcidae (and Eriococcidae).

The dorsal margin of the proepisternum is always heavily sclerotized and ridge-like; in Ceroputo group, the ventral margin also is similarly sclerotized.

The prosternum (stnl) is reduced to a small and usually triangular plate; in some species (O. africanus and N. bifrons) the

plate is very short and wide, and in others (T. newsteadi) comparatively long and narrow; in C. insolitus it is represented by two small separate plates, one on each side of the median line. Posteriorly, the prosternum is usually bounded by a narrow transverse prosternal ridge (stnlr), which however is absent in Saccharicoccus group and replaced by heavier sclerotization of the whole posterior margin (fig. 24); the median longitudinal ridge which occurs in many members of the other families (Margarodidae, Coccidae and Diaspididae) is absent in Pseudococcidae (and Eriococcidae).

Dermal structures of the prothorax:

A. Setae: The hair-like setae are always present on the prothorax; in Pseudococcus group, the fleshy setae also occur. These setae are arranged in the following groups:

(1) The medial pronotal setae (mpns): which are present on the median and submedian areas between the pronotal ridge and the posttergites; in some species 3 or more of these setae are present on each side of the median line (P. citriculus and S. sacchari, figs. 20 and 24), but in others their number is less than 3 (e.g. P. citri and T. newsteadi, figs. 1 and 16), or they might be absent altogether (Octococcus, Ceroputo and Nairobi groups).

(2) The posttergital setae (pts): These occur on, or immediately behind the posttergites; this group is present in F. virgata among the Planococcus group, and in all species of the Pseudococcus and Saccharicoccus group, and may be present or absent in Ceroputo group.

(3) The lateral pronotal setae (lps): situated on, or lateral to the lateral pronotal sclerites.

(4) The antespircular dorsal setae (asds): These occur laterally at about the level of the posttergites; 2 - 4 setae are usually present on each side, but in Saccharicoccus group there are 5 or more setae, and in Octococcus and Ceroputo groups they are usually absent.

- (5) The antespирacular ventral setae (asvs): These occur latero-ventrally, just behind the front coxa; one seta almost always present on each side, but in S. sacchari two setae were found in this position.
- (6) The prosternal setae (stnls): Present medially, on the prosternum or on the membranous part immediately anterior to it; there are less than 4 of these setae on each side of the median line in Planococcus and Nairobi groups, 4 or more in Pseudococcus group, and they are usually absent in Octococcus and Ceroputo groups.

B. The disc pores: These are entirely absent in Nairobi group; in the other groups of species they are present, usually occur^{ing} in association with the prothoracic setae, and are arranged in the following groups of pores: the medial pronotal pores (mpnp); the posttergital pores (ptdp); the lateral pronotal pores (lpp); the antespирacular dorsal pores (asdp); the prosternal pores (stnlp). The number of these pores is variable, but the posttergital pores were found in P. dioscreeae only.

2. THE MESOTHORAX:

The mesothorax, as the wing-bearing segment, is strongly developed. The shape and conditions of the sclerotized areas vary considerably within the family, providing a number of taxonomically important characters.

(I) The mesot^{er}gum is divided into a meso-notum (or alinotum) and a meso-postnotum, which are widely separated by a large membranous area (postscutellum, of Berlese 1893); the meso-notum is further subdivided into the distinct prescutum, scutum and scutellum.

(A) The prescutum (prsc), the antero-median area of the meso-notum, is well sclerotized and dome-shaped; in the dorsal view it is either transversely rectangular (Planococcus, Pseudococcus, Saccharicoccus and

Octococcus groups), or triangular (Ceroputo and Nairobi groups).

The anterior margin of the prescutum is invaginated forming the meso-prephragma (phrl) with its inner margin slightly notched in the middle. The prescutum is bounded laterally and posteriorly by the prescutal ridges (pscr) and the prescutal suture (pscs), respectively; the suture is sometimes absent (Saccharicoccus group), or strongly developed, ridge-like and continuous with the prescutal ridges (Ceroputo group, figs. 30 & 32).

(B) The scutum (sct) is a large sclerite, uniformly sclerotized throughout (Ceroputo and Nairobi groups), or with a median longitudinal narrow membranous area (the remaining groups), and with the antero-lateral extensions surrounding the prescutum later^oposteriorly. The lateral margin of each of these extensions is produced into the prealare (pra), from which it is separated by the secondary prealar ridge (prar); the latter is anteriorly invaginated into a small finger-like apodeme (a), and posteriorly supporting the small anterior notal wing process (anp). The prealare is laterally differentiated into a strongly sclerotized triangular plate (tp) which forms the antero-dorsal boundary of the episternum; this plate was called "prealar wing process" by Ezzat (1956). Behind the anterior notal wing process, the postero-lateral extensions of the scutum are inflected downwards then upwards to form the posterior notal wing process (pnp) which is attached to the postalare.

(C) The scutellum (scl) is pentagonal in dorsal view; antero-laterally bounded by the scutoscutellar suture (scts), and posteriorly by the inward fold of the posterior margin of the notum (rd); the semi-cylindrical structure of the scutellum is due to deep inward inflection of its anterior and posterior margins; these invaginated margins do not meet internally, thus the scutellar foramen which occurs in other families, e.g. Margarodidae, Diaspididae and Coccidae (Theron 1958,

Ghauri 1962 and Giliomee 1964) is absent in Pseudococcidae (and Eriococcidae). The relative lengths and widths of the various meso-notal structures differ considerably within the family and the following ratios were found of taxonomic importance: length to width of prescutum; length of prescutum to length of scutum; length to width of scutellum; length of scutellum to length of scutum.

The posteriormost part of the mesotergum, the mesopostnotum is overlapped by the metanotum and thus externally invisible. The invaginated posterior margin of the postnotum constitutes the meso-postophragma (phr2) which is slightly larger than the mesopreophragma, and also has a small median notch. Laterally, the postnotum gives rise to a pair of strong finger-like postnotal apophyses (pna) within the mesothoracic cavity; these apophyses are comparatively small in S. sacchari. Antero-laterad of the apophysis, the postnotum is produced into a well sclerotized postalare (pa) which reaches the pleural area and articulates with the pleural ridge of the mesothorax. The postalare is reinforced by the distinctly separated anterior and posterior postalar ridges (apar & ppar); dorsally, it bears two small processes associated with the posterior margin of the wing and the posterior marginal fold of the notum, respectively.

(II) The mesopleuron is characterized by the strong development of its ridges. The mesopleural ridge (plr2) posteriorly articulates with the base of coxa, and extends antero-dorsally towards the base of the wing. At about half length, the ridge makes the characteristic sharp double bend and carries at this point the internal mesopleural apophysis (pla2); externally, this part of the ridge is overlapped by the postalare. The ridge is interrupted at a short distance above the coxal articulation; this interruption was overlooked by Theron (1958) on describing P. citri, and according to Ghauri (1962) and Giliomee

(1964) does not occur in Diaspididae and many Coccidae. The dorsal part of the (plr2) is relatively strong and terminates in a large semi-circular pleural wing process (pwp2); the anterior margin of the (pwp2) is connected with the episternum by means of a ridge-like basalare (bas); the latter is comparatively strong and stout in Planococcus, Pseudococcus and Saccharicoccus groups, but weak and slender in Octococcus, Ceroputo and Nairobi groups. Behind the pleural wing process, there is a small sclerite, the subalare (sa), whose articulation with the alary sclerites is rather obscure. The subepisternal ridge (ser) articulates dorsally with the triangular plate and runs obliquely ventro-posteriorly approaching the marginal ridge of the basisternum and thus ^{ou} b₁nding the mesepisternum (eps2) anteriorly; the ridge was referred to as "the pleural ridge" by Ezzat (1956) and "the precoxal ridge" by Stickney (1934). The mesepisternum is divided into a larger dorsal part; the supraepisternum or anepisternum, and the small ventral part, the infraepisternum or katepisternum (Snodgrass 1935), both of which are separated by a membranous area. The katepisternum anteriorly fuses with the lateropleurite (lpl) which is attached to the lateral arms of the marginal ridge of the basisternum; the lateropleurite is narrow in Planococcus, Pseudococcus and Octococcus groups, but comparatively wide in Saccharicoccus, Ceroputo and Nairobi groups. A small and well sclerotized mesepimeron (epm2) is present immediately behind the pleural ridge, just above its articulation with the coxa. A slender sclerite, presumably representing the trochantin (tn) occurs just anterior to the coxal articulation, and was found in all the studied species except N. bifrons. This sclerite was first described and illustrated by Giliomee (1961).

The mesothoracic spiracle (sp2) with its atrium and its supporting bar, the peritrema is placed latero-ventrally anterior to the subepisternal ridge.

(III) The Mesosternum is represented by a large, slightly convex and hexagonal plate, the basisternum (stn2); this plate is framed antero-laterally and latero-posteriorly by the marginal and the precoxal ridges (mr & pcr2), respectively. The marginal ridge which separates the basisternum from the episternum, is posteriorly fused with the pleural ridge just below the point of interruption above the coxal articulation, and usually extends medially where it is fused with its partner of the opposite side; in Saccharicoccus group the median part of the marginal ridge is completely absent. The precoxal ridge posteriorly fades away before reaching the median line, where the posterior margin of the basisternum becomes slightly inflected to form a furcal pit (fp) from which the strong, two-armed furca (f) originates; the latter is usually large, but in Saccharicoccus group comparatively small. The longitudinal median ridge of the basisternum, which occurs in many species of Margarodidae, Diaspididae and Coccidae (Theron 1958, Ghauri 1962 and Giliomee 1964), is absent in Pseudococcidae (and Eriococcidae).

(IV) The wing articulation: The articular system of the fore-wings is apparently the same in all the coccids, and only slight differences are shown in the size of the alar sclerites, the pteralia, which include: the tegula (teg), the axillary (first, second and third) (ax1, ax2 and ax3) and the additional sclerites (asc). The costal complex of veins (ccx) and the axillary cord (axc) give support to the anterior and posterior margins of the wings at their bases. Apart from these structures, the articulation also involves the anterior notal wing process, the pleural wing process, the basalare and probably the subalare. The tegula is a small plate carried on a membranous bulge anterior to the pleural wing process. The first and the third axillary sclerites are triangular, the second is roughly parallelsided and the additional sclerite is usually semi-circular.

(V) The dermal structures of the mesothorax:

A. Setae: The fleshy setae occur in Pseudococcus group only, in the postmesostigmatal area, but the hair-like setae are always present, arranged in the following topographical groups:

- (1) The prescutal setae (pscse): Usually occupying the lateral areas of the prescutum.
- (2) The scutal setae (sctse).
- (3) The scutellar setae (scls).
- (4) The tegular setae (tegs): On the tegular bulge.
- (5) The postmesostigmatal setae (pms): These are present ventrally on the membrane between the prosternal ridge and the marginal ridge of the basisternum. They are absent in Nairobi group but present in all the others, either only laterally behind the mesothoracic spiracles (P. kenya, fig. 3 and C. pilosellae, fig. 30), or also in the median and the submedian areas in a transverse band (P. citriculus, fig. 20).
- (6) The basisternal setae (stn2s): Mostly arranged along the median longitudinal line of the basisternum.

The numbers of these setae vary in the different species and constitute useful key characters.

B. Pores: With the exception of Nairobi group, the meso-thorax carries a number of disc pores, usually associated with the spiracles, namely the mesospiracular disc pores (sp2p); sometimes a single submedian postmesostigmatal pore (pmp) also occurs on each side of the median line (e.g. Nipaecoccus spp. and M. hirsutus); in P. citriculus (fig. 20) one median pore only is always present.

3. THE METATHORAX:

The metathorax is largely membranous and the metathoracic sclerites are considerably reduced, as a result of the modification of the hind pair of wings into hamulohalterae. The metanotum overlaps the inflected mesopostnotum and is indicated externally by a pair of small lateral suspensorial sclerites (ss), attached to the base of the hamulohalterae by means of a fine sclerotized tendon. The metapostnotum (pn3) is represented at the posterior extremity of the metathorax by small subtriangular sclerites, one on each side of the median line; these sclerites are usually connected by a distinct transverse metapostnotal ridge (pn3r) (Planococcus, Pseudococcus and Saccharicoccus groups), but the ridge is weakly developed in Octococcus and Ceroputo groups, and entirely absent in Nairobi group (fig. 34). The metapostnotal ridge which is apparently absent in all other studied families, was overlooked by Theron (1958) and illustrated but not discussed by Giliomee (1961).

The metapleuron: The metapleural ridge (plr3) is well developed and articulates ventrally with the hind coxa; as the ridge obliquely extends antero-dorsally across the metapleuron, it attenuates near the middle where a small metapleural apophysis (pla3) is inwardly invaginated; at the lower part, the ridge separates two irregular, sclerotized areas, the anterior metepisternum (eps3), and the posterior metepimeron (epm3); dorsally it supports a minute metapleural wing process (pwp3). The precoxal ridge of the metathorax (pcr3) originates below the episternum and extends ventro-medially; this ridge while being well developed in Planococcus, Pseudococcus, Saccharicoccus and Octococcus groups, is comparatively weak in Ceroputo and Nairobi groups. The metathoracic spiracle (sp3) is identical with that of the mesothorax, and lies ventro-laterally in the membrane anterior to the metepisternum. The metasternum is represented by a pair of small submedian metasternal

apophyses (sta); according to Ghauri (1962) and Giliomee (1964) these apophyses are absent in Diaspididae and Coccidae. The metasternal plates are absent in Pseudococcidae (and Eriococcidae).

The dermal structures of the metathorax:

A. Setae: The fleshy setae occur in Pseudococcus group only, but the hair-like setae are present in all species. The metathoracic setae include the following groups:

- (1) The metatergal setae (mts): Usually present in sublateral clusters, and sometimes in a transverse band anterior to the metapostnotal sclerites.
- (2) The metapleural setae (mps): Occurring just behind the metathoracic spiracles.
- (3) The anterior metasternal setae (amss): Present in the median and the submedian areas on the membrane between the basisternum and the metasternal apophyses.
- (4) The postmetastigmatal setae (eps3s): Situated on the metepisternum along its antero-ventral margin, or just below it on the membranous area; this group of setae was found in P. citriculus only.
- (5) The posterior metasternal setae (pmss): Present medially on the metasternal membrane behind the metasternal apophyses.

B. Pores: The following groups of metathoracic derm pores, associated with the corresponding groups of setae, are recognized:

- (1) The metatergal pores (mtp): These are present in F. vingata and both the studied species of Ceroputo group only.
- (2) The metaspiracular pores (sp3p).
- (3) The anterior metasternal pores (amsp).
- (4) The posterior metasternal pores (pmsp).

4. THE WINGS AND THE HAMULOHALTERAE:

The fore-wings are membranous, large and elongate, rounded distally and narrow basally; the posterior margin of the wing is produced near its base to form a small alar lobe (al) which is adapted to receive the apically hooked seta of the hamulohaltera. The entire surface of the wing (except the area of the alar lobe) is evenly covered with minute hairs, the microtrichia. The venation is reduced to two veins, radius (rad) which is parallel to the anterior margin of the wing, and media (med) which distally curves towards the hind margin of the wing. Near their base, the wings usually carry a variable number of alar setae (als), and a dorsal compact row of few circular sensoria (sens.), just anterior to the radial vein.

The metathoracic wings are modified into small and elongate hamulohalterae (h). This term (singular hamulohaltera) was recently proposed for the coccid males by Kawecki (1965) as a substitute to what was referred to as "pseudohalteres" in his earlier paper (1958 b), or as "halteres" by other authors. On explaining the original definition of the word "halteres", Kawecki showed how correctly it could be applied for the second pair of wings in Diptera and male Strepsiptera, but emphasized that their different appearance, structure and function in Coccoidea demanded the adoption of another term. He also referred to the term "retinacoli", used by earlier authors, maintaining that it is equally erroneous because it denotes an apparatus for fastening the wings, located on the anterior pair. The writer is therefore inclined to adopt the proposed term since it seems to be more acceptable.

The hamulohaltera is membranous, supported along its anterior margin by a weak and slender hamulohalteral ridge (hr). This ridge was overlooked by many writers, but Jancke (1955) referred to a strengthening of the anterior margin of the hamulohaltera, and Giliomee (1964) described it as resembling a wing vein.

5. THE LEGS:

Three pairs of well developed legs, of variable lengths and stoutness, are present. The fore legs are usually the shortest and the hind legs the longest, but in Ceroputo group the middle legs are the shortest, and in Nipaecoccus spp. and O. africanus the fore and the middle legs are subequal. The legs consist of the usual segments, all of which (except the claw) are beset with numerous hair-like, and usually also fleshy setae.

The coxa (cx) is supported at its broad base by a well developed ridge; this ridge provides a small process dorsally, which articulates with the pleural ridge. The distal end of the coxa is narrower, and also supported by a ridge, which provides two processes, one on each side, serving for the articulation with the trochanter.

The trochanter (tr) with **sclerotized** basal and distal margins; this segment is divided into a relatively long proximal part and a short distal one, by means of a distinct constriction supported by a weakly developed short ridge. One comparatively long hair-like apical seta (ase) may occur on the outer side of the distal part (e.g. N. vastator and O. africanus). Three circular sensilla are usually arranged in a triangle on each side, but in few individuals two or four on one side were observed.

The femur (fem) is relatively long and stout, broadest near the distal end, where a ridge with two processes is well developed. Specialized setae or other structures are absent on the femur.

The tibia (tib) is usually the longest segment of the leg, but in few species (P. ireneus and S. sacchari) the tibia of the fore-leg is somewhat shorter than the femur; at its base, the tibia carries a ridge with two processes which articulate with the corresponding processes of the femur. The distal end of the tibia carries a pair of setae modified into strong spurs, and a varying number of smaller spines.

The tarsus (tar) is elongate, broad at the basal half and slightly tapers distally; composed of two tarsomeres, the first of which is very short, and the second much longer. A campaniform sensillum (cam.s) always present on the dorsal surface, at the base of the second tarsomere. Two long and apically-knobbed tarsal digitules (tdgt) are usually present near the apex of the tarsus; these digitules are absent in both Ceroputo and Nairobi groups.

The claw (cl) is slightly curved, uniformly tapering to a sharply pointed tip, and dorsally articulates with the tarsus; the ungual digitules (udgt), one on each side of the claw, are fine, with acute tips.

The ratios of several measurements of the legs were found to be taxonomically useful and the following were here employed: the length of the hind leg to the total body length; the width of the hind femur to its length; and the length of the femur to the length of the tibia in the front leg.

THE ABDOMEN:

The abdomen consists of the largely membranous pregenital segments and the sclerotized genital segment. The segmental boundaries are rather obscure, but the segmentation could be determined by the segmental arrangement of the setae (in transverse rows or bands, one on each segment).

1. The pregenital segments:

Eight pregenital abdominal segments are recognized, and considered to represent either I to VIII abdominal segments by some authors (Theron 1958, Ghauri 1962 and Giliomee 1964, and also here

adopted), or II to IX by the others (Beardsley 1960); Beardsley explained that his interpretation was based on the position of the posterior dorsal ostioles, equating their position with that established by Ferris (1950) for the females; Ferris ~~argues~~^{thinks} that the first abdominal segment (in the females) is completely absent, and that the posterior ostioles lie on what is morphologically the 7th abdominal segment. In a subsequent paper, Beardsley (1962) discussed Theron and Giliomee's views, and considered the abdominal segmentation in Pseudococcidae as an unsettled matter.

The first abdominal segment is developed dorsally and laterally only, and is indiscernible ventrally; this is indicated by a pair of small tergites, one on each side of the median line; similar, and even smaller tergites are usually also present on segment II and sometimes III. No tergites occur on segments IV to VII, but segment VIII carries a large, median tergal plate (at8). The ventral sclerotization is much reduced and only a pair of small, usually triangular plates represent the sternites of segment VIII.

The abdominal segment VI usually bears a pair of dorsal ostioles (ost) situated sub-laterally near the posterior margin of the segment; these ostioles are sometimes well developed, prominent and with a slit-like orifice (e.g. P. citri, D. alazon and S. sacchari), or ill-defined (e.g. P. obscurus, N. vastator and C. pilosellae), or absent altogether (e.g. N. nipae, O. africanus and N. bifrons). According to Beardsley (1964) two pairs of ostioles, though poorly defined, are present in the females and the apterous males of Phenacoleachia australis (Phenacoleachidae); apart from these (Pseudococcidae and Phenacoleachidae) the ostioles are not recorded in the females or the males of any other coccid family.

The dermal structures of the pregenital segments:

A. Setae: In Pseudococcus group, the dorsal and the ventral setae (ads & avs) are arranged in transverse bands, composed of both fleshy and hair-like setae; in the remaining groups where only the hair-like setae are present, they occur in segmental, transverse, irregular rows. The abdominal pleural setae (aps) are arranged in lateral groups.

B. Pores: A varying number of abdominal pleural pores (app) is usually present on segments I to VII; sometimes one or more segments of the abdomen are also with dorsal pores (adp) (e.g. O. africanus, fig. 28), or ventral pores (avp) (e.g. S. sacchari, fig. 24), or both (e.g. D. alazon, fig. 22). A cup-shaped glandular pouch (gp) is present on each side of segment VIII near its posterior margin, formed by a cluster of slightly smaller but numerous and tightly packed disc pores; within the pouch several setae (gls) originate, namely:

(a) A pair of long and stout "tail setae" (ts), arising from the centre of the pouch; in some groups these setae are comparatively short, i.e. the body more than 8 times as long (Nairobi group), or moderately long, i.e. the body 5 - 8 times as long (Ceroputo group), or long, i.e. the body 5 times as long or less (the remaining groups).

(b) There are also other shorter setae associated with the long ones: in Planococcus, Pseudococcus and Saccharicoccus groups, a much shorter seta, but conspicuously longer than the body setae, is always present; in Ceroputo and Nairobi groups, this seta is subequal in length to the other abdominal setae; in Octococcus group, two setae of medium but subequal lengths, and a short one are present.

In Ceroputo group, two pairs of glandular pouches and associated setae are present, one each on segments VII and VIII.

2. The genital segment and the external genitalia:

The genital segment is ventrally modified to form a penial sheath (ps) (or "genital valve" by Berlese 1893), which represents the fused lateral parts of the 9th sternum and distally terminates in a rather short projection, the style (st). A small sclerotized area occurs dorsally and probably represents the fused 9th tergite and the 10th segment (Theron 1958), behind which a small anus (an) is situated just anterior to the style. The style in lateral view, is slightly curved upwards (e.g. P. citri and D. alazon), or straight with a pointed apex (N. bifrons), or straight with a rounded apex (e.g. P. citriculus and O. africanus). Anteriorly, the ventro-lateral margin of the penial sheath is heavily sclerotized, forming a basal ridge (brps). The latter is usually interrupted medially and partly overlapped by the membrane of abdominal segment VIII forming there a pair of small internal projections (pr) (Giliomee 1961); in Nairobi group, the basal ridge of the penial sheath is medially continuous and its projections are absent. Ventrally, at a short distance behind the basal ridge, the penial sheath is longitudinally slit open to allow the protrusion of the aedeagus during copulation; the edges of this slit are sometimes produced each into a well pronounced and heavily sclerotized process (pro) (e.g. P. citri, figs. 1 & 2 and S. sacchari, figs. 24 & 25), or the process is vestigial (e.g. M. hirsutus, figs. 12 & 13 and O. africanus, figs. 28 & 29), or absent (e.g. P. citriculus, figs. 20 & 21 and N. bifrons, figs. 34 & 35). The term "process" was introduced by Giliomee (1961) ^{for} ~~to~~ the so-called "apophysis of the genital valve" used by Berlese (1893), "paramere-like projections" by Makel (1942) and "lobular extensions" by Theron (1958).

The aedeagus (aed) is connected to the ventral wall of the penial sheath, immediately behind the basal ridge, and supported there by a heavily sclerotized basal rod (bra). Dorsally, the aedeagus usually forms a curved tube, almost entirely concealed in the cavity of segment IX when at rest; in a few species (M. hirsutus, figs. 12 & 13 and

P. citriculus, figs. 20 & 21) the aedeagus is comparatively long and strongly curved anteriorly, reaching the cavity of segment VII. The ductus ejaculatorius enters the aedeagus through the internal genital aperture (iga) and runs posteriorly towards the gonopore at the apex of the penis (Giliomee 1961).

The dermal structures:

The setae of the genital segment (gts) are small and hair-like; dorsally, 3 setae are usually present on each side of the median line, near the base of the style, but in O. africanus (figs. 28 & 29) and C. insolitus (figs. 32 & 33) more than 3 setae are present. Ventrally, a varying number of setae occur on each side of the penial sheath. Few minute setal sensilla (pros) may be found on the process of the penial sheath (or its position if absent). Similar, minute sensilla (sts) may also occur dorsally on the style (N. bifrons, figs. 34 & 35).

C. THE APTEROUS MALES:

The only available wingless male form ^{was} ~~is~~ that of S. sacchari (figs. 26 & 27); these are slightly smaller than their winged counterparts. As a result of the complete absence of their wings and hamulohalterae, the sclerite and ridge degeneration is more pronounced, particularly in the mesothoracic region. The differences in body structures as compared with the winged males, are as follows:

THE HEAD: The separation of the head from the thorax by a neck region is hardly indicated. The midcranial ridge with its dorsal, lateral and ventral arms is entirely absent. The ocular ridges (preocular, interocular and postocular) are weakly developed and reduced to variable degrees. The dorsal and the ventral simple eyes are completely missing

and the antennae are 8-segmented and comparatively short.

THE THORAX:

Prothorax: The pronotal ridge is more or less reduced and sometimes absent altogether; the pronotal sclerites and the prosternum are conspicuously reduced.

Mesothorax: The mesotergum is represented only by a weakly sclerotized median sclerite; the dorsal subdivisions of the mesothorax with its associated structures and apodemes are entirely absent. The mesopleuron is greatly reduced and only an atrophied pleural ridge supporting anteriorly a small episternum, and posteriorly a vestigial epimeron, persists. The mesosternum is represented by a weakly sclerotized basisternum, whose posterior margin is invaginated into a vestigial furca.

Metathorax: The metanotum is indicated by a transverse median narrow sclerotized patch. A short pleural ridge, a small episternum and a small epimeron, represent the metapleuron. The metasternum is largely membranous and the metasternal apophyses are absent.

THE ABDOMEN:

The sclerite degeneration is less pronounced in the abdomen; transverse median narrow tergites and sternites are present on all the pregenital abdominal segments. The genital segment and the external genitalia are identical with those of the macropterous forms.

IV (A) DESCRIPTION OF THE SPECIES OF
PSEUDOCOCCIDAE

The following descriptions, conforming with those of Ghauri (1962) and Giliomee (1964) for Diaspididae and Coccidae respectively, contain all morphological details which could be observed; some of these might seem unnecessary, but was consciously done since the evaluation of the importance of the various characters has yet to be decisively determined.

PLANOCOCCUS GROUP:

GENUS PLANOCOCCUS:

(1) PLANOCOCCUS CITRI (RISSO) (Plate I, figs. 1 and 2)

The males of this species were studied in a much lesser detail by Newstead (1903), Leonardi (1920), Green (1922), Makel (1942), Jancke (1955), Theron (1958) and Beardsley (1960).

The winged forms only known; living individuals light brown in colour, with much darker thorax and a blackish tinge on the wings. A narrow and slender species, moderately long, with moderately long antennae and legs. When mounted 966 - 1232 (1120) μ long, 266 - 308 (280) μ wide at mesothorax and 2142 - 2380 (2282) μ wing expanse.

The body setae and derm pores: The antennae and the legs with numerous fleshy and few hair-like setae of subequal lengths, about 31 μ long on the antennae and 24 μ long on the legs; the body itself with hair-like setae only, also about 24 μ long. Quadrilocular and occasionally trilocular and quinquelocular disc pores, about 6 μ in diameter present on the head, the thorax and the abdomen.

PLATE I

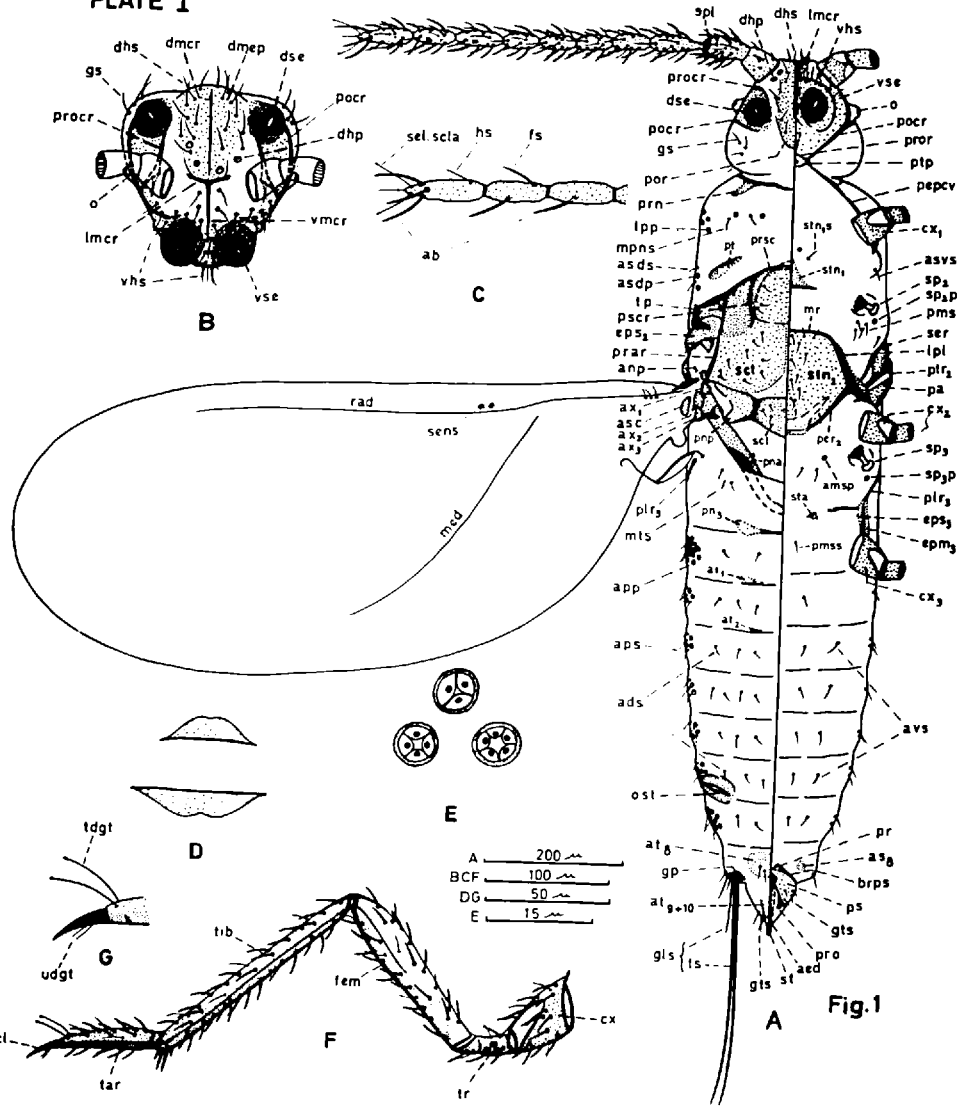
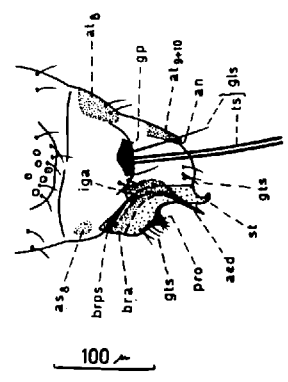
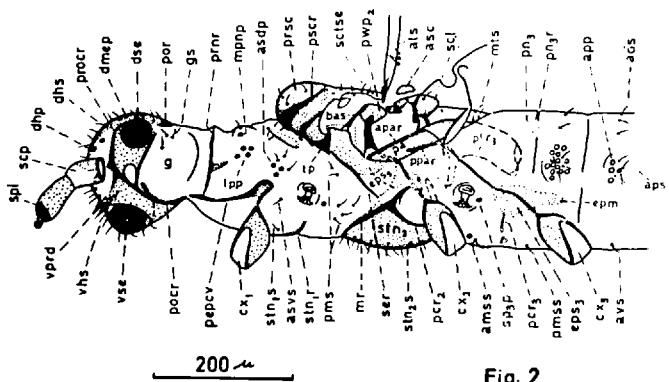


Fig. 2



Head: Irregular tetrahedron; widest across the genae, tapering anteriorly and ventrally; the ventral preocular depression (vprd) moderately pronounced. Length from apex to postoccipital ridge 113 - 128 (122) μ ; from apex to neck 153 - 174 (165) μ ; width across the genae 183 - 214 (198) μ . The dorsal arm of the midcranial ridge (dmcr) slender, anteriorly separated from the other arms and reaching the posterior margins of the dorsal eyes. The ventral arm (vmcr) well developed, anteriorly giving off the two lateral arms of the midcranial ridge (lmcr) and forming together a distinct Y-shaped ridge (fig.1,B). The postoccipital ridge (por) slender, U-shaped and with the anterior ends extending towards, but not reaching the preocular ridges; this ridge was described by Theron (1958) as two short meniscate ridges but in the examined specimens, the ridge was found medially continuous. The dorsomedial part of the epicranium (dmep) slightly raised. The preocular + the interocular ridges strong, joining the postocular ridge (pocr) just below the ocellus; a sclerotized rudiment of the preocular ridge below the articular process, well marked. The genae (g) membranous. The eyes: The corneae of the dorsal simple eyes (dse) 18 - 24 (21) μ in diameter and both separated by 92 - 104 (95) μ , i.e. 3.8 - 5.6 (4.1) times their diameter apart. The ventral simple eyes slightly larger, 24 - 31 (28) μ in diameter and 24 - 43 (31) μ apart. The lateral ocelli (o) well developed. The cranial apophysis apically truncate; the tentorial bridge slender and the anterior tentorial arms fused just before meeting the apophysis. The dorsal head setae (dhs) 7 - 12 (9.3) h.s. on each side of the median line; each gena always with 3 hair-like genal setae (gs). The ventral head setae (vhs) present in 3 well defined groups on each side: a group of 2 - 3 (2.6) h.s. forming on both sides an irregular longitudinal row along the median line between the ventral eyes; a group of 6 - 10 (7.9) h.s. forming with their partners of the other side a transverse band in front of the ventral eyes; a group of 2 - 4 (3.2) h.s. present anteriorly in a longitudinal row on each side of the ventral arm of the midcranial ridge. The head pores: Two

dorsal head pores (dhp) always occur on each side near the base of the antennal scape.

Antennae: Filiform; normally 10-segmented but sometimes two or more adjacent segments of the flagellum fused or incompletely separated; 589 - 631 (616) μ long, i.e. somewhat longer than half the body length (the ratio 1:1.6 - 1.9, av. 1.8), and somewhat shorter than the hind legs, the ratio 1:1.1 - 1.2 (1.16). Scape (scp) 37 - 43 (40) μ long and just as wide at the base; with 4 - 7 (5.6) h.s. Pedical (pdc) 58 - 64 (61) μ long and 34 - 37 (35) μ wide; with 19 - 26 (22.9) f.s., 3 - 10 (6.9) h.s. and a sensillum placodeum. Flagellum: Segment III club-shaped, about as long as segment X, and both being longest of all (the ratio lengths of segments III to X 1:0.9 - 1.1, av. 1.0); the ratio width to length of segment III 1:3.3 - 4.1 (3.9). Segments IV to X cylindrical and 21 - 24 (22) μ wide; the ratio width to length of segment IX being 1:2.4 - 3.0 (2.8). In the following table the lengths of segments III to X and the number of setae on each given:

	III	IV	V	VI	VII	VIII	IX	X
lengths in	76-89	49-55	52-61	55-64	55-64	61-64	58-64	78-89
(av.) μ	(82)	(52)	(55)	(61)	(61)	(63)	(61)	(82)
f.s.	10-17	11-18	13-18	13-18	13-20	12-16	12-17	13-20
(av.)	(12.8)	(12.9)	(14.8)	(15.5)	(14.7)	(14.2)	(14.1)	(16.1)
h.s.	2-5	1-3	1-3	1-3	1-2	1-2	1-2	1-3
(av.)	(3)	(1.8)	(2.2)	(1.9)	(1.6)	(1.7)	(1.4)	(2)

The antennal bristles (ab) easily distinguishable from the fleshy setae; segments VIII and IX each with a ventral bristle, about 43μ long. Segment X with 3 preapical bristles, two lateral, also about 43μ long and one dorsal, slightly shorter, this segment also with two capitate subapical setae (set. sola), about 40μ long, and one apical hair-like seta.

Thorax: 426 - 540 (486) μ long. Prothorax: Pronotal ridges (pmr) medially interrupted at a weak point. Lateral pronotal sclerites (pm) and posttergites (pt) small. Proepisternum + cervical sclerite (pepcv) well developed, with the usual constriction which indicates the point of fusion between the two component parts; Theron (1958) called it propleuron + cervical sclerite regarding it as a ridge-like structure but according to the writer's observations, the small episternum is distinct and its dorsal margin only ridge-like. The (pepcv) posteriorly articulates with the coxa by means of a short propleural ridge above which a small apophysis invaginated. Prosternum (stnl) triangular, 31 - 46 (40) μ long; posteriorly bounded by a transverse, 70 - 92 (79) μ long prosternal ridge (stnlr). Prothoracic setae on each side: Medial pronotal setae (mpns) 1 - 2 (1.4) h.s.; lateral pronotal setae usually absent but one seta may occasionally occur on either side (av.0.2). 2 - 4 (2.9) hair-like antespiracular dorsal setae (asds) and a single antespiracular ventral seta (asvs) always present. Prosternal setae (stnls) usually one and occasionally two (av.1.1) h.s. Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 1 - 2 (1.2.); lateral pronotal pores (lpp) 3 - 6 (4.3); antespiracular dorsal pores (asdp) 2 - 3 (2.2). Ventral prosternal pores 0-2 (0.5)

Mesothorax: Prescutum (prcs) subrectangular in dorsal view; 70 - 82 (79) μ long and 107 - 119 (116) μ wide (ratio 1:1.4 - 1.6, av. 1.5); laterally bounded by the prescutal ridge (pscr) and posteriorly by the prescutal suture. Scutum (sct) comparatively

large, with the antero-lateral extremities heavily sclerotized and with a narrow median longitudinal membranous area; the (sct) 107 - 116 (110) μ long, i.e. the ratio lengths of (prsc) to (sct) 1:1.3 - 1.5 (1.4). Prealare, prealar ridge, triangular plate (tp), tegula (teg), anterior and posterior notal wing processes (anp & pnp) well developed. Scutellum (scl) pentagonal, 49 - 61 (55) μ long and 89 - 104 (95) μ wide, the ratio being 1:1.6 - 1.9 (1.7) and the ratio its length to the length of (sct) 1:1.8 - 2.3 (2.0). Postalare (pa) with well separated anterior and posterior postalar ridges (apar & ppar); postnotal apophysis strong. Mesopleuron: Mesopleural ridge (plr2) interrupted at a short distance above the coxal articulation; Theron (1958) neither commented on this interruption nor showed it in his illustrations. Mesopleural apophysis, mesopleural wing process (pwp2), basalare and subepisternal ridge (ser) well developed; subalare small. The two parts of the episternum (eps2) weakly sclerotized; lateropleurite (lpl) thin; mesepimeron small. Mesosternum: Basisternum (stn2) 134 - 143 (140) μ long and 156 - 183 (171) μ wide; bounded antero-laterally and posteriorly by the marginal and the precoxal ridges (mr & pcr2) respectively; furca strong. Mesothoracic spiracles (sp2) 15 - 21 (18) μ wide at opening, with 31 - 37 (34) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 2 - 5 (3.3) h.s.; scutal setae (sctse) 9 - 12 (10.1) h.s.; scutellar setae 2 - 4 (3.1) h.s.; tegular setae 1 - 3 (1.9). Postmesostigmatal setae (pms) absent medially and occur laterally in two groups behind the spiracle, the dorso-lateral group comprising 1 - 3 (1.7) h.s., and the ventro-lateral with 4 - 6 (5.1) h.s. The basisternal setae (stn2s) 9 - 16 (12.6) h.s. Mesothoracic disc pores: 1 - 2 (1.3) Mesospiracular pores (sp2p) present behind each spiracle.

Metathorax: Metapostnotal sclerites (pn3) medially connected by the distinct, transverse metapostnotal ridge (pn3r); the latter which appears to be of taxonomic importance was overlooked by Theron (1958). The metapleural ridge (plr3) attenuates near the middle at

a small pleural apophysis; the metapleural ridge dorsally merges into a small metapleural wing process. The metepisternum (eps3) dorsally supports the precoxal ridge of metathorax (pcr3); metepimeron (epm3) irregularly triangular. The metasternal apophysis (sta) whose absence was emphasized by Theron (1958) and regarded as a specialized feature of the lecanoid type of male (which includes P. citri as a representative of Pseudococcidae), is definitely present. Metathoracic spiracle (sp3) identical with the mesothoracic. Metathoracic setae on each side: A submedian group of 3 hair-like metatergal setae (mts) always present; metapleural setae usually absent, but one seta was found in one specimen (av.0.1); anterior metasternal setae (amss) 1 - 2 (1.9) forming with their partners of the other side a short median transverse row; posterior metasternal setae (pms) 1 - 2 (1.7) h.s. in a similar arrangement. Metathoracic pores: 1 - 2 (1.1) metaspiracular pores (sp3p) present behind each spiracle and a single anterior metasternal pore (amsp) may occur on either side (av.0.5); posterior metasternal pores absent.

Wings: Hyaline; 938 - 1050 (1008) μ long and 378 - 476 (420) μ wide; usually with 3 hair-like alar setae (als) (4 setae observed in one occasion, av.3.1); a compact row of 2 - 3 (2.2) minute circular sensoria (sens.) also apparent. Hamulohalterae 70 - 76 (74) μ long and about 15 μ wide; with a weak ridge (hr) and an apical, 61 - 67 (64) μ long hooked seta, i.e. the seta slightly shorter than the hamulohaltera, the ratio their lengths being 1:1.1 - 1.2 (1.15).

Legs: Comparatively long and moderately stout; the ratio length of the hind leg to the total body length 1:1.3 - 1.7 (1.6). Coxa (cx) and trochanter (tr) about 46 and 24 μ wide; the proximal part of the latter longer than the distal and with 3 circular sensilla on each side. Femur (fem) about 37 μ wide; that of the fore leg shortest and that of the hind leg longest; the ratio width to length of the hind femur

1:5.2 - 5.8 (5.4). Tibia (tib) 21μ wide; with 2 strong apical spurs and 2 - 4 smaller spines; in front leg, the femur shorter than the tibia, the ratio their lengths 1:1.1 - 1.2 (1.13). The distal segment of the tarsus (tar) about 21μ wide; tarsal digitules (tdgt) apically knobbed, 34 - 40 (37) μ long. Claw (cl) gradually tapering, 34 - 40 (37) μ long; ungual digitules (udgt) extremely fine, about 15μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore Leg	Middle Leg	Hind Leg
	length	37 - 46 (40) μ	40 - 49 (43) μ	46 - 52 (49) μ
Coxa	f.s.	10 - 18 (13.2)	12 - 19 (15.1)	13 - 22 (17.3)
(cx)	h.s.	5 - 9 (6.8)	5 - 10 (6.2)	6 - 11 (8.8)
<hr/>				
	length	55 - 61 (59) μ	55 - 61 (60) μ	58 - 64 (62) μ
Trochanter	f.s.	3 - 8 (4.3)	3 - 9 (5.9)	4 - 9 (6.4)
(tr)	h.s.	2 - 4 (2.9)	2 - 4 (3.0)	2 - 5 (3.2)
<hr/>				
	length	177-183 (180) μ	183-198 (189) μ	192 - 211 (198) μ
Femur	f.s.	22 - 31 (26.9)	25 - 36 (28.6)	32 - 45 (36.4)
(fem)	h.s.	4 - 7 (5.0)	4 - 8 (5.9)	5 - 9 (6.9)
<hr/>				
	length	201 - 211 (204) μ	217-232 (223) μ	256-278 (265) μ
Tibia	f.s.	36 - 47 (41.6)	43 - 54 (47.6)	52 - 64 (58.3)
(tib)	h.s.	5 - 9 (6.8)	6 - 9 (7.3)	5 - 9 (7.1)
<hr/>				
	length	89 - 95 (92) μ	89 - 98 (95) μ	101-107 (104) μ
Tarsus	f.s.	21 - 27 (23.7)	22 - 34 (26.5)	24 - 37 (28.8)
(tar)	h.s.	2 - 5 (3.1)	3 - 6 (4.2)	3 - 7 (4.6)
<hr/>				
Total length of leg		598-619 (607) μ	628-662 (641) μ	695-735 (714) μ

Abdomen: 304 - 494 (395) μ long and 220 - 289 (258) μ wide. The tergites of segments I and II small; that of segment VIII large and that of segments IX + X (at 9 + 10) distinct. Sternites of segment VIII weakly sclerotized. Ostioles (ost) well developed, 27 - 34 (30) μ long at orifice. Abdominal setae: Dorsal and ventral setae (ads & avs) in segmental transverse rows; pleural setae (aps) in lateral groups. All abdominal setae of subequal lengths except a pleural seta on each side of segment VIII which is conspicuously longer. Abdominal disc pores in lateral groups. The following table shows the number of the abdominal setae and pores on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 3 (2.7)	3 - 4 (3.1)	3 - 4 (3.2)	3 - 4 (3.3)	3 - 4 (3.3)	(3)	2 - 3 (2.2)	(2)
(aps)	3 - 4 (3.3)	3 - 4 (3.6)	4 - 5 (4.3)	4 - 5 (4.3)	4 - 5 (4.6)	4 - 5 (4.2)	4 - 5 (4.5)	*1+2 - 3 (2.2)
(avs)	-	1 - 2 (1.3)	2 - 3 (2.6)	2 - 3 (2.1)	(2)	2 - 3 (2.1)	2 - 3 (2.1)	0
(app)	11 - 18 (14.1)	2 - 4 (3.1)	2 - 4 (2.7)	2 - 4 (2.7)	2 - 4 (3.2)	3 - 6 (4)	5 - 8 (6.2)	0

* A longer seta.

Glandular pouches (gp) well developed; the setae of the glandular pouch (gls) include a pair of long tail setae (ts), 299 - 342 (323) μ long and one seta, 70 - 104 (82) μ long, i.e. the ratio lengths of the (ts) to the length of the body 1:3.0 - 3.7 (3.5).

Genital segment comparatively small; conical in dorsal view, with a short and narrow style (st), which is curved upwards in lateral view. The penial sheath 107 - 113 (109) μ long and 73 - 82 (76) μ wide (the ratio 1.3 - 1.5, av. 1.4:1 and the ratio its length to the total body length 1:8.8 - 11.4, av. 10.2). Basal ridge of the penial sheath (brps) with a small projection (pr). Process of the penial sheath (pro) well pronounced and sclerotized, with 3 - 4 minute setal sensilla. Aedeagus (aed) relatively short, dorso-posteriorly curving from its basal rod (bra) towards its pointed apex; internal genital aperture (iga) distinct. Setae of the genital segment (gts): Dorsally, 3 hair-like setae always present on each side near the base of the style; ventrally a group of 3 - 5 (4.1) h.s. occur on each side of the penial sheath.

Material: 10 specimens were studied, collected by M. Kosztarab, on Coleus sp. (in green houses), in Ohio State University, Columbus, Ohio, U.S.A., on May 6th, 1961.

Other material: The writer also produced adult males of this species from the following sources:

On Ivy (Hedera helix), in Week's Hall, one of Imperial College residential buildings, South Kensington, during the second week of June 1963.

On Solanum sp., in the gardens of Manial Palace, Cairo, Egypt, U.A.R., during the second and third weeks of August 1964.

On Rhapes sp., same as above.

On Croton sp., in the Botanic gardens of Zohreya (green houses), Cairo, Egypt, U.A.R., also during the second week of August 1964.

On potato sprouts received from Dr. D. J. Williams on January 30th, 1965. The culture was sent from Angola, West Africa where the

insect was reported causing tremendous damage to potatoes. Dr. Williams although ^{he} identified the females as P. citri, was somewhat doubtful; the pleural prothoracic group of ducts, normally found anterior to, and around the spiracles in this species, were absent. When the males were mounted and examined, they completely agreed with the typical specimens.

(2) PLANOCOCCUS KENYAE (LE PELLEY) (Plate II, fig. 3)

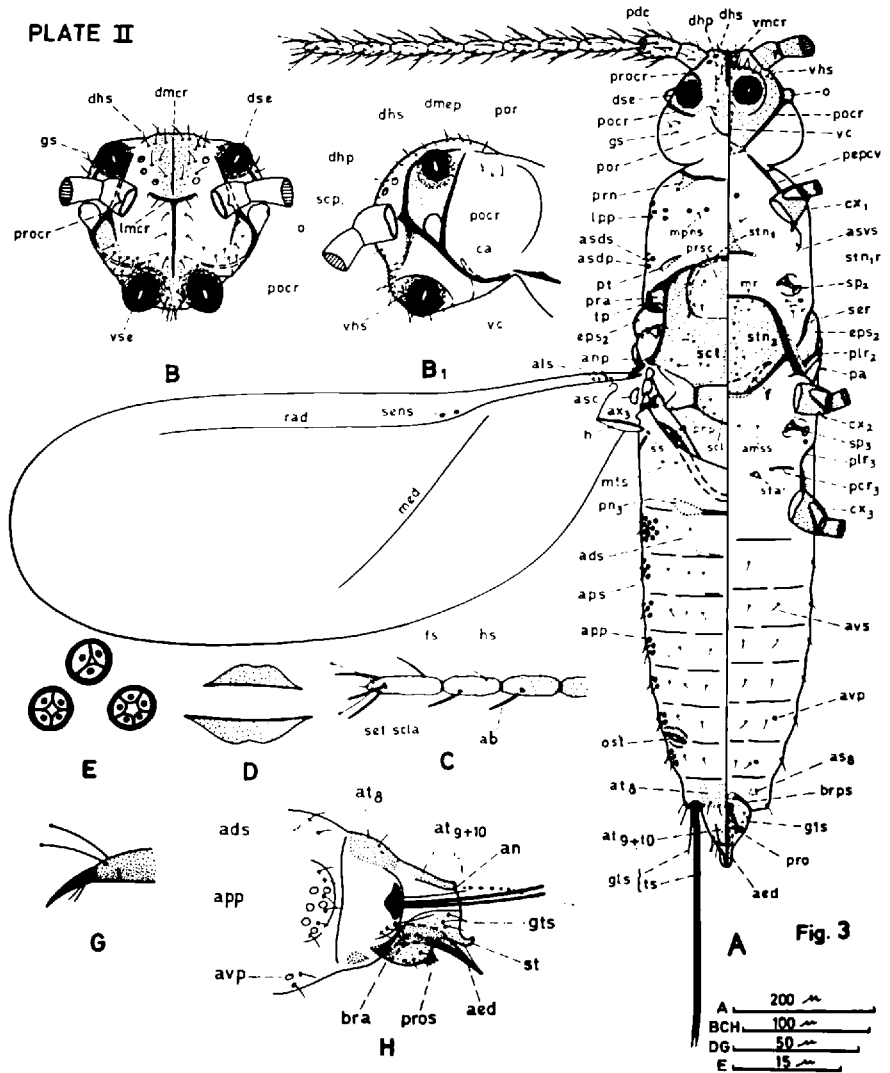
The macropterous forms only known; these narrow and slender, of medium size, with comparatively short antennae and long legs. Mounted specimens 1092 - 1204 (1162) μ long, 252 - 294 (280) μ wide at mesothorax and 2352 - 2576 (2478) μ wing expanse.

Body setae and pores: The antennae and the legs with numerous fleshy and a few hair-like setae, about 31 μ long on the former and 24 μ on the latter; the body itself with hair-like setae only, about 24 μ long. Quadriocular and sometimes trilocular or quinquelocular disc pores, about 6 μ in diameter, always present on the head, thorax and abdomen.

Head: Sub-tetrahedron; sub-triangular in dorsal and front views; Ventral preocular depression well pronounced in lateral view. Length from apex to postoccipital ridge 113 - 134 (122) μ ; from apex to neck 153 - 174 (168) μ ; width across the genae 180 - 207 (195) μ . The dorsal arm of the midcranial ridge (dmcr) slender, anteriorly detached from other arms, and almost reaching the posterior level of the dorsal eyes. The ventral and the lateral arms (vmcr & lmcr) forming together a Y-shaped ridge. The postoccipital ridge (por) U-shaped, not reaching the preocular ridges anteriorly. Dorsomedial part of the epicranium (dmep) slightly raised. Preocular + interocular ridges well developed, posteriorly fused with the postocular ridge (pocr) below the ocellus. A distinct ventral rudiment of the preocular ridge present below the articular process. Preoral ridge slender.

Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head; their corneae 21 - 27 (24) μ in diameter, and both separated by 85 - 98 (92) μ , i.e. 3.5 - 4.0 (3.8) their diameter apart. The ventral simple eyes (vse) larger and much closer, 27 - 34 (31) μ in diameter and 18-24 (21) μ apart. The lateral ocelli (o) well developed. Ocular sclerite traversed by the interocular ridge and divided into dorsal and ventral parts. Cranial apophysis (ca) apically truncate. Tentorial bridge slender. Dorsal head setae (dhs): 9 - 12

PLATE II



(10.2) h.s. present on each side of the (dmcr) anterior to the postoccipital ridge; each gena usually with 3 and occasionally 2 (av. 2.8) hair-like genal setae (gs). Ventral head setae (vhs) on each side of the median line as follows:- 2 - 4 (3.4) h.s. longitudinally arranged along the median line between the ventral eyes; 7 - 10 (8.6) h.s. in the area of the ventral preocular depression, forming with their partners of the other side a transverse band; anteriorly, 3 - 4 (3.3) h.s. in a longitudinal row on each side of the ventral arm of the midcranial ridge. Head pores: Usually 2 pores, and occasionally 3 or 4 (av. 2.3), present dorsally near the base of each antenna.

Antennae: Filiform; 10 segmented; 509 - 641 (577) μ long, i.e. about half the body length, the ratio being 1:1.8 - 2.2 (2.0), and slightly shorter than the hind leg, the ratio 1:1.1 - 1.3 (1.2). Scapae 37 - 43 (40) μ long and 34 - 40 (37) μ wide at base; with 5 - 7 (5.9) h.s. Pedicel (pdc) 55 - 64 (60) μ long and 31 - 37 (34) μ wide at widest; with 12 - 23 (17.3) f.s., 6 - 11 (8.9) h.s. and a sensillum placodeum. Flagellum: Segment III club-shaped, longest of all (the ratio its length to the length of segment X 1.1 - 1.3, av. 1.2:1) and about 21 μ wide (the ratio its width to its length 1:3.8 - 5.2, av. 4.3). Segments IV to X cylindrical, the terminal being apically rounded; with irregular margins and 18 - 21 (20) μ wide (the ratio width to length of segment IX 1:2.4 - 2.9, av. 2.5). The lengths of the flagellar segments and the number of setae on each as follows:-

	III	IV	V	VI	VII	VIII	IX	X
length	73-98	40-58	46-58	46-58	46-58	49-64	46-61	67-82
(av.)	(85) μ	(52) μ	(52) μ	(53) μ	(53) μ	(55) μ	(52) μ	(73) μ
f.s.	5-12	6-11	8-15	9-17	8-16	9-18	9-14	10-18
(av.)	(8.7)	(8.9)	(11.2)	(13.1)	(12.4)	(12.9)	(11.8)	(13.7)
h.s.	3-6	1-3	1-3	1-4	1-4	1-4	1-3	1-4
(av.)	(4.1)	(2.1)	(2.3)	(1.9)	(2.1)	(2.2)	(1.9)	(2.3)

Antennal bristles (ab) much stouter than the fleshy setae and easily recognized; segments VIII and IX each with a ventral bristle, about 40μ long; segment X with two preapical lateral bristles of about the same length and a dorsal one slightly shorter, at a greater distance from the apex. Terminal segment also with two subapical sensory setae (set. scl.) about 43μ long, and one apical hair-like seta.

Thorax: 479 - 555 (524) μ long. Prothorax: pronotal ridge well developed though medially interrupted by a weak sclerotization; lateral pronotal sclerites (prn) moderately large and well sclerotized. Posttergites (pt) small and narrow. Proepisternum with a ridge-like dorsal margin. Prosternum (stnl) triangular, 31 - 43 (37) μ long; prosternal ridge 79 - 95 (85) μ long. Prothoracic setae on each side of the median line as follows: One medial pronotal seta usually present, but sometimes absent on either or both sides (av. 0.8); lateral pronotal and posttergital setae absent. Antespiracular dorsal setae (asds) 1 - 3 (2.1) and one antespiracular ventral seta (asvs) always occur. One prosternal seta present. Prothoracic disc pores on each side: medial pronotal pores 2 - 4 (3.2); lateral pronotal pores (lpp) 2 - 6 (4.1); antespiracular dorsal pores (asdp) 2 - 5 (3.4). Prosternal pores usually 1 - 2, but sometimes 3 pores may occur on either side or the pores may be absent altogether (av. 1.6).

Mesothorax: Prescutum (prsc) subrectangular in dorsal view; 76 - 89 (82) μ long and 104 - 122 (119) μ wide, the ratio being 1:1.3 - 1.6 (1.4); prescutal ridges well developed and prescutal suture distinct. Scutum (sct) large, heavily sclerotized antero-laterally and with a median longitudinal narrow membranous area; scutum 95 - 116 (104) μ long, i.e. the ratio length of (prsc) to (sct) 1:1.1 - 1.4 (1.3). Prealare (pra), prealar ridge, triangular plate (tp), tegula, anterior and posterior notal wing processes (anp & pnp) well developed.

Scutellum (scl) pentagonal, 46 - 58 (52) μ long, 82 - 101 (92) μ wide, i.e. the ratio 1:1.7 - 1.9 (1.8) and the ratio its length to the length of (sct) 1:1.9 - 2.2 (2.0). The anterior and the posterior ridges of the postalare (pa) well separated; postnotal apophysis strong. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; mesopleural apophysis, mesopleural wing process, basalare and subepisternal ridge (ser) well developed. The two parts of the mesepisternum (eps2) well-defined and the lateropleurite narrow; mesepimeron well sclerotized. Mesoternum: Basisternum (stn2) 128 - 146 (140) μ long and 156 - 183 (171) μ wide; the marginal (mr) and the precoxal ridges well developed; furca (f) strong. Mesothoracic spiracle (sp2) 15 - 21 (18) μ wide at opening, with a 34 - 40 (37) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 4 - 6 (4.6); scutal setae 6 - 9 (7.5); scutellar setae 2 - 3 (2.5). Tegular setae 2 - 3 (2.1); postmesostigmatal setae 4 - 7 (5.1), occurring laterally behind each spiracle and absent medially. Basisternal setae 9 - 14 (11.4), mostly arranged along the median line. Mesothoracic disc pores: 1 - 2 mesospiracular pores usually present behind each spiracle, but sometimes entirely absent (av. 0.9).

Metathorax: Metapostnotal sclerites (pn3) well defined and the median metapostnotal ridge distinct. Metapleural ridge (plr3) attenuating near the middle at the position of the metapleural apophysis; metapleural wing process small. Precoxal ridge of metathorax (pcr3) well developed; metepisternum, metepimeron and metasternal apophysis (sta) well defined. Metathoracic spiracle (sp3) similar to the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) 2 - 3 (2.7); metapleural setae absent; anterior metasternal setae (amss) 1 - 3 (2.3), forming with their partners of the other side a median transverse row; posterior metasternal setae 0 - 2 (0.4). Metathoracic disc pores on each side: Metathoracic pores 0 - 1 (0.3); anterior metasternal pores 0 - 2 (1.2); other pores absent on the metathorax.

Wings: Hyaline and elongate; 1064 - 1162 (1120) μ long and 406 - 462 (434) μ wide; usually with 4 hair-like alar setae (als) and occasionally 3 or 5 (av. 3.9); a compact row of 2 - 3 (2.3) minute circular sensoria (sens.) also present. Axillary and additional sclerites distinct. Hamulohalterae (h) 67 - 89 (73) μ long and 15 - 18 (16) μ wide; with a slender ridge and a 61 - 67 (64) μ long apically hooked seta, i.e. the ratio length of seta to the length of the hamulohaltera 1:1 - 1.2 (1.1).

Legs: Comparatively long and moderately stout; the ratio length of the hind legs to the total body length 1:1.5 - 1.8 (1.7). Coxa and trochanter about 46 and 24 μ wide respectively; the proximal part conspicuously longer than the distal and with 3 circular sensilla on each side. Femur about 37 μ wide; that of the middle leg shortest and that of the hind leg longest; the ratio width to length of the hind femur 1:5.5 - 6.3 (5.7). Tibia about 21 μ wide; with 2 apical strong spurs and 2 - 4 smaller spines; in the front legs the femur is slightly shorter than the tibia, the ratio their length 1:1.04 - 1.2 (1.1). The tarsus about 21 μ wide; tarsal digitules apically knobbed, 37 - 43 (40) μ long. Claw gradually tapering towards a pointed end; 34 - 40 (37) μ long; ungual digitules with acute tips, about 15 μ long. In the following table, the lengths of the leg segments and the number of setae on each are given:

		Fore-leg	Middle leg	Hind leg
Coxa	length	40-46 (44) μ	43-49 (46) μ	46-52 (48) μ
	f.s.	13-19 (15.6)	14-19 (16.2)	15-21 (17.8)
	h.s.	4-8 (6.2)	5-8 (6.4)	5-10 (7.8)
Trochanter	length	58-64 (62) μ	58-64 (62) μ	61-70 (65) μ
	f.s.	5-8 (6.6)	5-9 (6.2)	6-9 (7.6)
	h.s.	2-4 (3.2)	2-4 (3.0)	2-4 (3.2)
Femur	length	174-189 (183) μ	171-186 (177) μ	183-211 (192) μ
	f.s.	24-32 (27.6)	24-30 (26.4)	31-43 (37.2)
	h.s.	4-8 (5.8)	4-8 (5.2)	4-9 (6.8)
Tibia	length	180-214 (195) μ	192-223 (207) μ	238-265 (253) μ
	f.s.	33-46 (40.6)	39-51 (45.4)	47-58 (53.6)
	h.s.	5-8 (6.6)	5-9 (7.2)	6-9 (7.4)
Tarsus	length	85-92 (88) μ	85-92 (89) μ	92-101 (95) μ
	f.s.	20-26 (23.2)	21-28 (24.8)	24-31 (27.4)
	h.s.	3-5 (3.6)	3-6 (4.4)	3-6 (4.8)
Total length of leg		577-634 (604) μ	586-637 (613) μ	665-738 (692) μ

Abdomen: 388 - 441 (418) μ long and 236 - 274 (251) μ wide. The tergites of segments I and II small and narrow; those of segments VIII and IX + X distinct. Sternites of segment VIII (as 8) weak. Ostioles (ost) well developed, 31 - 37 (34) μ long at orifice. Abdominal setae segmentally arranged in transverse dorsal and ventral rows (ads & avs); pleural setae (aps) in lateral clusters. All

abdominal setae of subequal lengths except one pleural seta of segment VIII which is somewhat longer. Abdominal disc pores: pleural pores (app) relatively numerous on segment I, and much fewer on segments II to VII; one or two ventral pores (avp) occur at least on one side of segment VII and sometimes segment VIII; dorsal pores absent. The number of the abdominal setae and pores on each side of the median line are given in the following table:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 3 (2.4)	2 - 3 (2.3)	2 - 3 (2.6)	2 - 3 (2.8)	2 - 3 (2.8)	2 - 3 (2.4)	2 - 3 (2.3)	(2)
(aps)	2 - 4 (2.8)	3 - 4 (3.6)	4 - 5 (4.4)	4 - 5 (4.5)	4 - 5 (4.6)	4 - 5 (4.2)	4 - 5 (4.7)	*1 + (2)
(avs)	-	(1)	2 - 3 (2.7)	(2)	(2)	2 - 3 (2.1)	(2)	0
(app)	9-16 (12.2)	3-5 (3.7)	2 - 4 (2.9)	2 - 5 (3.1)	2 - 4 (2.9)	3 - 4 (3.4)	3 - 6 (4.6)	0
(avp)	-	0	0	0	0	0 - 1 (0.4)	0 - 2 (1.1)	0

* A slightly longer seta.

Glandular pouches well developed; setae of the glandular pouch (gls) consist of a pair of 336 - 366 (351) μ long tail setae (ts), and one seta of medium length (70 - 92, av. 79 μ long); i.e. the ratio length of the tail setae to the total body length 1:3.1 - 3.4 (3.3).

Genital segment small; triangular in dorsal view, with a short narrow style (st); the latter curving upwards in lateral view. The penial sheath 98 - 110 (104) μ long and 70 - 82 (76) μ wide, i.e. the ratio length to width 1.2 - 1.5 (1.4):1, and the ratio its length to the total body length 1:10.1 - 12.5 (11.2). Basal ridge of the penial sheath (brps) with a small projection. Process of the penial sheath (pro) well pronounced and usually with 3 - 4 minute setal sensilla. Aedeagus relatively long and broad, dorso-posteriorly curving from its basal rod (bra); with a wide internal genital aperture. Setae of the genital segment (gts): Dorsally, 3 h.s. always present on each side near the base of the style; ventrally 3 - 4 (3.5) slightly smaller setae occur on each side of the penial sheath.

Material: 10 specimens examined, collected by T. J. Crowe, on Coffea arabica, in Ruiru, Kenya on 25.9.1962.

Remarks: This species although closely related to P. citri, could be separated by having: the third antennal segment longer than the terminal; the femur of the middle leg shortest; a ventral pore, at least on one side of abdominal segment VII; a comparatively stouter aedeagus.

(3) PLANOCOCCUS DIOSCOREAE WILLIAMS (Plate III, figs. 4 & 5)

Only the winged forms known; living specimens not available. The mounted males narrow and slender, of medium or large size, with short antennae and moderately long legs. The total length of the body 1246 - 1400 (1330) μ , the width at mesothorax 280 - 308 (290) μ and the wing span 1960 - 2128 (2044) μ .

Body Setae and Pores: Numerous fleshy and few hair-like setae occur on the antennae and the legs; the body itself with hair-like setae only. All the setae about 21 μ long. Quadrilocular and few quinquilocular disc pores present on the head, thorax and abdomen, about 6 μ in diameter.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression (vpvd) well pronounced in lateral view. Length from apex to postoccipital ridge 116 - 122 (120) μ ; from apex to neck 168 - 183 (174) μ ; width across the genae 198 - 229 (207) μ . The dorsal arm of midcranial ridge (dmcr) weak, anteriorly detached from the other arms and posteriorly reaching the hind-most level of the dorsal eyes. The ventral and the lateral arms of the midcranial ridge (vmcr and lmcr) much stronger, forming together a Y-shaped ridge. Postoccipital ridge (por) weak and slender, anteriorly continuous with the preocular ridges; the postoccipital ridge binds the dorsomedial part of the epicranium (dmp) posteriorly. The preocular ridge (procr) continuous with the interocular ridge, and both intimately joined to the postocular ridge (pocr); the ventral rudiment of the (procr) well marked by a short sclerotization just below the articular process. Preoral ridge (pror) slender. Genae large and membranous. Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; their

PLATE III

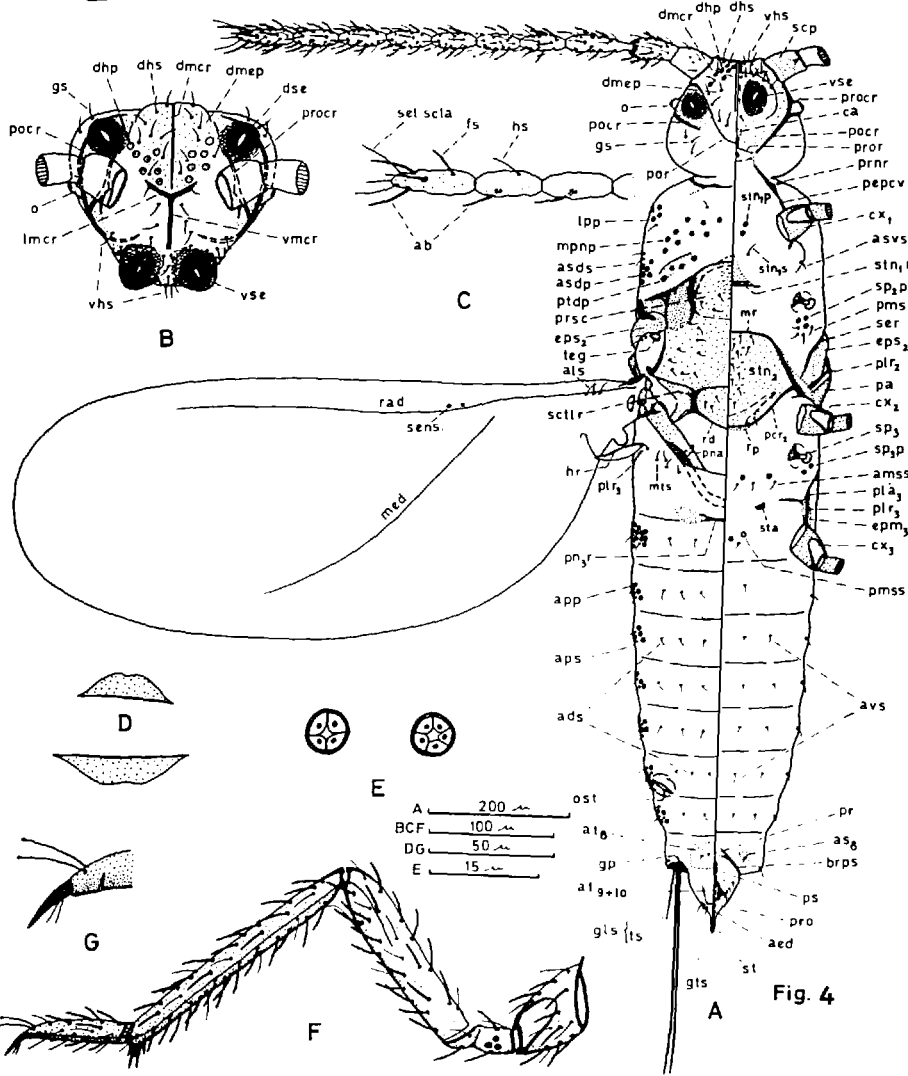


Fig. 4

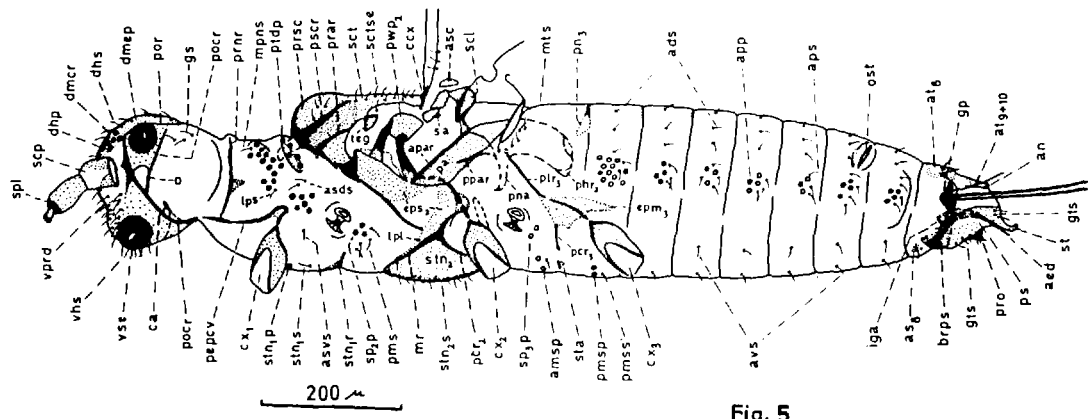


Fig. 5

corneae 21 - 27 (24) μ in diameter and the distance between their inner margins 98 - 107 (104) μ , i.e. 3.9 - 4.6 (4.3) times as much as the corneae apart. The ventral simple eyes (vse) slightly larger and much closer, 27 - 31 (29) μ in diameter and 21 - 27 (24) μ apart. Lateral ocelli (o) comparatively large and dorsally supported by a slender ocellar ridge. Ocular sclerites traversed by the interocular ridges. Cranial apophysis (ca) apically truncate. Tentorial bridge slender. Dorsal head setae (dhs) 8 - 12 (9.7) h.s. on each side of the median line; each gena with 2 - 3 (2.7) hair-like genal setae (gs). Ventral head setae (vhs) arranged in three groups on each side; a longitudinal row of 3 - 4 (3.4) h.s. between the ventral eyes; a group of 9 - 11 (10.4) h.s. forming with their partners on the other side a transverse band in the area of the ventral preocular depression; anteriorly, 2 - 3 (2.4) h.s. occur on each side of the ventral arm of the midcranial ridge. Head disc pores: Dorsally, 5 - 8 (6.4) pores (dhp) present on each side near the base of the antennal scape; ventral pores absent. Antennae: Filiform; normally 10-segmented; 616 - 665 (641) μ long, i.e. about as long as half the body length and slightly shorter than the hind legs, the ratios being 1:2.0 - 2.1 (2.05) and 1:1.1 respectively. Scape (scp) 43 - 46 (45) μ long and 43 - 49 (46) μ wide at base; with 4 - 7 (5.0) h.s. Pedicel 61 - 67 (63) μ long and 34 - 37 (35) μ wide at widest; with 15 - 21 (18.4) f.s., 5 - 12 (9.3) h.s. and a distal sensillum placodeum. Flagellum: Segment III club-shaped, being the longest of all and about 25 μ wide; the ratio lengths of segments III to X 1.1:1 and the ratio width to length of segment III 1:3.6 - 3.7 (3.65). Segments IV to X cylindrical, with irregular margins and about 23 μ wide; segments IV - IX subequal in length and the terminal segment slightly longer; the ratio width to length of segment IX 1:2.7 - 2.9 (2.8).

The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length (av.)	79-89 (85) μ	61-64 (62) μ	55-61 (58) μ	58-64 (61) μ	61-64 (62) μ	61-67 (64) μ	61-64 (62) μ	73-79 (76) μ
f.s. (av.)	11-16 (13.5)	12-14 (13.0)	11-16 (13.5)	12-14 (13.0)	15-16 (15.5)	13-15 (14.0)	14-16 (15.0)	13-16 (14.5)
h.s. (av)	3-4 (3.5)	2-4 (3.0)	2-3 (2.5)	2-3 (2.5)	2-3 (2.5)	3-4 (3.5)	3-4 (3.5)	4-5 (4.5)

Antennal bristles (ab): Segments VIII and IX each with a ventral antennal bristle, about 34 μ long; segment X with 3 similar, preapical bristles, two lateral and one dorsal, slightly shorter and at a greater distance from the apex. Terminal segment also with two capitate subapical sensory setae (set. scla), about 37 μ long, and one apical hair-like seta.

Thorax: 509 - 547 (524) μ long. Prothorax: Pronotal ridges (prnr) well developed, interrupted in the middle; lateral pronotal sclerites and posttergites small. Proepisternum with ridge-like dorsal margin; propleural ridge short and propleural apophysis small. Prosternal ridge (stnlr) double barred, 76 - 92 (85) μ long. Prothoracic setae on each side of the median line: One medial pronotal seta (mpns) usually present and sometimes absent (av. 0.9); one lateral pronotal seta (lps) also may be present or absent (av. 0.8); posttergital setae absent. Antespiracular dorsal setae (asds) 1 - 2 (1.8) h.s. One antespiracular ventral seta (asvs) and one prosternal seta (stnls) always present. Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 5 - 10 (8.4); lateral pronotal pores (lpp) 3 - 4 (3.8). Antespiracular dorsal pores (asdp) 5 - 9 (7.4); posttergital pores (ptdp) 2 - 6 (4.4). Ventrally, 1 - 2 (1.8) prosternal pores (stmp) occur medially.

Mesothorax: Prescutum (prsc) subrectangular in dorsal view: 82 - 85 (84) μ long and 122 - 143 (134) μ wide, i.e. the ratio length to width 1:1.4 - 1.7 (1:1.6). Prescutal ridge (pscr) strong and prescutal suture distinct. Scutum (sct) large, with heavily sclerotized antero-lateral extremities and with a longitudinal median narrow membranous area. Length of (sct) 98 - 116 (104) μ , i.e. the ratio lengths of prescutum to scutum 1:1.2 - 1.4 (1:1.22). Prealare, prealar ridge (prar), triangular plate, tegula (teg), anterior and posterior notal wing processes well developed. Scutellum (scl) pentagonal, 58 - 67 (61) μ long and 98 - 116 (104) μ wide, the ratio length to width 1:1.6 - 1.7 (1.68), and the ratio its length to the length of scutum 1:1.6 - 1.7 (1.67). Postalare (pa) with well separated anterior and posterior postalar ridges (apar and ppar); postnotal apophysis (pna) strong.

Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; mesopleural apophysis, mesopleural wing process (pwp2) and basalare well developed; subalare small. The mesepisternum (eps2) anteriorly bounded by the subepisternal ridge (ser); lateropleurite (lpl) narrow; mesepimeron small and heavily sclerotized. Mesosternum: Basisternum (stn2) 137 - 156 (143) μ long and 180 - 204 (189) μ wide; the marginal (mr) and precoxal ridges (pcr2) as well as the furca strongly developed. Mesothoracic spiracles 18 - 21 (20) μ wide at opening, with 31 - 40 (35) μ long supporting bar. Mesothoracic setae on each side of the median line: Prescutal setae 3 - 4 (3.8); scutal setae (sctse) 8 - 10 (9.4); scutellar setae 2 - 4 (2.8). Tegular setae 2 - 3 (2.6); postmesostigmatal setae (pms) 4 - 5 (4.4) h.s. in a lateral group behind each spiracle. Basisternal setae (stn2s) 10 - 13 (11.8).

Mesothoracic disc pores: 2 - 4 (3.0) mesospiracular pores (sp2p) present behind each spiracle; postmesostigmatal pores absent.

Metathorax: Metapostnotal sclerites (pn3) well developed and metapostnotal ridge (pn3r) distinct. Metapleural ridge (plr3) provides a small metapleural apophysis (pla3) near the middle; metapleural wing process, small. Precoxal ridge (pcr3), metepisternum, metepimeron (epm3) and metasternal apophysis (sta) well developed. Metathoracic spiracle (sp3) identical with that of the mesothorax. Metathoracic setae on each side: Metatergal setae (mts) 3 - 5 (4.0), usually occurring in a sublateral group; metapleural setae absent. Anterior metasternal setae (amss) 4 - 6 (5.0) forming on both sides a transverse row; posterior metasternal setae (pmss) 0 - 2 (1.0). Metathoracic disc pores on each side: Metaspiracular pores (sp3p) 2 - 3 (2.4); anterior metasternal pores (amsp) 3 - 4 (3.4); and posterior metasternal pores (pmsp) also 3 - 4 (3.5).

Wings: Hyaline; 854 - 924 (896) μ long and 308 - 364 (336) μ wide; axillary and additional sclerites well developed. 3 alar setae (als) and 2 circular sensoria (sens.) always present. Hamulohalterae 67 - 73 (70) μ long and 15 - 18 (17) μ wide; with a slender ridge (hr) and an apically hooked seta, 40 - 46 (43) μ long (the ratio its length to the length of the hamulohaltera 1:1.6 - 1.7 (1.64)).

Legs well developed; comparatively long and moderately stout; the ratio length of the hind leg to the total length of the body about 1:1.9. Coxa about 49 and trochanter about 30 μ wide; the basal part of the latter conspicuously longer than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur about 43 μ wide; that of the fore-leg being the shortest and that of the hind leg the longest; the ratio width to length of hind femur 1:4.5 - 5.2 (4.9). Tibia about 24 μ wide; with 2 apical stout spurs and 2 - 4 smaller spines; the ratio length of femur to tibia in fore-leg being 1:1.1. The tarsus about 21 μ wide; tarsal digitules apically knobbed, about 34 μ long. Claw gradually tapering to a sharp point,

27 - 31 (29) μ long; ungual digitules extremely fine, about 14 μ long. The lengths of the leg segments and the number of setae on each are given in the following table:-

		Fore-leg	Middle leg	Hind leg
Coxa	length	40-46 (43) μ	40-46 (43) μ	43-49 (46) μ
	f.s.	8-12 (10.0)	9-11 (10.0)	10-13 (11.5)
	h.s.	4-6 (5.0)	5-7 (6.0)	5-8 (6.5)
Trochanter	length	64-73 (70) μ	64-73 (70) μ	67-76 (73) μ
	f.s.	3-4 (3.5)	2-4 (3.0)	3-4 (3.5)
	h.s.	0-1 (0.5)	1-2 (1.5)	1-2 (1.5)
Femur	length	168-189 (180) μ	171-189 (180) μ	180-207 (195) μ
	f.s.	16-23 (19.5)	19-25 (22)	22-32 (27)
	h.s.	7-10 (8.5)	9-11 (10.0)	7-10 (8.5)
Tibia	length	183-204 (195) μ	198-217 (207) μ	250-268 (259) μ
	f.s.	32-38 (35)	33-40 (36.5)	46-51 (48.5)
	h.s.	6-9 (7.5)	6-10 (8.0)	7-11 (9.0)
Tarsus	length	76-85 (82) μ	79-85 (82) μ	92-98 (95) μ
	f.s.	9-12 (10.5)	9-11 (10.0)	11-14 (12.5)
	h.s.	8-10 (9.0)	7-10 (8.5)	9-12 (10.5)
Total length of leg		558-628 (592) μ	580-641 (610) μ	659-729 (695) μ

Abdomen: Length 471 - 532 (502) μ and width 274 - 319 (296) μ . The tergites of segments I and II small; that of segment VIII (atg) large and that of segments 9 + 10 (at 9 + 10) distinct. Sternites of segment VIII (as8) small and weak. Ostioles (ost) prominent and well developed,

37 - 46 (40) μ long at orifice. Abdominal setae: Dorsal and ventral setae (ads & avs) in segmental transverse rows; pleural setae (aps) in lateral groups. All abdominal setae subequal in length except a pleural seta of segment VIII, which is somewhat longer. Disc pores: Pleural pores (app) only present on the abdomen. The following table shows the number of the abdominal setae and disc pores on each side of the median line:-

	I	II	III	IV	V	VI	VII	VIII
(ads)	(2.0)	(3.0)	(3.0)	3-4 (3.2)	3-4 (3.2)	2-3 (2.5)	2-3 (2.2)	2-3 (2.5)
	h.s.	h.s.	h.s.	h.s.	h.s.	h.s.	h.s.	h.s.
(aps)	2-3 (2.5)	2-3 (2.5)	(3.0)	(3.0)	3-4 (3.5)	3-4 (3.5)	3-4 (3.5)	*1+2-3 (2.5)
	h.s.	h.s.	h.s.	h.s.	h.s.	h.s.	h.s.	h.s.
(avs)	-	(1.0) h.s.	(2.0) h.s.	(2.0) h.s.	(2.0) h.s.	(2.0) h.s.	(2.0) h.s.	(2.0) h.s.
(app)	10-17 (13.5)	(4.0)	3-4 (3.5)	4-5 (4.5)	3-4 (3.5)	3-4 (3.7)	3-4 (3.7)	0

* A longer seta.

Glandular pouch (gp) well developed; the setae of the glandular pouch (gls) consist of the two long tail setae (ts), 305 - 320 (314) μ long, and one much shorter seta, 55 - 92 (73) μ long; the ratio length of the tail setae to the total length of the body 1:4.1 - 4.4 (1:4.2).

Genital Segment: Comparatively small: triangular in dorsal view; the style(st) short, curving upwards in lateral view. The penial sheath (ps) 122 - 128 (125) μ long and about 76 μ wide, i.e. the ratios its length to its width about 1.6:1, and its length to the

total body length 1:10.2 - 10.9 (1:10.6). Basal ridge of penial sheath (brps) well developed, with a small projection (pr). Process of the penial sheath (pro) well pronounced, with 3 - 4 (3.6) minute setal sensilla. Aedeagus (aed) gradually tapering from its basal rod to a sharply pointed tip. Setae of the genital segment (gts) arranged in two groups on each side: a dorsal group of 3 h.s. near the base of the (st); the ventral group including 4 - 5 (4.5) h.s. on the penial sheath.

Material examined: 3 specimens only of this species were available for study, collected by H. Standfast, on Yam (Dioscorea sp.), in Sepik district, Tenteguna, New Guinea, on 23.6.59 (received from D. J. Williams).

GENUS PLANOCOCCOIDES:(4) PLANOCOCCOIDES IRENEUS DE LOTTO (Plate IV, figs. 6 and 7)

Winged forms only known; living specimens not available.

The males narrow and slender, of medium size, with comparatively short antennae and moderately long legs. When mounted, total body length 1008 - 1414 (1162) μ , width at mesothorax 280 - 350 (322) μ and wing expanse 1932 - 2422 (2114) μ .

Body setae and pores: The appendages clothed with many fleshy and few hair-like setae, about 39 μ long; the body itself with much shorter hair-like setae only, about 24 μ long. Numerous quadrilocular and occasionally quinquilocular disc pores, about 9 μ in diameter, occur on the head, the thorax and the abdomen.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression (vprd) hardly indicated in lateral view. Length from apex to postoccipital ridge 98 - 122 (113) μ ; from apex to neck 153 - 180 (165) μ ; width across genae 174 - 214 (192) μ . The dorsal arm of the midcranial ridge (dmcr) slender, anteriorly detached from other arms and posteriorly reaching the posterior level of the dorsal eyes. The ventral and the lateral arms of the midcranial ridge (vmcr and lmcr) well developed, forming together a Y-shaped ridge. The meniscate, U-shaped postoccipital ridge (por) anteriorly separated from the preocular ridges. The dorsomedial part of the epicranium (dmp) weakly sclerotized and slightly raised. Preocular (procr) + interocular ridges meet the postocular ridge (pocr) below the ocellus; the ventral rudiment of the former entirely absent. Preoral ridge (pror) slender. Genae large. Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; the diameter of their corneae 21 - 27 (24) μ , and separated by 79 - 101 (89) μ i.e. 3.1 - 4.7 (3.6) times as much as their corneae apart. The ventral simple eyes (vse) larger and much closer, 24 - 31 (29) μ in diameter and

PLATE IV

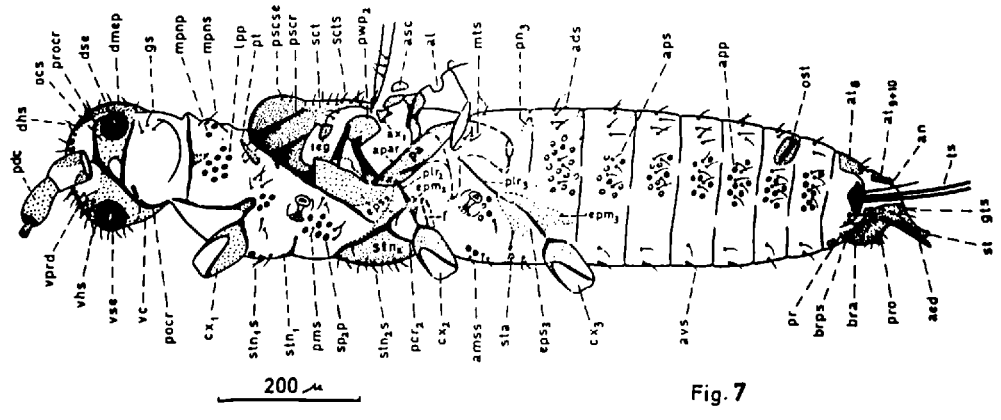
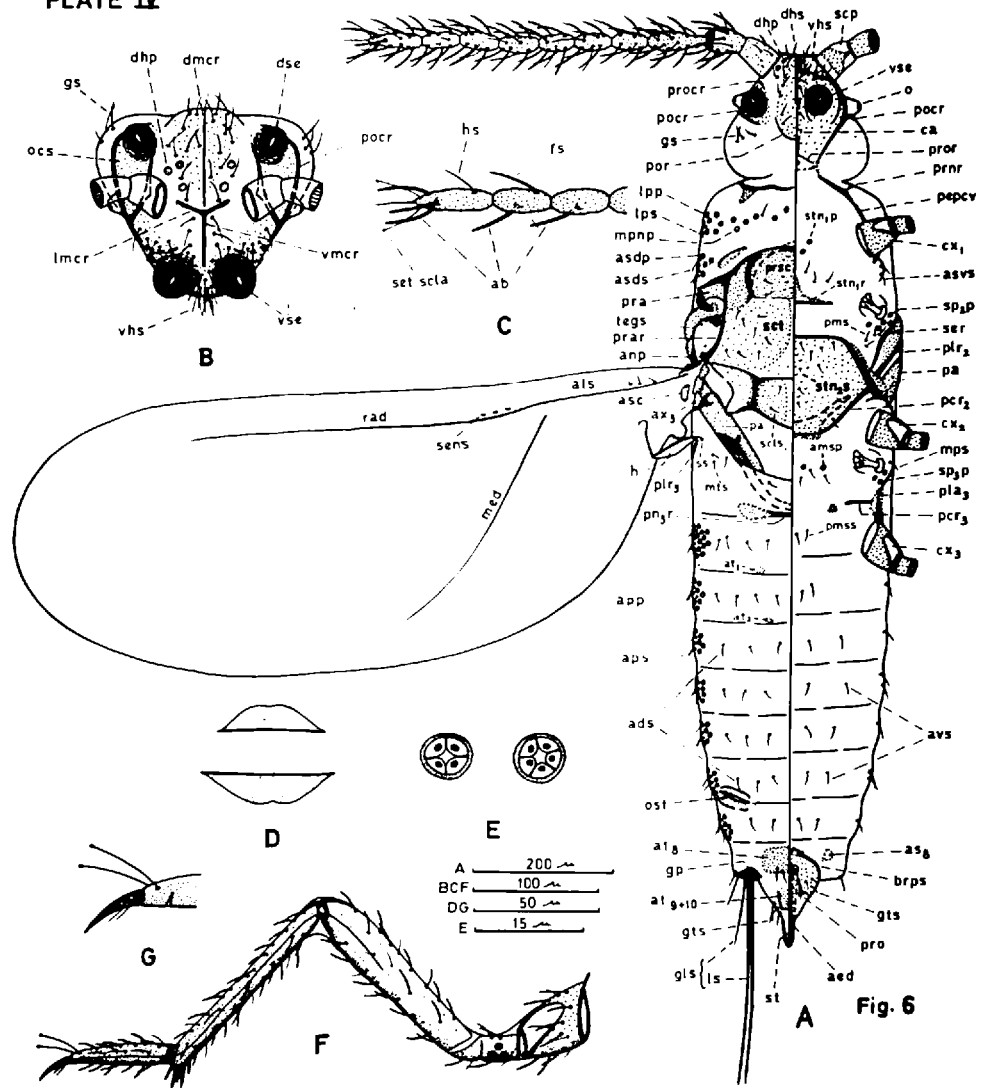


Fig. 7

18 - 40 (25) μ apart. The lateral ocelli (o) large and well developed; ocellar ridge fine. Ocular sclerite (ocs) traversed by the interocular ridge. Cranial apophysis (ca) truncate; tentorial bridge slender. Dorsal head setae: 8 - 11 (9.9) h.s. on each side of the median line; each gena always with 3 hair-like genal setae (gs). Ventral head setae (vhs) on each side: a longitudinal median row of 3 - 5 (3.9) h.s. present between the ventral eyes; 7 - 11 (7.7) h.s. in the area of the preocular depression forming a transverse band continuous with those of the other side; 3 - 5 (4.3) h.s. occur anteriorly on each side of the ventral arm of the midcranial ridge. Head disc pores: 2 - 3 (2.4) dorsal pores (dhp) present near the base of each antenna; ventral head pores absent.

Antennae: Filiform; normally 10-segmented but cases of fusion between adjacent segments very common; 494 - 580 (545) μ long, i.e. equal or slightly shorter than half the body length, the ratio 1:2.0 - 2.5 (1:2.1); somewhat shorter than the hind leg, the ratio 1:1.1 - 1.3 (1:1.2). Scape (scp) 31 - 40 (37) μ long and 40 - 46 (42) μ wide at base; always with 5 hair-like setae. Pedicel (pdc) 52 - 55 (54) μ long and 31 - 37 (34) μ wide (at widest); with 12 - 77 (15.1) f.s., 5 - 10 (6.8) h.s. and a sensillum placodeum. Flagellum: Flagellar segments with irregular margins; segment III club-shaped, usually the longest (sometimes equal in length to terminal segment), the ratio length of segments III to X being 1.0 - 1.1 (1.05):1; segment III about 25 μ wide, the ratio its width to its length being 1:2.6 - 3.3 (3.1). Segments IV - X cylindrical and about 23 μ wide; segments IV - IX subequal or slightly increasing in length distally, and segment X considerably longer; the ratio width to length of segment IX 1:2.9 - 3.6 (3.3). Flagellar segments with many fleshy and a few hair-like setae. In the following table the length of the flagellar segments and the number of setae on each are given:

	III	IV	V	VI	VII	VIII	IX	X
length (av.)	70-82 (76) μ	43-52 (49) μ	43-52 (49) μ	46-58 (52) μ	46-58 (52) μ	49-58 (55) μ	49-58 (55) μ	70-79 (73) μ
f.s. (av.)	12-15 (14.1)	8-14 (11.3)	9-14 (12.5)	11-17 (14.7)	13-17 (15.4)	12-18 (14.8)	13-16 (14.7)	14-20 (18.3)
h.s. (av.)	2-5 (3.9)	1-3 (2.0)	0-2 (1.1)	0-2 (0.7)	0-1 (0.4)	0-1 (0.7)	0-1 (0.7)	0-2 (0.8)

Antennal bristles (ab): Each of antennal segments VIII and IX with one ventral bristle. Terminal segment with 3 preapical bristles, two lateral, and one dorsal slightly shorter; terminal segment also with two capitate subapical sensory setae (set. scla) about 40 μ long, and one apical hair-like seta.

Thorax: 395 - 578 (464) μ long. Prothorax: Pronotal ridges (prnr) well developed but medially interrupted; lateral pronotal sclerites small. Posttergites (pt) of medium size. Proepisternum with ridge-like dorsal margin; propleural ridge short and propleural apophysis small. Prosternum subtriangular, narrow medially, 37 - 43 (39) μ long; with a transverse, 85 - 101 (89) μ long prosternal ridge (stnlr). Prothoracic setae on each side: One medial pronotal seta (mpns) usually present, but two setae may occasionally occur (av. 1.1); lateral pronotal seta (lps) 0-1 (0.6); posttergital setae absent. Antespiracular dorsal setae (asds) 3 - 5 (3.7) and antespiracular ventral setae (asvs) 1 - 2 (1.2). Prosternal setae (stnls) 2 - 3 (2.5). Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 4 - 10 (6.3) and lateral pronotal pores (lpp) 3 - 11 (5.6); these two groups sometimes fuse with one another and become rather difficult to separate. Antespiracular dorsal pores (asdp) 4 - 8 (5.5); posttergital pores absent. Prosternal pores (stnlp) 1 - 3 (1.6) forming with those of the other side a median group.

Mesothorax: Prescutum (prsc) subrectangular in dorsal view; 64 - 76 (70) μ long and 116 - 137 (125) μ wide, the ratio being 1:1.6 - 2.0 (1:1.8); prescutal ridges(pscr) well developed and prescutal suture well marked. Scutum (sct) large; with well sclerotized antero-lateral extremities, and with a longitudinal median narrow membranous area. Scutum 95 - 119 (101) μ long, i.e. the ratio length of (prsc) to (sct) 1:1.3 - 1.8 (1.4). Prealare (pra), prealar ridge (prar), triangular plate and tegula (teg) well developed. Scutellum (scl) pentagonal in dorsal view; 55 - 70 (58) μ long, and 98 - 125 (107) μ wide, the ratio being 1:1.7 - 1.9 (1:1.8), and the ratio its length to the length of scutum 1:1.6 - 1.8 (1:1.7). Postalare (pa) with well separated anterior and posterior postalar ridges. Postnotal apophysis strong. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare well developed. Mesepisternum (eps2) semi-membranous; lateropleurite narrow; mesepimeron (epm2) well sclerotized. Mesosternum: Basisternum (stn2) large, 122 - 143 (128) μ long and 183 - 229 (195) μ wide; the marginal, the precoxal ridges (pcr2) and the furca well developed. Mesothoracic spiracles 18 - 24 (21) μ wide at opening and with a 37 - 46 (43) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 1 - 2 (1.7); scutal setae (sctse) 7 - 10 (8.1) h.s.; scutellar setae (scls) usually 2 and occasionally 3 (av. 2.1); tegular setae (tegs) 2 - 3 (2.2). Postmesostigmatal setae (pms) 3 - 5 (4.3), in a latero-ventral group behind the spiracle; basisternal setae (stn2s) 7 - 11 (9.2), mostly disposed in the median area. Mesothoracic disc pores: Mesospiracular pores (sp2p) comparatively numerous, 4 - 7 (5.1) associated with each spiracle posteriorly.

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pn3r) well developed. Metapleural ridge (plr3) with the usual attenuation near the middle at the point of origin of the metapleural apophysis; metapleural wing process small. Precoxal ridge of

metathorax (pcr3) distinct; metepisternum (eps3) and metepimeron (epm3) well developed; metasternal apophysis (sta) small. Metathoracic spiracles identical with the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) always include a group of 3 setae sublaterally and one seta isolated submedially; one metapleural seta (mps) usually present (sometimes the seta absent on one side). Anterior metasternal setae (amss) 2 - 4 (3.1) forming together with their partners of the other side a transverse median row; posterior metasternal setae (pmss) comprising 1 - 3 (1.9) similarly arranged setae. metathoracic disc pores on each side: Metaspiracular pores (sp3p) 2 - 4 (2.6); anterior metasternal pores (amsp) 1 - 2 (1.5); posterior metasternal pores absent.

Wings: Membranous; 854 - 1050 (924) μ long, and 322 - 434 (364) μ wide; costal complex of veins, axillary cord, axillary and additional sclerites well developed. The wings usually with 3 alar setae (als) (and occasionally 2 only, av. 2.9) and 3 - 4 (3.3) circular sensoria (sens.). Hamulohalterae (h) 64 - 73 (70) μ long, and 12 - 18 (15) μ wide; with a weak slender ridge and one, apically hooked, 52 - 58 (55) μ long seta; i.e. the ratio length of seta to the length of the hamulohaltera 1:1.2 - 1.4 (1:1.3).

Legs: Well developed and moderately long; the fore-legs and their component segments shortest, and the hind legs longest; the ratio length of the hind leg to the total body length 1:1.8 - 2.1 (1:1.9). Trochanter about 24 μ wide; the basal part much longer than the distal and with 3 circular sensilla on each side; differentiated long apical seta absent. Femur about 40 μ wide, the ratio width to length of hind femur 1:4.2 - 5.0 (4.5). Tibia about 24 μ wide with 2 strong apical spurs and 2 - 4 smaller spines; the femur in front leg longer than the tibia, the ratio their length being 1.02 - 1.4 (1.1):1. The distal segment of the tarsus about 21 μ wide; tarsal digitules apically knobbed,

about 34μ long. Claw uniformly tapering to a sharply pointed apex; $37 - 46 (40) \mu$ long; ungual digitules finely pointed, about 14μ long. The following table shows the lengths of the leg segments and the number of setae on each:-

		Fore-leg	Mid-leg	Hind leg
Coxa	length in μ	37-43 (40)	37-48 (40)	43-52 (46)
	f.s.	6-11 (9.0)	8-14 (9.6)	9-17 (12.0)
	h.s.	3-7 (4.3)	3-6 (4.1)	4-7 (5.0)
Troch- anter	length in μ	61-67 (62)	61-67 (64)	67-73 (70)
	f.s.	3-5 (4.4)	3-7 (4.7)	4-10 (6.3)
	h.s.	1-3 (2.0)	1-2 (1.3)	1-4 (2.4)
Femur	length in μ	153-174 (162)	156-177 (168)	165-198 (180)
	f.s.	17-24 (20.1)	16-26 (20.9)	20-29 (24.6)
	h.s.	3-6 (3.9)	3-6 (4.3)	3-6 (4.1)
Tibia	length in μ	137-162 (153)	153-183 (168)	189-217 (204)
	f.s.	21-30 (25.6)	24-32 (26.1)	33-40 (35.6)
	h.s.	3-5 (3.6)	3-5 (4.0)	3-6 (4.3)
Tarsus	length in μ	73-79 (76)	73-79 (76)	76-82 (79)
	f.s.	18-23 (20.3)	16-23 (19.4)	19-26 (21.6)
	h.s.	0-2 (1.0)	0-2 (0.9)	0-3 (1.0)
Total length of leg in μ		503 - 570 (534)	519-598 (555)	577-665 (619)

Abdomen: 380 - 562 (448) μ long and 281 - 342 (319) μ wide. The tergites of segments I, II and III (at1, at2 and at3) small; those of segments VIII (at8) and IX + X (at9 + 10) rather large. The sternites of segment VIII (as8) distinct. Ostioles (ost) well developed, with a 52 - 61 (55) μ long orifice. Abdominal setae: Dorsal and ventral setae (ads and avs) segmentally arranged in transverse rows; pleural setae in lateral groups. All abdominal setae more or less subequal in length except one of the pleural setae of segment VIII which is conspicuously longer. Abdominal disc pores: Pleural pores (app) only present; those on segment I more numerous than on succeeding segments. The following table shows the number of the abdominal setae and pores on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	3-4 (3.8) h.s.	3-4 (3.9) h.s.	3-4 (3.7) h.s.	3-4 (3.2) h.s.	3-4 (3.1) h.s.	2-3 (2.8) h.s.	2-3 (2.7) h.s.	(2.0) h.s.
(aps)	3-4 (3.2) h.s.	(4.0) h.s.	4-5 (4.2) h.s.	4-5 (4.6) h.s.	4-5 (4.5) h.s.	4-5 (4.6) h.s.	4-5 (4.6) h.s.	* 1 +1-2 (1.8) h.s.
(app)	9-23 (14.1)	4-11 (7.4)	4-11 (7.4)	5-10 (6.7)	5-10 (6.9)	4-9 (7.3)	5-12 (7.8)	
(avs)	-	1-2 (1.9) h.s.	2-3 (2.6) h.s.	(2.0) h.s.	(2.0) h.s.	(2.0) h.s.	(2.0) h.s.	0

* A longer seta.

Setae of glandular pouch (gls): These include two 275 - 305 (290) μ long tail setae (ts) and one seta of medium length, 79 - 107 (92) μ long; the ratio length of the tail setae to the total length of the body 1:3.7 - 4.6 (4.0).

Genital segment: Conical in dorsal view, extending posteriorly into a tubular, apically rounded style (st); the latter slightly curving upwards in lateral view. The penial sheath 113 - 134 (122) μ long and 85 - 98 (89) μ wide, i.e. the ratio 1.3 - 1.5:1 (1.4:1), and the ratio its length to the total body length 1:8.9 - 10.6 (1:9.5). Basal ridge of penial sheath (brps) well developed, with a small internal projection (pr); process of the penial sheath (pro) well developed, with 3 - 4 (3.6) setal sensilla. Aedeagus (aed) tapering to a pointed end; internal genital aperture large. Setae of the genital segment (gts) slightly smaller than the other body setae; the dorsal always includes 3 h.s. on each side near the base of the style; the ventral group consists of 3 - 4 (3.4) h.s. on each side of the penial sheath.

Material: 10 specimens examined, collected by D. N. McNutt, on roots of Coffea arabica, in Buwagogo, Uganda, on August 23rd, 1961.

GENUS NIPAECOCCUS:(5) NIPAECOCCUS VASTATOR (MASKELL) (Plate V, figs. 8 and 9)

Only the winged males known. A slender species, of medium size, with moderately long antennae and legs. Mounted specimens 1148 - 1358 (1246) μ long, 280 - 322 (294) μ wide and 2310 - 2660 (2520) μ wing expanse.

Body setae and disc pores: The antennae with fleshy and hair-like setae, approximately 37 μ long; the body itself and the legs with hair-like setae only, about 28 μ long. Quadriocular and occasionally quinquelocular disc pores about 6 μ in diameter, occur on the head, thorax and abdomen; Beardsley (1960) observed few pores with 6 peripheral loculi.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression (vprd) hardly indicated in lateral view. Length from apex to postoccipital ridge 107 - 131 (116) μ ; from apex to neck 177 - 198 (186) μ ; width across the genae 207 - 244 (229) μ . The midcranial ridge well developed; dorsal arm (dmcr) anteriorly detached from other arms by a short distance, and posteriorly meeting the postoccipital ridge; ventral and lateral arms (vmcr & lmcr) forming a T-shaped ridge (see front view of head). Postoccipital ridge (por) distinct, U-shaped and anteriorly continuous with the preocular ridges. Dorsomedial part of the epicranium (dmep) weakly sclerotized. Preocular + interocular ridges strong, posteriorly joined to the postocular ridge (pocr) below the ocellus; the preocular ridge (procr) without any apparent ventral rudiment. Preoral ridge (pror) slender.

PLATE V

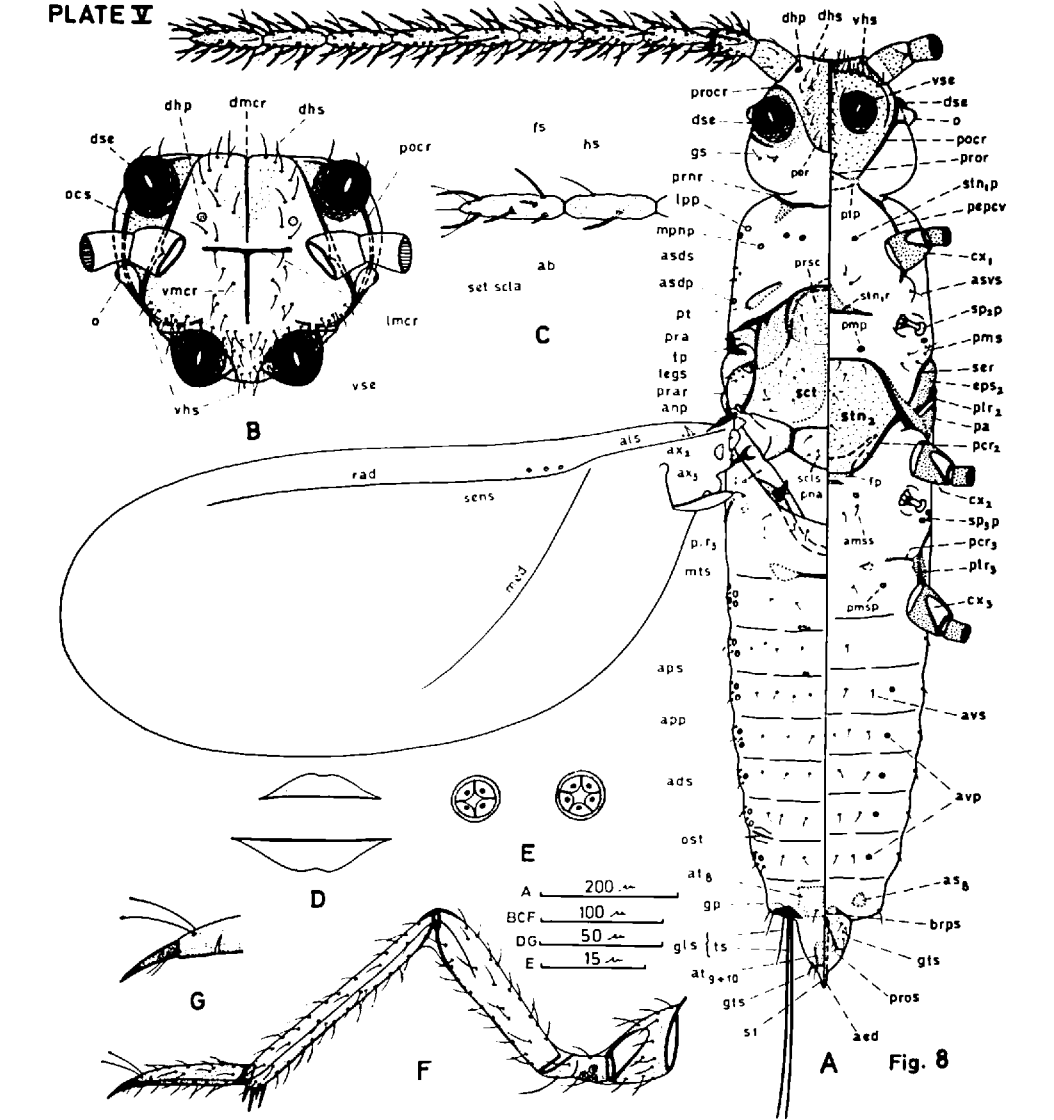


Fig. 8

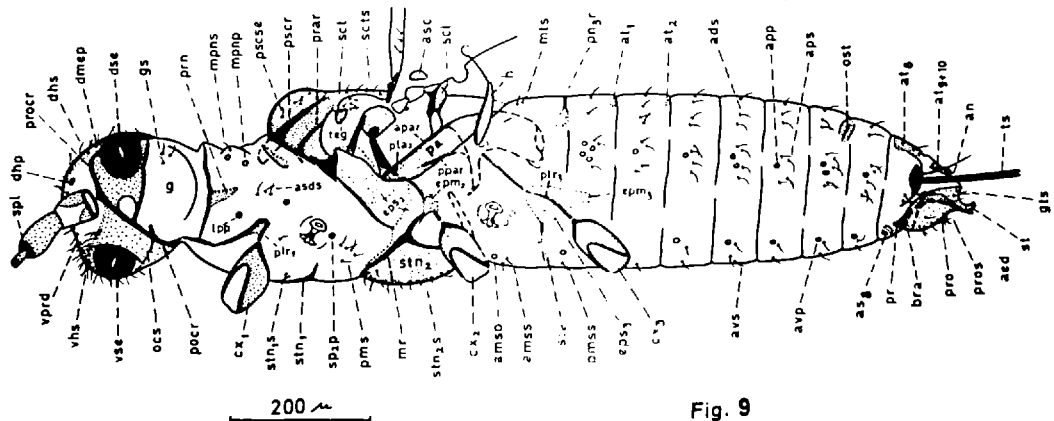


Fig. 9

Eyes: The dorsal simple eyes (dse) project beyond the outer margins of the head in dorsal view; their corneae 34 - 46 (40) μ in diameter and separated by 107 - 125 (113) μ , i.e. 2.5 - 3.5 (2.8) times as much as their diameter apart. The ventral simple eyes (vse) usually smaller than the dorsal, 31 - 43 (37) μ in diameter, and separated by 27 - 40 (34) μ . Lateral ocelli (o) large. Ocular sclerites (ocs) weakly sclerotized. Cranial apophysis well developed, apically truncate. Posterior tentorial pits (ptp) minute and tentorial bridge slender. Dorsal head setae (dhs) 10-14 (11.8) h.s. on each side of the median line; each gena almost always with 3 genal setae (occasionally 2). Ventral head setae (vhs) on each side as follows: 5 - 6 (5.4) h.s. in a median longitudinal row between the ventral eyes; 8 - 12 (10.1) h.s. forming with their partners of the other side a transverse band across the area of the ventral preocular depression; 4 - 6 (5.1) h.s. in a longitudinal row on each side anteriorly. Dorsal and ventral ocular setae absent. Head disc pores: One dorsal pore (dhp) always present near the base of the antennae. Antennae: Filiform; 10-segmented; 744 - 903 (821) μ long, i.e. longer than half the total length of the body (ratio 1:1.4 - 1.6, av. 1.5), and longer than the hind legs (ratio 1.2 - 1.4, av. 1.3:1). Scape 43 - 49 (46) μ long and 46 - 52 (49) μ wide at base; usually with 4 h.s. (occasionally with 5 or 6, av. 4.2). Pedicel (pdo) 58 - 73 (67) μ long and 40 - 46 (43) μ wide; with 20 - 36 (27.2) f.s., 5 - 11 (7.6) h.s. and a sensillum placodeum. Flagellum: Segment III club-shaped; subequal in length or somewhat shorter than the terminal segment (ratio 1:1 - 1.1, av. 1.03); about 31 μ wide, i.e. the ratio its width to its length 1:2.8 - 3.4 (3.0). Segments IV to X cylindrical, with irregular margins and about 24 μ wide, the ratio width to length of segment IX being 1:3 - 3.8 (3.4). The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length (av.)	85-104 (93) μ	73-95 (85) μ	76-95 (85) μ	79-101 (89) μ	79-104 (92) μ	89-101 (95) μ	73-92 (82) μ	85-101 (95) μ
f.s. (av.)	14-24 (19.6)	16-30 (22.4)	20-31 (24.3)	17-32 (23.2)	19-28 (24.6)	22-29 (24.6)	16-27 (21.3)	23-29 (25.5)
h.s. (av.)	3-8 (5.5)	3-6 (4.3)	2-4 (2.8)	4-6 (4.7)	3-6 (4.2)	4-6 (4.7)	3-5 (4.0)	1-4 (2.5)

Antennal bristles (ab) slightly stouter than the fleshy setae. One ventral bristle present on each of antennal segments VIII and IX. Terminal segment with 3 subapical bristles and 2 much smaller, latero-ventral ones, at a greater distance from the apex. The segment also with two capitate subapical sensory setae (set.scla.) and one apical, hair-like seta.

Thorax: 456 - 570 (524) μ long. Prothorax: Pronotal ridges (prnr) with the usual interruption medially; lateral pronotal sclerites (prn) well developed. Posttergites (pt) small. Proepisternum with a ridge-like dorsal margin. Prosternum (stnl) subtriangular, 37 - 52 (43) μ long; prosternal ridge (stnlr) slender, 92 - 113 (104) μ long. Prothoracic setae on each side of the median line: Medial pronotal and lateral pronotal setae 0 - 1 (av. 0.2 and 0.3 respectively); posttergital setae absent; antespiracular dorsal setae (asds) 2 - 4 (2.7) h.s. One antespiracular ventral seta (asvs) always present. Prosternal setae (stnls) 1 - 3 (1.9) . Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 1 - 3 (1.9); lateral pronotal pores (lpp) 1 - 3 (2.1); one antespiracular dorsal pore (asdp) always present. Prosternal pores

(stnlp) usually one, but sometimes either side may be with 2 pores or none at all (av. 0.9).

Mesothorax: Prescutum 70 - 95 (79) μ long and 110 - 134 (122) μ wide (ratio 1:1.4 - 1.7, av. 1.5). Prescutal ridges (pscr) well developed and prescutal suture distinct. Scutum (sct) with heavier antero-lateral sclerotizations, and with a medial longitudinal narrow membranous area; 89 - 113 (104) μ long, i.e. the ratio lengths of (pscr) to (sct) 1:1.1 - 1.4 (1.3). Prealare (pra), prealar ridge (prar) and triangular plate (tp) well developed. Scutellum (scl) 49 - 64 (58) μ long and 85 - 104 (98) μ wide, i.e. the ratios its length to its width 1:1.6 - 1.9, av. 1.7, and its length to the length of the scutum 1:1.6 - 2, av. 1.8. Postalare (pa) well developed, with well separated anterior and posterior postalar ridges (apar & ppar). Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare strong. Other pleural structures typical of the family. Mesosternum: Basisternum (stn2) 122 - 153 (137) μ long and 171 - 214 (189) μ wide; marginal and precoxal ridges (pcr2) well developed. Mesothoracic spiracle (sp2) 18 - 21 (20) μ wide at opening, and with 40 - 46 (43) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 3 - 5 (3.6) h.s.; scutal setae (scts) 7 - 11 (8.1) h.s.; scutellar setae (scls) 2 - 4 (2.8) h.s. Tegular setae (tegs) 4 - 6 (4.9) h.s. Postmesostigmatal setae (pms) 5 - 8 (5.9) h.s., occurring in a lateral group behind each spiracle; absent medially. Basisternal setae (stn2s) 6 - 9 (7.3) h.s. Mesothoracic disc pores: 1 - 2 (1.2) mesospiracular pores (sp2p) and 0-1 (0.9) postmesostigmatal pores (pmp) present on each side of the median line.

Metathorax: Metapostnotal sclerites and metapostnotal ridge (pn3r) well developed. Pleural ridge (plr3) attenuated near the middle where a pleural apophysis originates; pleural wing process small. Episternum (eps3) and epimeron (epm3) distinct. Precoxal ridge (pcr3) and a small metasternal apophysis (sta) present. Metathoracic spiracle similar to the mesothoracic one. Metathoracic setae on each side: Metatergal setae (mts) 2 - 5 (2.6) h.s.; metapleural setae (mps) usually absent, but one hair-like seta may occasionally occur on one side (av. 0.2). Anterior metasternal setae (amss) 1 - 3 (1.9) h.s. forming with their partners of the other side a transverse row; posterior metasternal setae (pmss) 1 - 2 (1.3) h.s., similarly arranged. Metathoracic disc pores: Metaspiracular pores (sp3p) 2 - 3 (2.2); anterior metasternal pores (amsp) 0 - 2 (0.9), and posterior metasternal pores (pmsp) 0 - 2 (1.0) on each side.

Wings: Hyaline; 980 - 1120 (1050) μ long and 378 - 448 (406) μ wide. Alar lobe, axillary and additional sclerites well developed. Alar setae (als) usually 3 h.s., but 2 or 4 may occasionally occur (av. 2.9); with 3 circular sensoria (sens) in a compact row. Hamulohalterae (h) 76 - 92 (80) μ long and 15 - 18 (17) μ wide; with a 58 - 67 (61) μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1:1.2 - 1.4 (1.3).

Legs: Moderately long and slender; the ratio length of the hind leg to the total length of the body 1:1.9 - 2.1 (2.0). Coxa and trochanter about 55 and 27 μ wide respectively; the latter with the basal part much longer than the distal; also with 6 circular sensilla and a long apical seta. Femur about 40 μ wide; femur of the middle leg shortest; the ratio width to length of hind femur 1:4.3 - 5.1 (4.7). Tibia about 23 μ wide, with 2 apical strong spurs and 3 - 5 smaller spines; the ratio lengths of femur to tibia in front leg 1:1 - 1.1 (1.04). Tarsus about 21 μ wide and tarsal digitules about 40 μ long. Claw gradually tapering towards a pointed end; 31 - 37 (34) μ long;

with a pair of approximately 15μ long ungual digitules. The lengths of the leg segments and the number of setae on each are given below:

		Fore-leg	Middle leg	Hind leg
Coxa	lengths in μ	40-46 (43)	40-49 (46)	43-52 (49)
	h.s.	9-14 (11.2)	10-15 (12.8)	10-16 (13.0)
Trochanter	lengths in μ	58-67 (64)	58-67 (64)	61-70 (67)
	h.s.	4-7 (5.4)	4-6 (5.2)	4-7 (5.6)
Femur	lengths in μ	156-183(171)	146-177(162)	156-186(171)
	h.s.	28-41 (33.2)	22-36 (27.6)	25-40 (31.4)
Tibia	lengths in μ	159-192(177)	168-207(186)	192-250(220)
	h.s.	32-43 (36.4)	33-47 (38.8)	35-50 (42.3)
Tarsus	lengths in μ	82-92 (85)	82-92 (85)	85-101 (92)
	h.s.	20-27 (23.6)	22-28(24.6)	24-31 (26.6)
Total length of leg in μ		522-613(570)	522-628(577)	567-689(631)

Abdomen: 448 - 517 (479) μ long and 258-304 (281) μ wide. The tergites of segments I and II small, and those of segments VIII and IX + X distinct. A weak sternite on each side of segment VIII present. Ostioles (ost) ill-defined. Abdominal setae: Dorsal (ads) and ventral setae (avs) in transverse rows; pleural setae (aps) in lateral groups. Abdominal discs: Dorsal pores absent; pleural pores (app) numerous on segment I, and fewer on segments II to VII; one ventral pore (avp) almost always present on each side of segments III to VII, forming together a longitudinal submarginal line on each side. In the following table, the number of abdominal setae and pores on each side of the median line are given:

	I	II	III	IV	V	VI	VII	VIII
(ads)	1 - 2 (1.8)	3 - 4 (3.6)	3 - 4 (3.5)	2 - 4 (3.1)	2 - 3 (2.6)	2 - 3 (2.5)	2 - 3 (2.5)	(1.0)
(aps)	2 - 3 (2.9)	3 - 4 (3.3)	3 - 5 (3.9)	3 - 4 (3.8)	3 - 5 (4.6)	4 - 5 (4.9)	4 - 5 (4.9)	*1 + (2.0)
(avs)	-	1 - 2 (1.2)	2 - 3 (2.6)	2 - 3 (2.1)	2 - 3 (2.1)	2 - 3 (2.1)	(2.0)	0
(app)	2 - 4 (3.2)	1 - 2 (1.5)	1 - 2 (1.2)	1 - 3 (1.7)	1 - 3 (1.7)	1 - 2 (1.8)	1 - 2 (1.7)	0
(avp)	0	0	(1.0)	1 - 2 (1.1)	(1.0)	1 - 2 (1.1)	0 - 1 (0.9)	0

* A slightly longer seta.

The glandular pouch (gp) well developed; the glandular pouch setae (gls) include a pair of 244 - 300 (268) μ long tail setae (ts), and one seta of medium length, about 70 μ long, i.e. the ratio length of the tail setae to the total length of the body 1:4.2 - 5.2 (4.6).

Genital segment small; subtriangular in dorsal view; the style (st) curving upwards in lateral view. The penial sheath 101 - 119 (107) μ long and 64 - 76 (70) μ wide (ratio 1.5 - 1.6, av. 1.52:1, and the ratio its length to the total body length 1:11.1 - 12.3, av. 11.6). The basal ridge of the penial sheath (brps), its projection (pr) and the process of the penial sheath (pro) well developed. Aedeagus (aed) curving dorso-posteriorly towards its pointed tip. Setae of the genital segment (gts): 3 hair-like setae always present dorsally on each side, near the base of the style; ventrally, 4 - 7 (5.4) h.s. occur on each side of the penial sheath, and 3 - 4 (3.6) setal sensilla (pros) on its process.

Material: 10 specimens examined, collected by G. M. Das, in Cinnamara, Assam, India, during October, 1961; host plant not stated.

(6) NIPAEBOCCUS NIPAE (MASKELL) (Plate VI, figs. 10 and 11)

Macropterous forms only known. A narrow and slender species; comparatively very small, with moderately long antennae and legs. When mounted 840 - 980 (896) μ long, 210 - 224 (214) μ wide and 1974 - 2240 (2086) μ wing expanse.

Body setae and pores: Fleshy and hair-like setae rather difficult to separate; those occurring on the antennae about 31 μ long and those on the legs slightly shorter; the body itself only with hair-like setae, about 18 μ long. Disc pores present on the head, thorax and abdomen; about 6 μ in diameter, usually with 5 or 6, and occasionally 4 peripheral loculi.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression hardly indicated in lateral view. Length from apex to postoccipital ridge 85 - 98 (92) μ ; from apex to neck 128 - 143 (137) μ ; width across the genae 162 - 177 (171) μ . The dorsal arm of the midcranial ridge (dmcr) distinct, anteriorly separated from the other arms and posteriorly meeting the postoccipital ridge. Lateral and ventral arms forming a T-shaped ridge. Postoccipital ridge (por) weakly developed, U-shaped and anteriorly confluent with the preocular ridges. Dorsomedial part of the epicranium slightly raised. Preocular + interocular ridges well developed, joining the postocular ridge (pocr) below the ocellus; ventral rudiment of the preocular ridge (procr) absent.

Eyes: The dorsal eyes (dse) not projecting beyond the outer margins of the head in dorsal view; 18 - 21 (19) μ in diameter and separated by 79 - 89 (85) μ , i.e. 4.1 - 4.8 (4.6) times as much as their diameter apart. The ventral eyes (vse) larger, 24 - 27 (26) μ in diameter and 18 - 21 (20) μ apart. The lateral ocelli (c) well

developed. Ocular sclerites weakly sclerotized. Cranial apophysis (ca) apically truncate. Tentorial bridge slender. Dorsal head setae (dhs) 8 - 10 (8.8) h.s. on each side of the median line; each gena always with 2 hair-like genal setae (gs). Ventral head setae (vhs) on each side: 4 - 5 (4.1) h.s. in a longitudinal row between the ventral eyes; 9 - 13 (10.1) h.s. forming on both sides a transverse band in the area of the ventral preocular depression; 2 - 3 (2.3) h.s. in a row on each side of the ventral arm of the midcranial ridge. The head also with 1 - 2 (1.3) dorsal pores (dhp) on each side near the antennal base.

Antennae: Filiform; 10-segmented; 479 - 540 (509) μ long, i.e. somewhat longer than half the length of the body (ratio 1:1.6 - 1.9, av. 1.8) and as long as, or slightly longer than the hind leg (ratio 1.0 - 1.1, av. 1.05:1). Scape (scp) 34 - 37 (36) μ long and 31 - 34 (33) μ wide at base; always with 4 h.s. Pedicel 52 - 55 (54) μ long and 31 μ wide; with 14 - 21 (17.2) f.s., 8 - 11 (9.4) h.s. and a sensillum placodeum. Flagellum: Segment III club-shaped, with a narrow stem; about as long as segment X (ratio 1:1 - 1.1 (1.04)), and both being the longest of all; segment III about 20 μ wide, i.e. the ratio its width to its length 1:2.7 - 3.0 (2.9). Segments IV to X cylindrical, with irregular margins and about 18 μ wide; the ratio width to length of segment IX being 1:2.3 - 2.8 (2.5). The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	58-64 (61)	43-52 (46)	46-55 (51)	49-58 (52)	49-55 (52)	46-55 (51)	43-52 (46)	58-67 (62)
f.s. (av.)	8-14 (11.4)	10-15 (12.0)	12-17 (15.2)	15-18 (16.6)	15-19 (17.2)	15-20 (16.8)	11-16 (14.5)	18-25 (21.1)
hs. (av.)	3-5 (4.8)	2-4 (2.5)	2-3 (2.4)	2-3 (2.4)	2-3 (2.3)	1-2 (1.6)	1-2 (1.4)	1-2 (1.4)

Antennal bristles (ab) slightly stouter than the fleshy setae, and of subequal length; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles, two capitate subapical sensory setae (set.scla.) and one apical hair-like seta.

Thorax: 372 - 418 (395) μ long. Prothorax: Pronotal ridges medially interrupted at a weak point. Lateral pronotal sclerites (prn) and posttergites (pt) small. The dorsal margin of the proepisternum ridge-like. Prosternum (stnl) subtriangular, anteriorly forming a weakly sclerotized ring; 31 - 37 (34) μ long and posteriorly bounded by a transverse, 70 - 79 (76) μ long prosternal ridge (stnlr). Prothoracic setae on each side: Medial pronotal setae (mpns) 0 - 2 (1.1) h.s.; lateral pronotal and posttergital setae absent; antespiracular dorsal setae (asds) 1 - 3 (1.2) h.s. One antespiracular ventral seta (asvs) and one prosternal seta always present. Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 8 - 11 (9.6); lateral pronotal pores (lpp) 2 - 3 (2.2); antespiracular dorsal pores 1 - 2 (1.2). One median prosternal pore (stnlp) usually present, but sometimes one pore occurs on each side of the median line (av. 0.8).

Mesothorax: Prescutum (prsc) 67 - 76 (73) μ long and 82 - 92 (89) μ wide, the ratio being 1:1.2 - 1.3 (1.22). Prescutal ridge strong and prescutal suture (pscs) distinct. Scutum (sct) heavily sclerotized

antero-laterally, with a medial longitudinal narrow membranous area; 70 - 76 (74) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.0 - 1.1 (1.02). Prealare, prealar ridge and triangular plate (tp) well developed. Scutellum (scl) 34 - 40 (37) μ long and 64 - 73 (70) μ wide, i.e. the ratios its length to its width 1:1.8 - 2.1 (1.9) and its length to the length of scutum 1:1.9 - 2.3 (2.0).

Postalare (pa) with well separated anterior and posterior ridges.

Mesopleuron: Mesopleural ridge interrupted above the coxal articulation; basalare stout and subepisternal ridge (ser) well developed. The two parts of the mesepisternum (eps2) well sclerotized; lateropleurite (lpl) narrow; mesepimeron (epm2) small. Mesosternum: Basisternum (stn2) 92 - 107 (102) μ long and 131 - 137 (135) μ wide; bounded by the marginal and precoxal ridges. Mesothoracic spiracles (sp2) about 15 μ wide at opening, with 31 - 34 (32) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 2 - 3 (2.4) h.s.; scutal setae 2 - 3 (2.6) h.s.; scutellar seta 0 - 1 (0.6) h.s. Tegular setae 2 - 3 (2.2) h.s. Postmesostigmatal setae (pms) 2 - 3 (2.4) h.s. in a latero-ventral group. Basisternal setae (stn2s) 6 - 8 (6.6) h.s. mostly along the median line. Mesothoracic disc pores: Mesospiracular pores (sp2p) 1 - 2 (1.2) behind each spiracle; one postmesostigmatal pore (pmp) always present.

Metathorax: Metapostnotal sclerites (pn3) connected by means of the transverse metapostnotal ridge (pn3r). Pleural ridge (plr3) slender, attenuated near the middle where a small pleural apophysis originates, and dorsally supports the wing process. Metepisternum and metepimeron distinct. Precoxal ridge (pcr3) well developed and metasternal apophysis small. Metathoracic spiracles identical with those of mesothorax. Metathoracic setae on each side: Metatergal setae (mts) 1 - 2 (1.4) h.s.; metapleural setae usually absent, although one seta was found in one specimen (av. 0.1). Anterior metasternal setae absent and posterior metasternal seta 0 - 1 (0.3) h.s. Metathoracic

disc pores: Metatergal and metaspiracular pores missing; anterior and posterior metasternal pores (amsp & pmsp) 1 - 2 (averages 1.1 and 1.3 respectively).

Wings: Hyaline; 840 - 952 (896) μ long and 322 - 378 (336) μ wide. Alar lobe, axillary and additional sclerites small. The wings always with 3 hair-like alar setae (als) and 2 minute circular sensoria (sens.). Hamulohalterae well developed, 55 - 61 (58) μ long and 12 - 15 (14) μ wide; with a slender ridge and one apically hooked, 37 - 46 (41) μ long seta, i.e. the ratio lengths of the seta to the hamulohaltera 1:1.2 - 1.6 (1.4).

Legs: Comparatively long and slender; the ratio length of the hind leg to the total length of the body 1:1.8 - 1.9 (1.84). Coxa and trochanter about 37 and 18 μ wide respectively; the basal part of the latter longer than the distal, and with 6 circular sensilla; differentiated long apical setae absent. Femur about 27 μ wide; that of the middle leg shortest and that of the hind leg longest; the ratio width to length of the hind femur 1:4.7 - 5.2 (5.0). Tibia about 18 μ wide; with 2 apical spurs and 2 - 4 smaller spines; the ratio length of femur to length of tibia in the front leg 1:1.0 - 1.1 (1.03). Tarsus about 16 μ wide; tarsal digitules apically knobbed, about 31 μ long. Claw gradually tapering to a sharply pointed apex, 31 - 36 (34) μ long; ungual digitules extremely fine, about 12 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	24-27 (26)	24-27 (26)	27-31 (29)
	f.s.	7-10 (8.7)	7-11 (9.6)	9-12 (10.3)
	h.s.	4-6 (5.1)	4-6 (4.9)	4-7 (5.6)
Troch- anter	length in μ	46-49 (48)	46-49 (48)	49-52 (51)
	f.s.	2-4 (2.9)	2-4 (2.5)	2-5 (3.1)
	h.s.	3-4 (3.7)	2-4 (3.4)	3-4 (3.7)
Femur	length in μ	125-137 (131)	119-131 (125)	131-143 (137)
	f.s.	18-23 (20.4)	15-19 (16.9)	16-21 (19.5)
	h.s.	6-9 (7.2)	5-7 (6.1)	5-8 (7.0)
Tibia	length in μ	125-140 (134)	137-146 (143)	162-183 (171)
	f.s.	19-28 (24.4)	21-29 (26.7)	24-32 (28.2)
	h.s.	6-9 (7.6)	7-10 (7.8)	7-11 (8.1)
Tarsus	length in μ	55-58 (57)	55-58 (57)	61-67 (63)
	f.s.	12-16 (13.6)	11-16 (12.9)	13-18 (15.1)
	h.s.	4-6 (5.2)	4-6 (4.9)	4-7 (5.8)
Total length of leg in μ		418-442 (427)	424-445 (433)	470-512 (485)

Abdomen: 274 - 357 (312) μ long and 198 - 213 (205) μ wide. A small tergite on each side of segments I and II present; the tergites of segments VIII and IX + X large and distinct. A weak sternite on each side of segment VIII present. Ostioles entirely absent. Abdominal setae: Dorsal and ventral setae (ads & avs) arranged in transverse rows; pleural setae (aps) in lateral groups. Abdominal disc pores only present laterally. In the following table the number of abdominal setae and pores, on each side of the median line, are given:

	I	II	III	IV	V	VI	VII	VIII
(ads)	1 - 2 (1.2)	(2.0)	1 - 2 (1.9)	1 - 2 (1.1)	1 - 2 (1.3)	2 - 3 (2.3)	2 - 3 (2.5)	1 - 2 (1.1)
(aps)	2 - 3 (2.6)	(3.0)	3 - 4 (3.1)	(3.0)	(3.0)	(3.0)	(3.0)	*1 + (2.0)
(avs)	0	(1.0)	(2.0)	(2.0)	(2.0)	(2.0)	(2.0)	0
(app)	10-15 (12.2)	4 - 5 (4.5)	4 - 6 (4.8)	4 - 7 (5.3)	4 - 7 (5.2)	4 - 7 (4.9)	4 - 6 (5.1)	0

* A slightly longer seta .

The setae of the glandular pouch (gls) consist of a pair of tail setae (ts), 238 - 259 (250) μ long, and one much shorter seta, 37 - 46 (40) μ long, the ratio length of the tail seta to the total length of the body being 1:3.2 - 3.9 (3.6).

Genital segment small; subtriangular in dorsal view. The style (st) curving upwards in lateral view. Penial sheath (ps) 76 - 82 (79) μ long and 55 - 61 (58) μ wide, the ratio being 1.3 - 1.5 (1.4):1, and the ratio its length to the total body length 1:10.4 - 11.5 (11.2). The basal ridge of the penial sheath (brps) with a small projection (pr); the process of the penial sheath well pronounced. The aedeagus (aed) gradually tapering towards a pointed tip. Setae of the genital segment (gts): 3 hair-like setae always present dorsally on each side near the base of the style; 3 - 4 (3.3) h.s. occur ventrally on each side of the penial sheath and 3 - 4 setal sensilla on its process.

Material: 10 specimens examined, collected by J. Munting, on Palm, in Durban, South Africa, on 1.10.1963.

GENUS MACONELLICOCCUS:(7) MACONELLICOCCUS HIRSUTUS (GREEN) (Plate VII, Figs. 12 and 13)

Macropterous forms only known; living specimens light brown or yellowish. The males narrow and slender, of medium size, with comparatively short antennae and moderately long legs. Mounted specimens 1022 - 1428 (1232) μ long, 252 - 322 (294) μ wide and 1708 - 2310 (2016) μ wing expanse.

Body setae and disc pores: The antennae and the legs with many fleshy and few hair-like setae, about 21 μ long; the body itself only with hair-like setae, somewhat shorter than those on the appendages. Quadrilocular and occasionally trilocular or quinquilocular pores present on the head, thorax and abdomen.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression (vprd) hardly pronounced in lateral view. Length from apex to postoccipital ridge 113 - 134 (125) μ ; from apex to neck 153 - 192 (174); width across the genae 186 - 226 (214) μ . The dorsal arm of the midcranial ridge (dmcr) slender, anteriorly detached from the other arms and posteriorly meeting the postoccipital ridge. The lateral arms (lmcr) well developed, forming with the ventral arm (vmcr) a Y-shaped ridge. Postoccipital ridge (por) U-shaped, with a sclerotized area at its medio-posterior base; anteriorly extending to fuse with the preocular ridges. The dorsomedial part of the epicranium (dmepe) slightly raised. Preocular (procr) and interocular ridges join the postocular ridge (pocr) below the ocellus; the preocular ridge without any ventral rudiment. Genae (g) large.

Eyes: The dorsal simple eyes (dse) slightly projecting beyond the outer margins of the head in dorsal view; the diameter of their corneae 24 - 37 (31) μ , and separated by 104 - 128 (119) μ , i.e. 3.3 -

PLATE VII

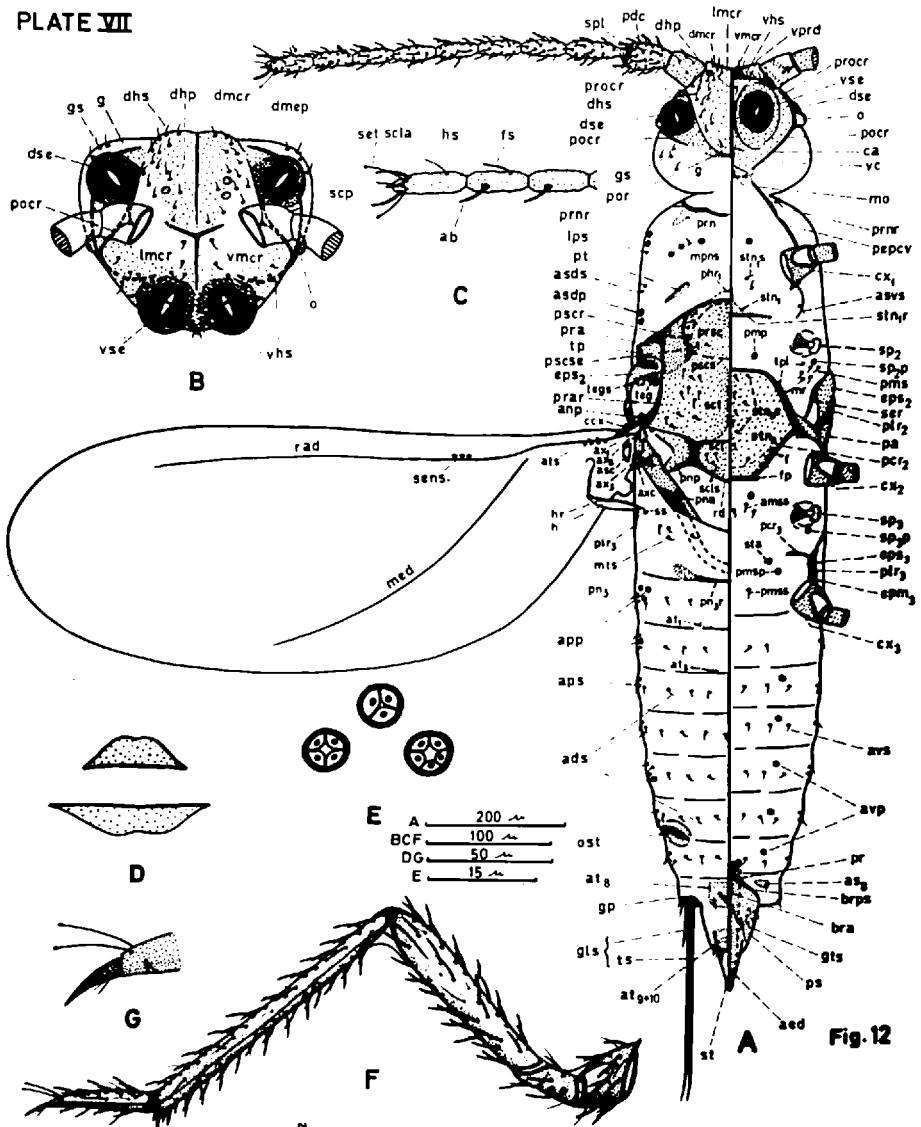


Fig. 12

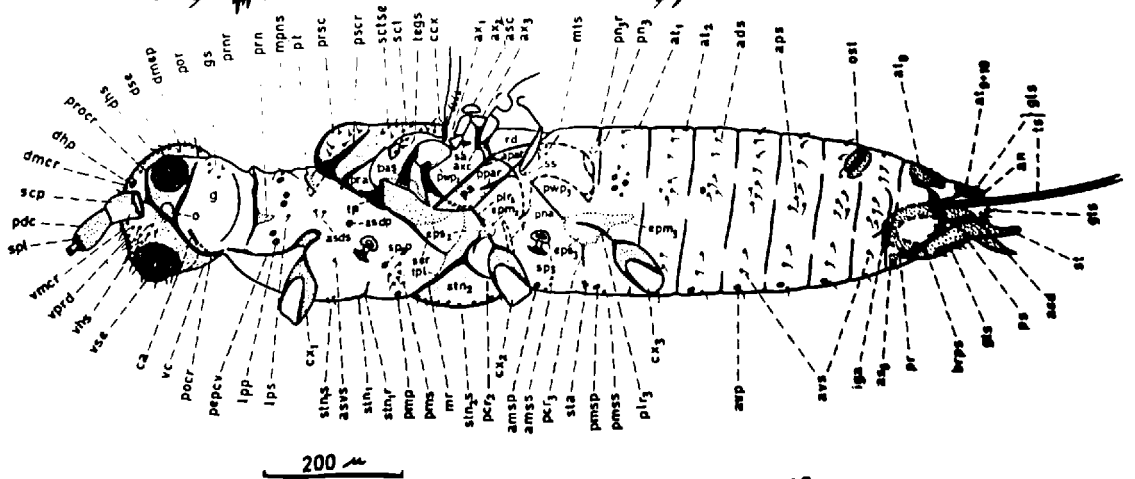


Fig. 13

200

4.4 (3.7) times their diameter apart. Ventral simple eyes (vse) slightly larger, 27 - 40 (34) μ in diameter and 21 - 31 (28) μ apart. Lateral ocelli (o) well developed. Ocular sclerites weakly sclerotized. Cranial apophysis (ca) with truncate apex. Tentorial bridge slender. Mouth opening (mo) small. Dorsal head setae (dhs) 12 - 16 (13.4) h.s. on each side of the median line; each gena usually with 3 - 4 and occasionally 5 hair-like genal setae (gs) (av. 3.3). Ventral head setae on each side: 1 - 2 (1.9) h.s. in a median longitudinal line between the ventral eyes; 13 - 16 (14.1) h.s. forming with their partners of the other side a transverse band across the area of the preocular depression; anteriorly, 2 - 3 (2.2) h.s. longitudinally arranged on each side of the ventral arm of the midcranial ridge. Dorsal head pores (dhp) 1 - 2 (1.2) near the base of each antenna; ventral head pores absent.

Antennae: Filiform; normally 10-segmented; 470 - 653 (573) μ long, i.e. as long as or shorter than half the total length of the body (ratio 1:2.0 - 2.3, av. 2.2), and shorter than the hind leg (ratio 1: 1.1 - 1.2, av. 1.17). Scape (scp) 40 - 49 (43) μ long and 37 - 46 (43) μ wide at base; always with 4 h.s. Pedicel (pdc) 55 - 67 (64) μ long and 31 - 40 (37) μ wide; with 26 - 36 (31.7) f.s., 10 - 18 (12.3) h.s. and a sensillum placodeum (spl). Flagellar segments with irregular margins. Segment III club-shaped and longest of all (the ratio lengths of segments III to X 1.2 - 1.4, av. 1.3:1); the segment about 23 μ wide, i.e. the ratio its width to its length 1:2.9 - 3.8 (3.4). Segments IV to X cylindrical and about 21 μ wide, the ratio width to length of segment IX being 1:2.1 - 3.3 (2.7). The lengths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	61-85	43-67	43-61	43-61	43-63	46-70	46-58	52-70
(av.)	(76)	(55)	(52)	(52)	(53)	(56)	(52)	(59)
f.s.	13-18	13-20	13-20	12-18	13-19	12-19	12-16	10-16
(av.)	(15.9)	(16.3)	(16.1)	(14.9)	(16.4)	(15.0)	(14.2)	(13.6)
h.s.	3-7	2-5	2-3	2-5	2-6	3-6	3-6	3-6
(av.)	(4.7)	(3.4)	(2.5)	(3.5)	(3.9)	(4.4)	(4.4)	(4.5)

Antennal bristles (ab) easily distinguished; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles, the dorsal of which about half as long; the segment also with two 34 - 40 (37) μ long, capitate subapical sensory setae (set.scla.) and one apical hair-like seta.

Thorax: 418 - 600 (540) μ long. Prothorax: Well separated from head. Pronotal ridges (prnr) medially constricted at a weak point. Lateral pronotal sclerites (prn) moderately large and posttergites (pt) narrow. Proepisternum with a ridge-like dorsal margin. Prosternum (stnl) subtriangular, 31 - 46 (38) μ long; prosternal ridge (stnlr) 85 - 104 (96) μ long. Prothoracic setae on each side: Medial pronotal setae (mpns) 0 - 2 (1.3) h.s.; lateral pronotal setae (lps) 0 - 3 (1.1) h.s.; posttergital setae absent and antespiracular dorsal setae (asds) 1 - 3 (2.0) h.s. One antespiracular ventral seta (asvs) always present; prosternal setae (stnls) 1 - 3 (1.7) h.s. Prothoracic disc pores on each side: Medial pronotal pores 2 - 5 (3.1); lateral pronotal pores (lpp) 1 - 3 (2.1); antespiracular dorsal pores (asdp) 1 - 2 (1.7). Prosternal pores 1 - 2 (1.1).

Mesothorax: Prescutum (prsc) 61 - 89 (76) μ long and 104 - 143 (131) μ wide (ratio 1:1.6 - 1.8, av. 1.7); prescutal ridge (psor) strong and prescutal suture well marked. Scutum (sct) heavily

sclerotized antero-laterally, with a median longitudinal narrow membranous area; 85 - 125 (113) μ long, i.e. the ratio length of prescutum to scutum 1:1.3 - 1.5 (1.46). Pleural structures typical of the family.

Scutellum pentagonal, 46 - 64 (58) μ long and 85 - 116 (104) μ wide, the ratio being 1:1.7 - 1.9 (1.8); subequal to half the length of the scutum, ratio 1:1.8 - 2.1 (1.9). Postalare (pa) well developed, with well separated anterior and posterior postalar ridges. Postnotal apophysis (pna) large. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare (bas) stout. Subepisternal ridge (ser) well developed. Mesepisternum (eps2) and mesepimeron (epm2) distinct; lateropleurite (lpl) narrow. Mesosternum: Basisternum (stn2) 122 - 174 (152) μ long and 146 - 201 (180) μ wide; marginal and precoxal ridges (mr & pcr2) well developed. Mesothoracic spiracles (sp2) 18 - 21 (19) μ wide at opening, with 37 - 43 (40) μ long supporting bar. Mesothoracic setae on each side of the median line: Prescutal setae 5 - 9 (6.3) h.s.; scutal setae (sctse) usually 8 - 11, although 13 setae were found on one side of one specimen (av. 10.0) h.s.; scutellar setae (scls) 3 - 6 (3.4) h.s. Tegular setae (tegs) 3 - 5 (4.1) h.s. Postmesostigmatal setae (pms) 4 - 9 (6.1) h.s. in a latero-ventral group. Basisternal setae (stn2s) 7 - 15 (9.9) h.s. Mesothoracic pores: Mesospiracular pore (sp2p) 0 - 1 (0.8); one postmesostigmatal pore (pmp) almost always present submedially on each side, but none at all or two pores may occur on one side (av. 1.0).

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pn3r) well developed. Metapleural ridge (plr3) attenuated at the point of origin of the metapleural apophysis; dorsally supporting a small wing process (pwp3). Precoxal ridge (pcr3) well developed and metasternal apophysis (sta) well defined. Metathoracic spiracle (sp3) similar to mesothoracic. Metathoracic setae on each side: Metatengal setae (mts) 3 - 5 (4.1) h.s.; metapleural setae 0 - 2 (0.8) h.s. Anterior and

posterior metasternal setae (amss & pmss) 2 - 4 (3.1) and 0 - 1 (0.6) h.s. respectively. Metathoracic pores: Metatergal pores absent and metaspiracular pores (sp3p) 0 - 1 (0.7). Anterior metasternal pores (amsp) 1 - 2 (1.1) and posterior metasternal pores (pmsp) 0 - 1 (0.9).

Wings: Hyaline; 742 - 1008 (910) μ long and 294 - 392 (350) μ wide. Alar lobe, axillary and additional sclerites (ax1, ax2, ax3 & asc) well developed; with 4 - 5 (4.2) hair-like alar setae (als) and a compact row of 3 - 4 (3.2) minute circular sensoria (sens.). Hamulohalterae (h) well developed, 61 - 79 (73) μ long and 12 - 15 (14) μ wide; each with a slender ridge (hr) and one 43 - 55 (49) μ long apically hooked seta, i.e. the ratio length of seta to the length of hamulohaltera 1:1.4 - 1.6 (1.5).

Legs: Moderately long and slender; the ratio length of the hind leg to the total body length 1:1.8 - 1.9 (1.85). Coxa about 49 and trochanter about 27 μ wide; the latter with the basal part longer than the distal and with 6 circular sensilla; differentiated long apical setae absent. Femur about 37 μ wide; that of the front leg shortest, and that of the hind leg longest; the ratio width to length of the hind femur 1:5.0 - 5.9 (5.6). Tibia about 19 μ wide; with two apical strong spurs and 3 - 5 smaller spines; in front leg, the femur always shorter than the tibia, the ratio their lengths being 1:1.0 - 1.1 (1.12). Tarsus about 17 μ wide; tarsal digitules apically knobbed, 31 - 37 (34) μ long. Claw gradually tapering to a pointed tip, 21 - 27 (24) μ long; unequal digitules fine, about 13 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore-leg	Middle leg	Hind leg
Coxa	Length in μ	37-43 (40)	37-43 (40)	40-49 (46)
	f.s.	8-17 (13.0)	9-16 (12.6)	10-20 (14.8)
	h.s.	5-9 (6.0)	5-8 (6.4)	6-8 (6.8)
Troch- anter	length in μ	49-64 (58)	49-64 (58)	55-70 (64)
	f.s.	4-6 (4.6)	4-9 (6.2)	5-8 (6.4)
	h.s.	3-6 (3.8)	3-6 (4.0)	3-6 (4.2)
Femur	length in μ	137-198 (177)	143-204 (183)	153-214 (192)
	f.s.	32-44 (38.4)	33-44 (39.0)	38-54 (46.4)
	h.s.	6-9 (7.6)	6-9 (7.7)	7-9 (7.6)
Tibia	length in μ	159-226 (198)	165-241 (211)	214-299 (256)
	f.s.	33-48 (39.4)	38-58 (47.8)	45-69 (54.8)
	h.s.	4-8 (5.4)	5-8 (6.2)	6-9 (6.8)
Tarsus	length in μ	70-89 (82)	70-89 (82)	82-98 (92)
	f.s.	10-17 (13.6)	11-21 (15.0)	13-25 (17.0)
	h.s.	5-8 (6.6)	6-8 (6.8)	6-8 (6.8)
Total length of leg in μ		467-644 (580)	479-665 (598)	564-750 (671)

Abdomen: 334 - 494 (403) μ long and 236 - 312 (281) μ wide. The tergites of segments I and II small; of segments VIII and IX + X large and distinct. The sternites of segment VIII weakly sclerotized. Ostioles (ost) well developed, 37 - 46 (40) μ long at orifice. Abdominal setae segmentally arranged in dorsal, ventral transverse rows, and pleural groups. Abdominal disc pores: Dorsal pores absent; pleural pores (app) always present on segment I and sometimes absent on the succeeding segments II to VII; a ventral pore (avp) occurs at least

on one side of segments III to VII, forming together a sublateral, longitudinal row on each side. In the following table the number of abdominal setae and pores on each side of the median line are given:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 3 (2.4)	3 - 4 (3.2)	3 - 4 (3.3)	3 - 4 (3.2)	3 - 4 (3.2)	3 - 4 (3.3)	3 - 4 (3.1)	2 - 3 (2.9)
(aps)	2 - 4 (2.6)	4 - 5 (4.1)	4 - 5 (4.3)	4 - 5 (4.5)	4 - 5 (4.6)	4 - 5 (4.6)	4 - 6 (4.7)	*1+2-3 (2.4)
(avs)	-	1 - 2 (1.6)	2 - 3 (2.4)	2 - 3 (2.6)	2 - 3 (2.5)	2 - 3 (2.5)	2 - 3 (2.1)	0 - 1 (0.3)
(app)	2 - 4 (2.8)	0 - 1 (0.2)	0 - 1 (0.1)	0 - 1 (0.1)	0 - 1 (0.1)	0 - 1 (0.1)	0	0
(avp)	-	0	0 - 1 (0.9)	0 - 1 (0.9)	0 - 1 (0.9)	(1.0)	(1.0)	0

* A slightly longer seta.

Glandular pouch (gp) well developed; setae of the glandular pouch (gls) include a pair of tail setae (ts), 229 - 296 (265) μ long and one seta of medium length, 52 - 82 (61) μ long, i.e. the ratio length of the tail setae to the total length of the body 1:4.0 - 4.9 (4.5).

Genital segment moderately large; subtriangular in dorsal view; the style (st) more or less straight and apically rounded in lateral view. Penial sheath (ps) 140 - 180 (162) μ long and 67 - 89 (82) μ wide, the ratio being 1.8 - 2.4 (2.0):1, and the ratio its length to the total body length 1:7.1 - 8.4 (7.6). Basal ridge of the penial

sheath (brps) with a small projection (pr). Process of the penial sheath vestigial and hardly indicated. Aedeagus (aed) comparatively long, anteriorly bent to reach the cavity of abdominal segment VII; internal genital aperture (iga) small. Setae of the genital segment: Dorsally, 3 hair-like setae always occur on each side near the base of the style; ventrally 4 - 6 (5.1) h.s. present on each side of the penial sheath, and 3 - 4 (3.8) setal sensilla on its vestigial process.

Material: 10 specimens examined, collected by myself, on Psidium guava, in Fayoum, Egypt, U.A.R., during the second week of August, 1964; the females were identified by A. I. Ezz and confirmed by Y. M. Ezzat.

GENUS FERRISIANA:(8) FERRISIANA VIRGATA (COCKERELL) (Plate VIII, figs. 14 and 15)

Macropterous forms only known; these comparatively long and slender, with moderately long antennae and long legs. When mounted, total body length 1274 - 1596 (1386) μ , width at mesothorax 294 - 364 (322) and the wing expanse 2296 - 2576 (2422) μ .

Body setae and pores: Antennae and legs with numerous fleshy and very few hair-like setae, about 55 μ long; the body itself only with much shorter hair-like setae, about 28 μ long. Disc pores usually quadrilocular and occasionally trilocular or quinquilocular, about 6 μ in diameter; the pores absent on the head, but present on the thorax and abdomen.

Head: Irregularly tetrahedron; subtriangular in dorsal and front views; the ventral preocular depression (vprd) well pronounced in lateral view. Length from apex to postoccipital ridge 113 - 137 (125) μ ; from apex to neck 174 - 204 (186) μ ; width across genae 204 - 253 (220) μ . The dorsal arm of the midcranial ridge only indicated by a median longitudinal heavy sclerotization. Lateral and ventral arms (lmc & vmc) strongly developed, forming together a Y-shaped ridge. Postoccipital ridge (por) U-shaped; anteriorly confluent with the preocular ridges. The dorsomedial part of the epicranium (dmep) well sclerotized and slightly raised. Preocular (procr) + interocular ridge join the postocular ridge (pocr) below the ocellus; the ventral rudiment of the preocular ridge weakly indicated.

Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; their corneae 24 - 28 (26) μ in diameter and separated by 98 - 110 (104) μ , i.e. 3.6 - 4.5 (4.2) times their diameter apart. The ventral simple eyes (vse) slightly larger

PLATE VIII

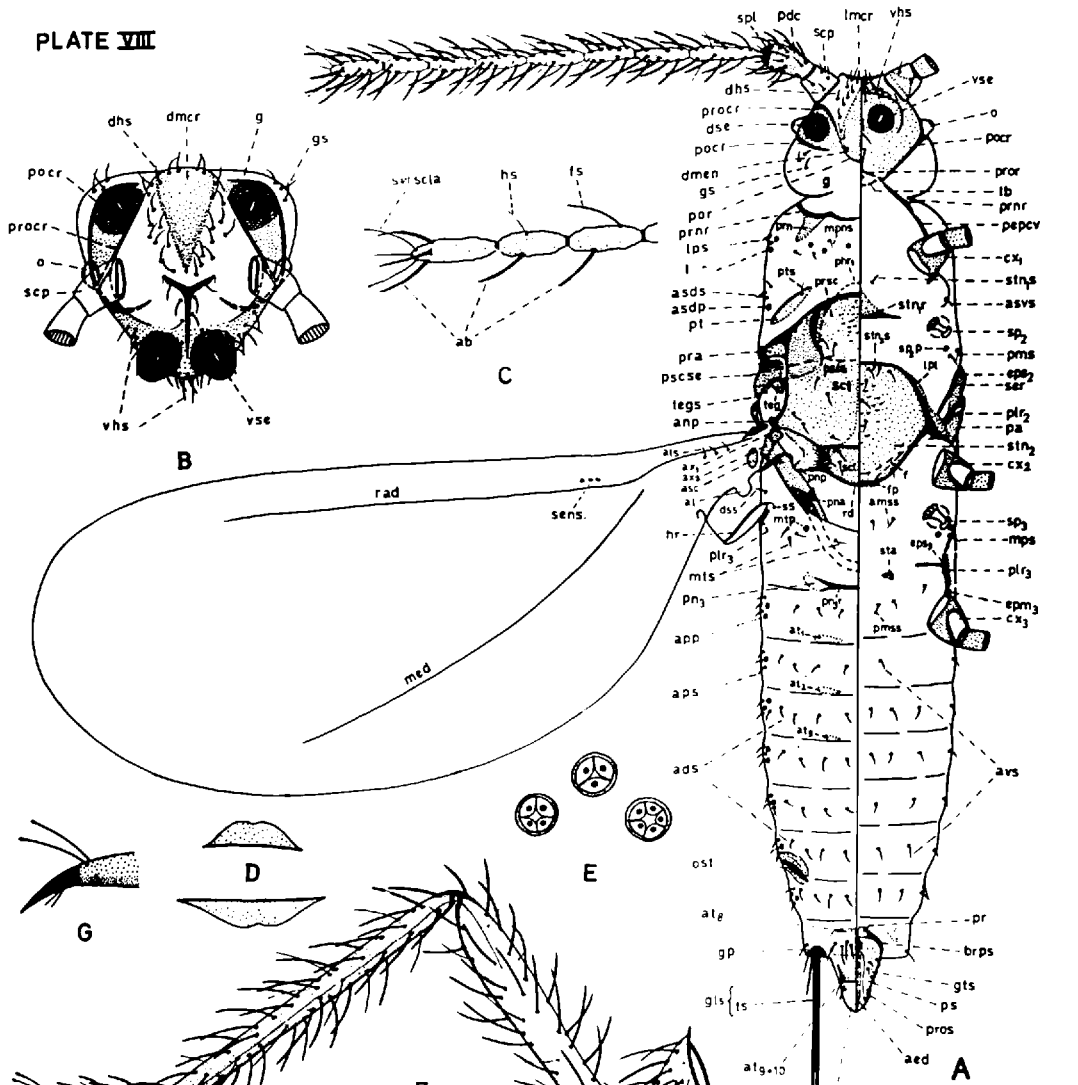


Fig. 14

A	200
BCF	100
DG	50
E	15

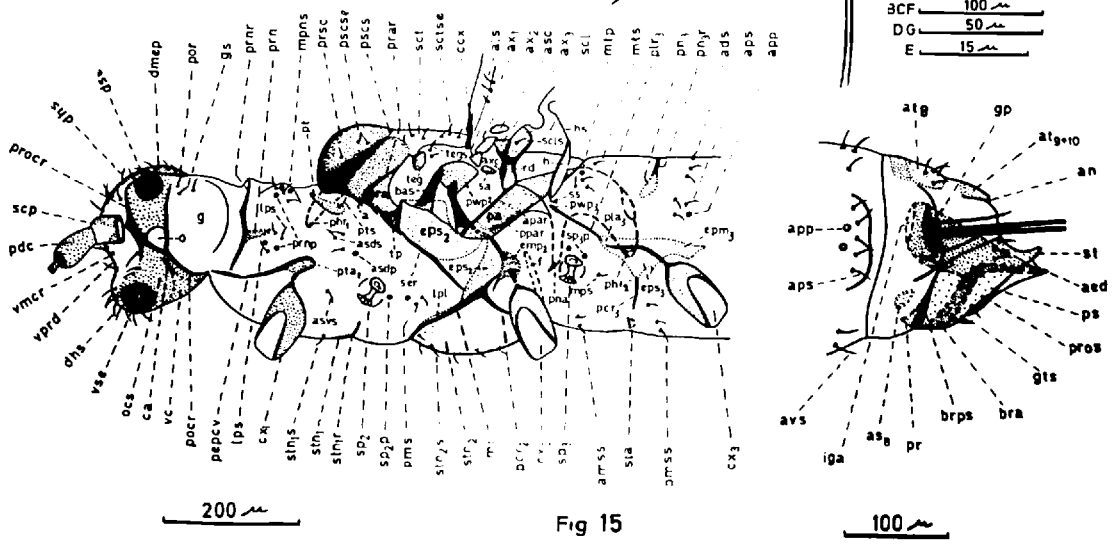


Fig 15

and much closer, 28 - 31 (29) μ in diameter and 25 - 31 (28) μ apart. Lateral ocelli (o) well developed. Ocular sclerites (ocs) traversed by the interocular ridges. Cranial apophysis (ca) apically truncate. Posterior tentorial pits distinct and tentorial bridge (tb) slender. Dorsal head setae (dhs) 11-14 (12.5) h.s., anterior to the postoccipital ridge on each side of the median line; each gena with 3 - 4 (3.3) hair-like genal setae (gs). Ventral head setae (vhs) on each side: 2 - 4 (3.2) h.s. longitudinally arranged between the ventral eyes; 5 - 8 (6.7) h.s. forming with their partners on the other side a band across the area of the preocular depression; anteriorly, 2 - 4 (3.3) h.s. occur on each side of the ventral arm of the midcranial ridge.

Antennae: Filiform; normally 10-segmented; 674 - 848 (760) μ long, i.e. slightly longer than half the total body length (ratio 1:1.7 - 1.9, av. 1.8) and shorter than the hind legs (ratio 1:1.1 - 1.2, av. 1.14). Scape (scp) 37 - 46 (43) μ long and 46 - 52 (49) μ wide at base; always with 4 h.s. Pedicel (pdc) 64 - 79 (70) μ long and 34 - 40 (37) μ wide; with 12 - 19 (16.9) f.s., 5 - 8 (6.0) h.s. and a sensillum placodeum (spl). Flagellar segments with irregular margins; segment III being longest (ratio its length to the length of segment X 1.2 - 1.6, av. 1.4:1); segment III about 23 μ wide, the ratio its width to its length being 1:4.3 - 5.6 (5.1). Segment IV to X cylindrical and about 21 μ wide, the ratio width to length of segment IX being 1:2.7 - 3.1 (2.9) The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
lengths in μ	92-131	64-89	73-95	67-92	67-82	64-76	58-73	73-89
(av.)	(116)	(76)	(79)	(82)	(73)	(70)	(67)	(82)
f.s.	13-19	9-15	13-17	14-19	12-17	12-17	11-15	9-15
(av.)	(15.9)	(12.2)	(14.5)	(17.0)	(14.1)	(14.2)	(12.9)	(12.6)
h.s.	0-2	0-2	0-2	1-2	1-2	0-2	0-1	0-1
(av.)	(0.7)	(0.8)	(0.3)	(1.8)	(1.4)	(1.0)	(0.1)	(0.1)

Antennal bristles (ab) conspicuously stout; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles (the dorsal of which slightly shorter and at a greater distance from the apex), two capitate subapical sensory setae (set. scla.) about 46μ long, and one apical hair-like seta.

Thorax: 555 - 737 (608μ) long. Prothorax: Pronotal ridges (prnr) strongly developed, though medially interrupted at a weakly sclerotized point. Lateral pronotal sclerites (prn) and posttergites (pt) comparatively large. The dorsal margin of the proepisternum ridge-like. Prosternum (stnl) triangular, 31 - 46 (37μ) long; posteriorly supported by a transverse, 107 - 128 (113μ) long prosternal ridge (stnlr). Prothoracic setae on each side of the median line: Medial pronotal setae (mpns) 2 - 3 (2.6) h.s.; lateral pronotal setae (lps) 2 - 4 (2.9) h.s.; posttergital setae (pts) 0 - 3 (1.4) h.s.; antespiracular dorsal setae (asds) 2 - 4 (3.1) h.s. One antespiracular ventral seta (asvs) and one prosternal seta (stnls) always present. Prothoracic pores on one side: Medial pronotal pores (mpnp) 2 - 6 (3.2); lateral pronotal pores (lpp) 1 - 3 (1.8); antespiracular dorsal pores (asdp) 0 - 1 (0.5). Prosternal pores absent.

Mesothorax: Prescutum (prsc) 92 - 113 (98) μ long and 128 - 165 (147) μ wide (ratio 1:1.4 - 1.6, av. 1.5); prescutal ridge well developed and prescutal suture (pscs) distinct. Scutum (sot) large; heavily sclerotized antero-laterally, with a median longitudinal narrow membranous area; 116 - 156 (131) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.2 - 1.4 (1.3). Prealare (pra), prealar ridge (prar), triangular plate (tp), anterior and posterior notal wing processes (anp & pnp) well developed. Scutellum (scl) pentagonal, 49 - 64 (58) μ long and 101 - 131 (116) μ wide (the ratio being 1:1.9 - 2.2, av. 2.0, and the ratio its length to the length of the scutum 1:2.1 - 2.6, av. 2.3). The postalare (pa) with well separated anterior and posterior postalar ridges (apar & ppar). Postnotal apophysis (pna) strong. Mesopleuron: Mesopleural ridge (plr2) interrupted in the usual manner; basalare (bas) stout. Subepisternal ridge (ser), mesepisternum (eps2), lateropleurite (lpl) and mesepimeron (epm2) typical of the family. Mesosternum: Basisternum (stn2) 143 - 198 (162) μ long and 180 - 229 (211) μ wide; bounded by the marginal and precoxal ridges (mr & pr2). Mesothoracic spiracles (sp2) 18 - 21 (20) μ wide at opening, with 37 - 43 (40) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 2 - 4 (3.1) h.s.; scutal setae (sctse) 6 - 7 (6.3) h.s.; scutellar setae (scls) 3 - 4 (3.2) h.s. Tegular setae (tegs) 1 - 3 (1.7) h.s. Postmesostigmatal setae (pms) 2 - 3 (2.3) h.s. occurring only latero-ventrally behind each spiracle. Basisternal setae (stn2s) 6 - 9 (6.8) h.s. Mesothoracic disc pores: Mesospiracular pores (sp2p) 0 - 2 (0.8); postmesostigmatal pores absent.

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pr3r) well developed. Metapleural ridge (plr3) attenuated at the point of origin of the metapleural apophysis (pla3); metapleural wing process (pwp3) small. Precoxal ridge (pcr3) and metasternal apophysis

(sta) well developed. Metathoracic spiracle (sp3) identical with that of the mesothorax. Metathoracic setae on each side: Metatergal setae (mts) 4 - 5 (4.2) h.s. Dorsostigmatal setae (dss) 0 - 1 (0.3) h.s. and metapleural seta (mps) always one behind each spiracle. Anterior and posterior metasternal setae (amss & pmss) 1 - 2 (1.5) and 2 - 3 (2.7) h.s. respectively. Metathoracic pores: 1 - 2 (1.2) sub-marginal metatergal pores (mtp) and 2 - 3 (2.2) metaspiracular pores (sp3p) present; anterior and posterior metasternal pores absent.

Wings: Hyaline; 1008 - 1120 (1064) μ long and 420 - 532 (462) μ wide. Alar lobe (al), axillary and additional sclerites well developed; with 3 and occasionally 4 (av. 3.1) hair-like alar setae (als), and a compact row of 3 minute circular sensoria (sens.). Hamulohalterae well developed, 76 - 89 (82) μ long and 15 - 21 (18) μ wide; each with a slender ridge (hr) and 61 - 70 (64) μ long apically hooked seta, i.e. the ratio length of seta to hamulohaltera being 1: 1.2 - 1.5 (1.3).

Legs: Comparatively long and slender; the ratio length of the hind leg to the total body length 1:1.5 - 1.7 (1.6). Coxa and trochanter about 51 and 27 μ wide respectively; the latter with the basal part longer than the distal, and with 6 circular sensilla; differentiated apical seta absent. Femur narrow, about 37 μ wide; that of the fore leg shortest and that of the hind leg longest; the ratio width to length of hind femur 1:6.8 - 7.6 (7.0). Tibia about 21 μ wide; with two apical stout spurs and 5 - 8 smaller spines; femur of front leg shorter than the tibia, the ratio their lengths being 1:1.1 - 1.3 (1.2). Tarsus about 21 μ wide; tarsal digitules apically knobbed, 34 - 43 (37) μ long. Claw gradually tapering to a pointed tip, 24 - 31 (28) μ long; ungual digitules fine, about 15 μ long. The lengths of the leg segments and the number of setae on each are given below:

		Fore leg	Middle leg	Hind leg
Coxa	length in μ	43-49 (46)	46-52(49)	52-58 (55)
	f.s.	13-18 (15.3)	12-18 (14.0)	12-23 (17.5)
	h.s.	2-5 (3.7)	3-5 (4.1)	2-5 (3.6)
Trochanter	length in μ	58-67 (64)	61-67 (64)	64-70 (67)
	f.s.	3-5 (3.6)	3-5 (4.0)	3-5 (4.3)
	h.s.	1-4 (2.7)	1-3 (1.6)	1-3 (1.8)
Femur	length in μ	198-253 (226)	207-259 (232)	232-278 (256)
	f.s.	25-40 (32.6)	27-34 (30.1)	32-41 (35.6)
	h.s.	2-6 (3.6)	2-3 (2.5)	2-5 (3.0)
Tibia	length in μ	220-290 (262)	238-308 (281)	317-397 (357)
	f.s.	30-43 (37.8)	39-48 (43.5)	47-59 (53.0)
	h.s.	1-3 (2.0)	0-3 (1.4)	2-5 (2.9)
Tarsus	length in μ	79-92 (89)	85-95 (91)	98-110(104)
	f.s.	18-22 (19.6)	20-23(21.3)	19-24(22.1)
	h.s.	0-3 (1.7)	0-2 (1.0)	0-2 (0.9)
Total length of leg in μ		622-778 (708)	670-805 (741)	796-946 (872)

Abdomen: 448 - 593 (509) μ long and 274 - 327 (304) μ wide. Tergites of segments I, II, III and sometimes IV present; those of segment VII and segments IX + X large. Sternites of segment VIII weak. Ostioles (ost) well developed, 37 - 46 (40) μ long at orifice. Abdominal setae: Dorsal and ventral setae (ads & avs) in transverse rows; pleural setae (aps) in lateral clusters. Abdominal pores present only laterally. The following table shows the number of abdominal setae and pores on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	3 - 4 (3.6)	3 - 4 (3.8)	3 - 4 (3.9)	3 - 4 (3.9)	3 - 4 (3.9)	3 - 4 (3.9)	3 - 4 (3.8)	3 - 4 (3.5)
(aps)	1 - 2 (1.9)	2 - 3 (2.1)	2 - 3 (2.3)	2 - 3 (2.4)	2 - 3 (2.3)	2 - 3 (2.3)	2 - 3 (2.3)	*1 + (2.0)
(avs)	•	1 - 2 (1.1)	2 - 3 (2.9)	2 - 3 (2.9)	2 - 3 (2.1)	(2.0)	(2.0)	0
(app)	1 - 3 (1.3)	1 - 2 (1.2)	1 - 3 (1.8)	1 - 3 (2.1)	1 - 3 (1.9)	(1.0)	(1.0)	0

* A slightly longer seta.

The glandular pouch (gp) well developed; setae of the glandular pouch (gls) consist of a pair of 409 - 427 (421) μ long tail setae (ts), and one seta of medium length, 70 - 101 (82) μ long, i.e. the ratio length of the tail setae to the total length of the body 1:3.0 - 3.6 (3.3).

Genital segment comparatively small; subtriangular in dorsal view, with a broadly rounded apex; style (st) more or less straight in lateral view. Penial sheath (ps) 122 - 137 (128) μ long and 76 - 92 (79) μ wide; i.e. the ratio length to width 1.5 - 1.7 (1.6):1 and the ratio its length to the total body length 1:10.0 - 11.6 (10.8). Basal ridge of the penial sheath (brps) and its projection (pr) well developed; process of penial sheath absent. Aedeagus (aed) rather stout; internal genital aperture (iga) large. Setae of the genital segment: Dorsally, 3 hair-like setae always present on each side near the base of the style; ventrally, 3 - 5 (3.8) h.s. and 3 - 4 (3.3) minute setal sensilla (pros) occur on each side of the penial sheath.

Material: 10 specimens examined, collected by A. I. Ezz, on Croton sp., in Cairo, Egypt, U.A.R., on 22.11.62.

GENUS TRIONYMUS:(9) TRIONYMUS NEWSTEADI (GREEN) (Plate IX, figs. 16 and 17)

Winged forms only known; newly emerged males light brown, becoming darker soon afterwards, with dark brown or blackish eyes. These narrow and slender, comparatively large with short antennae and moderately long legs. When mounted 1190- 1498 (1372) μ long, 308 - 378 (350) μ wide at mesothorax and 2926 - 3542 (3318) μ wing expanse.

Body setae and disc pores: The antennae with numerous fleshy setae, about 31 μ long, and a few slightly longer hair-like ones; the legs and the main parts of the body with hair-like setae only. Disc pores usually quadrilocular and occasionally quinquilocular, about 6 μ in diameter and occur on the thorax, abdomen and sometimes on the head.

Head: Subtetrahedron; subtriangular in dorsal and front views; with a hardly indicated ventral preocular depression (vprd). Length from apex to postoccipital ridge 116 - 125 (122) μ ; from apex to neck 183 - 201 (192) μ ; width across the genae 214 - 250 (235) μ . Dorsal arm of the midcranial ridge anteriorly separated from the other arms and posteriorly extending to meet the postoccipital ridge. Lateral and ventral arms well developed, forming a Y-shaped ridge. Postoccipital ridge U-shaped and anteriorly confluent with the preocular ridges. Preocular + interocular ridges strongly developed, joining the postocular ridge (pocr) below the ocellus; the preocular ridge with a well defined ventral rudiment. Preoral ridge (pror) slender.

Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; their corneae 21 - 27 (24) μ in diameter and separated by 113 - 134 (125) μ , i.e. 4.6 - 6.1 (5.1)

PLATE IX

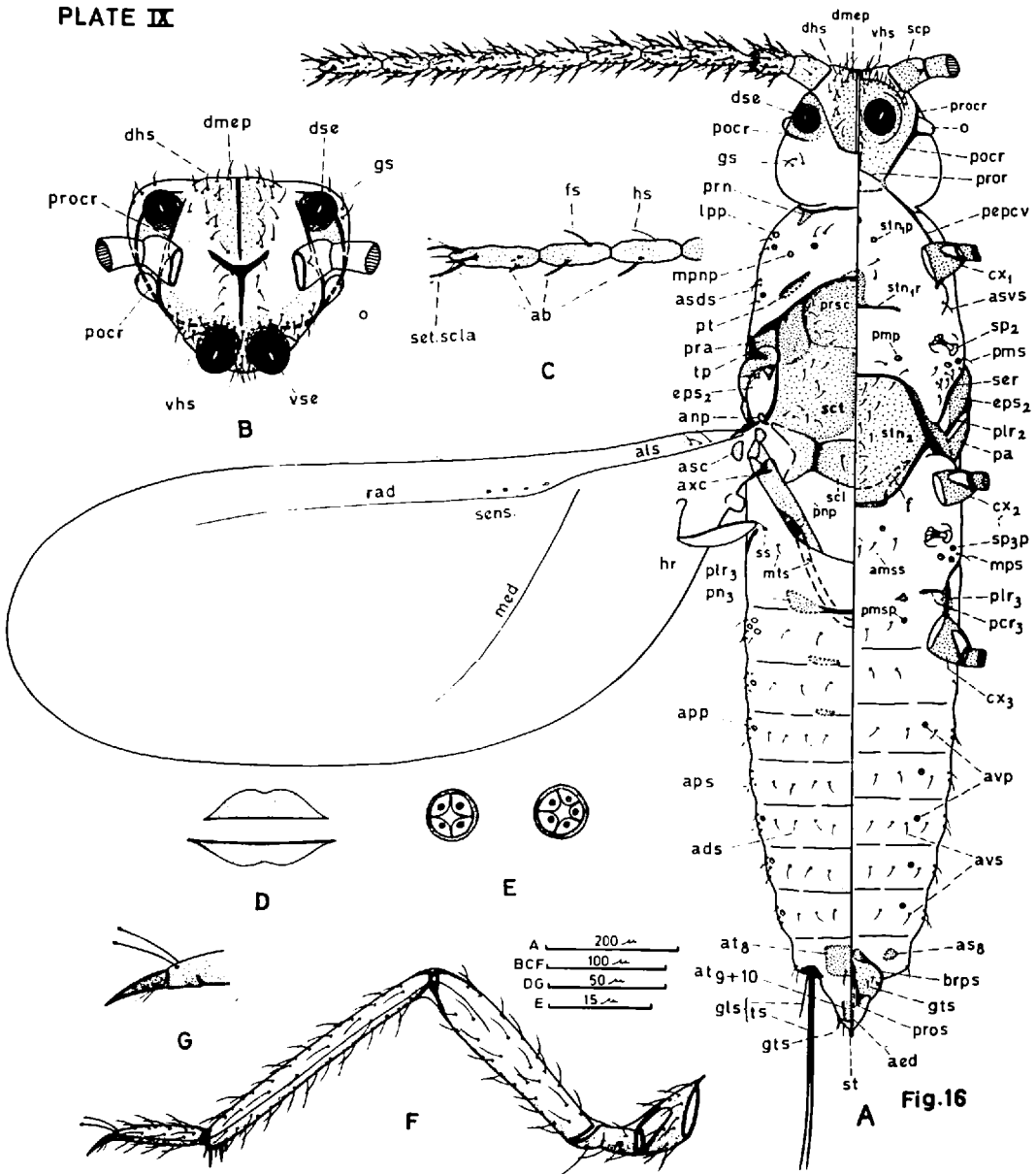


Fig.16

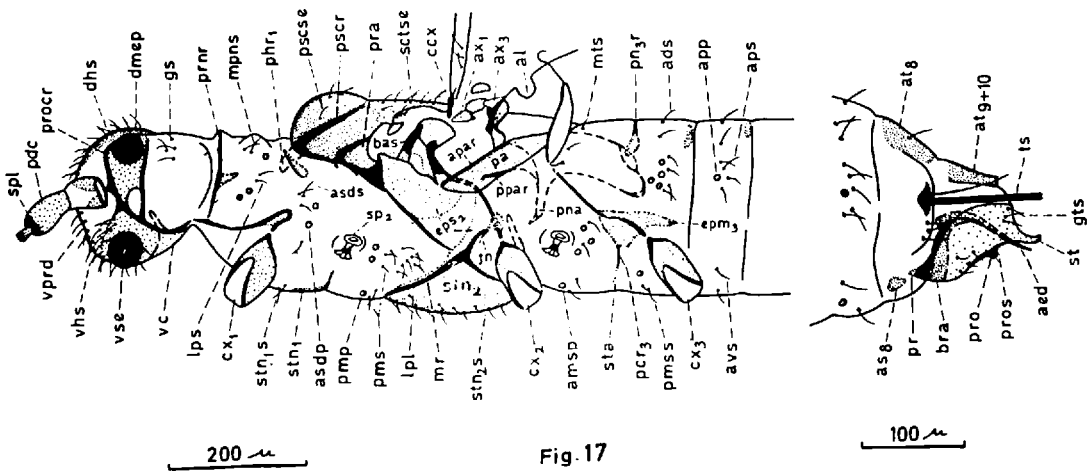


Fig.17

times as much as their corneae apart. The ventral simple eyes (vse) slightly larger, 24 - 34 (30) μ in diameter and 24 - 31 (27) μ apart. Lateral ocelli (o) well developed. Ocular sclerites traversed by the interocular ridge. Cranial apophysis with truncate apex. Mouth opening small. Posterior tentorial pits minute and tentorial bridge slender. Dorsal head setae 13 - 16 (14.7) h.s. on each side of the median line anterior to the postoccipital ridge; each gena usually with 4 and occasionally 3 or 5 genal setae (gs) (av. 3.8) h.s. ventral head setae (vhs) on each side: 1 - 2 (1.8) h.s. in a longitudinal irregular row between the ventral eyes; 11 - 16 (12.4) h.s. forming with their partners on the other side a transverse band in the area of the ventral preocular depression; 3 - 4 (3.8) h.s. on each side of the ventral arm of the medcranial ridge. Head disc pores: Dorsal pores usually absent, although one pore was found on one side of a few specimens near the base of the antennae (av. 0.3); ventral pores missing.

Antennae: Filiform; 10-segmented; 610 - 769 (705) μ long, i.e. subequal to half the total length of the body (ratio 1:1.8 - 2.1, av. 1.9), and subequal to the hind legs (ratio 1:0.8 - 1.1, av. 0.95). Scape (scp) 46 - 55 (52) μ long and 46 - 49 (47) μ wide at base; always with 4 h.s. Pedicel (pdc) 61 - 70 (66) μ long and 37 - 43 (40) μ wide; with 19 - 29 (23.1) f.s., 10 - 14 (12.1) h.s. and a sensillum placodeum (spl).

Flagellum: Segment III club-shaped, about as long as segment X, both being the longest (ratio approximately 1:1); segment III about 29 μ wide, the ratio its width to its length being 1:2.5 - 3.2 (2.9). Segments IV to X cylindrical and 24 - 27 μ wide, the ratio width to length of segment IX being 1:2.4 - 2.9 (2.7). The lengths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	70-92 (82)	61-76 (67)	58-79 (70)	58-89 (73)	61-89 (73)	58-76 (70)	58-73 (67)	76-92 (82)
f.s. (av.)	13-21 (17.0)	16-24 (18.8)	19-30 (23.9)	21-33 (25.9)	21-31 (25.7)	20-26 (22.6)	17-24 (21.0)	16-27 (20.1)
h.s. (av.)	5-11 (7.4)	2-5 (2.6)	2-5 (3.9)	3-5 (4.3)	2-5 (3.7)	3-6 (4.2)	2-5 (3.1)	1-2 (1.7)

Antennal bristles (ab) well-defined; segments VIII and IX each with one ventral bristle. Terminal segment with 3 similar preapical bristles and two much smaller ones near the base of the segment; terminal segment also with a pair of capitate subapical sensory setae (set. scl.) and one apical hair-like seta.

Thorax: 532 - 707 (722) μ long. Prothorax: Pronotal ridges (prnr) strong, with the usual median interruption. Lateral pronotal sclerites (prn) and posttergites (pt) small. Proepisternum with a ridge-like dorsal margin. Prosternum (stnl) 43 - 58 (52) μ long and comparatively very narrow; posteriorly bounded by the transverse, slender, 92 - 110 (104) μ long prosternal ridge (stnlr). Prothoracic setae on each side of the median line: Medial pronotal setae (mpns) 1 - 2 (1.7) h.s.; lateral pronotal setae (lps) 1 - 3 (2.1) h.s.; posttergital setae almost always absent, but one seta was found on each side of one specimen (av. 0.1 h.s.); antespiracular dorsal setae (asds) 2 - 4 (2.9) h.s.. One antespiracular ventral seta (asvs) always present. Prosternal setae (stnls) 2 - 4 (2.5) h.s. Prothoracic pores on each side: Medial and lateral pronotal pores (mpnp & lpp)

1 - 3 (averages 2.2 and 2.1 respectively); antespiracular dorsal pores (asdp) 1 - 2 (1.1). One prosternal pore (Stnlp) usually present, but sometimes two pores or none at all may occur on either side (av. 1.1).

Mesothorax: Prescutum (prsc) 92 - 119 (104) μ long and 131 - 163 (153) μ wide (ratio 1:1.4 - 1.7, av. 1.5); laterally bounded by the prescutal ridges (pscr) and posteriorly by the prescutal suture. Scutum (sct) comparatively large, heavily sclerotized antero-laterally and with a medial longitudinal narrow membranous area; 110 - 137 (128) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.1 - 1.3 (1.2). Prealare (pra), prealar ridge, triangular plate (tp), anterior and posterior notal processes (anp & pnp) well developed. Scutellum (scl) 61 - 73 (70) μ long and 98 - 125 (116) μ wide, the ratio being 1:1.6 - 1.7 (1.65) and the ratio lengths of scutellum to scutum 1:1.7 - 2.0 (1.8). Postalare (pa) with well separated anterior and posterior ridges (apar & ppar).

Mesopleuron: Mesopleural ridge (plr2) with a short interruption above the coxal articulation; basalare (bas) stout and subepisternal ridge (ser) well developed. Mesepisternum (eps2) distinct; lateropleurite (lpl) narrow; mesepimeron small and well sclerotized. Mesosternum: Basisternum (stn2) 162 - 204 (186) μ long and 168 - 235 (207) μ wide; bounded antero-laterally and latero-posteriorly by the marginal and the precoxal ridges respectively. Mesothoracic spiracles (sp2) about 21 μ wide at opening, with 40 - 46 (43) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 4 - 7 (5.7) h.s.; scutal setae (sctse) 8 - 12 (10.1) h.s.; scutellar setae 1 - 2 (1.1) h.s. Figular setae 3 - 5 (4.2) h.s. Postmesostigmatal setae (pms) in two separable groups, a latero-ventral cluster of 8 - 12 (9.6) h.s. behind each spiracle, and 1 - 3 (1.7) h.s. submedially, forming with their partners on the other side a transverse irregular row. Basisternal setae (stn2s) 10 - 16 (12.7) h.s. Mesothoracic disc pores on each side: Mesospiracular pores 1 - 2 (1.5); one postmesostigmatal pore (pmp) usually present submedially, but sometimes absent on one side (av. 0.8).

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pn3r) well developed. Metapleural ridge (plr3) attenuated at the position of the pleural apophysis; with a small metapleural wing process. Metepisternum and metepimeron well defined. Precoxal ridge (pcr3) strong and metasternal apophysis (sta) distinct. Metathoracic spiracles similar to the mesothoracic ones. Metathoracic setae on each side: metatergal setae (mts) 1 - 3 (1.7) h.s.; metapleural setae (mps) 1 - 2 (1.1) h.s.; anterior metasternal setae (3.0) h.s. and posterior metasternal setae 2 - 3 (2.2) h.s. Metathoracic pores: metaspiracular pores (sp3p) 2 - 3 (2.3) behind each spiracle; one anterior metasternal pore (amsp) and one posterior metasternal pore (pmsp) almost always present on each side (averages 0.8 and 0.9 respectively).

Wings: Hyaline; 1330 - 1610 (1484) μ long and 462 - 532 (504) μ wide. Alar lobe, axillary and additional sclerites well developed. The wings usually with 3 hair-like alar setae (als) (sometimes 4 or 5, av. 3.4) and a row of 4 minute circular sensoria (sens.). Hamulohalterae well developed, 104 - 122 (110) μ long and 21 - 31 (25) μ wide; with a weak hamulohalteral ridge (hr) and one apically hooked, 46 - 55 (52) μ long seta, i.e. the ratio lengths of the seta to the hamulohaltera 1:1.9 - 2.5 (2.1).

Legs: Moderately long and slender; the ratio length of the hind leg to the total length of the body 1:1.7 - 2.1 (2.0). Coxa and trochanter about 49 and 24 μ wide respectively; the basal part of the latter conspicuously longer than the distal and with 6 circular sensilla; with one differentiated long apical seta (ase). Femur about 43 μ wide; that of the front leg shortest and that of the hind longest; the ratio width to length of the hind femur 1:4.1 - 5.0 (4.6). Tibia about 24 μ wide; with 2 apical strong spurs and 3 - 4 smaller spines; the ratio lengths of femur to tibia in front legs 1:1.0 - 1.1 (1.05). Tarsus about 21 μ wide; tarsal digitules apically knobbed,

about 37μ long. Claw uniformly tapering to a pointed apex, $27 - 31$ (29) μ long; ungual digitules extremely fine, about 13μ long. In the following table the lengths of the leg segments and the number of setae on each are given:

		Fore leg	Middle leg	Hind leg
	length in μ	43 - 49 (46)	43 - 49 (46)	46 - 52 (49)
Coxa	h.s.	11 - 14 (12.2)	9 - 13 (11.4)	10 - 15 (12.6)
	length in μ	58 - 70 (64)	58 - 70 (64)	64 - 73 (70)
Troch- anter	h.s.	4 - 6 (5.1)	4 - 6 (5.0)	4 - 6 (5.2)
	length in μ	153-189 (174)	159 - 201 (183)	168-220 (198)
Femur	h.s.	17-25 (20.2)	19-26 (22.2)	19-25 (22.8)
	length in μ	168-198 (183)	174-229 (204)	223-278 (253)
Tibia	h.s.	24 - 35 (28.6)	23 - 33 (28.2)	25 - 37(30.6)
	length in μ	76 - 92 (85)	76 - 92 (85)	82-104 (95)
Tarsus	h.s.	15 - 19 (17.2)	13 -20 (16.6)	15-20 (17.4)
Total length of leg in μ		525-619 (580)	537-668 (613)	610-753 (692)

Abdomen: $365 - 532$ (456) μ long and $266 - 327$ (312) μ wide. Tergites of segments I and II small; that of segment VIII and segments IX + X large and distinct. Sternites of segment VIII ill-defined. Ostioles entirely absent. Abdominal setae: dorsal and ventral setae (ads & avs) arranged in transverse irregular rows. Pleural setae (aps) in lateral groups. Abdominal pores: dorsal pores absent; pleural pores (app) present on segments I, II and usually also on segments III to

VII; one ventral pore (avp) usually occurs sublaterally on each side of segments III to VII. The following table shows the number of abdominal setae and pores on one side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 3 (2.2)	3 - 4 (3.3)	3 - 4 (3.5)	3 - 4 (3.6)	3 - 4 (3.3)	3 - 4 (3.4)	2 - 3 (2.7)	(1.0)
(aps)	3 - 4 (3.1)	4 - 5 (4.2)	4 - 5 (4.7)	4 - 6 (4.9)	4 - 5 (4.7)	4 - 5 (4.6)	4 - 5 (4.6)	(3.0)
(avs)	-	1 - 2 (1.7)	3 - 4 (3.4)	3 - 5 (3.9)	3 - 4 (3.5)	2 - 3 (2.9)	(2.0)	0
(app)	2 - 5 (3.7)	0 - 2 (1.1)	0 - 1 (0.5)	0 - 1 (0.6)	0 - 1 (0.7)	0 - 1 (0.5)	0 - 2 (0.7)	0
(avp)	-	0	0 - 1 (0.8)	0 - 1 (0.7)	0 - 1 (0.7)	0 - 1 (0.3)	0 - 1 (0.2)	0

The glandular pouch well developed; its setae (gls) include a long pair of tail setae (ts), 229 - 305 (272) μ long and one seta of medium length, 40 - 92 (64) μ long (the ratio lengths of the tail setae to the total body length 1:4.6 - 5.7, av. 5.0).

Genital segment comparatively small; subtriangular in dorsal view; style (st) curving upwards in lateral view. Penial sheath 113 - 131 (125) μ long and 79 - 95 (89) μ wide, i.e. the ratio length to width 1.3 - 1.4 (1.38):1 and the ratio its length to the total body length 1:10.2 - 12.0 (11.0). The basal ridge of the penial sheath (brps) as well as its projection (pr) well developed; process of the penial sheath (pro) well pronounced. Aedeagus (aed) broad at the basal rod (bra) and gradually narrows dorso-posteriorly to a pointed tip. Setae of the genital segment (gts): dorsally, 3 hair-like setae always present on each side near the base of the style; ventrally 3 - 4 (3.7) h.s. occur on each side of the penial sheath and 4 - 5 (4.3) setal sensilla (pros) on its process.

Material: 10 specimens examined, collected by myself, on beech trees (Fagus sylvatica), in the Imperial College Field Station, Silwood Park, Sunninghill, Berkshire, England, during March and April, 1964.

Remarks: Although the present study is mainly concerned with morphology and taxonomy, some biological observations were also made. According to Blaire (1958) the second stage larvae of this species, usually males, migrate from the small twigs towards the main branches and trunk of the trees between February 12th and April 10th; however, the writer was able to produce adult males from larvae collected during the last two weeks of April. It was found that the second stage larvae take about 48 hours to reach the third stage, and the latter about another 48 hours to become prepupae; the prepupae take about 7 days to develop to pupae, and the pupae about 8 - 10 days to produce adult males with well developed antennae, legs and wings, but still in a stationary condition or with very limited movement. The males became active after about 48 hours, after which the long waxy ^{tassels} ~~hairs~~ covering the abdominal segment VIII were produced; they were then ready to emerge from their puparia and search for the females. The males mated 5 - 10 times with females introduced to them in the same glass tube; each copulation usually lasts $1\frac{1}{2}$ - 3 minutes and may be repeated with the same female or another one at variable intervals from several minutes to a few hours. The males fly in rapid and rather short (a few inches) jumps, and all died within 72 hours from their emergence.

PSEUDOCOCCUS GROUP:GENUS PSEUDOCOCCUS:(10) PSEUDOCOCCUS OBSCURUS (ESSIG) (Plate X, figs. 18 and 19)

The winged forms only known; living specimens not available. The males narrow and slender, of medium or large size and with comparatively short antennae and moderately long legs. When mounted, the total length of the body 1106 - 1470 (1330) μ , the width at mesothorax 280 - 350 (322) μ and the wing expanse 1932 - 2520 (2240) μ .

Body setae and pores: Fleshy and hair-like setae present on the body, antennae and legs; all subequal in length, about 24 μ long. Quadrilocular and quinquilocular disc pores about 6 μ in diameter, occurring on the head, thorax and abdomen.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression (vprd) well pronounced in lateral view. Length from apex to postoccipital ridge 125 - 153 (137) μ ; from apex to neck 153 - 192 (180) μ ; width across the genae 180 - 220 (207) μ . The dorsal arm of the midcranial ridge (dmcr) slender, anteriorly separated from the other arms by a short distance and posteriorly extending to meet the postoccipital ridge. The ventral arm (vmcr) well developed, giving off the lateral arms (lmcr) at the apex of the head and forming together a Y-shaped ridge. Postoccipital ridge (por) distinct, U-shaped and not reaching the preocular ridges anteriorly. The dorsomedial part of the epicranium (dmep) well sclerotized. The preocular (procr) + interocular ridges join the postocular ridge below the ocellus; the ventral rudiment of the preocular ridge hardly indicated. Preoral ridge slender. Genae membranous.

PLATE X

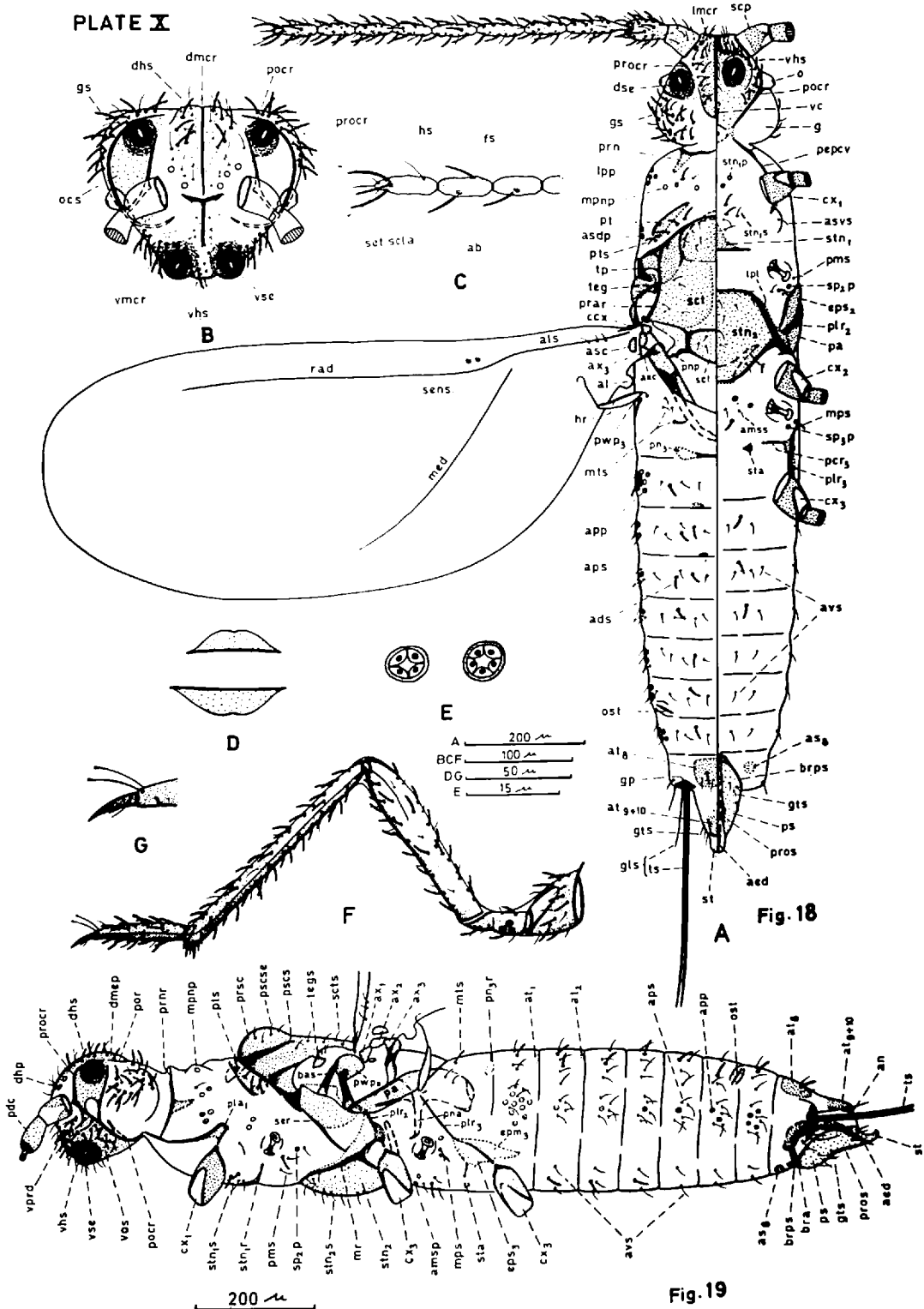


Fig. 18

Fig. 19

200 μ

Eyes: The dorsal simple eyes (dse) projecting beyond the outer margins of the head in dorsal view; their corneae $24 - 27 (25) \mu$ in diameter and separated by $92 - 113 (104) \mu$, i.e. $3.8 - 4.6 (4.3)$ times as much as their corneae apart. The ventral simple eyes (vse) slightly larger, $27 - 31 (29) \mu$ in diameter and $24 - 31 (27) \mu$ apart. Lateral ocelli (o) large. Ocular sclerites (ocs) well sclerotized. Cranial apophysis apically truncate. Tentorial bridge slender. Dorsal head setae (dhs): $5 - 8 (6.6)$ f.s. and $7 - 11 (9.6)$ h.s. present on each side of the median line anterior to the postoccipital ridge; each gena with $13 - 18 (15.2)$ fleshy and $3 - 4 (3.3)$ hair-like genal setae (gs). Ventral head setae (vhs) on each side: $3 - 4 (3.3)$ h.s. in a median longitudinal row between the ventral eyes; $5 - 9 (7.1)$ f.s. and $2 - 4 (3.2)$ h.s. forming with their partners on the other side a transverse band in the area of the ventral preocular depression; the ventral part of the ocular sclerite with $5 - 11 (8.5)$ fleshy ventral ocular setae (vos); anteriorly, $3 - 4 (3.3)$ h.s. longitudinally arranged on each side of the ventral arm of the midcranial ridge.

Head disc pores: Dorsal head pores (dhp) $2 - 3 (2.2)$ on each side near the base of the antennae; ventral pores absent.

Antennae: Filiform; normally 10-segmented; $616 - 668 (647) \mu$ long, i.e. as long as, or somewhat shorter than half the body length, and slightly shorter than the hind legs, the ratios $1:2.0 - 2.2 (2.1)$ and $1:1.1 - 1.2 (1.12)$ respectively. Scape (scp) $43 - 62 (46) \mu$ long and $43 - 46 (45) \mu$ wide at base; with $6 - 8 (6.7)$ h.s. Pedicel (pdc) $61 - 73 (70) \mu$ long and $31 - 37 (34) \mu$ wide; with $11 - 18 (14.7)$ f.s., $9 - 16 (12.1)$ h.s. and a sensillum placodeum. Flagellar segment with irregular margins; segment III club-shaped, longest of the antennal segments and about 24μ wide; the ratio lengths of segments III to X $1.4 - 1.5 (1.42):1$ and the ratio width to length of segment III $1:3.7 - 4.6 (4.3)$. Segments IV to X cylindrical and about 22μ wide; the ratio width to length of segment X being $1:2.4 - 2.9 (2.6)$.

The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
lengths in μ (averages)	79-98 (92)	61-73 (67)	61-73 (67)	58-64 (61)	55-67 (61)	52-67 (58)	52-61 (58)	61-70 (67)
f.s. (av.)	9-14 (11.3)	8-16 (12.4)	12-16 (14.1)	8-16 (11.7)	11-16 (13.0)	10-17 (12.9)	8-14 (11.1)	10-13 (10.7)
h.s. (av.)	4-7 (5.1)	2-6 (3.5)	2-4 (3.3)	2-5 (2.7)	2-5 (3.1)	3-5 (3.6)	3-8 (5.4)	5-7 (6.3)

Antennal bristles (ab): Segments VIII and IX each with one ventral bristle; segment X with 3 subapical bristles, a pair of capitate, about 37μ long subapical sensory setae (set. scl.) and one apical hair-like seta.

Thorax: 426 - 570 (524) μ long. Prothorax: Pronotal ridge (prnr) well developed, medially interrupted at a weak point. Lateral pronotal sclerites (prn) and posttergites (pt) comparatively large. Proepisternum with a ridge-like dorsal margin. Prosternum (stnl) triangular, 37 - 49 (43) μ long; prosternal ridge (stnlr) distinct, 85 - 116 (101) μ long. Prothoracic setae on each side of the median line: Medial pronotal setae 0 - 2 (0.9) f.s. and 0 - 3 (1.3) h.s.; lateral pronotal setae 0-1 (0.3) h.s.; posttergital setae (pts) only fleshy, 3 - 6 (4.0) on each side; antespiracular dorsal setae 0 - 2 (0.5) h.s. One, hair-like antespiracular ventral seta (asvs) always present. Prosternal setae (stnls) 1 - 3 (2.1) f.s. and 1 - 3 (1.8) h.s. Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 2 - 4 (2.6); lateral pronotal pores (lpp) also 2 - 4 (3.1); antespiracular dorsal pores (asdp) 2 - 4 (2.1). Prosternal pores (stnlp) 1 - 3 (2.1).

Mesothorax: Prescutum (prsc) subrectangular in dorsal view; 73 - 92 (79) μ long and 113 - 146 (131) μ wide, the ratio being 1:1.5 - 1.8 (1.7); prescutal ridge well developed and prescutal suture (pscs) well defined. Scutum (sct) large, with the antero-lateral extremities heavily sclerotized and with a longitudinal median narrow membranous area. Scutum 101 - 128 (116) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.3 - 1.6 (1.5). Scutellum (scl) pentagonal, 46 - 61 (55) μ long and 89 - 119 (107) μ wide, the ratio being 1:1.8 - 2.1 (1.9) and the ratio its length to the length of scutum 1:2.0 - 2.2 (2.1). Anterior and posterior postalar ridges well separated; postnotal apophysis (pna) well developed. Mesopleuron: Mesopleural ridge (plr2) interrupted above the articulation with coxa; pleural apophysis, pleural wing process (pwp2) and basalare (bas) and subepisternal ridge (ser) well developed; lateropleurite (lpl) narrow, mesepisternum (eps2) and mesepimeron distinct. Mesosternum: Basisternum (stn2) 128 - 171 (150) μ long and 168 - 217 (192) μ wide; marginal (mr), precoxal ridges (pcr2) and furca (f) strongly developed. Mesothoracic spiracles 21 - 24 (22) μ wide at opening, with a 34 - 43 (40) μ long supporting bar. Mesothoracic setae on each side: prescutal (pscse) 4 - 6 (4.7) h.s.; scutal setae (scts) 4 - 7 (5.2) h.s. h.s.; scutellar setae 2 - 4 (2.6) h.s. Tegular setae (tegs) 3 - 5 (3.7) h.s.; postmesostigmatal setae (pms) 1 - 3 (1.6) f.s. and 2 - 4 (2.6) h.s. occurring only laterally behind each spiracle. Basisternal setae (stn2s) 7 - 12 (9.1) h.s. Mesothoracic disc pores: 1 - 2 (1.6) mesospiracular pores (sp2p) posteriorly associated with each spiracle.

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pn3r) well developed. Pleural ridge (plr3), pleural wing process (pwp3), pleural apophysis, episternum (eps3) and epimeron (epm3) typical of the family. Precoxal ridge (pcr3) and metasternal apophysis (sta) well developed. Metathoracic spiracle identical with the mesothoracic.

Metathoracic setae on each side: Metatergal setae (mts) 1 - 2 (1.2) f.s. and 3 - 4 (3.3) h.s. in a submedian cluster; metapleural setae (mps) 1 - 2 (1.1) f.s. behind the metathoracic spiracles. Anterior metasternal setae (amss) 1 - 2 (1.5) f.s. and 1 - 3 (2.1) h.s. forming with their partners of the other side a transverse median band; posterior metasternal setae absent. Metathoracic disc pores on each side: Metaspiracular pores (sp3p) 0-1 (0.7); anterior metasternal pores (amsp) 1 - 2 (1.6); posterior metasternal pores absent.

Wings: Hyaline; 840 - 1092 (980) μ long and 392 - 476 (434) μ wide. Axillary and additional wing sclerites well defined. 3 hair-like alar setae (als) and 2 circular sensoria (sens.) always apparent. Hamulohalterae 76 - 85 (79) μ long and 15 - 21 (18) μ wide; with one, 55 - 61 (58) μ long apically hooked seta, i.e. the ratio length of seta to the length of the hamulohaltera about 1:1.4

Legs: Well developed and moderately long; the ratio length of the hind leg to the total length of the body 1:1.6 - 1.8 (1.7). Coxa and trochanter about 52 and 27 μ wide respectively; the latter with the basal part longer than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur of the fore-leg shortest and that of the hind leg longest; femur about 43 μ wide, the ratio width to length of the hind femur being about 1:5.4. Tibia about 24 μ wide; with 2 apical stout spurs and 3 - 5 smaller ones; the ratio lengths of femur to tibia in fore-leg 1:1.1 - 1.2 (1.16). Tarsus about 21 μ wide; tarsal digitules apically knobbed, about 34 μ long. Claw uniformly tapering to a pointed tip, 24 - 30 (27) μ long; ungual digitules about 14 μ long. In the following table, the lengths of the leg segments and the number of setae on each are given:

		Fore-leg	Mid leg	Hind leg
Coxa	length in μ	40-46 (43)	40-46 (43)	43-49 (46)
	f.s.	6-11 (9.8)	7-12 (8.5)	9-13 (11.8)
	h.s.	4-9 (6.7)	4-8 (6.2)	6-8 (6.8)
Troch- anter	length in μ	67-70 (68)	67-70 (68)	70-73 (71)
	f.s.	1-3 (2.2)	1-4 (2.3)	2-5 (3.0)
	h.s.	3-6 (4.5)	3-6 (4.2)	4-7 (4.8)
Femur	length in μ	189-201 (192)	195-204 (198)	207-220(211)
	f.s.	23-30 (28.2)	21-29 (26.8)	27-38 (32.2)
	h.s.	9-12 (9.8)	7-11 (8.2)	9-13 (10.0)
Tibia	length in μ	214-235 (223)	232-253 (241)	244-305(281)
	f.s.	34-48 (42.0)	45-57 (50.8)	58-69 (64.3)
	h.s.	4-7 (5.3)	4-7 (5.2)	4-8 (5.8)
Tarsus	length in μ	85-92 (89)	85-92 (89)	92-104 (98)
	f.s.	17-23 (20.1)	22-27 (24.9)	20-29 (26.2)
	h.s.	3-6 (4.2)	3-6 (4.3)	4-7 (5.3)
Total length of leg in μ		622-659 (634)	644-683(659)	677-772(732)

Abdomen: 403 - 578 (486) μ long and 251 - 327 (296) μ wide. Tergites of segments I and II small; those of segments VIII and IX + X large and distinct. Sternites of segment VIII ill-defined. Ostioles (ost) weakly developed. Abdominal setae: Dorsal and ventral setae (ads & avs) in transverse bands or irregular rows; pleural setae (aps) in lateral groups. Abdominal disc pores: Dorsal and ventral pores absent; pleural pores (app) numerous on segment I and fewer on other segments. The following table shows the number of abdominal dorsal, pleural, ventral setae, and the pleural pores on each side of the median line:

		I	II	III	IV	V	VI	VII	VIII
(ads)	f.s.	0 - 1 (0.6)	2 - 3 (2.1)	1 - 3 (1.8)	1 - 2 (1.6)	1 - 2 (1.1)	1 - 2 (1.3)	1 - 2 (1.2)	1 - 2 (1.2)
	h.s.	2 - 4 (3.0)	3 - 4 (3.3)	3 - 4 (3.8)	3 - 4 (3.7)	3 - 4 (3.6)	2 - 3 (2.9)	2 - 4 (3.0)	1 - 2 (1.4)
(aps)	h.s.	2 - 4 (2.9)	4 - 5 (4.1)	4 - 5 (4.2)	4 - 5 (4.4)	4 - 5 (4.3)	4 - 5 (4.7)	4 - 5 (4.4)	*1+2-3 (2.1)
(avs)	f.s.	-	0 - 1 (0.9)	0 - 1 (0.5)	0 - 1 (0.4)	0	0	0	0
	h.s.	-	1 - 3 (2.0)	2 - 4 (2.9)	1 - 3 (2.0)	2 - 3 (2.1)	2 - 3 (2.1)	(2.0)	0
(app)		6 - 11 (8.6)	1 - 2 (1.6)	1 - 2 (1.5)	1 - 2 (1.5)	1 - 3 (1.9)	2 - 4 (2.5)	3 - 5 (4.3)	-

* A slightly longer seta.

Glandular pouches (gp) well developed; setae of the glandular pouch (gls) include two 360 - 412 (387) μ long tail setae (ts) and one seta of medium length, 58 - 92 (76) μ long, the ratio length of the tail setae to the total length of the body being 1:3.0 - 3.8 (3.4).

Genital segment: Subtriangular in dorsal view, with the style (st) comparatively broad and apically rounded; the style curving upwards in lateral view. The penial sheath 153 - 168 (162) μ long and 76 - 89 (85) μ wide, i.e. the ratio its length to its width 1.8 - 2.0 (1.9) :1, and its length to the total length of the body 1:7.2 - 8.9 (8.2). Basal ridge of the penial sheath (brps) with a small projection; process of penial sheath absent. Aedeagus (aed) tapering to a pointed tip. Setae of the genital segment (gts): Dorsally, 3 small hair-like setae always present on each side near the base of the style; ventrally 4 - 5 (4.4) similar setae and 4 - 5 (4.3) minute setal sensilla (pros) occur on each side of the penial sheath.

Material: 10 specimens examined, obtained by K. Boratynski in a laboratory culture on Potato, in London during June, 1961.

Remarks: Wilkey and McKenzie (1961) attempted to reveal the long puzzling identity of P. maritimus and whether more than one species of mealybug is involved under the so-called P. maritimus-malacearum complex. They carried out a morphological investigation on the females primarily based on the shape of the hind legs and the number of the translucent dots on the leg segments; this investigation led to the conclusion that P. maritimus and P. obscurus are distinct species, P. bakeri Essig and P. omnivera Hollinger being synonyms of the former, and P. capensis P. longispinus var. latipes Green and P. malacearum Ferris of the latter. Accordingly, Beardsley (1963) realized that the species long believed to be P. maritimus in Hawaii, whose males were described as such by him in an earlier paper (1960), is in fact obscurus.

Beardsley's description of this species indicates that it is identical with P. obscurus here studied, and both entirely agree with "P. maritimus Ehrhorn, type B" described by Giliomee (1961); P. maritimus, type A at present is uncertain and may perhaps be the true P. maritimus.

(11) PSEUDOCOCCUS CITRICULUS GREEN (Plate XI, figs. 20 and 21)

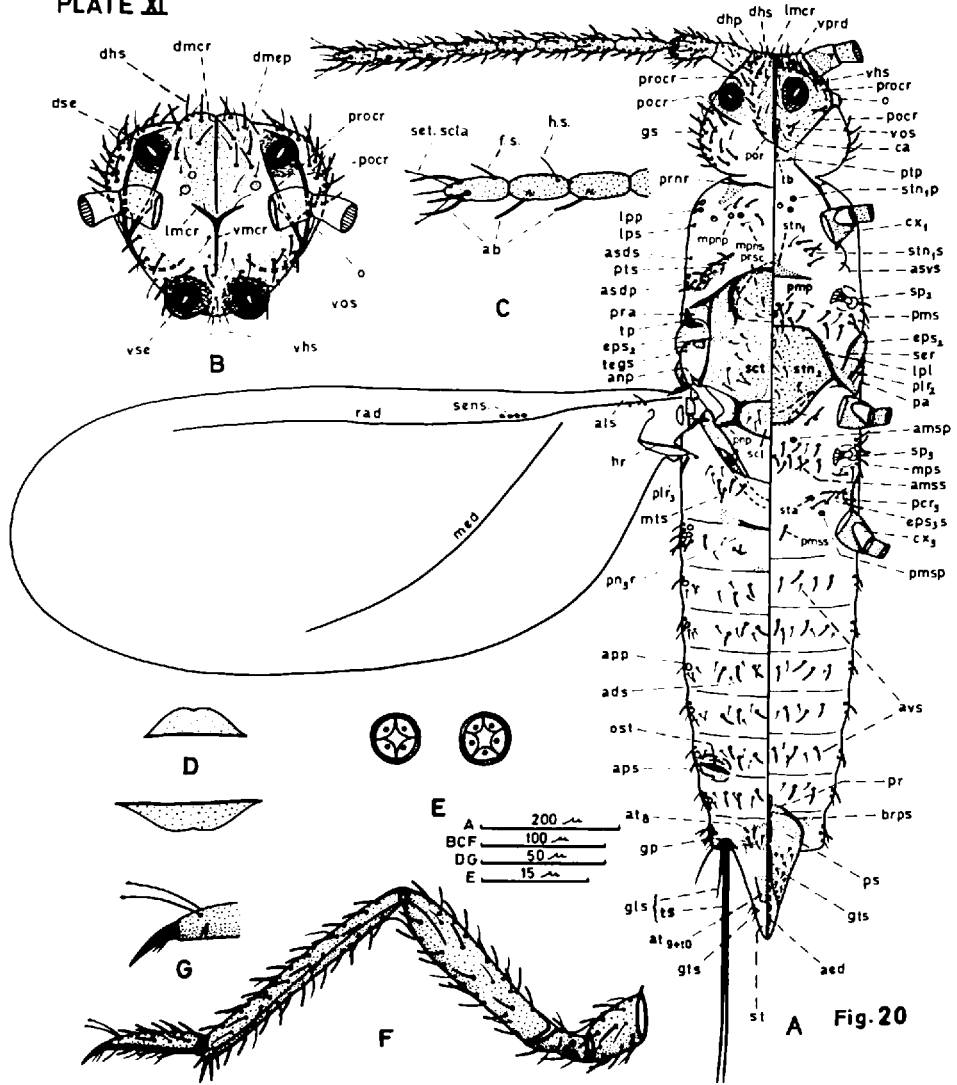
Winged forms only known; living specimens not available. The males comparatively slender, of medium or large size, with short antennae and moderately long legs. When mounted, total body length 1232 - 1400 (1302) μ , width at mesothorax 280 - 322 (294) μ and the wing expanse 2016 - 2338 (2128) μ .

Body setae and pores: The body itself, the antennae and the legs with fleshy and hair-like setae, about 27 μ long. Quadrilocular and quinquilocular disc pores present on the head, thorax and abdomen, 6 - 9 μ in diameter.

Head: Subtetrahedron; triangular in dorsal and front views; ventral preocular depression (vprd) well pronounced in lateral view. Length from apex to postoccipital ridge 122 - 140 (128) μ ; from apex to neck 171 - 214 (186) μ ; width across the genae 201 - 229 (214) μ . Dorsal arm of the midcranial ridge (dmcr) distinct, anteriorly detached from other arms, and posteriorly meeting or almost meeting the postoccipital ridge. The ventral and the lateral arms (vmcr & lmc) forming together a Y-shaped ridge. Postoccipital ridge (por) U-shaped, not reaching the preocular ridges anteriorly. Dorsomedial part of the epicranium (dmp) well sclerotized and slightly raised. Preocular + interocular ridges well developed; the ventral rudiment of the former hardly indicated by a weak sclerotization. Preoral ridge slender.

Eyes: Dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; their corneae 21 - 24 (23) μ in diameter, and separated by 92 - 119 (104) μ , i.e. 3.8 - 5.0 (4.3) times their cornea^e apart. Ventral simple eyes (vse) somewhat larger, 24 - 27 (26) μ in diameter, and 18 - 37 (27) μ apart. Lateral ocelli

PLATE XI



A Fig. 20

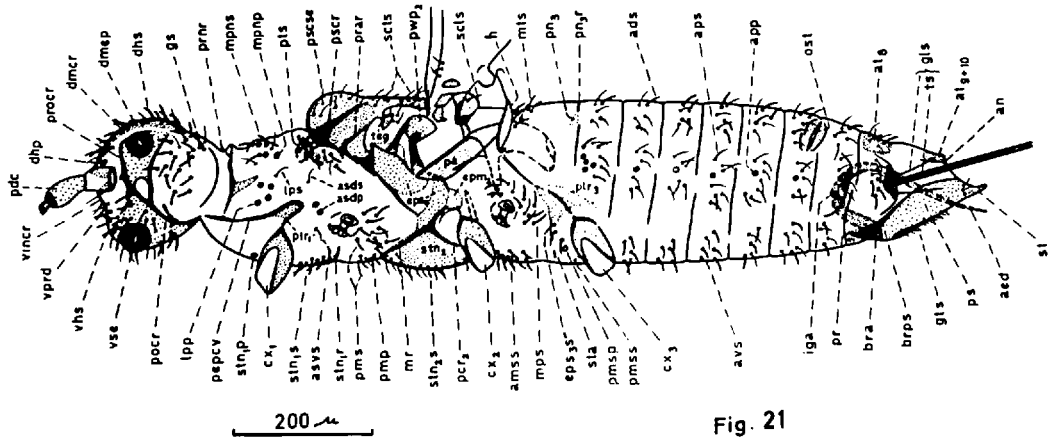


Fig. 21

(o) well developed. Ocular sclerite traversed by the interocular ridge. Cranial apophysis (ca) with truncate apex; tentorial bridge (tb) slender. Dorsal head setae (dhs): 8 - 11 (9.3) f.s. and 9 - 12 (10.5) h.s. present on each side of the median line anterior to the postoccipital ridge; each gena with 16 - 23 (19.0) fleshy and 2 - 4 (3.0) hair-like genal setae (gs). Ventral head setae (vhs) on each side: 2 - 3 (1.3) h.s. in a longitudinal irregular row between the ventral eyes; 7 - 10 (8.8) f.s. and 2 - 5 (3.3) h.s. forming with their partners of the other side a transverse band in the area of the ventral preocular depression; the ventral part of the ocular sclerite with 4 - 7 (3.8) fleshy ventral ocular setae (vos); anteriorly, 0 - 1 (0.2) f.s. and 3 - 4 (3.5) h.s. present in a longitudinal row on each side of the ventral arm of the midcranial ridge.

Head disc pores: 1 - 3 (1.6) dorsal head pores (dhp) occur on each side near the base of the antennae; ventral pores absent.

Antennae: Filiform; normally 10-segmented; 540 - 604 (570) μ long, i.e. slightly shorter than half the body length, the ratio being 1:2.2 - 2.3 (2.28), and shorter than the hind legs, the ratio 1:1.1 - 1.3 (1.13). Scape 46 - 52 (49) μ long and 40 - 43 (42) μ wide at base; with 6 - 9 (7.3) h.s. Pedicel (pdc) 58 - 64 (61) μ long and 34 - 37 (35) μ wide; with 17 - 22 (20.0) f.s., 10 - 14 (12.0) h.s. and a sensillum placodeum. Flagellum: Segment III club shaped, longest of the flagellar segments and about 24 μ wide; the ratio lengths of 3rd and terminal segments being 1.3 - 1.6 (1.4):1 and the ratio width to length of segment III 1:3.3 - 4.3 (3.7). Segments IV - X cylindrical, with irregular margins and approximately 22 μ wide; the ratio width to length of segment IX 1:2.0 - 2.3 (2.1). The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (average)	70-92 (79)	52-55 (54)	52-58 (55)	52-58 (56)	52-58 (56)	49-58 (54)	49-55 (53)	55-58 (57)
f.s. (av.)	11-14 (12.3)	15-19 (17.0)	12-16 (14.0)	12-15 (13.5)	10-16 (12.5)	9-12 (10.3)	8-10 (8.8)	6-8 (7.0)
h.s. (av.)	4-7 (5.3)	3-4 (3.3)	2-4 (3.0)	3-4 (3.5)	5-7 (5.5)	6-7 (6.8)	7-9 (8.0)	7-8 (7.3)

Antennal bristles (ab) easily distinguished; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles, a pair of capitate subapical sensory setae (set. scl.) and one apical hair-like seta.

Thorax: 494 - 608 (547) μ long. Prothorax: Pronotal ridge (pnr) medially interrupted in the usual manner. Lateral pronotal sclerites and posttergites large. The dorsal margin of the proepisternum ridge-like. Prosternum (stn) triangular, 31 - 40 (34) μ long; posteriorly bounded by the transverse, 92 - 101 (98) μ long prosternal ridge (stnlr). Prothoracic setae on each side: Medial pronotal setae (mpnp) 2 - 4 (3.3) f.s. and 1 - 3 (2.7) h.s.; lateral pronotal setae (lps) 0 - 1 (0.9) h.s.; posttergital setae (pts) 10 - 13 (11.5) f.s. and 1 - 2 (1.7) h.s.; antespiracular dorsal setae (asds) 0 - 2 (1.3) h.s. Antespiracular ventral setae (asvs) 1 - 2 (1.3) h.s. Prosternal setae (stnls) 3 - 5 (4.3) f.s. and 1 - 2 (1.3) h.s. Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 2 - 4 (2.5); lateral pronotal pores (lpp) 4 - 5 (4.3); antespiracular dorsal pores (asdp) 1 - 3 (2.0). Prosternal pores (stnlp) 2 - 4 (3.3).

Mesothorax: Prescutum (prsc) 67 - 82 (73) μ long and 122 - 137 (128) μ wide, i.e. the ratio 1:1.6 - 1.9 (1.7); prescutal ridge (pscr) strong and prescutal suture distinct. Scutum (sct) large, with the antero-lateral extremities heavily sclerotized and with a longitudinal median narrow membranous area. The scutum 110 - 128 (119) μ long, the ratio lengths of prescutum to scutum being 1:1.5 - 1.8 (1.6). Prealare (pra), prealar ridge (prar) and triangular plate (tp) well developed. Scutellum (scl) 52 - 58 (55) μ long and 101 - 116 (107) μ wide, the ratio being 1:1.9 - 2.0 (1.94) and the ratio its length to the length of scutum 1:2.1 - 2.2 (2.17). Anterior and posterior postalar ridges well separated. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; mesopleural apophysis and pleural wing process (pwp2) well developed; basalare strong. Subepisternal ridge (sec), mesepisternum (eps2), mesepimeron (epm2) and lateropleurite (lpl) typical of the family. Mesosternum: Basisternum (stn2) 131 - 156 (143) μ long and 168 - 198 (177) μ wide; marginal (mr) and precoxal ridges (pcr2) well developed. Mesothoracic spiracles (sp2) 18 - 21 (20) μ wide at opening, with a 34 - 40 (37) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 5 - 7 (6.0) h.s.; scutal setae (sctse) usually in two groups, the anterior including 3 - 5 (3.3) h.s. and the posterior with 4 - 5 (4.3) slightly longer setae; scutellar setae (scls) 2 - 3 (2.7) h.s. Tegular setae (tegs) 3 - 4 (3.3) h.s.; postmesostigmatal setae (pms) 13 - 19 (16.8) f.s. and 1 - 4 (2.8) h.s. forming on both sides a transverse band. Basisternal setae (stn2s) 10 - 13 (11.5) h.s., mostly arranged along the median longitudinal area. Mesothoracic disc pores: Mesospiracular pores 0 - 1 (0.5) behind each spiracle; one postmesostigmatal pore (pmp) always present medially anterior to the marginal ridge of the basisternum.

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pn3r) well developed; pleural ridge (plr3), pleural wing process, mesepisternum (eps2) and mesepimeron well developed. Precoxal ridge

(pcr3) and metasternal apophysis (sta) strong. Metathoracic spiracle (sp3) identical with the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) 2 - 5 (3.8) f.s. and 3 - 4 (3.7) h.s.; metapleural setae (mps) 8 - 10 (8.8) f.s. and 0 - 2 (0.5) h.s.; postmetastigmatal setae (eps3s) 3 - 4 (3.5) f.s. Anterior metasternal setae (amss) 7 - 12 (9.3) f.s. and 2 - 3 (2.6) h.s. forming with their partners of the other side a transverse band; posterior metasternal setae (pmss) 0 - 1 (0.8) f.s. and 0 - 1 (0.5) h.s. forming a transverse irregular row. Metathoracic disc pores: Metaspiracular pores absent; anterior and posterior metasternal pores (amp & pmsp) 0 - 1 (0.8) and 0 - 1 (0.5) on each side respectively.

Wings: Membranous; length 882 - 1022 (938) μ and width 350 - 420 (378) μ . Axillary and additional wing sclerites well developed. The wings with 3 - 4 (3.2) hair-like alar setae (als) and a compact row of 3 - 4 (3.2) minute circular sensoria (sens.) Hamulohalterae (h) 67 - 82 (76) μ long and 15 - 18 (17) μ wide; with one, 43 - 49 (46) apically hooked seta, i.e. the ratio lengths of the seta to the hamulohaltera 1:1.4 - 1.8 (1.7).

Legs: Well developed and moderately long; the ratio length of the hind leg to the total length of the body 1:2.0 - 2.1 (2.02). Coxa and trochanter about 48 and 24 μ wide respectively; the latter with the basal part longer than the distal and with 3 circular sensilla on each side; differentiated apical setae absent. Femur about 40 μ wide; that of the fore-leg usually shortest but sometimes equal to that of the middle leg; the ratio width to length of the hind femur about 1:4.7. Tibia about 24 μ wide; with 2 apical stout spurs and 4 - 6 smaller spines; the ratio lengths of femur to tibia of the fore-leg 1:1 - 1.1 (1.03). The tarsus about 21 μ wide; with a pair of apically knobbed tarsal digitules. Claw gradually tapering to a pointed end, 24 - 30

(27) μ long; with a pair of fine, about 14 μ long ungual digitules (udgt). The lengths of the leg segments and the number of setae on each are given in the following table:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	40-46 (43)	40-46 (43)	43-49 (46)
	f.s.	8-16 (12.0)	9-15 (11.3)	10-17 (13.0)
	h.s.	6-10 (7.8)	7-10 (8.3)	7-9 (8.3)
Trochanter	length in μ	58-61 (59)	58-61 (59)	61-67 (64)
	f.s.	4 - 5 (4.3)	4 - 5 (4.3)	4 - 5 (4.8)
	h.s.	4 - 6 (5.0)	4 - 7 (5.3)	4 - 6 (4.8)
Femur	length in μ	168-183 (174)	171-186 (177)	177-195 (186)
	f.s.	29-34 (31.0)	28-35 (32.0)	36-48 (40.0)
	h.s.	8-13 (10.0)	8-12 (9.3)	7-14 (9.8)
Tibia	length in μ	183-192 (189)	195-207 (201)	229-244 (238)
	f.s.	33-43 (39.0)	38-46 (41.8)	48-60 (53.0)
	h.s.	6 - 8 (7.0)	6 - 10 (8.3)	8 - 10 (9.0)
Tarsus	length in μ	73-79 (76)	73-79 (76)	76-82 (79)
	f.s.	10-16 (14.0)	10-16 (13.3)	12-18 (15.0)
	h.s.	8-12 (9.8)	8-13 (10.5)	8-14 (11.3)
Total length of leg in μ		558-577 (567)	567-595 (583)	628-656 (644)

Abdomen: 403 - 433 (418) μ long and 266 - 304 (281) μ wide. The tergite of segment I small; those of segments VIII and IX + X well sclerotized. Sternite of segment VIII ill-defined. Ostioles (ost) large and prominent, 43 - 49 (45) μ long at orifice. Abdominal setae:

Dorsal and ventral setae (ads & avs) segmentally arranged in transverse bands; pleural setae (aps) in lateral groups. Abdominal disc pores: Pleural pores (app) only present; these comparatively numerous on segments I and VII and fewer on segments II to VI. In the following table the number of abdominal setae and pores on each side of the median line are given:

	I	II	III	IV	V	VI	VII	VIII
f.s.	2 - 3 (2.5)	2 - 3 (2.7)	2 - 3 (2.7)	3 - 4 (3.7)	3 - 4 (3.5)	3 - 4 (3.6)	2 - 4 (3.4)	2 - 4 (2.5)
(ads) h.s.	2 - 3 (2.9)	3 - 4 (3.3)	3 - 4 (3.5)	3 - 4 (3.4)	3 - 4 (3.2)	2 - 3 (2.8)	2 - 3 (2.9)	2 - 4 (3.2)
f.s.	4 - 7 (3.5)	1 - 3 (2.3)	1 - 2 (1.1)	1 - 2 (1.3)	1 - 3 (1.8)	1 - 2 (1.3)	1 - 2 (1.5)	4 - 6 (5.3)
(aps) h.s.	1 - 3 (1.8)	(4.0)	(5.0)	(5.0)	(5.0)	5 - 6 (5.3)	(5.0)	*1+2-4 (3.3)
f.s.	-	4 - 5 (3.9)	4 - 6 (4.6)	3 - 5 (4.0)	3 - 4 (3.3)	2 - 3 (2.6)	2 - 3 (2.2)	0
(avs) h.s.	-	1 - 2 (1.4)	2 - 3 (2.9)	(2.0)	(2.0)	(2.0)	(2.0)	0
(app)	3 - 6 (4.3)	1 - 2 (1.3)	1 - 2 (1.3)	1 - 2 (1.5)	1 - 2 (1.5)	1 - 3 (1.8)	3 - 4 (3.8)	0

*A conspicuously longer seta.

Glandular pouch (gp): Well developed; setae of the glandular pouch (gls) comprise a pair of 336 - 366 (354) μ long tail setae (ts) and one seta of medium length, 64 - 79 (73) μ long; the ratio length of the tail setae to the total length of the body 1:3.4 - 4.0 (3.7).

Genital segment: Comparatively large; triangular in dorso-ventral view. The style (st) more or less straight in lateral view; apically rounded. The penial sheath (ps) 183 - 214 (198) μ long and 104 - 107 (105) μ wide, i.e. the ratio length to width 1.7 - 2.1 (1.9) :1, and the ratio its length to the total length of the body 1:6.3 - 6.9 (6.6). Basal ridge of the penial sheath (brps) and its projection (pr) well developed; process of the penial sheath absent. Aedeagus (aed) comparatively long and slender, anteriorly reaching the cavity of abdominal segment VII and tapering to a sharply pointed tip, Setae of genital segment (gts) on each side: Dorsally, 3 small hair-like setae always present near the base of the (st); ventrally, 10 - 15 (12.3) much finer setae scattered on the penial sheath.

Material: 4 specimens only were available, collected by C. R. Wallace, on Citrus, in Sarawak, during November, 1963 (received from D. J. Williams).

GENUS DYSMICOCCUS:(12) DYSMICOCCUS ALAZON WILLIAMS (Plate XII, figs. 22 and 23)

Only the winged forms known. These are brown greenish with dark red eyes. A relatively long and slender species, with short antennae and moderately long legs. Mounted specimens 1274 - 1470 (1358) μ long; 280 - 322 (294) μ wide at mesothorax and 2632 - 3094 (2800) μ wing expanse.

Body setae and pores: The body itself and the appendages with numerous fleshy and hair-like setae, about 24 μ long. Quadriocular and quinquilocular disc pores occur on the head, the thorax and the abdomen, 6 - 9 μ in diameter.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression well pronounced in lateral view. Length from apex to postoccipital ridge 116 - 134 (125) μ ; from apex to neck 168 - 198 (180) μ ; and width across the genae 198 - 229 (214) μ . The dorsal arm of the midcranial ridge slender, anteriorly separated from other arms, and posteriorly fading out before reaching the postoccipital ridge. Ventral (vmcr) and lateral arms well developed, forming a Y-shaped ridge. Postoccipital ridge (por) U-shaped and anteriorly confluent with the preocular ridges. Dorsomedial part of the epicranium (dmp) slightly raised. Preocular + interocular ridges well developed, posteriorly joining the postocular ridge (pocr) below the ocellus; the ventral rudiment of the preocular ridge (procr) indicated by a weak sclerotization. Preoral ridge (pror) slender.

Eyes: Dorsal simple eyes (dse) projecting beyond the outer margins of the head in dorsal view; their corneae 21 - 27 (24) μ in diameter and both separated by 101 - 116 (110) μ , i.e. 3.9 - 5.3 (4.5) times

PLATE XII

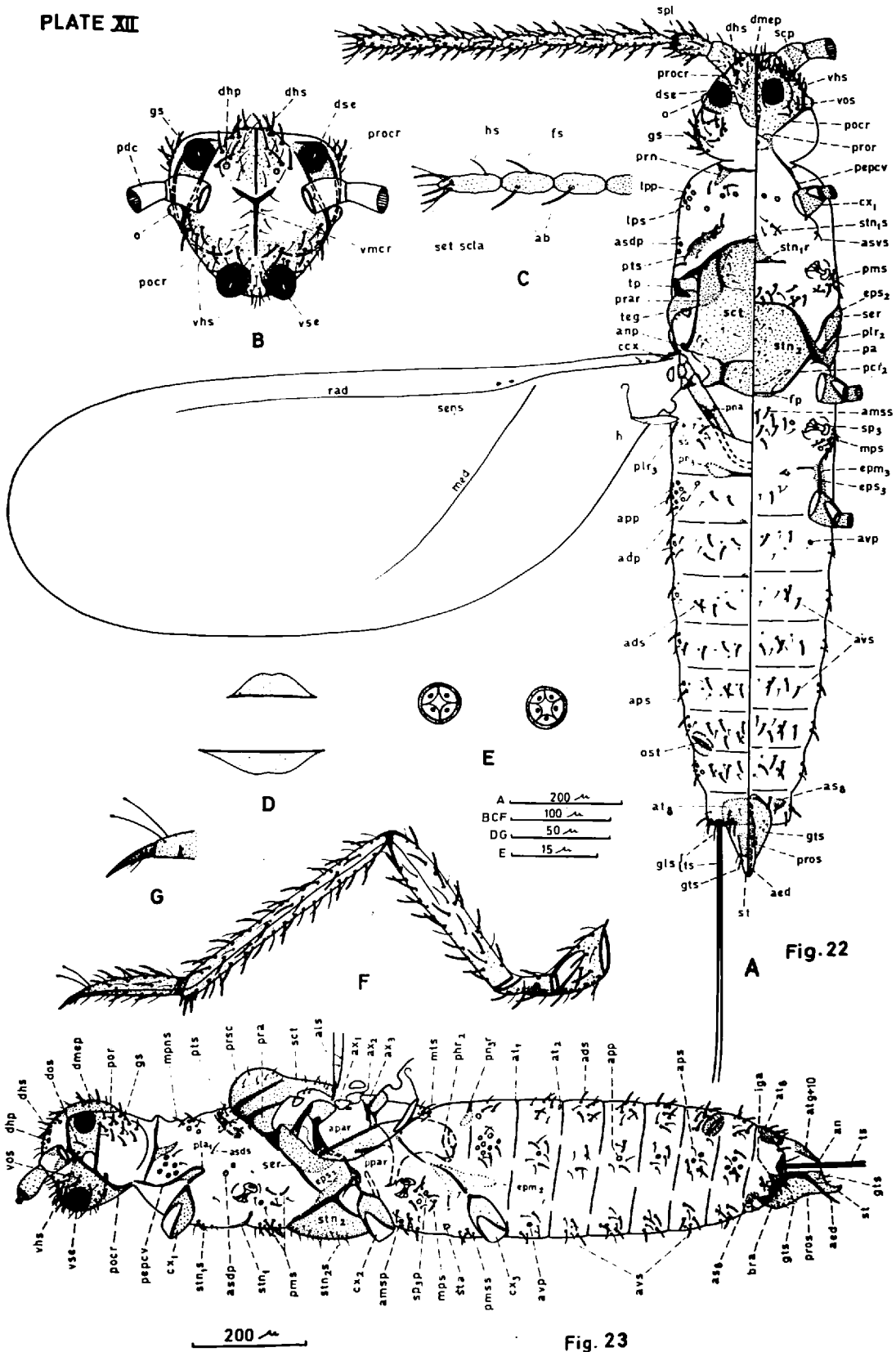


Fig. 22

Fig. 23

their diameter apart. Ventral eyes (vse) slightly larger, 24 - 31 (27) μ in diameter, and 21 - 34 (28) μ apart. Lateral ocelli (o) large. Ocular sclerites well sclerotized. Cranial apophysis with truncate apex. Tentorial bridge slender. Dorsal head setae (dhs) on each side of the median line: 5 - 10 (7.3) f.s. and 6 - 12 (9.4) h.s. anterior to postoccipital ridge; dorsal ocular setae (dos) 0 - 2 (1.1) f.s.; genal setae (gs) 7 - 15 (10.9) f.s. and 3 - 7 (4.0) h.s. Ventral head setae (vhs) on each side: 3 - 5 (4.1) h.s. in a longitudinal irregular row between the ventral eyes; 10 - 16 (12.2) f.s. and 1 - 3 (2.3) h.s. forming with their partners of the other side a transverse band in the area of the ventral preocular depression; ventral ocular setae (vos) 3 - 6 (4.4) f.s. and 0 - 2 (0.9) h.s.; a row of 0 - 1 (0.1) f.s. and 2 - 4 (2.8) h.s. present on each side of the ventral arm of the midcranial ridge.

Head disc pores: 1 - 2 (1.1) dorsal head pores (dhp) occur near the base of each antenna; ventral pores absent.

Antennae: Filiform; normally 10-segmented; 586 - 599 (647) μ long, i.e. about as long as half the body length (ratio 1:2.0 - 2.2, av. 2.1) and shorter than the hind legs (ratio 1:1.1 - 1.3 av. 1.2). Scape 46 - 50 (48) μ long and 43 - 46 (44) μ wide at base; with 5 - 8 (5.9) h.s. Pedicoel (pdc) 61 - 70 (67) μ long and 34 - 37 (35) μ wide; with 14 - 20 (17.3) f.s., 10 - 17 (13.3) h.s. and a sensillum placodeum. Flagellum: Segment III club-shaped and longest of all, the ratio lengths of 3rd to terminal segments being 1.3 - 1.5 (1.4):1; segment III about 24 μ wide, the ratio its width to its length 1:3.5 - 5.0 (4.6). Segments IV to X cylindrical, with irregular margins and about 22 μ wide, the ratio width to length of segment IX being 1:2.5 - 2.9 (2.7). The lengths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	85-107	55-76	58-70	52-67	52-64	52-64	55-64	64-76
average	(98)	(67)	(64)	(61)	(58)	(58)	(58)	(70)
f.s.	10-17	12-19	13-16	11-16	11-14	13-16	9-13	8-12
(av.)	(13.5)	(14.8)	(14.0)	(13.8)	(12.7)	(14.5)	(11.2)	(10.1)
h.s.	2 - 6	1 - 4	1 - 4	2 - 6	2 - 6	2 - 5	2 - 6	2 - 6
(av.)	(4.3)	(3.0)	(3.2)	(4.3)	(3.7)	(3.7)	(4.0)	(3.2)

Antennal bristles (ab) easily distinguished; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles, a pair of capitate subapical sensory setae (setc.scla) and one apical hair-like seta.

Thorax: 532 - 616 (570) μ long. Prothorax: Pronotal ridge medially interrupted by a weak sclerotization. Lateral pronotal sclerites (prn) and posttergites distinct. Proepisternum with a ridge-like dorsal margin. Prosternum triangular, 31 - 40 (37) μ long; prosternal ridge (stnlr) 85 - 95 (92) μ long. Prothoracic setae on each side: Medial pronotal setae (mpns) 1 - 5 (1.9) f.s. and 1 - 3 (1.6) h.s.; lateral pronotal setae (lps) 1 - 2 (1.3) h.s.; posttergital setae (pts) 3 - 9 (5.9) f.s. and 1 - 2 (1.2) h.s.; antespiracular dorsal setae (asds) 1 - 2 (1.2) h.s. One, hair-like antespiracular ventral seta (asvs) always present. Prosternal setae (stnls) 1 - 4 (1.8) f.s. and 1 - 3 (1.6) h.s. Prothoracic disc pores on each side: Medial pronotal pores 2 - 4 (2.7); lateral pronotal pores (lpp) 4 - 6 (5.1); antespiracular dorsal pores (asdp) 1 - 3 (1.9). Prosternal pores 1 - 3 (2.0).

Mesothorax: Prescutum (prsc) 79 - 98 (85) μ long and 116 - 143 (131) μ wide, the ratio being 1:1.4 - 1.6 (1.5); laterally bounded by the prescutal ridge and posteriorly by the prescutal suture. Scutum (sct) heavily sclerotized antero-laterally, with a median longitudinal narrow membranous area; scutum 107 - 128 (116) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.3 - 1.5 (1.4). Prealare, prealar ridge (prar) and triangular plate (tp) well developed. Scutellum 52 - 70 (61) μ long and 92 - 110 (101) μ wide (ratio 1:1.6 - 1.7 av. 1.65, and the ratio its length to the length of scutum 1:1.8 - 2.1, av. 1.9). Anterior and posterior postalar ridges (apar & ppar) separated. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; mesopleural apophysis, mesopleural wing process, subepisternal ridge (ser) well developed; basalare stout; mesepisternum (eps2), mesepimeron distinct; lateropleurite narrow. Mesosternum: Basisternum (stn2) 143 - 186 (156) μ long and 177 - 192 (186) μ wide; bounded by the marginal and the precoxal ridges (pcr2). Mesothoracic spiracles 18 - 21 (20) μ wide at opening, with a 37 - 46 (40) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 3 - 5 (4.1) h.s.; scutal setae 4 - 6 (4.8) h.s.; scutellar setae 4 - 7 (5.1) h.s. Tegular setae 1 - 2 (1.4) h.s. Postmesostigmatal setae (pms) in two groups, 3 - 7 (4.6) f.s. and 1 - 4 (2.1) h.s. behind each spiracle, and 3 - 9 (6.1) f.s. and 1 - 3 (1.9) h.s. separated medially. Basisternal setae (stn2s) 9 - 16 (11.9) h.s. Mesothoracic disc pores: Mesospiracular pores 0 - 1 (0.2); postmesostigmatal pores absent.

Metathorax: Metapostnotal sclerites (pn3), metapostnotal ridge (pn3r) and metapleural structures well developed and typical of the family. Metathoracic spiracles (sp3) identical with the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) 1 - 5 (2.7) f.s. and 2 - 6 (4.7) h.s.; metapleural setae (mps) 2 - 8 (4.8) f.s. and 1 - 3 (1.4) h.s. Anterior metasternal setae (amss) 3 - 7 (5.3) f.s.

and 2 - 6 (3.4) h.s. in a median group; posterior metasternal setae (pmss) 0 - 2 (1.3) f.s. and 1 - 4 (1.8) h.s. usually in a transverse irregular row. Metathoracic disc pores: Metaspiracular pores (sp3p) 0 - 2 (0.9); anterior metasternal pores (amsp) 0 - 1 (0.4); posterior metasternal pores absent.

Wings: Hyaline; 1190 - 1400 (1274) μ long and 406 - 532 (448) μ wide. Axillary and additional sclerites well developed. Wings with 1 - 4 (2.2) hair-like alar setae (als) and 2 minute circular sensoria (sens.). Hamulohalterae (h) 73 - 82 (76) μ long and 15 - 18 (16) μ wide; with a 49 - 61 (55) μ long apically hooked seta, i.e. the ratio length of seta to the length of hamulohaltera 1:1.3 - 1.5 (1.4).

Legs: Moderately long and slender; the ratio length of the hind leg to the total length of the body 1:1.7 - 2.0 (1.8). Coxa and trochanter about 52 and 24 μ wide respectively; the latter with the basal part longer than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur about 37 μ wide; that of fore-leg shortest and that of hind leg longest; the ratio width to length of the hind femur 1:5.8 - 6.4 (6.1). Tibia about 22 μ wide, with 2 apical spurs and 3 - 5 smaller spines; the ratio lengths of femur to tibia of fore-leg 1:1.0 - 1.2 (1.1). Tarsus about 21 μ wide; with a pair of apically knobbed tarsal digitules. Claw uniformly tapering to a pointed end; 27 - 34 (30) μ long; with a pair of fine, about 15 μ long ungual digitules. The following table shows the lengths of leg segments and the number of setae on each:-

		Fore-leg	Mid leg	Hind leg
Coxa	length in μ	40-46 (44)	40-46 (44)	43-49 (45)
	f.s.	9-12 (10.4)	9-13 (11.1)	10-14 (11.2)
	h.s.	7-10 (8.8)	8-14 (10.2)	10-15 (12.4)
Troch- anter	length in μ	61-64 (63)	61-64 (63)	64-70 (68)
	f.s.	1-5 (2.8)	2-5 (3.2)	3-5 (3.9)
	h.s.	2-4 (3.1)	2-4 (3.6)	2-5 (4.1)
Femur	length in μ	186-211 (198)	189-217 (204)	214-235 (226)
	f.s.	13-19 (15.6)	19-26 (21.7)	22-31 (25.4)
	h.s.	14-21 (17.3)	13-25 (20.6)	18-31 (26.1)
Tibia	length in μ	198-238 (214)	229-259 (241)	284-320 (299)
	f.s.	20-31 (24.0)	23-36 (29.4)	32-43 (37.7)
	h.s.	22-35 (26.2)	22-39 (32.2)	28-49 (40.3)
Tarsus	length in μ	85-92 (88)	89-95 (92)	98-107 (104)
	f.s.	8-12 (10.4)	8-12 (10.6)	9-14 (11.7)
	h.s.	12-17 (14.7)	14-19 (15.5)	14-20 (17.4)
Total length of leg in μ		616-680 (637)	662-711 (683)	741-808 (769)

Abdomen: 464 - 585 (502) μ long and 274 - 304 (289) μ wide. The tergites of segments I and II small; those of segments VIII and IX + X large and well sclerotized. Sternites of segment VIII ill-defined. Ostioles (ost) well developed, 40 - 46 (43) μ long at orifice. Abdominal setae: Dorsal and ventral setae (ads & avs) in transverse bands; pleural setae (aps) in lateral groups. Abdominal disc pores: Pleural pores (app) usually present only, but one dorsal pore was occasionally found on segments I & II and one ventral pore occasionally on segments II and III. The following table shows the number of abdominal setae and pores on each side of the median line:-

	I	II	III	IV	V	VI	VII	VIII
(ads)	f.s. 1 - 3 (1.7)	1 - 5 (2.8)	2 - 5 (3.3)	2 - 5 (3.3)	2 - 6 (4.5)	2 - 5 (3.5)	2 - 6 (4.2)	1 - 3 (2.2)
	h.s. 0 - 2 (0.8)	2 - 3 (2.7)	2 - 4 (3.2)	2 - 3 (2.8)	2 - 4 (3.3)	2 - 4 (2.5)	2 - 3 (2.2)	0 - 3 (1.8)
(aps)	f.s. 0 - 4 (2.2)	0 - 4 (1.7)	0 - 3 (1.2)	0 - 3 (1.2)	0 - 4 (1.2)	0 - 3 (1.3)	0 - 4 (1.3)	0 - 4 (2.7)
	h.s. 2 - 4 (2.7)	3 - 5 (4.0)	3 - 4 (3.7)	3 - 5 (4.3)	2 - 5 (4.0)	3 - 5 (4.3)	3 - 5 (4.2)	*1+1-4 (2.2)
(avs)	f.s. -	1 - 2 (1.8)	2 - 4 (2.8)	2 - 4 (3.2)	2 - 4 (3.3)	2 - 6 (3.5)	2 - 5 (3.7)	1 - 4 (2.8)
	h.s. -	2 - 4 (3.2)	3 - 5 (3.5)	2 - 3 (2.5)	2 - 4 (2.7)	2 - 4 (2.5)	(2.0)	0 - 1 (0.7)
(adp)	0 - 1 (0.2)	0 - 1 (0.2)	0	0	0	0	0	0
(app)	6-10 (7.5)	0 - 2 (0.3)	0 - 2 (0.5)	0 - 2 (0.5)	0 - 1 (0.8)	1 - 3 (1.5)	2 - 4 (2.8)	0
(avp)		0 - 1 (0.3)	0 - 1 (0.2)	0	0	0	0	0

* A slightly longer seta.

Setae of the glandular pouch (gls) consist of a pair of 397 - 488 (424) μ long tail setae (ts) and one seta of medium length, about 40 μ long, i.e. the ratio length of the tail setae to the total length of the body 1:2.7 - 3.7 (3.2).

Genital segment comparatively small; subtriangular in dorsal view; the style (st) slightly curving upwards in lateral view. The penial sheath 140 - 153 (150) μ long and 82 - 95 (89) μ wide, i.e. the ratio length to width 1.5 - 1.9 (1.7):1, and the ratio its length to the total length of the body 1:8.7 - 10.3 (9.1). The basal ridge of the penial

sheath and its projection well developed; the process of the penial sheath absent. Aedeagus (aed) relatively wide at its basal rod (bra), becoming narrower dorso-posteriorly towards its pointed apex; internal genital aperture (iga) small. Setae of the genital segment (gts) on each side. 3 hair-like setae always occur dorsally near the base of the style; 3 - 4 (3.8) smaller setae and 3 - 4 (3.2) setal sensilla present ventrally on the penial sheath.

Material: 8 specimens examined, collected by the writer on 20.4.1964, on a bunch of Bananas bought in a London fruit shop, imported from the Canary Islands; the females were identified by K. Boratynski and confirmed by D. J. Williams.

SACCHARICOCCUS GROUP :GENUS SACCHARICOCCUS:(13) SACCHARICOCCUS SACCHARI (Ck11.)

Both macropterous and apterous forms of this species were available.

(A) The macropterous form (Plate XIII, figs. 24 and 25)

Living specimens light brown. A narrow and slender species, comparatively large, with short antennae and short legs. When mounted, total length of the body 1260 - 1400 (1316) μ , width at mesothorax 252 - 280 (226) μ and wing expanse 1764 - 2072 (1932) μ .

Body setae and pores:

Antennae and legs with numerous fleshy, 21 - 27 μ long setae, and a few hair-like, slightly longer ones. The body itself with fine hair-like setae only. Quadrilocular and occasionally quinquilocular disc pores always present on head, thorax and abdomen, about 6 μ in diameter.

Head: Subtetrahedron; subtriangular in dorsal view; dorso-ventrally flattened in front and lateral views; ventral preocular depression entirely absent. Length from apex to postoccipital ridge 122 - 137 (131) μ ; from apex to neck 159 - 180 (171) μ ; width across the genae 180 - 198 (192) μ . Dorsal arm of the midcranial ridge (dmcr) only marked by weak, slender sclerotization; sometimes short or posteriorly extending to the level of the dorsal eyes. The lateral arms well developed, forming together with the ventral arm, a Y-shaped ridge. Postoccipital ridge (por) distinct, V-shaped and medially interrupted at a weak point; the ridge not reaching the preocular ridges anteriorly. The dorsomedial part of the epicranium (dmep) weakly sclerotized and slightly raised. Preocular and interocular ridges well developed; ventral rudiment of the preocular ridge absent.

The dorsal part of the postocular ridge (pocr) reduced to an atrophied arm. Preoral ridge (pror) slender.

Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; their corneae 15 - 21 (18) μ in diameter and both separated by 104 - 116 (110) μ , i.e. 5.0 - 7.6 (6.0) times their diameter apart. The ventral simple eyes (vse) 18 - 21 (20) μ in diameter and 21 - 31 (24) μ apart. Lateral ocelli (o) well developed. Cranial apophysis apically truncate. Tentorial bridge slender. Dorsal head setae (dhs): 10 - 14 (11.6) h.s. on each side of the median line in front of the postoccipital ridge; each gena always with 3 hair-like genal setae (gs). Ventral head setae (vhs) on each side: 2 - 3 (2.4) h.s. in a median longitudinal irregular row between the ventral eyes; 8 - 11 (9.3) h.s. just anterior to the ventral eyes, and forming on both sides a transverse band. The head pores: 4 - 7 (5.1) dorsal head pores (dhp) present on each side near the base of the antennae; ventral pores absent.

Antennae: Filiform; normally 10-segmented but fusion between two adjacent segments of the flagellum seems to be common; 412 - 482 (455) μ long, i.e. shorter than half the length of the body, the ratio being 1:2.7 - 3.1 (2.9), and shorter than the hind leg, the ratio 1:1.1 - 1.3 (1.2). Scape (scp) 34 - 37 (36) μ long and 40 - 43 (41) μ wide at base; with 5 - 7 (6.2) h.s. Pedicel 46 - 49 (48) μ long and 31 - 34 (33) μ wide; with 8 - 16 (12.2) f.s., 6 - 10 (8.4) h.s. and a sensillum placodeum (spl). Flagellar segments: Segment III club-shaped, subequal in length to segment X, the ratio their lengths being 0.8 - 1.1 (0.9):1. The flagellar segments about 21 μ wide, i.e. the ratio width to length of segments III and IX 1:2.3 - 2.9 (2.6) and 1:1.9 - 2.3 (2.1), respectively. The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	49-61 (55)	31-40 (36)	34-40 (38)	37-46 (43)	43-49 (47)	43-55 (49)	43-49 (48)	55-61 (58)
f.s. (av.)	5-9 (7.2)	5-10 (7.4)	5-10 (7.6)	6-13 (10.4)	9-17 (13.4)	8-16 (13.2)	8-13 (11.6)	10-15 (12.6)
h.s. (av.)	1-3 (1.8)	1-2 (1.6)	1-2 (1.2)	2-3 (2.2)	3-5 (4.0)	2-5 (3.8)	2-4 (3.4)	4-6 (4.8)

Antennal bristles (ab) longer than the fleshy setae; segments VIII and IX each with one ventral bristle. Terminal segment with 3 preapical bristles, two capitate subapical sensory setae (set. scla) and one apical hair-like seta.

Thorax: 517 - 570 (540) μ long. Prothorax: Pronotal ridges (pmnr) well developed, medially interrupted in the usual manner. Lateral pronotal sclerites small, and posttergites comparatively large. Proepisternum with a ridge-like dorsal margin. Prosternum (stnl) subtriangular, 49 - 58 (52) μ long and 89 - 98 (92) μ wide; prosternal ridge absent and its position only indicated by a narrow sclerotization. Prothoracic setae on each side: Medial pronotal setae (mpns) 3 - 5 (3.9) h.s.; lateral pronotal setae (lps) 3 - 5 (3.4) h.s.; posttergital setae (pts) 2 - 4 (3.0) h.s.; antespiracular dorsal setae (asds) usually 5 - 7 and occasionally 9 (average 6.1 h.s.). Antespiracular ventral setae (asvs) usually 2 and occasionally 3 h.s. (av. 2.1); prosternal setae 2 - 4 (2.9) h.s. Prothoracic disc pores on each side: Medial pronotal pores (mpnp) 0 - 1 (0.3); lateral pronotal pores 2 - 4 (2.6); posttergital pores absent; antespiracular dorsal pores (asdp) 2 - 3 (2.1). One prosternal pore may occur on either side (av. 0.4).

Mesothorax: Mesoprephragma comparatively small. Prescutum 85 - 95 (92) μ long (it is difficult to determine the actual length of the scutum due to the absence of the prescutal suture) and 125 - 140 (134) μ wide, the ratio length to width being 1:1.4 - 1.6 (1.5); prescutal ridge (pscr) well developed and prescutal suture absent. Scutum (sct) heavily sclerotized anterolaterally, with a median membranous longitudinal narrow area; 92 - 116 (110) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.1 - 1.3 (1.2). Prealare, prealar ridge, triangular plate, anterior and posterior notal wing processes well developed. Scutellum (scl) 46 - 52 (49) μ long and 92 - 104 (95) μ wide, i.e. the ratio its length to its width 1:1.9 - 2.1 (1.94) and the ratio its length to the length of scutum 1:2.0 - 2.4 (2.3). Postalare (pa) with well separated anterior and posterior ridges. Postnotal apophysis comparatively small. Mesopleuron: Mesopleural ridge interrupted above the coxal articulation; basalare stout. Subepisternal ridge (ser) slender. Mesepisternum (eps2) and mesepimeron distinct; lateropleurite (lpl) moderately large. Mesosternum: Basisternum (stn2) 134 - 159 (153) μ long and 137 - 159 (146) μ wide; the antero-median part of the marginal ridge (mr) absent; precoxal ridge (pcr2) well developed. Furca comparatively small. Mesothoracic spiracle (sp2) 18 - 21 (20) μ wide at opening, with 34 - 40 (37) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 3 - 5 (3.6) h.s.; scutal setae 5 - 7 (5.3) h.s.; scutellar setae 1 - 3 (2.1) h.s. Tegular setae (tegs) 2 - 4 (2.6) h.s. Postmesostigmatal setae (pms) 6 - 10 (7.7) h.s. in a latero-ventral group. Basisternal setae 5 - 7 (6.1) h.s. Mesothoracic pores: 1 - 2 (1.4) mesospiracular pores (sp2p) present behind each spiracle; postmesostigmatal pores absent.

Metathorax: Metapostnotal sclerites (pn3) and metapostnotal ridge (pn3r) well developed. Metapleural ridge (plr3) with usual attenuation near the middle at the point of origin of the metapleural apophysis.

Precoxal ridge (pcr3) slender and metasternal apophyses (sta) small. Metathoracic spiracle identical with the mesothoracic one. Metathoracic setae on one side: Metatergal setae (mts) 4 - 7 (5.1) h.s.; metapleural setae (mps) 1 - 3 (2.4) h.s. Anterior metasternal setae (amss) 3 - 6 (4.3) h.s. forming on both sides a short transverse median band; posterior metasternal setae (pmss) 2 - 3 (2.2) h.s. Metathoracic pores on each side: Metaspiracular pores 1 - 3 (1.9); anterior metasternal pores (amsp) usually 1 - 2 and occasionally 3 or 4 (av.1.9); posterior metasternal pores absent.

Wings: Hyaline; 770 - 910 (854) μ long and 280 - 350 (322) μ wide; with well developed alar lobe, axillary and additional sclerites; also with 2 - 4 (3.1) hair-like alar setae (als) and 2 minute circular sensoria (sens.). Hamulohalterae (h) 64 - 70 (69) μ long and 12 - 15 (14) μ wide; with a slender ridge and one apically hooked, 40 - 46 (43) μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1:1.4 - 1.7 (1.6).

Legs: Short and slender; the ratio length of hind leg to the total body length 1:2.3 - 2.4 (2.38). Coxa and trochanter about 49 and 24 μ wide respectively; the latter with the basal part longer than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur about 40 μ wide; that of the hind leg longest and those of the front and middle legs of about the same length; the ratio width to length of the hind femur 1:3.8 - 4.2 (4.1). Tibia about 19 μ wide; with two apical strong spurs and 2 - 4 smaller spines; the ratio lengths of femur to tibia in front leg being 1 - 1.1 (1.06):1. Tarsus about 18 μ wide; tarsal digitules apically knobbed. Claw uniformly tapering to a sharply pointed tip, 24 - 30 (27) μ long; ungual digitules extremely fine, about 15 μ long. The lengths of the leg segments and the number of setae on each are given below:

		Front leg	Middle leg	Hind leg
Coxa	length in μ	40-43 (42)	40-43 (42)	43-46 (44)
	f.s.	1 - 2 (1.6)	1 - 3 (1.8)	1 - 2 (1.6)
	h.s.	5 - 7 (6.2)	5 - 8 (7.2)	6 - 8 (7.4)
Trochanter	length in μ	52-58 (55)	52-58 (55)	55-61 (58)
	f.s.	1 - 2 (1.4)	1 - 2 (1.4)	1 - 3 (2.2)
	h.s.	3 - 6 (4.6)	3 - 5 (4.2)	4 - 5 (4.4)
Femur	length in μ	143-159 (153)	143-159 (153)	153-168 (162)
	f.s.	10-17 (12.4)	10-16 (11.6)	9-14 (12.0)
	h.s.	6 - 9 (7.4)	5 - 9 (7.2)	6 - 8 (7.4)
Tibia	length in μ	134-159 (143)	146-171 (159)	177-192 (186)
	f.s.	14-17 (15.4)	12-18 (15.2)	12-19 (15.6)
	h.s.	4 - 7 (5.8)	4 - 9 (6.2)	5 - 8 (6.4)
Tarsus	length in μ	67-70 (68)	67-70 (68)	73-76 (74)
	f.s.	3 - 6 (4.6)	2 - 4 (3.2)	3 - 2 (4.4)
	h.s.	7 - 9 (8.2)	6 - 9 (7.4)	7 - 9 (7.8)
Total length of leg in μ		464-512 (485)	476-525 (500)	528-573 (552)

Abdomen: 448 - 562 (502) μ long and 243 - 274 (258) μ wide. Tergites of segments I and II small; those of segments VIII and IX + X large and distinct. Sternites of segment VIII weakly sclerotized. Ostioles (ost) well developed, 40 - 46 (43) μ long at orifice. Abdominal setae segmentally arranged in dorsal and ventral irregular rows; pleural setae in lateral groups. Abdominal pores: Dorsal pores absent; pleural pores (app) relatively numerous on segment I and fewer on other segments. Ventral pores (avp) usually absent on segment II; one, and occasionally two pores occur at least on one side of

segments III to VII forming together a submarginal longitudinal row. The following table shows the number of abdominal setae and pores on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	4 - 5 (4.3)	3 - 5 (4.1)	3 - 5 (3.9)	3 - 4 (3.7)	3 - 5 (3.9)	3 - 4 (3.3)	2 - 4 (3.0)	2 - 4 (3.1)
(aps)	4 - 6 (4.9)	5 - 7 (5.7)	6 - 7 (6.2)	5 - 7 (5.9)	5 - 7 (5.6)	5 - 7 (5.7)	5 - 7 (6.1)	*1+2-3 (2.3)
(avs)	-	2 - 3 (2.2)	3 - 4 (3.1)	2 - 4 (2.6)	2 - 3 (2.7)	2 - 3 (2.4)	(2.0)	0
(app)	3 - 5 (3.9)	1 - 3 (1.4)	1 - 3 (1.7)	1 - 3 (1.7)	1 - 3 (1.7)	1 - 2 (1.3)	(1.0)	0
(avp)	-	0 - 1 (0.1)	0 - 2 (1.1)	0 - 2 (1.1)	0 - 2 (1.0)	0 - 1 (0.7)	0 - 2 (0.9)	0

* A slightly longer seta.

Glandular pouch (gp) small; the setae of the glandular pouch (gls) include a pair of 305 - 336 (320) μ long tail setae (ts) and one seta of medium length, 40 - 55 (46) μ long, i.e. the ratio length of the tail setae to the total length of the body 1:4.0 - 4.2 (.41).

Genital segment subtriangular in dorsal view. Style (st) apically rounded, rather straight in lateral view. Penial sheath 131 - 150 (137) μ long and 70 - 79 (73) μ wide, the ratio being 1.8 - 1.9 (1.87) :1 and the ratio its length to the total body length 1:9.3 - 10.1 (9.6). Basal ridge of the penial sheath (brps) with a small projection. Process of the penial sheath (pro) well pronounced. Aedeagus (aed) comparatively slender, with a large internal genital aperture. Setae

of the genital segment: Dorsally, 3 hair-like setae always present on each side near the base of the style; ventrally, 5 - 6 (5.2) smaller setae occur on each side of the penial sheath; process of the penial sheath with 2 - 3 setal sensilla (pros).

Material: 7 specimens examined, collected by Mr. A. I. Ezz and myself, on sugar cane, in Giza, Cairo, U.A.R., during the second and third weeks of August, 1964.

(B) The apterous form (Plate XIV, figs. 26 and 27)

Living specimens not available. The males moderately robust, of medium size, with very short antennae and comparatively short legs. Mounted specimens 1120 - 1190 (1148) μ long and 308 - 350 (322) μ wide.

Body setae and pores: Antennae and legs with comparatively few, about 15 μ long fleshy setae, and about 27 μ long hair-like ones. The body itself only with hair-like setae, 31 - 49 μ long; each of abdominal segments VI, VII and VIII also with a rather long and stout seta on each side. Numerous quadrilocular, and occasionally trilocular pores, about 6 μ in diameter, present on the head, thorax and abdomen.

Head with a narrow truncate apex, becoming broader posteriorly as it fuses with the thorax. Length from apex to postoccipital ridge 85 - 101 (95) μ and width across the genae 174 - 189 (180) μ . The midcranial ridge with its dorsal, lateral and ventral arms entirely

PLATE XIV

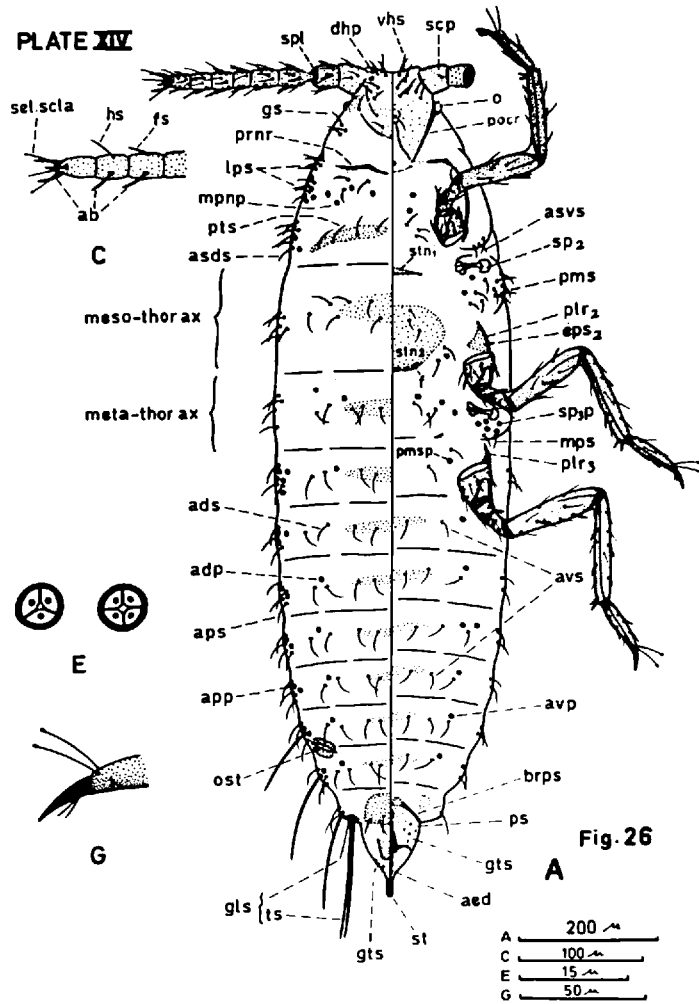


Fig. 26

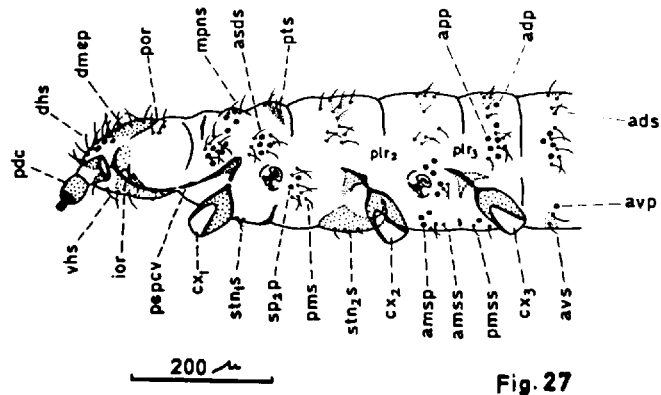


Fig. 27

absent. Postoccipital ridge (por) V-shaped. The dorsomedial part of the epicranium (dmep) well sclerotized. Ocular ridges usually present but sometimes atrophied or absent altogether. If present, the preocular and interocular ridges (ior) join the postocular ridge just below the ocellus. Preoral ridge rather weak.

Eyes: Dorsal and the ventral simple eyes absent; lateral ocelli (o) small. Cranial apophysis comparatively small, apically truncate. Posterior tentorial pits minute and tentorial bridge slender. Dorsal head setae (dhs): 9 - 12 (10.5) h.s. present on each side of the median line anterior to the (por); each gena always with 3 hair-like genal setae (gs). Ventral head setae (vhs) on each side: 7 - 9 (8.3) h.s. present just anterior to the level of the ocelli; posteriorly, 0 - 1 (0.6) h.s. occur medially. Head pores: Dorsal head pores (dhp) 2 - 4 (2.8) near the base of each antenna; ventral pores absent.

Antennae: Filiform; 8 - segmented; 256 - 293 (275) μ long, i.e. the ratio its length to the total body length 1:3.9 - 4.6 (4.2) and the ratio its length to the length of the hind leg 1:1.7 - 2.0 (1.8). Scape (scp) 40 - 46 (43) μ long and 37 - 43 (40) μ wide at base; with 4 - 5 (4.2) h.s. Pedicel (pdc) 37 - 40 (39) μ long and 31 - 34 (33) μ wide; with 4 - 5 (4.5) f.s., 4 - 8 (5.8) h.s. and a sensillum placodeum. Flagellar segments: Segment III club-shaped and subequal in length to segment VIII (ratio 0.9 - 1.2, av. 1.1:1). Flagellar segments about 24 μ wide, the ratio width to length of segments III and VII being 1:1.4 - 1.8 (1.8) and 1:1.2 - 1.3 (1.25), respectively. The lengths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII
Length in μ (av.)	34-36 (40)	24-40 (34)	21-27 (24)	27-34 (30)	27-31 (29)	27-40 (39)
f.s. (av.)	4 - 8 (5.8)	1 - 5 (3.0)	1 - 3 (2.3)	1 - 4 (2.1)	1 - 2 (1.5)	1 - 3 (2.3)
h.s. (av.)	1 - 3 (2.3)	3 - 5 (4.2)	4 - 5 (4.8)	3 - 5 (4.5)	4 - 6 (4.8)	6 - 8 (6.6)

Antennal bristles (ab) much stouter and longer than the antennal fleshy setae; segments VI and VII each with a ventral bristle. Segment VIII with 3 preapical bristles, two capitate subapical sensory setae (set. scl.) and one apical hair-like seta.

Thorax: Length from postoccipital ridge to 1st abdominal segment 418 - 441 (433) μ . Prothorax: Pronotal ridges (pmr) usually weak or atrophied but sometimes well developed; pronotal sclerites small. Posttergites (pt) comparatively large. Dorsal margin of the proepisternum ridge-like. Prosternum (stnl) small, triangular, 9 - 15 (12) μ long and 61 - 70 (65) μ wide; prosternal ridge absent and its position only marked by weak sclerotization. Prothoracic setae on each side of the median line: Medial pronotal setae 3 - 4 (3.3) h.s.; lateral pronotal setae (lps) 7 - 9 (8.3) h.s.; posttergital setae (pts) 3 - 4 (3.8) h.s.; antespiracular dorsal setae (asds) 5 - 7 (5.8) h.s. Antespiracular ventral setae (asvs) 3 - 5 (3.4) h.s.; prosternal setae (stnls) 2 - 4 (2.8) h.s. Prothoracic disc pores on one side: Medial pronotal pores (mpnp) 3 - 4 (3.8); lateral pronotal pores 4 - 7 (5.3); posttergital pores absent; antespiracular disc pores (asdp) 3 - 4 (3.3). Prosternal pores 2 - 3 (2.2).

Mesothorax: Largely reduced; the mesotergum represented by a weakly sclerotized sclerite. The mesopleural ridge (plr2) atrophied; mesepisternum distinct and mesepimeron small. Basisternum (stn2) weakly sclerotized and rather hard to detect; marginal and precoxal ridges absent; the furca (f) vestigial. Mesothoracic spiracle (sp2) 18 - 21 (20) μ wide at opening, with 49 - 55 (52) μ long supporting bar. Mesothoracic setae on each side: Dorsal setae 5 - 7 (6.2) h.s., forming on both sides a transverse band; pleural setae 4 - 5 (4.5) h.s.; postmesostigmatal setae (pms) 9 - 13 (11.3) h.s. behind each spiracle. Basisternal setae (stn2s) 3 - 5 (4.2) h.s.
Mesothoracic pores: Mesospiracular pores (sp2p) 1 - 2 (1.5).

Metathorax: Metapleural ridge (plr3) dorsally reduced; precoxal ridge absent. Metasternal apophyses vestigial. Metathoracic spiracle similar to the mesothoracic. Metathoracic setae on each side: Dorsal setae 5 - 7 (5.8) h.s.; metapleural setae (mps) 5 - 9 (6.8) h.s.; anterior metasternal setae (amss) 2 - 4 (3.3) h.s.; posterior metasternal setae (pms) always 2. Metathoracic pores: 1 - 2 (1.8) dorsal pores present on each side of the metathorax; metaspiracular pores (sp3p) 5 - 8 (6.2) behind each spiracle; anterior metasternal pores (amsp) 2 - 4 (3.1) and posterior metasternal pores 1 - 2 (1.3) on each side.

Legs: Comparatively short; the ratio length of the hind leg to the total body length 1:2.3 - 2.4 (2.32). Coxa about 46 and trochanter about 24 μ wide; the latter with the basal part longer than the distal, and with 3 circular sensilla on each side. Femur about 37 μ wide; that of the hind leg longest and those of the front and middle legs of about the same length; the ratio width to length of the hind femur 1:3.8 - 4.0 (3.9). Tibia about 20 μ wide; with 2 apical spurs (smaller spines absent); the femur of fore-leg always longer than the tibia, the ratio being 1.2 - 1.3 (1.21):1. Tarsus about 18 μ

wide; tarsal digitules apically knobbed. Claw gradually tapering to a pointed end, 27 - 31 (29) μ long; ungual digitules fine, about 15 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Front leg	Middle leg	Hind leg
Coxa	length in μ	37-43 (40)	37-43 (40)	40-46 (43)
	f.s.	1-3 (1.8)	1 - 3 (2.1)	1-2 (1.5)
	h.s.	4-7 (5.6)	5-8 (6.8)	5-8 (7.1)
Troch- anter	length in μ	58-61 (60)	58-61 (60)	61-64 (63)
	f.s.	0-1 (0.8)	0-1 (0.9)	1-2 (1.3)
	h.s.	3-5 (4.1)	3-5 (3.8)	4-6 (4.8)
Femur	length in μ	134-140 (137)	134-140 (137)	140-146 (143)
	f.s.	2-3 (2.8)	1-3 (2.6)	2-4 (3.1)
	h.s.	5-8 (6.5)	5-8 (6.9)	6-9 (7.6)
Tibia	length in μ	110-116 (113)	116-128 (122)	137-146 (140)
	f.s.	2-4 (3.2)	2-4 (3.4)	2-4 (3.3)
	h.s.	6-8 (6.9)	6-9 (7.5)	7-9 (8.2)
Tarsus	length in μ	64-70 (67)	64-70 (67)	70-76 (73)
	f.s.	1-3 (2.3)	1-3 (2.6)	2-3 (2.4)
	h.s.	4-6 (5.3)	4-7 (6.1)	5-7 (6.4)
Total length of leg in μ		436-461 (445)	445-473 (455)	482-503 (494)

Abdomen: Total length from 1st abdominal segment to projection of basal ridge of the penial sheath 448 - 509 (479) μ and width at 3rd segment 289 - 342 (312) μ . Tergites and sternites of segments I - VII occurring as narrow median sclerotized areas; tergite of segment VIII

large and that of segments IX + X distinct; sternites of segment VIII ill-defined. Ostioles (ost) well developed, 34 - 40 (37) μ long at orifice. Abdominal setae in dorsal and ventral irregular rows; pleural setae in lateral groups. Segments VI, VII and VIII each with one ^{very} ~~considerably~~ long and stout pleural seta on each side (nearly as long as the tail setae of the genital pouch). Abdominal pores: Dorsal pores (adp) usually present; pleural pores (app) always on segments I to VI and sometimes VII; ventral pores (avp) present at least on one side of segments II to VI and sometimes VII. The number of abdominal setae and pores on each side of the median line are as follows:

	I	II	III	IV	V	VI	VII	VIII
(ads)	3 - 4 (3.6)	4 - 5 (4.4)	3 - 5 (4.2)	3 - 5 (4.2)	4 - 5 (4.1)	3 - 5 (3.8)	3 - 5 (3.8)	2 - 4 (2.9)
(aps)	5 - 6 (5.3)	5 - 6 (5.3)	6 - 7 (6.5)	5 - 7 (5.8)	5 - 7 (5.8)	*1+5-6 (5.2)	*1+4-5 (4.7)	*1+2-3 (2.8)
(avs)	-	1 - 3 (2.3)	3 - 4 (3.2)	2 - 3 (2.8)	2 - 4 (3.0)	2 - 3 (2.8)	(2.0)	0
(adp)	0 - 2 (0.8)	0 - 2 (0.4)	0 - 2 (0.5)	0 - 2 (1.2)	0 - 2 (0.9)	0 - 1 (0.3)	0 - 1 (0.3)	0
(app)	3 - 5 (4.2)	2 - 5 (2.9)	2 - 5 (2.8)	2 - 3 (2.7)	1 - 3 (2.1)	1 - 2 (1.8)	0 - 1 (0.5)	0
(avp)	-	0 - 2 (1.5)	0 - 2 (1.3)	0 - 2 (1.1)	0 - 2 (1.3)	0 - 1 (0.6)	0 - 1 (0.3)	0

^{very}
* A ~~considerably~~ long and stout seta.

Glandular pouch small; setae of the glandular pouch (gls) include a pair of 153 - 229 (180) μ long tail setae (ts), and one seta of medium length, 61 - 76 (70) μ long, i.e. the ratio length of the tail setae to the total length of the body 1:5 - 7.8 (6.4). The genital

segment identical with that of their macropterous counterparts. Penial sheath (ps) 128 - 143 (140) μ long and 79 - 89 (82) μ wide, ratio 1.6 - 1.7 (1.68):1 and the ratio its length to the total body length 1:7.8 - 8.9 (8.2).

Material: 12 specimens examined, collected by B. S. Chandel, on Sugar cane, in U.P. Bichpuri farm, Balawant Rajput College, Agra, United Provinces, ^{(now Uttar Pradesh),} India, during the summer of 1964 (received from D. J. Williams).

OCTOCOCCUS GROUP:GENUS OCTOCOCCUS:(14) OCTOCOCCUS AFRICANUS (BRAIN) (Plate XV, figs. 28 and 29)

Only winged forms known. These moderately robust, small, with very long antennae and long legs. Mounted specimens 882 - 1064 (966) μ long, 308 - 336 (322) μ wide and 2212 - 2534 (2366) μ wing expanse.

Body setae and pores: The antennae with numerous fleshy setae, about 24 μ long, and a few hair-like ones, of about the same length. The body itself and the legs with hair-like setae only. Quadrilocular and occasionally quinquilocular disc pores present only on the thorax and the first abdominal segment, about 6 μ in diameter.

Head: Subtetrahedron; subtriangular in dorsal and front views; the ventral preocular depression (vprd) well pronounced in lateral view. Length from apex to postoccipital ridge 89 - 110 (101) μ ; from apex to neck 137 - 153 (146) μ ; width across the genae 165 - 192 (177) μ . Dorsal arm of the midcranial ridge (dmcr) anteriorly separated from other arms and posteriorly fading out before reaching the postoccipital ridge. The lateral and the ventral arms of the midcranial ridge well developed, forming together a Y-shaped ridge. Postoccipital ridge (por) distinct, U-shaped and not reaching the preocular ridges anteriorly. The dorsomedial part of the epicranium (dmep) slightly raised. Preocular and interocular ridges intimately joined; the former with a hardly indicated ventral rudiment below the articular process. Postocular ridge (pocr) well developed and preoral ridge (pror) slender.

Eyes: The dorsal simple eyes (dse) slightly projecting beyond the outer margins of the head in dorsal view; their cornea 18 - 21 (20) μ in diameter and separated by 92 - 119 (104) μ , i.e. 4.4 - 6.0 (5.1)

PLATE IV

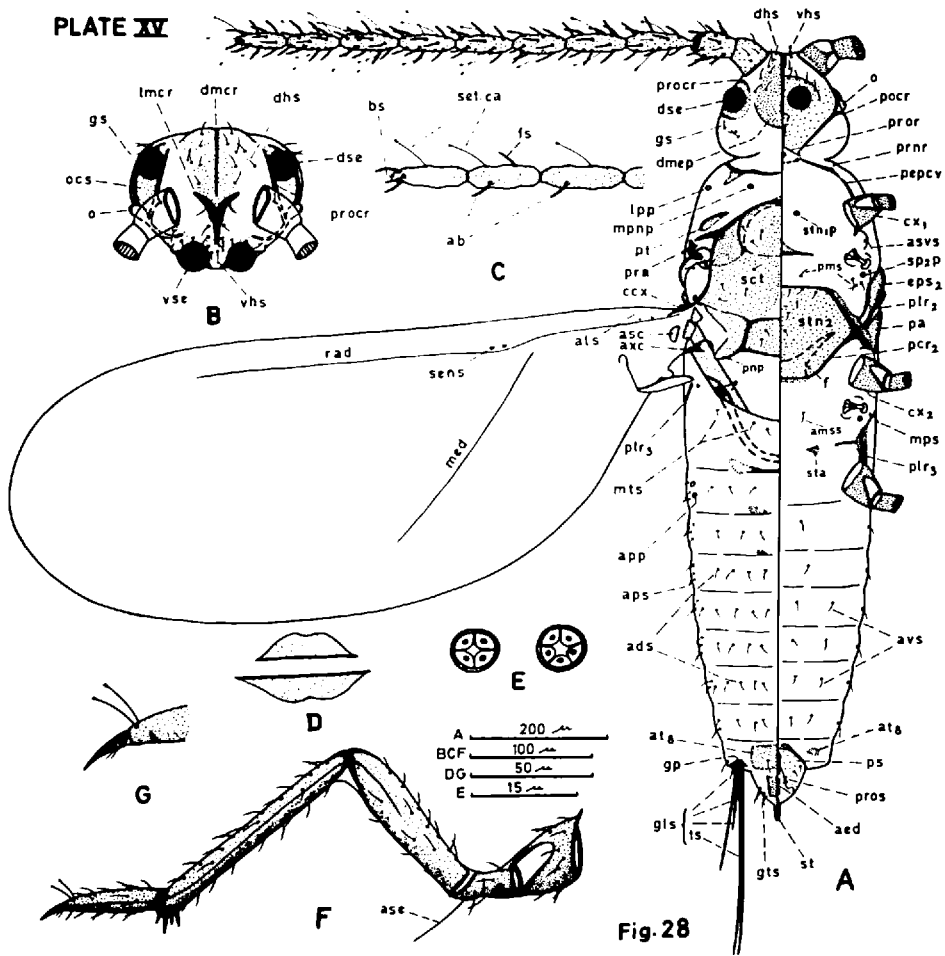


Fig. 28

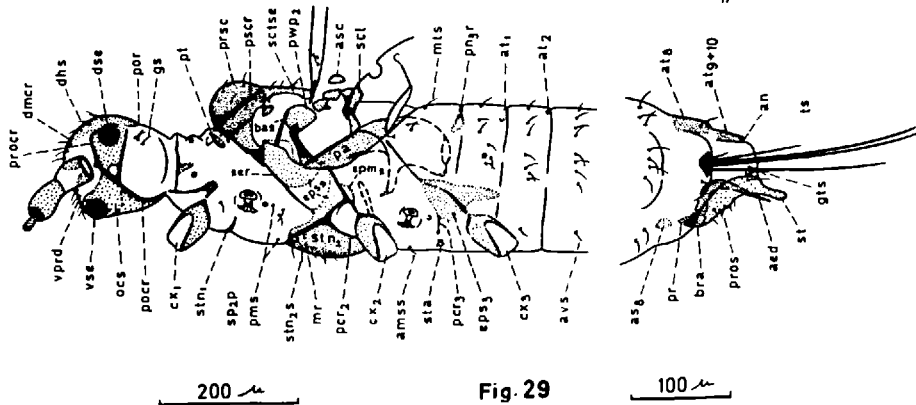


Fig. 29

times their diameter apart. The ventral simple eyes (vse) 15 - 21 (18) μ in diameter and 24 - 31 (27) μ apart. Lateral ocelli (o) large. Cranial apophysis comparatively short and apically truncate. Tentorial bridge slender. Dorsal head setae (dhs): 5 - 7 (5.9) h.s. present on each side anterior to the postoccipital ridge; each gena always with 3 hair-like genal setae (gs). Ventral head setae (vhs) on each side of the median line: The setae between the ventral eyes absent; 3 - 4 (3.6) h.s. in the area of the ventral preocular depression, forming with their partners of the other side a transverse irregular row; anteriorly 2 - 3 (2.2) h.s. present on each side of the ventral arm of the midcranial ridge. The head disc pores entirely absent.

Antennae: Filiform; normally 10-segmented; 668 - 769 (729) μ long, i.e. much longer than half the total body length (ratio 1:1.2 - 1.6, av. 1.3) and longer than the hind legs (ratio 1.1 - 1.3, av. 1.2:1). Scape 43 - 49 (46) μ long and 46 - 49 (47) μ wide at base; almost always with 4 and occasionally 5 h.s. (av. 4.1). Pedicel 58 - 64(61) μ long and 37 - 40 (38) μ wide; with 10 - 18 (13.1) f.s., 3 - 8 (5.3) h.s. and a sensillum placodeum. Flagellar segments cylindrical, with irregular margins and with a few apically knobbed, about 40 μ long capitate sensory setae (set. ca). Segment III club-shaped, longest of all and about 27 μ wide, the ratio its length to the length of segment X 1.2 - 1.4 (1.3):1, and the ratio its width to its length 1:3.1 - 3.7 (3.3). Segments IV to X slightly narrower, the ratio width to length of segment IX being 1:2.7 - 3.3 (3.0). The lengths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII	IX	X
length	85-101	67-82	70-82	70-85	67-82	70-85	64-79	70-73
(av.)	(92) μ	(76) μ	(79) μ	(82) μ	(76) μ	(79) μ	(73) μ	(71) μ
f.s.	12-19	10-20	10-19	13-20	13-20	12-21	14-20	13-16
(av.)	(15.6)	(14.6)	(14.1)	(16.3)	(17.8)	(18.4)	(17.9)	(14.7)
h.s.	2 - 4	0	0	0	0	0	0	0
(av.)	(3.4)	0	0	0	0	0	0	0
set.ca.	1 - 2	2 - 3	1 - 2	3 - 4	4 - 5	5 - 6	4 - 6	4
(av.)	(1.6)	(2.7)	(1.3)	(3.7)	(4.4)	(5.3)	(5.1)	(4.0)

Antennal bristles (ab) inconsiderably stouter than the fleshy setae; segments VIII and IX each with a ventral bristle. Terminal segment with 3 preapical bristles and 1 - 2 apical sensilla basiconica (bs).

Thorax: 418 - 479 (448) μ long. Prothorax: Pronotal ridges (prnr) well developed though medially interrupted by a weak sclerotization. Lateral pronotal sclerites and posttergites (pt) distinct. The dorsal margin of the proepisternum ridge-like. Prosternum (stn1) triangular, 12 - 18 (15) μ long; posteriorly bounded by the transverse, 82 - 98 (92) μ long prosternal ridge. Prothoracic setae on each side of the median line: Medial pronotal setae absent; lateral pronotal seta 0 - 1 (0.3) h.s.; posttergital and antespiracular dorsal setae absent. One antespiracular ventral seta (asvs) always present; prosternal setae almost always absent although one seta may occur on one side (av. 0.2). Prothoracic disc pores on each side: Medial and lateral pronotal pores (mpnp & lpp) 0 - 1 (0.8) and 0 - 2 (0.9) respectively; antespiracular dorsal pores absent. Prosternal pores (stnlp) 1 - 2 (1.3).

Mesothorax: Prescutum (prcs) 67 - 79 (73) μ long and 116 - 137 (128) μ wide, the ratio being 1:1.6 - 1.9 (1.8); laterally and posteriorly bounded by the prescutal ridge (pscr) and the prescutal suture. Scutum (sct) large, well sclerotized antero-laterally and with a median longitudinal membranous narrow area; 73 - 89 (76) μ long, i.e. the ratio lengths of prescutum to scutum 1:1.0 - 1.2 (1.1). Prealare (pra), prealar ridge, triangular plate, anterior and posterior notal wing processes well developed. Scutellum (scl) pentagonal in dorsal view, 49 - 61 (55) μ long and 82 - 104 (92) μ wide, i.e. the ratio length to width 1:1.6 - 1.8 (1.7) and the ratio its length to the length of the scutum 1:1.3 - 1.5 (1.4). Postalare (pa) well developed, with well separated anterior and posterior postalar ridges. Postnotal apophysis strong. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare (bas) comparatively slender. Mesepisternum (eps2) and mesepimeron (epm2) distinct; lateropleurite narrow. Mesosternum: Basisternum (stn2) 113 - 134 (122) μ long and 189 - 232 (204) μ wide; bounded by the marginal (mr) and the precoxal ridges (pcr2); furca (f) well developed. Mesothoracic spiracle 21 - 24 (23) μ wide at opening, with 40 - 46 (43) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 2 - 4 (3.1) h.s.; scutal setae (sctse) 4 - 6 (4.9) h.s.; scutellar setae 2 - 3 (2.4) h.s. One hair-like tegular seta always present. Postmesostigmatal setae (pms) 2 - 4 (3.1) h.s. behind the spiracles, and one medially separated. Basisternal setae (stn2s) 5 - 7 (5.3) h.s. Mesothoracic disc pores: Mesospiracular pores (sp2p) 1 - 2 (1.1); postmesostigmatal pores absent.

Metathorax: Metapostnotal sclerites well-defined and metapostnotal ridge (pn3r) weakly developed. Metapleural ridge (plr3) slender, attenuated at the point of origin of the metapleural apophysis. Precoxal ridge of metathorax (pcr3) well developed and metasternal apophysis (sta) distinct. Metathoracic spiracle similar

to the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) always 3 h.s.; metapleural setae (mps) 0 - 1 (0.4) h.s. Anterior metasternal setae (amss) usually 1 and occasionally 2 (av. 1.1 h.s.); posterior metasternal setae 0 - 1 (0.1) h.s. Metathoracic pores: one metaspiracular pore always present behind each spiracle; anterior and posterior metasternal pores absent.

Wings: Hyaline; 966 - 1120 (1036) μ long and 392 - 462 (420) μ wide; with well developed alar lobe, axillary and additional sclerites; 2 hair-like alar setae (als) and 2 minute circular sensoria (sens.) always present. Hamulohalterae 79 - 85 (82) μ long and 18 - 21 (19) μ wide; with a 52 - 61 (55) μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1:1.4 - 1.6 (1.5).

Legs: Comparatively long and stout; the ratio length of the hind leg to the total body length 1:1.5 - 1.7 (1.6). Coxa about 55 and trochanter about 27 μ wide; the basal part of the latter longer than the distal, with 3 circular sensilla on each side; the trochanter also with a differentiated long apical seta (ase). Femur about 40 μ wide; that of the fore-leg longest and that of the middle leg shortest; the ratio width to length of the hind femur 1:3.7 - 4.2 (4.0). Tibia about 24 μ wide; with 2 apical strong spurs and 2 - 3 smaller spines; in fore-legs the femur usually shorter and sometimes as long as the tibia, the ratio their lengths being 1:1 - 1.1 (1.06). Tarsus about 21 μ wide; tarsal digitules apically knobbed, about 37 μ long. Claw gradually tapering to a pointed end, about 24 μ long; ungual digitules fine, about 12 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	43-49 (46)	43-49 (46)	46-52 (49)
	h.s.	8-12 (9.3)	8-13 (10.4)	9-12 (10.5)
Troch- anter	length in μ	58-67 (61)	58-67 (61)	61-70 (66)
	h.s.	4-6 (4.8)	4-7 (5.2)	5-7 (5.4)
Femur	length in μ	162-174 (168)	143-159 (153)	150-165 (159)
	h.s.	19-25 (21.3)	14-20 (17.2)	15-21 (17.8)
Tibia	length in μ	162-189 (177)	177-211 (189)	198-232 (214)
	h.s.	20-27 (23.5)	21-29 (24.7)	23-30 (27.1)
Tarsus	length in μ	76-82 (79)	76-82 (79)	79-85 (82)
	h.s.	13-18 (15.4)	15-18 (16.9)	16-20 (18.1)
Total length of leg in μ		522-580 (555)	525-586 (555)	561-619 (592)

Abdomen: 266 - 334 (296) μ long and 289 - 327 (312) μ wide. The tergites of segments I and II small; those of segments VIII and IX + X large and distinct. Sternites of segment VIII ill-defined. Ostioles entirely absent. Abdominal setae in dorsal and ventral segmental rows; pleural setae in lateral clusters. Abdominal pores: Dorsal and ventral pores absent; pleural pores (app) only occur on segment I. The number of abdominal setae and pores on each side, as follows:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 3 (2.9)	3 - 4 (3.1)	3 - 4 (3.6)	3 - 4 (3.9)	3 - 4 (3.9)	3 - 4 (3.7)	2 - 3 (2.8)	1 - 2 (1.1)
(aps)	2 - 3 (2.6)	3 - 4 (3.1)	3 - 4 (3.2)	3 - 4 (3.2)	3 - 4 (3.5)	3 - 4 (3.7)	3 - 4 (3.4)	(1.0)
(avs)	-	(1.0)	1 - 2 (1.1)	2 - 3 (2.1)	2 - 3 (2.3)	2 - 3 (2.1)	2 - 3 (2.1)	0
(app)	1 - 3 (2.6)	0	0	0	0	0	0	0

Glandular pouches (gp) well developed; the setae of the glandular pouch (gls) consist of a pair of 229 - 275 (256) μ long tail setae (ts), a pair of shorter setae of unequal lengths, 159 - 183 (171) and 70 - 116 (82) μ long respectively and a short one, subequal in length to the abdominal setae, the ratio length of the tail setae to the total body length being 1:3.4 - 4.2 (3.8). Genital segment small, subtriangular in dorsal view. The style (st) rather straight in lateral view, with a rounded apex. Penial sheath (ps) 104 - 116 (110) μ long and 76 - 92 (85) μ wide, the ratio being 1.1 - 1.5 (1.3):1 and the ratio its length to the total body length 1:8.1 - 10.0 (8.9). Basal ridge of the penial sheath and its projection (pr) well developed. Process of the penial sheath hardly indicated. Aedeagus (aed) broad at its basal rod (bra), gradually tapering dorso-posteriorly. Setae of the genital segment (gts) on each side of the median line: Dorsally 4 h.s. always present near the base of the style; ventrally 2 - 4 (2.6) h.s. occur on the penial sheath and 3 - 4 small setal sensilla (pros) on its process.

Material: 10 specimens examined, collected by O. W. Richards, on Nolletia sp., in Colesberg bridge (over Orange River), Cape Province, South Africa, on 26.9.1952.

CEROPUTO GROUP:GENUS CEROPUTO:(15) CEROPUTO PILOSELLAE SULC (Plate XVI, figs. 30 and 31)

Macropterous forms only known; these narrow and slender, of medium size, with comparatively very long antennae and moderately long legs. Mounted specimens 938 - 1260 (1106) μ long, 266 - 322 (294) μ wide at mesothorax and 2254 - 2506 (2366) μ wing expanse.

Body setae and pores: The body and the appendages with numerous hair-like setae; fleshy setae entirely absent. The antennal setae about 61 μ long, the body setae about 24 μ long and the leg setae of intermediate length. Quadriocular and occasionally quinquilocular disc pores present on head, thorax and abdomen, about 6 μ in diameter.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression well pronounced in lateral view. Length from apex to postoccipital ridge 98 - 122 (104) μ ; from apex to neck 143 - 165 (153) μ ; width across the genae 159 - 198 (180) μ . The dorsal arm of the midcranial ridge absent though its position marked by a weak sclerotization; anteriorly continuous with the ventral arm and posteriorly fading out before reaching the postoccipital ridge. The lateral and the ventral arms well developed. The position of the postoccipital ridge (por) indicated by slender, U-shaped sclerotization, anteriorly confluent with the preocular ridges. The dorsomedial part of the epicranium (dmp) well sclerotized and slightly raised. Preocular ridge (procr) widely separated from the postocular ridge (pocr); interocular ridge absent; preoral ridge slender.

Eyes: The dorsal simple eyes (dse) projecting beyond the outer margins of the head in dorsal view; the diameter of their corneae 15 - 21 (17) μ , and separated by 107 - 137 (122) μ , i.e. 5.4 - 9.0 (6.9)

PLATE XVI

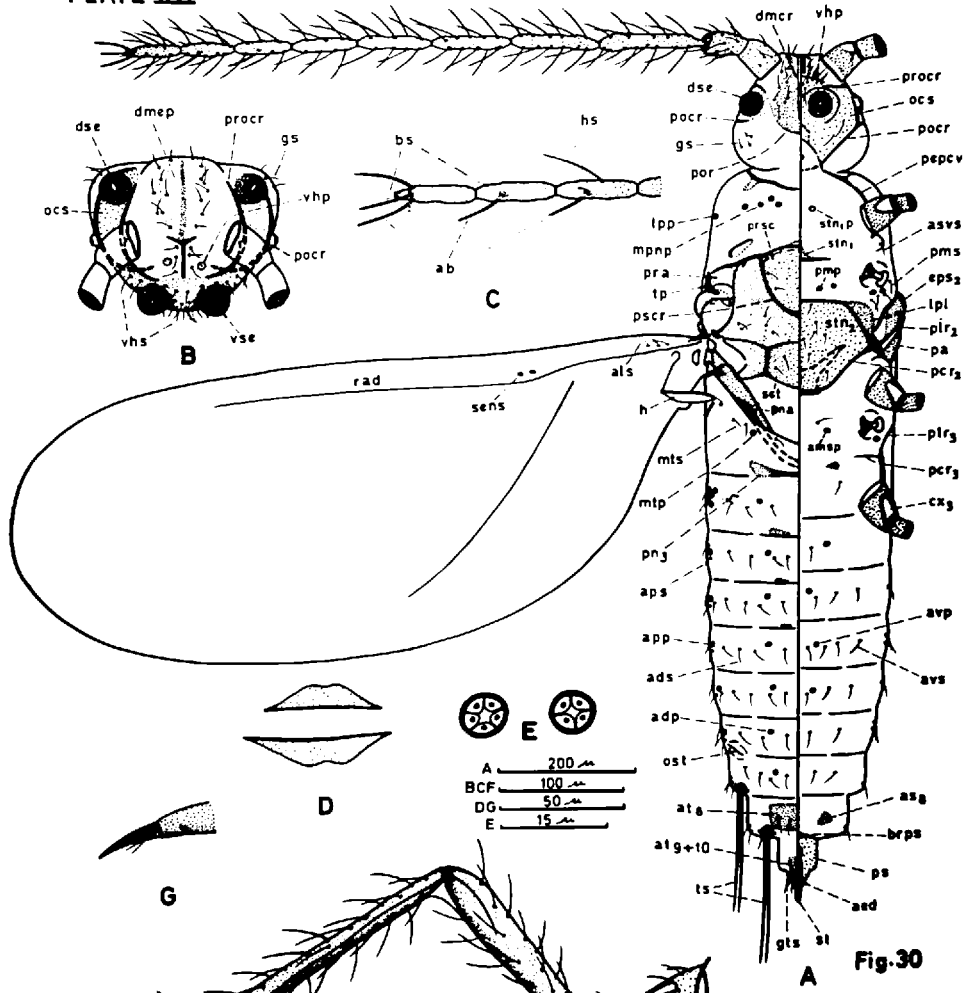


Fig. 30

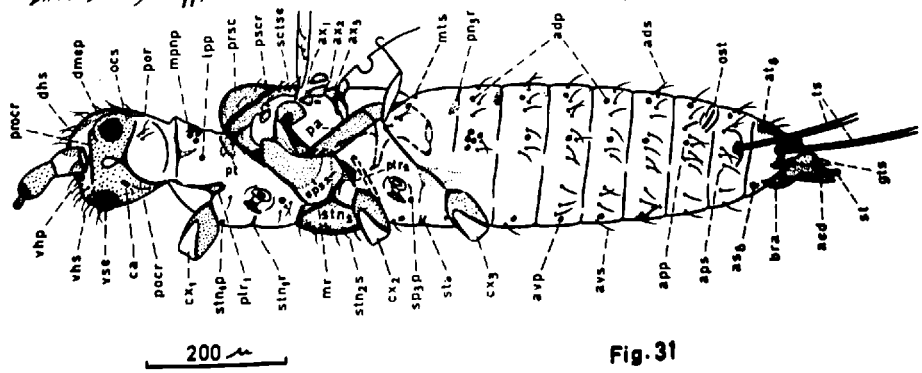


Fig. 31

times their diameter apart. The corneae of the ventral eyes (vse) of about the same size or somewhat larger, 15 - 21 (19) μ in diameter and 31 - 46 (37) μ apart. The lateral ocelli well developed, attached to the postocular ridges by means of a short sclerotized arm. Ocular sclerites (ocs) large. Cranial apophysis (ca) apically truncate; tentorial bridge slender. Dorsal head setae on each side: 8 - 11 (9.7) h.s. anterior to the postoccipital ridge; each gena almost always with 3 and occasionally 2 (av. 2.8) hair-like genal setae (gs). Ventral head setae (vhs): 1 - 2 (1.5) h.s. in a longitudinal median row between the ventral eyes; 6 - 9 (7.0) h.s. in the area of the ventral preocular depression forming with their partners of the other side a transverse band; anteriorly 2 - 3 (2.8) h.s. present on each side of the ventral arm of the midcranial ridge. Head disc pores: Dorsal pores absent; one ventral pore (vhp) always present on each side.

Antennae: Filiform; 10-segmented; 760 - 970 (878) μ long, i.e. much longer than half the body length (ratio 1:1.2 - 1.3, av. 1.25) and longer than the hind legs (ratio 1.2 - 1.4, av. 1.3:1). Scape 46 - 52 (49) μ long and 43 - 47 (46) μ wide at base; always with 4 h.s. Pedicel 58 - 64 (61) μ long and 31 - 37 (34) μ wide; with 8 - 16 (11.3) h.s. and a sensillum placodeum. Flagellum: Flagellar segments cylindrical, with irregular margins and about 21 μ wide. Segment III longest of all, the ratio its length to the length of segment X 1.6 - 2.1 (1.8):1 and the ratio width to length of segments III and IX 1:5.4 - 7.1 (6.4) and 1:3.6 - 4.5 (4.2), respectively. The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	116-153	95-131	92-119	76-113	73-95	67-85	70-82	61-85
(av.)	(137)	(113)	(107)	(98)	(85)	(76)	(76)	(76)
h.s.	17-28	10-18	10-15	9-14	9-13	9-12	8-15	12-18
(av.)	(22.8)	(14.1)	(12.5)	(11.0)	(10.7)	(10.1)	(11.1)	(15.6)

Antennal bristles (ab) inconsiderably stouter than the antennal setae and slightly shorter; segments VIII and IX each with one ventral bristle. Segment X with three preapical bristles and 2 - 3 preapical sensilla basiconica (bs). Capitate, apically knobbed setae entirely absent.

Thorax: 388 - 479 (433) μ long. Prothorax: Pronotal ridges well developed though medially interrupted. Lateral pronotal sclerites and posttergites (pt) small. The dorsal and the ventral margins of the proepisternum with ridge-like sclerotizations (fig. 31); propleural ridge short. Prosternum (stnl) triangular, 24 - 31 (27) μ long; posteriorly supported by the transverse, 82 - 98 (89) μ long prosternal ridge (stnlr). Prothoracic setae: Medial pronotal, lateral pronotal, posttergital and antespiracular dorsal setae all absent; one hair-like antespiracular ventral seta (asvs) always present on each side. Prosternal setae usually absent, but one seta was found on one side of one specimen (av. 0.1). Prothoracic pores on each side: Medial pronotal pores (mpnp) 2 - 4 (3.1); lateral pronotal pores (lpp) 1 - 2 (1.3); antespiracular dorsal pores absent. Prosternal pores (stnlp) usually 1 - 2 and sometimes absent altogether on one side (av. 1.1).

Mesothorax: Prescutum (prsc) triangular in dorsal view; 76 - 98 (85) μ long and 92 - 119 (104) μ wide, the ratio being 1:1.1 - 1.3 (1.2). Prescutal ridges (pscr) well developed and continuous postero-medially replacing the prescutal suture. Scutum very short and evenly sclerotized; 27 - 46 (37) μ long, i.e. the ratio lengths of prescutum to scutum 2.0 - 3.2 (2.3):1. Prealare (pra), prealar ridge, triangular plate, tegula, anterior and posterior notal wing processes well developed. Scutellum (scl) pentagonal in dorsal view; 58 - 73 (64) μ long and 79 - 110 (92) μ wide, i.e. the ratio its length to its width 1:1.3 - 1.5 (1.4) and the ratio its length to the length of scutum 1.4 - 2.2 (1.8):1. Postalare (pa) with well separated anterior and posterior postalar ridges. Postnotal apophysis strong.

Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare comparatively slender. Mesepisternum (eps2) and mesepimeron well defined; lateropleurite (lpl) moderately large.

Mesosternum: Basisternum (stn2) 101 - 128 (116) μ long and 162 - 198 (180) μ wide; the marginal (mr), precoxal ridges and the furca well developed. Mesothoracic spiracles 21 - 24 (23) μ wide at opening, with a 37 - 43 (40) μ long supporting bar. Mesothoracic setae on each side of the median line: Prescutal setae usually 2 and occasionally 3 h.s. (av. 2.2); scutal setae (sctse) 4 - 5 (4.5) h.s.; scutellar setae 1 - 2 (1.3) h.s. Tegular setae 1 - 4 (2.5) h.s. Postmesostigmatal setae (pms) 3 - 5 (3.7) h.s. in a latero-ventral group and absent medially. Basisternal setae (stn2s) 6 - 8 (7.2) h.s. Mesothoracic disc pores on each side; Mesospiracular pores 1 - 2 (1.6); postmesostigmatal pores (pmp) 1 - 2 (1.2) submedially.

Metathorax: Metapostnotal sclerites (pn3) distinct and metapostnotal ridge (pn3r) weakly developed. Metapleural ridge (plr3) attenuating near the middle; with a small metapleural wing process. Precoxal ridge of metathorax (pcr3) weakly developed; metepisternum, metepimeron and metasternal apophysis (sta) distinct. Metathoracic spiracles identical with the mesothoracic. Metathoracic setae on

each side: Metatergal setae (mts) 2 - 3 (2.5) h.s.; metapleural setae 0 - 1 (0.1). Anterior metasternal setae always one and posterior metasternal setae 0 - 2 (0.9) h.s. Metathoracic disc pores on each side: Metatergal pores (mtp) 1 - 2 (1.3); metaspiracular pores (sp3p) 1 - 2 (1.1). Anterior metasternal pores (amsp) 1 - 2 (1.3) and posterior metasternal pores 0 - 1 (0.4).

Wings: Hyaline; 1008 - 1134 (1078) μ long and 378 - 448 (406) μ wide; axillary, additional sclerites and alar lobe well developed; with 2 - 3 (2.8) hair-like alar setae (als) and a compact row of 2 minute circular sensoria (sens.) Hamulohalterae (h) 79 - 98 (85) μ long and 21 - 24 (23) μ wide; with a weak ridge and a 49 - 55 (52) μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1:1.5 - 1.9 (1.7).

Legs: Well developed and moderately long; the middle legs shortest and the hind legs longest; the ratio length of the hind leg to the total body length 1:1.5 - 1.7 (1.6). Coxa about 49 and trochanter about 24 μ wide; the basal part of the latter longer than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur about 34 μ wide; that of the fore-leg longest and that of the middle leg shortest; the ratio width to length of the hind femur 1:4.7 - 5.8 (5.1). Tibia about 21 μ wide; with 2 apical spurs; in fore-leg the femur shorter than the tibia, the ratio their lengths 1:1.2 - 1.4 (1.3). Tarsus about 18 μ wide; tarsal digitules absent. Claw uniformly tapering to a sharply pointed apex; 27 - 34 (31) μ long; ungual digitules fine, about 12 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Front leg	Middle leg	Hind leg
	length in μ	40-46 (43)	40-46 (43)	43-49 (46)
Coxa	h.s.	11-14 (12.8)	11-15 (13.2)	13-16 (13.8)
	length in μ	55-61 (58)	55-61 (58)	58-64 (61)
Troch- anter	h.s.	5-8 (6.7)	5-8 (6.8)	6-9 (7.3)
	length in μ	174-217(198)	153-201(180)	159-211(186)
Femur	h.s.	34-42 (36.8)	26-35 (30.9)	27-38(30.4)
	length in μ	235-290(256)	226-284(247)	238-299(265)
Tibia	h.s.	35-46 (41.1)	36-44 (39.5)	37-49 (42.4)
	length in μ	89-107 (98)	89-107 (98)	92-110 (101)
Tarsus	h.s.	26-31 (28.8)	26-33 (29.5)	28-35 (30.5)
Total length of leg in μ		619-750(680)	589-729(653)	622-766(692)

Abdomen: 357 - 562 (464) μ long and 258 - 304 (281) μ wide. The tergites of segments I, II and sometimes III small; those of segments VIII and IX + X distinct. Ostioles (ost) ill-defined. Abdominal setae: Dorsal and ventral setae (ads & avs) in transverse irregular rows; pleural setae (aps) in lateral groups. Abdominal pores. Pleural pores (app) always occur on segments I to VI; dorsal (adp) and ventral pores (avp) also usually present. The number of the abdominal setae and pores are given in the following table:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 4 (2.9)	3 - 5 (3.5)	3 - 5 (3.9)	3 - 4 (3.8)	3 - 4 (3.7)	3 - 4 (3.2)	3 - 4 (3.3)	(2.0)
(aps)	1 - 2 (1.6)	2 - 3 (2.7)	3 - 4 (3.5)	3 - 4 (3.8)	4 - 5 (4.1)	4 - 5 (4.7)	3 - 4 (3.3)	(3.0)
(avs)	-	(1.0)	3 - 4 (3.6)	3 - 4 (3.7)	2 - 3 (2.8)	2 - 3 (2.2)	(2.0)	0
(adp)	0 - 1 (0.6)	1 - 2 (1.2)	1 - 2 (1.1)	0 - 2 (1.1)	0 - 1 (0.9)	0 - 1 (0.9)	0 - 1 (0.8)	0
(app)	3 - 5 (4.1)	1 - 2 (1.1)	(1.0)	1 - 2 (1.1)	(1.0)	(1.0)	0	0
(avp)	-	0 - 2 (0.6)	0 - 2 (0.7)	0 - 1 (0.5)	0 - 1 (0.3)	0 - 1 (0.1)	0	0

Glandular pouches well developed, occurring on each side of segments VII and VIII. Setae of the glandular pouch of segment VII include a pair of 168 - 207 (177) μ long tail setae (ts); those of segment VIII include a pair of 189 - 223 (204) μ long tail setae and one seta about as long as the abdominal setae, i.e. the ratio length of the tail setae of segment VIII to the total body length 1:4.7 - 6.4 (5.4).

Genital segment comparatively small; style (st) rather straight in lateral view, with rounded apex. Penial sheath (ps) 92 - 107 (98) μ long and 49 - 61 (55) μ wide, i.e. the ratio length to width 1.6 - 2.1 (1.8):1 and the ratio its length to the total body length 1:10.2 - 12.6 (11.3). Basal ridge of the penial sheath (brps) slender and its projection small. Process of the penial sheath absent. Aedeagus (aed) comparatively stout and short. Setae of the genital segment (gts): Dorsally 3 h.s. always present on each side near the base of the style; ventrally the setae of the genital segment absent, but 0 - 3 (1.1) setal sensilla occur on each side of the penial sheath.

Material: 10 specimens examined, collected by N. Mitic-Muzina, on Fragaria vesca, in Belgrade, Yugoslavia, on 30.9.1961.

GENUS CENTROCOCCUS:(16) CENTROCOCCUS INSOLITUS (GREEN) (Plate XVII, figs. 32 and 33)

Macropterous forms only known; these moderately robust, large, with comparatively very long antennae, long and slender legs. When mounted, the total length of the body 1302 - 1512 (1386) μ , the width at mesothorax 350 - 392 (379) μ and the wing expanse 3136 - 3556 (3374) μ .

Body setae and pores: The antennae with numerous, about 60 μ long fleshy setae and a few much shorter, about 24 μ long hair-like ones; the legs also with fleshy (about 40 μ long) and hair-like setae. The body itself with hair-like setae only. Quadrilocular and occasionally trilocular disc pores present on the head, thorax and abdomen, about 6 μ in diameter.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression well pronounced in lateral view. Length from apex to postoccipital ridge 128 - 146 (137) μ ; from apex to neck 183 - 201 (192) μ ; width across the genae 211 - 238 (220) μ . Dorsal arm of the midcranial ridge (dmcr) distinct, anteriorly continuous with the short ventral arm and posteriorly meeting the postoccipital ridge. The lateral arms only indicated by weak sclerotization. The postoccipital ridge (por) U-shaped, anteriorly confluent with the preocular ridges. The dorsomedial part of the epicranium (dmepe) well sclerotized and slightly raised. Preocular ridge (procr) well developed and completely separated from the postocular ridge. The interocular ridge replaced by a short arm attached to the postocular ridge and dorsally supporting the ocellus. Preoral ridge (pror) slender.

Eyes: The dorsal simple eyes (dse) projecting beyond the outer margins of the head in dorsal view; their corneae 27 - 34 (31) μ in diameter and both separated by 122 - 156 (137) μ , i.e. 3.7 - 5.7 (4.5)

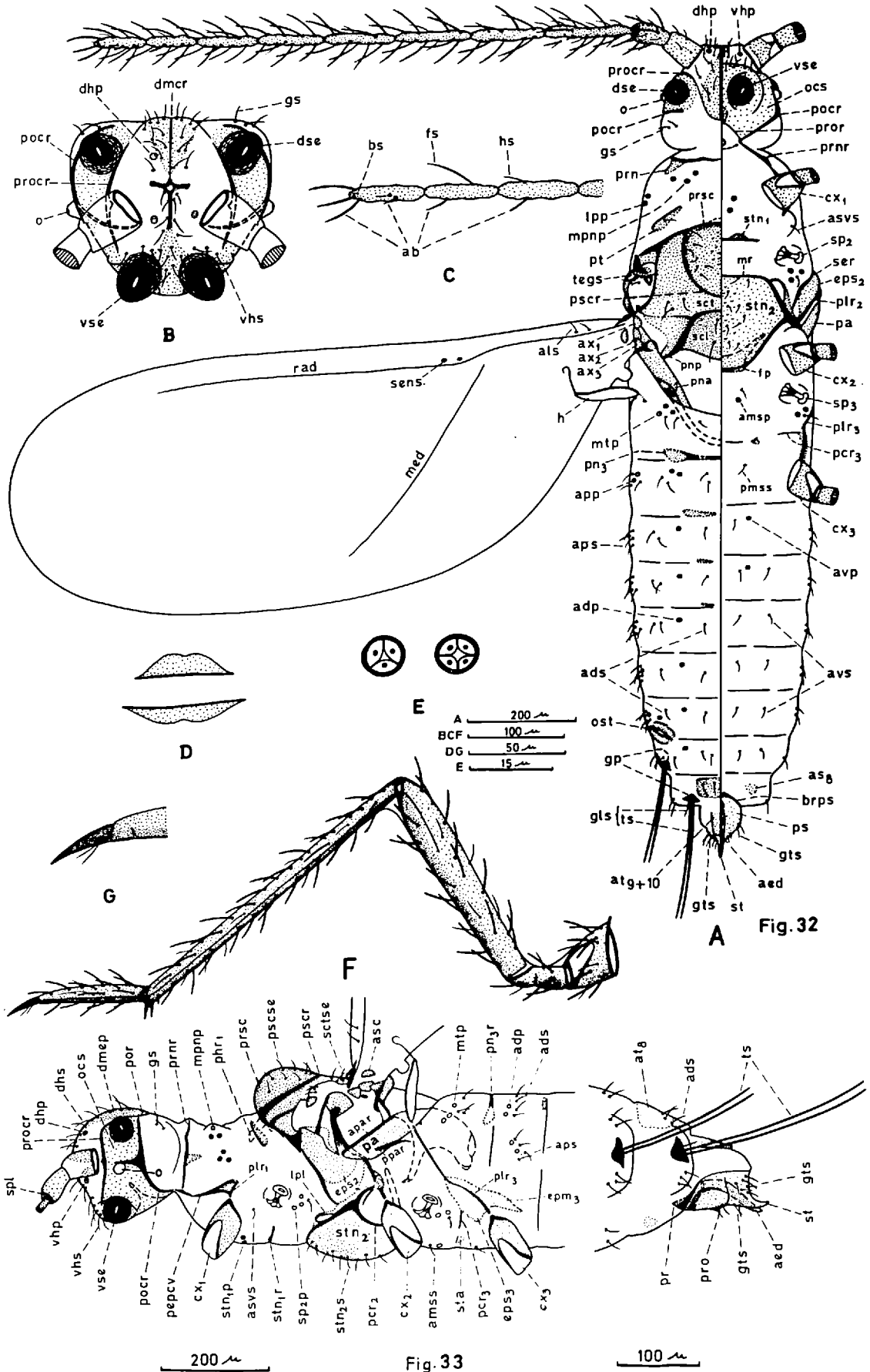


Fig. 32

Fig. 33

times their diameter apart. The ventral simple eyes (vse) slightly larger, 31 - 43 (37) μ in diameter and 27 - 43 (34) μ apart. Lateral ocelli (o) well developed, dorsally supported by the ridge-like arm as previously mentioned. Cranial apophysis apically truncate. Tentorial bridge slender. Dorsal head setae (dhs): 7 - 12 (9.8) h.s. on each side of the median line anterior to the postoccipital ridge; each gena usually with 1 - 3 genal setae (gs) but in few specimens the setae of either gena were absent altogether (av. 1.6). Ventral head setae (vhs) on each side: Setae between the ventral eyes absent; 5 - 8 (6.2) h.s. present in the area of the ventral preocular depression, forming on both sides a transverse band; anteriorly 2 - 3 (2.3) h.s. present on each side of the ventral arm of the midcranial ridge. The head disc pores: One dorsal and one ventral head pore usually present at least on one side of the dorsal and ventral arms of the midcranial ridge (averages 0.6 and 0.9 respectively).

Antennae: Filiform; 10-segmented; 875 - 1254 (1095) μ long, i.e. longer than half the total length of the body (ratio 1:1.1 - 1.5, av. 1.3) and longer than the hind legs (ratio 1.1 - 1.3, av. 1.2:1). Scape 61 - 64 (63) μ long and 52 - 58 (55) μ wide at base; always with 4 h.s. Pedicel 61 - 73 (67) μ long and 37 - 40 (39) μ wide; with 6 - 11 (7.3) f.s., 4 - 8 (5.3) h.s. and a sensillum placodeum (spl). Flagellar segments cylindrical, with irregular margins and about 21 μ wide. Segment III longest of all, the ratio lengths of segments III to X being 1.4 - 1.9 (1.6):1 and the ratio width to length of segments III and IX 5.3 - 7.4 (6.5):1 and 3.7 - 5.1 (4.4):1 respectively. In the following table the lengths of the flagellar segments and the number of setae on each are given:

	III	IV	V	VI	VII	VIII	IX	X
length in μ	128-180	101-165	98-168	92-153	85-134	82-122	79-110	85-116
(av.)	(159)	(137)	(137)	(128)	(116)	(107)	(95)	(98)
f.s.	15-21	11-19	13-21	11-21	12-16	13-17	12-14	10-15
(av.)	(18.3)	(14.3)	(17.5)	(16.1)	(14.6)	(14.3)	(13.2)	(13.0)
h.s.	5-8	1-3	1-3	1-2	1-2	1-2	1-2	1-2
(av.)	(7.1)	(1.6)	(1.9)	(1.2)	(1.3)	(1.1)	(1.2)	(1.4)

Antennal bristles (ab) inconsiderably stouter than the fleshy setae. Segments VIII and IX each with a ventral bristle, about 31μ long. Segment X with 3 preapical bristles, about 55μ long and two much shorter ventral ones, about 18μ long, at a greater distance from the segment's apex; terminal segment also with a preapical sensilla basiconica (bs). Capitulate, apically knobbed sensory setae entirely absent.

Thorax: 532 - 623 (562μ) long. Prothorax: Pronotal ridges medially interrupted as usual. Lateral pronotal sclerites (prn) and posttergites (pt) well defined. The dorsal and the ventral margins of the proepisternum ridge-like. Prosternum (stnl) represented by a small plate on each side of the median line, each about 10μ long; prosternal ridge (stnlr) 107 - 128 (116μ) long. Prothoracic setae on each side: Medial and lateral pronotal setae usually absent, but one seta of each was observed on one side of one specimen; posttergital setae 0 - 2 (0.5); antespiracular dorsal setae absent. One antespiracular ventral seta (asvs) always present; prosternal setae usually absent, but one seta may occur on either or both sides (av. 0.3 h.s.). Prothoracic disc pores on each side: Medial and lateral pronotal pores (mpnp & lpp) 1 - 3 (averages 1.4 and 2.1 respectively); antespiracular dorsal pores absent. Prosternal pores (stnlp) 1 - 3 (1.7).

Mesothorax: Prescutum (prso) 122 - 162 (140) μ long and 131 - 146 (137) μ wide, the ratio being 1:0.9 - 1.1 (1.0). The prescutal ridges (pscr) well developed and continuous medially, replacing the prescutal suture and bounding the prescutum lateroposteriorly. Scutum (sct) comparatively very short and evenly sclerotized; 21 - 31 (27) μ long, i.e. the ratio lengths of prescutum to scutum 4.3 - 6.4 (5.1):1. Prealare, prealar ridge, triangular plate, tegula, anterior and posterior notal wing processes well developed. Scutellum (scl) pentagonal in dorsal view and laterally supported by a strong additional ridge; 85 - 101 (92) μ long and 131 - 143 (137) μ wide, i.e. the ratio length to width 1:1.4 - 1.7 (1.5) and the ratio lengths of scutellum to scutum 3.0 - 4.0 (3.3):1. Postalare (pa) with well separated anterior and posterior postalar ridges (apar & ppar). Postnotal apophysis strong. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare comparatively slender. Mesepisternum (eps2) and mesepimeron well defined; lateropleurite moderately large, with a distinct oval semi-membranous area. Mesosternum: Basisternum (stn2) 146 - 183 (165) μ long and 226 - 250 (235) μ wide; the marginal (mr), the precoxal ridges (pcr2) and the furca well developed. Mesothoracic spiracles (sp2) 21 - 24 (23) μ wide at opening, with a 43 - 49 (46) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 6 - 9 (7.2) h.s.; scutal setae (sctse) 2 - 4 (2.9) h.s.; scutellar setae 1 - 2 (1.8) h.s. Tegular setae (tegs) 3 - 6 (4.7) h.s. Postmesostigmatal setae 1 - 3 (1.3) h.s. occurring sublaterally. Basisternal setae (stn2s) 8 - 16 (11.6) h.s. Mesothoracic disc pores: Mesospiracular pores (sp2p) 2 - 4 (2.6); postmesostigmatal pores absent.

Metathorax: Metapostnotal sclerites (pn3) well defined; metapostnotal ridge (pn3r) weakly developed. Metapleural ridge (plr3) attenuated near the middle as usual; pleural apophysis small. Precoxal ridge of metathorax (pcr3) weakly developed and metasternal apophysis (sta) distinct.

Metathoracic spiracles (sp3) identical with the mesothoracic. Metathoracic setae on each side: Metatergal setae 3 - 4 (3.2) h.s., metapleural setae 1 - 2 (1.1) h.s. Anterior metasternal setae (amss) 0 - 1 (0.8) h.s.; posterior metasternal setae (pmss) 0 - 2 (0.9) h.s. Metathoracic pores on each side: Metaspiracular pores 1 - 2 (1.3); anterior metasternal pores (amsp) 0 - 2 (1.2); posterior metasternal pores 0 - 1 (0.3).

Wings: Hyaline; 1400 - 1610 (1484) μ long and 462 - 546 (504) μ wide; alar lobe, axillary and additional sclerites well developed; with 2 - 3 (2.3) hair-like alar setae (als) and a compact row of 2 - 3 (2.2) minute circular sensoria (sens.). Hamulohalterae (h) 113 - 122 (119) μ long and 21 - 24 (23) μ wide; with a slender ridge and a 52 - 61 (55) μ long apically hooked seta, i.e. the ratio lengths of seta to hamulohaltera 1:1.9 - 2.3 (2.2).

Legs: Comparatively long and slender; the middle legs shortest and the hind legs longest; the ratio length of the hind leg to the total length of the body 1:1.2 - 1.6 (1.4). Coxa and trochanter about 58 and 31 μ wide respectively; the basal part of the latter conspicuously longer than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur about 40 μ wide; that of the fore-leg longest and those of middle and hind legs subequal in length; the ratio width to length of the hind femur 1:6.5 - 7.5 (6.9). Tibia about 21 μ wide; with 2 apical spurs and usually 2 smaller spines; in the fore-leg the femur shorter than the tibia, the ratio their lengths being 1:1.3 - 1.4 (1.33). Tarsus about 18 μ wide; tarsal digitules entirely absent. Claw gradually tapering to a sharply pointed tip; 37 - 43 (40) μ long; ungual digitules (udgt) about 12 μ long. The lengths of the leg segments and the number of setae on each are given in the following table:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	49-55 (52)	49-55 (52)	52-58 (55)
	f.s.	9-13 (11.6)	10-13 (12.5)	10-14 (12.7)
	h.s.	2-5 (3.8)	2-4 (3.1)	3-5 (4.2)
Trochanter	length in μ	70-76 (73)	70-76 (73)	73-79 (76)
	f.s.	4-6 (4.8)	4-6 (4.5)	4-7 (5.1)
	h.s.	2-3 (2.4)	2-3 (2.6)	2-4 (2.7)
Femur	length in μ	268-308 (287)	259-296 (275)	259-296(275)
	f.s.	28-39 (33.4)	27-36 (31.2)	28-38 (32.6)
	h.s.	6-9 (7.1)	6-8 (6.9)	7-10 (7.8)
Tibia	length in μ	351-421 (381)	351-415(372)	387-451(409)
	f.s.	47-56 (51.8)	43-53 (48.2)	48-62 (57.7)
	h.s.	6-8 (6.7)	6-10 (8.3)	8-12 (10.4)
Tarsus	length in μ	113-131 (119)	113-134 (122)	128-150(134)
	f.s.	23-27 (24.6)	23-29 (25.1)	27-35 (32.8)
	h.s.	6-8 (6.9)	6-9 (7.6)	7-11 (8.3)
Total length of leg in μ		888-1025 (949)	878-1016(933)	939-1074(988)

Abdomen: 494 - 661 (555) μ long and 327 - 365 (342) μ wide. The tergites of segments I, II, III and sometimes IV small; those of segments VIII and IX + X well sclerotized. Sternites of segment VIII ill-defined. Ostioles (ost) well developed, 37 - 43 (40) μ long at orifice. Abdominal setae in dorsal and ventral segmental irregular rows; pleural setae (aps) in lateral groups. Abdominal pores: Dorsal (adp), pleural (app) and ventral pores (avp) usually present. The following table shows the number of setae and pores on the abdominal segments:

	I	II	III	IV	V	VI	VII	VIII
(ads)	3 - 4 (3.9)	2 - 4 (2.9)	2 - 3 (2.9)	2 - 3 (2.8)	2 - 3 (2.1)	2 - 3 (2.3)	3 - 4 (3.8)	1 - 3 (2.4)
(aps)	3 - 4 (3.7)	4 - 6 (5.8)	5 - 6 (5.8)	5 - 6 (5.9)	5 - 6 (5.9)	5 - 6 (5.8)	3 - 4 (3.1)	3 - 4 (3.2)
(avs)	-	1 - 2 (1.3)	2 - 3 (2.1)	(2.0)	(2.0)	(2.0)	(2.0)	0
(adp)	1 - 3 (1.9)	1 - 2 (1.2)	1 - 2 (1.1)	0 - 2 (0.9)	0 - 1 (0.7)	0 - 2 (0.8)	0 - 1 (0.7)	0
(app)	2 - 3 (2.4)	0	0	0 - 1 (0.2)	0 - 1 (0.4)	1 - 2 (1.3)	0	0
(avp)	-	0 - 2 (0.7)	0 - 1 (0.3)	0 - 1 (0.2)	0	0	0	0

Glandular pouches (gp) well developed, occurring on each side of segments VII and VIII. Setae of the glandular pouch (gls) of segment VII include a pair of 168 - 204 (183) μ long tail setae (ts) only; the glandular pouches of segment VIII with a pair of 198 - 229 (214) μ long tail setae and a short one subequal to the abdominal setae in length, i.e. the ratio length of the tail setae of segment VIII to the total body length 1:5.6 - 7.1 (6.5).

Genital segment comparatively small; style (st) rather straight in lateral view, with a rounded apex. Penial sheath (ps) 107 - 116 (113) μ long and 73 - 82 (76) μ wide, the ratio length to width being 1.3 - 1.6 (1.5):1 and the ratio its length to the total body length 1:11.8 - 13.4 (12.3). Basal ridge of the penial sheath (brps) slender and its projection (pr) small. Process of the penial sheath (pro) hardly pronounced. Aedeagus (aed) comparatively stout. Setae of the genital segment (gts) on each side: Dorsal setae 5 - 7 (6.4) h.s. near the base of the style; ventral setae 2 - 4 (2.8) h.s. on the penial sheath.

Material: 10 specimens examined, collected by H.K. Patel, on Cajanus indicus, in India (Anand), on 14.12.1955 (received from D.J. Williams).

GENUS NAIROBLA:(17) NAIROBLA BIFRONS DE LOTTO (Plate XVIII, figs. 34 and 35)

Winged forms only known; these narrow and slender, comparatively large, with moderately long antennae and legs. The mounted males 1260 - 1596 (1442) μ long, 308 - 350 (336) μ wide at mesothorax and 2814 - 3528 (3248) μ wing expanse.

Body setae and pores: The fleshy setae entirely absent. The hair-like setae present on the antennae, legs and the main parts of the body, about 21 μ long. The disc pores absent altogether.

Head: Subtetrahedron; subtriangular in dorsal and front views; ventral preocular depression hardly indicated in lateral view. Length from apex to postoccipital ridge 128 - 140 (131) μ ; from apex to neck 177 - 195 (186) μ ; width across the genae 220 - 241 (232) μ . The dorsal arm of the midcranial ridge absent though marked by a narrow, weak sclerotization; this sclerotization continuous with those indicating the lateral and the ventral arms anteriorly, and almost meeting the postocular ridge posteriorly. Postoccipital ridge (por) distinct, U-shaped and confluent with preocular ridges. Dorsomedial part of the epicranium slightly raised. Preocular ridge (procr) well developed and completely separated from the postocular ridge (poor); interocular ridge absent. preoral ridge slender.

Eyes: The dorsal simple eyes (dse) projecting beyond the outer margins of the head in dorsal view; their corneae 18 - 24 (21) μ in diameter and separated by 125 - 162 (146) μ , i.e. 5.5 - 7.6 (6.9) times their diameter apart. The corneae of the ventral simple eyes (vse) equal or slightly larger, 21 - 24 (23) μ in diameter and 34 - 55 (46) μ apart. The lateral ocelli vestigial. Ocular sclerites (ocs) large. Cranial apophysis truncate; tentorial bridge slender. Dorsal head

PLATE XVIII

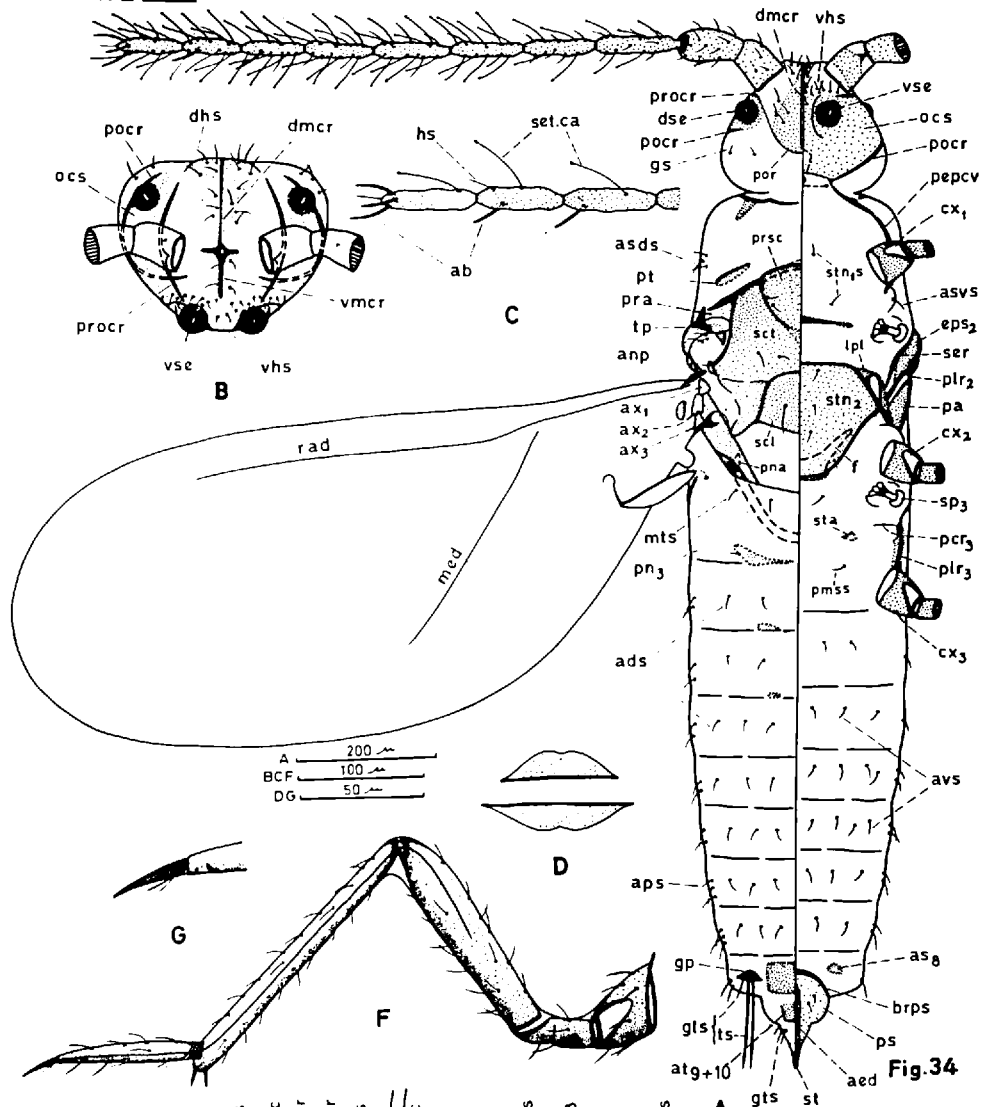


Fig. 34

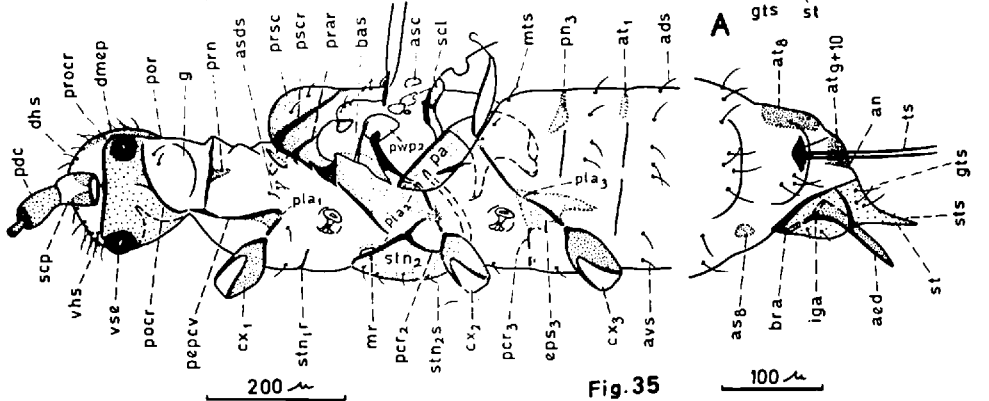


Fig. 35

setae (dhs) on each side of the median line: The setae in front of the postoccipital ridge in two separable groups, 3 - 5 (4.1) h.s. anteriorly and 4 - 6 (4.4) h.s. posteriorly; each gena usually with 2 hair-like genal setae (gs) but 1 or 3 setae may occur on one side (av. 2.1).

Ventral head setae (vhs) on each side: One seta may occur along the median line between the ventral eyes (av. 0.4); 8 - 11 (8.8) h.s. forming with their partners of the other side a transverse band in the area of the ventral preocular depression; anteriorly 2 - 3 (2.2) h.s. present in a longitudinal row.

Antennae: Filiform; normally 10-segmented but cases of fusion between two or more adjacent segments on one or both antennae very common; 799 - 933 (894) μ long, i.e. much longer than half the body length, the ratio 1:1.4 - 1.7 (1.6) and subequal in length to the hind legs, the ratio 1.0 - 1.1 (1.08):1. Scape (scp) 58 - 64 (61) μ long and 52 - 58 (55) μ wide at base; always with 4 h.s. Pedioel (pdc) 76 - 85 (79) μ long and 43 - 46 (45) μ wide; with 10 - 13 (11.6) h.s. and a sensillum placodeum. Flagellum: Flagellar segments cylindrical, with irregular margins and 21 - 24 μ wide. Segment III approximately as long as segment X, both being usually longest, the ratio their lengths 0.9 - 1.1 (1.06):1 and the ratio width to length of segments III and IX 1:3.4 - 4.2 (3.9) and 1:3.5 - 4.0 (3.7) respectively. Apart from the hair-like setae, the flagellar segments also with numerous apically knobbed, capitate sensory setae (set. ca.). The lengths of the flagellar segments and the number of setae on each are given below:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	89-116 (98)	73-104 (92)	89-107 (95)	95-116 (107)	85-107 (101)	79-95 (89)	79-92 (85)	85-98 (92)
h.s. (av.)	6 - 9 (7.3)	3 - 6 (4.4)	1 - 3 (1.9)	3 - 4 (3.7)	2 - 4 (2.7)	1 - 3 (1.7)	1 - 2 (1.1)	1 - 2 (1.6)
set.ca. (av.)	2 - 5 (3.6)	2 - 5 (4.3)	7 - 11 (8.7)	8 - 13 (11.1)	7 - 12 (10.2)	6 - 12 (9.4)	7 - 15 (11.1)	9- 13 (10.9)

Antennal bristles (ab) well defined; segments VIII & IX each with one ventral bristle, about 46μ long. Segment X with 3 preapical bristles, the dorsal of which slightly shorter; terminal segment also with one apical hair-like seta.

Thorax: 502 - 578 (540μ) long. Prothorax: Pronotal ridges well developed though medially interrupted as usual; lateral pronotal sclerites (prn) and posttergites (pt) well defined. Proepisternum with a ridge-like dorsal margin; propleural ridge short and propleural apophysis (plal) small. Prosternum very short, triangular, 12 - 18 (15μ) long; prosternal ridge (stnlr) 101 - 113 (107μ) long. Prothoracic setae: Medial pronotal, lateral pronotal and posttergital setae absent. 2 - 4 (3.1) antespiracular dorsal setae (adv_s), one antespiracular ventral seta (asv_s) and 2 - 3 (2.4) hair-like prosternal setae (stnls) present on each side.

Mesothorax: Prescutum (prsc) triangular in dorsal view; 95 - 113 (107μ) long and 116 - 128 (125μ) wide, the ratio being 1:1.1 - 1.3 (1.2). Prescutal ridge (pscr) well developed and prescutal suture distinct. Scutum (sct) comparatively short and evenly sclerotized throughout; 55 - 67 (61μ) long, i.e. the ratio lengths of prescutum to

scutum 1.6 - 2.1 (1.8):1. Prealare (pra), prealar ridge (prar), triangular plate (tp), tegula, anterior (anp) and posterior notal wing processes well developed. Scutellum (scl) pentagonal in dorsal view; 82 - 98 (92) μ long and 107 - 119 (113) μ wide, ratio 1:1.2 - 1.3 (1.23) and the ratio its length to the length of the scutum 1.4 - 1.7 (1.5):1. Postalare (pa) with well separated anterior and posterior postalar ridges. Postnotal apophysis (pna) strong. Mesopleuron: Mesopleural ridge (plr2) interrupted above the coxal articulation; basalare (bas) weak and slender. Mesepisternum (eps2) and mesepimeron well defined; lateropleurite (lpl) moderately large, with a distinct oval membranous area. Mesosternum: Basisternum (stn2) 153 - 168 (162) μ long and 198 - 232 (223) μ wide; the marginal (mr), the precoxal ridges (pcr2) and the furca (f) well developed. Mesothoracic spiracles 24 - 27 (26) μ wide at opening, with a 43 - 49 (46) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 1 - 2 (1.7) h.s.; scutal setae 1 - 3 (1.8) h.s.; scutellar setae usually 1 and occasionally 2 (1.1) h.s. Tegular setae 3 - 4 (3.7). Postmesostigmatal setae absent. Basisternal setae (stn2s) 2 - 4 (3.6) h.s.

Metathorax: Metapostnotal sclerites (pn3) distinct but the metapostnotal ridge absent. Metapleural ridge (plr3) with the usual attenuation near the middle; pleural apophysis (pla3) and metapleural wing process small. Precoxal ridge of metathorax (pcr3) weakly developed; metasternal apophysis (sta) distinct. Metathoracic spiracles similar to the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) always 2 h.s.; metapleural setae (mps) usually 1 - 2 h.s. but sometimes missing on one side (av. 0.8). Anterior and posterior metasternal setae 1 - 2 (averages 1.3 and 1.1 h.s. respectively).

Wings: Hyaline; 1260 - 1610 (1470) μ long and 420 - 532 (490) μ wide; axillary, additional sclerites and alar lobe well developed;

alar setae absent and circular sensoria could not be detected and presumably also absent. Hamulohalterae 110 - 125 (119) μ long and 24 - 31 (28) μ wide; with a slender ridge and one apically hooked seta, 40 - 49 (46) μ long, the ratio lengths of seta to the hamulohaltera being 1:2.4 - 3.0 (2.6).

Legs: Moderately long; the fore-legs shortest and the hind legs longest; the ratio length of the hind leg to the total body length 1:1.5 - 2.0 (1.8). Coxa and trochanter about 55 and 31 μ wide; the basal part of the latter longer than the distal and with 3 circular sensilla on each side; long apical setae absent. Femur about 40 μ wide; that of the fore-leg shortest and that of the hind leg longest; the ratio width to length of the hind femur 1:5.4 - 6.2 (5.8). Tibia about 21 μ wide; with 2 apical spurs; in front leg, the femur slightly shorter than the tibia, the ratio their lengths being 1:1.1 - 1.2 (1.17). Tarsus about 18 μ wide; tarsal digitules absent. Claw gradually tapering to a sharply pointed tip; 31 - 37 (34) μ long; ungual digitules about 15 μ long. The lengths of the leg segments and the number of setae on each are given in the following table:

		Front leg	Middle leg	Hind leg
Coxa	length in μ	49-55 (52)	49-55 (52)	52-58 (55)
	h.s.	6-9 (7.1)	6-10 (7.9)	8-11 (9.4)
Trochanter	length in μ	64-73 (69)	64-73 (69)	67-76 (73)
	h.s.	4-6 (5.2)	4-6 (5.0)	4-7 (5.6)
Femur	length in μ	207-241 (226)	214-244 (229)	214-247 (232)
	h.s.	15-23 (19.2)	18-25 (20.6)	16-24 (19.8)
Tibia	length in μ	244-281 (265)	250-293 (278)	268-311 (296)
	h.s.	16-22 (19.8)	17-26 (21.4)	19-30 (26.2)
Tarsus	length in μ	107-122 (116)	107-122 (119)	113-128 (122)
	h.s.	11-15 (13.3)	11-14 (12.8)	12-16 (14.5)
Total length of leg in μ		702-796 (744)	720-821 (784)	747-857 (814)

Abdomen: 464 - 707 (623) μ long and 319 - 365 (350) μ wide. The tergites of segments I and II small; those of segments VIII and IX + X well defined. Sternites of segment VIII small. The ostioles entirely absent. Abdominal setae: Dorsal and ventral setae (ads& avs) in transverse rows; pleural setae (aps) in lateral groups. The following table shows the number of the abdominal setae on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	(2.0)	2 - 3 (2.2)	2 - 3 (2.5)	2 - 3 (2.8)	2 - 3 (2.9)	2 - 3 (2.8)	2 - 3 (2.7)	0
(aps)	(2.0)	2 - 3 (2.8)	3 - 4 (3.1)	3 - 4 (3.4)	3 - 4 (3.8)	3 - 5 (4.1)	4 - 5 (4.6)	2 - 3 (2.2)
(avs)	-	(2.0)	3 - 4 (3.4)	3 - 5 (3.9)	3 - 5 (3.9)	2 - 3 (2.8)	2 - 3 (2.6)	0

Setae of the glandular pouch (gls) include a pair of 122 - 153 (137) μ long tail setae (ts) and one seta about as long as the abdominal setae, i.e. the ratio length of tail setae to the total body length 1:8.2 - 11.9 (10.5).

Genital segment comparatively small; style (st) rather straight in lateral view, with a pointed apex. Penial sheath (ps) 134 - 146 (140) μ long and 92 - 98 (95) μ wide, the ratio being 1.4 - 1.6 (1.5):1 and the ratio its length to the total length of the body 1:9.2 - 11.5 (10.3). Basal ridges of the penial sheath (brps) medially continuous; their projections as well as the processes of the penial sheath absent. Aedeagus (aed) stout, with a large internal genital aperture (iga). Setae of the genital segment (gts): Dorsally 3 h.s. always present on each side near the base of the style; ventrally 2 - 3 (2.1) smaller setae occur on each side of the penial sheath. The style also carries about 3 latero-dorsal minute sensilla (sts) on each side.

Material: 10 specimens examined, collected by G. De Lotto, on Lonicera battiscombei Hutch., in Nairobi, Kenya, on 8.11.1962.

((2)) THE MALES OF ERIOCOCCIDAE:

To avoid unnecessary repetition, the description of the general features of the males Eriococcidae is here omitted, but the condition of the structures characteristic of the family and different from those found in Pseudococcidae are discussed in detail.

A. General:

The studied species were represented by 3 male forms, the macropterous (E. araucariae, E. oraricusis, E. buxi and O. agavium), the brachypterous (G. salicicola) and the apterous (P. fraxini); macropterous and brachypterous forms of one species, G. spuria were also available.

Pupation of the eriococcid males (at least of the species obtained by the writer in the laboratory) takes place within compact, closely felted and rather flattened waxy puparia; the puparia of the different instars are split open along the rear edge, to allow emergence of the adult males.

I. Appearance:

The macropterous forms are moderately robust, if compared with most of Pseudococcidae; the brachypterous males are even stouter, with the body broadest at the third abdominal segment, and the apterous males are spindle-shaped. The legs are well developed.

II. Size:

The males Eriococcidae share about the same range of variation in size as the Pseudococcidae; among the studied species the smallest was P. fraxini (518 - 658, av. 602 μ long), and the largest the winged males of G. spuria (1442 - 1512, av. 1484 μ long).

III. Colour:

The living specimens show a larger variation in colour than in Pseudococcidae; sometimes they are light yellowish (P. fraxini), light brown (E. araucariae) or dark red (O. agavium). Some of the material was alcohol-preserved (Gossyparia spp.), or already mounted on slides in "Berlese fluid" (E. ororiensis), or dry samples (E. buxi), whose normal colour had changed.

IV. Derm Vestiture:

A. Body setae: The hair-like setae are present on the body and on the appendages; the fleshy setae may occur on the antennae only (O. agavium and Gossyparia spp.) or on the antennae and the legs (Eriococcus spp.), but always absent on the body itself.

B. Disc pores: These are entirely absent.

C. Organs of unknown homology: Peculiar organs (X) appearing as small, irregularly oval or rounded discs, occur dorsally on each side of the midcranial ridge in some species (E. araucariae and Gossyparia spp.); a histological study is required to elucidate their obscure nature which however, was beyond the scope of the present work.

B. THE MACROPTEROUS MALES:

THE HEAD:

1. The head capsule:

Shape: In front view, the head is usually more or less rounded, but sometimes subtriangular (E. buxi). The ventral preocular depression is hardly indicated (Eriococcus spp.) or absent (Gossyparia spp.). The arms of the midcranial ridge are always joined together at the apex

of the head forming a cruciform structure; the dorsal arm fades away well before reaching the postoccipital ridge, usually at the level of the dorsal simple eyes. The postoccipital ridge (por) is comparatively strong and well developed, with the lateral ends distinctly forked. The pre and the postocular ridges (procr & pocr) are widely separated, and the interocular ridge is absent; in E. buxi, the ventral part of the preocular ridge is much reduced. The corneae of the dorsal and the ventral simple eyes (dse & vse) are usually subequal in diameter, but sometimes the latter are distinctly smaller (E. araucariae). The lateral pair of ocelli (o) are usually well developed and close to the postocular ridges; in O. agavium, they are reduced to small spots only, and attached to the postocular ridges by means of short sclerotized arms. The cranial apophysis (ca) is apically bifurcate except in E. buxi where it is truncate. The tentorial bridge (tb) is well developed and comparatively stout; the anterior tentorial arms (ata) are not fused, each joining the cranial apophysis separately. A small mouth tubercle (mt) sometimes occur just behind the preoral ridge (pror) (O. agavium, figs. 42 & 43).

Chaetotaxy: The same groups of head setae which occur in Pseudococcidae are also present in Eriococcidae.

2. The antennae:

The flagellar segments are comparatively short and barrel-shaped, and sometimes the width of the segments, especially the terminal, becomes equal or subequal to their length (E. orariensis, fig. 30 and G. spuria, fig. 44) giving the antennae a moniliform rather than a filiform appearance; usually 10-segmented (only 9-segmented in E. buxi).

The structure and the distribution of the antennal setae are the same as in Pseudococcidae, except the position of the large antennal bristles (ab) on the terminal segment which is slightly different; sometimes all three bristles are near the base of the segment (E. buxi,

fig. 40, C), or only the dorsal bristle preapical and the other two at a greater distance from the apex (the remaining spp.). In E. araucariae (fig. 36, C) two additional, much smaller bristles are also present on the terminal segment.

The scape (scp) is always with 4 hair-like setae, and the pedicel (pdc) is comparatively short. The terminal segment is distinctly pear-shaped, i.e. wide basally and becoming narrower distally; in some species (G. agavium) its apex is conspicuously pointed.

THE THORAX:

1. THE PROTHORAX:

The prothorax is comparatively short. The proepisternum without any ridge-like sclerotizations. The prosternum (stnl) is triangular, usually long (Eriococcus spp.) but sometimes rather short (G. spuria); the prosternal ridge (stnlr) is well developed.

The prothoracic setae: The medial pronotal, the posttergital, the lateral pronotal and the antespiracular dorsal setae are usually absent.

2. THE MESOTHORAX:

The prescutum (prsc) is transversely rectangular, with well developed prescutal ridges (pscr) and is separated from the scutum by a distinct prescutal suture (pscs). The scutum (sct) is comparatively short (the prescutum 1 - 2 times as long) and evenly sclerotized throughout. The scutellum (scl) is transversely rectangular, with an additional, strong scutellar ridge (sclr), obliquely traversing the scutellum on each side and dividing it into three well defined triangular areas, the largest of which is the median one, and the two lateral (one on each side) smaller. The width of the scutellum is twice or more its length. The anterior and the posterior ridges of the postalare (apar & ppar) are always joined anteriorly.

The mesopleural ridge (plr2) is continuous above the coxal articulation, and the basalare (bas) is comparatively stout. The lateropleurite (lpl) is large, sometimes with a circular or oval membranous area (e.g. E. buxi & G. spuria). The trochantin is absent.

The mesothoracic setae: The postmesostigmatal (pms) and the basisternal setae (stn2s) were found only in E. buxi; the other groups of the mesothoracic setae are usually present. Apart from the setae present in Pseudococcidae, some eriococcid species have additional groups of mesothoracic setae, namely:

- 1) In E. buxi, the mesepisternum carries few mesepisternal setae (eps2s).
- 2) In E. orariensis, on each lateropleurite there is always one minute lateropleurital seta (lpls).

3. THE METATHORAX:

The suspensorial sclerites are usually present, but in O. agavium they are absent as a result of the complete absence of the hamulohalterae. The metapostnotal ridge is always absent. The precoxal ridge of the metathorax (pcr3) is either well developed (E. araucariae and G. spuria) or rather weak (E. buxi and O. agavium).

The metathoracic setae: The metapleural (mps) and the postmetastigmatal setae (eps3s) are present in E. buxi only; the posterior metasternal setae are absent.

4. THE WINGS AND HAMULOHALTERAE:

The circular sensoria could not be detected on the wings, and are presumably absent. The hamulohalterae are sometimes absent (O. agavium, figs. 42 & 43); the hooked seta is usually subequal in length to the hamulohaltera (Ericococcus spp.), but sometimes considerably shorter (G. spuria).

5. THE LEGS:

The fore and the middle legs are usually subequal in length, but sometimes the latter are slightly shorter (G. spuria); the hind legs are always longest. The proximal part of the trochanter is distinctly longer than the distal; in O. agavium, a long apical seta (ase) occurs on the distal part. The femur of the middle leg is always the shortest, and that of the hind leg the longest. The claw (cl) is relatively broad at the base and abruptly tapering towards a sharply pointed tip; the ungual digitules (udgt) are extremely fine, with small thought distinct apical knob.

THE ABDOMEN:

1. The pregenital segments:

The tergites of segments I, II and VIII, and the sternites of segment VIII are usually discernible; the ostioles are always absent. The abdominal setae are arranged in dorsal and ventral irregular transverse rows, and in pleural clusters; one dorsal seta on each side of segment VIII is noticeably longer than the others. A dorso-median, transverse sclerotization sometimes occurs on segment VIII and anteriorly ^{ou} binds its tergite (E. buxi); similar, longitudinal sclerotizations may be also present ventrally along the outer margins of the sternites of the same segment (E. ororiensis, figs. 38 & 39 and E. buxi, figs. 40 & 41). The glandular pouches (gp) are present on segment VIII alone, and their setae (gls) only include a pair of comparatively short tail setae (ts) (the body more than 5 times as long).

2. The genital segment:

The structure of the genital segment and the external genitalia is of great taxonomic significance; it appears to be the most reliable feature distinguishing all forms of males Eriococcidae from those of Pseudococcidae. The basal ridges of the penial sheath are medially continuous and modified into a complete, well sclerotized ring. The

basal part of the penial sheath is rather long, intimately fused with the 9th tergite + the 10th segment, forming together a compact, cylindrical genital capsule (gc). The anal opening (an) is comparatively large, and the style (st) is usually short but sometimes rather long (E. ororiensis, figs. 38 & 39, and E. buxi, figs. 40 & 41); the style in lateral view, is either sinuate (e.g. E. araucariae and G. spuria) or straight (e.g. E. ororiensis and O. agavium). Ventrally, the slit-like opening of the penial sheath is removed far posteriorly, and the aedeagus (aed) arises at a comparatively large distance from the basal ring of the genital capsule; the aedeagus usually consists of a basal rod (bra) and a sclerotized tube, ventrally accommodated in the style (E. ororiensis and O. agavium); in E. araucariae the structure of the aedeagus is rather complex, with secondary sclerotizations, as will be discussed in the individual description.

It appears that the structure of the genital segment shows closer relationship of Eriococcidae with Diaspididae than ~~it is~~ with Pseudococcidae.

The dermal structures:

The dorsal setae of the genital segment (gts) always consist of a pair of relatively long and stout setae on each side of the median line, usually near the base of the style. A variable number of smaller setae also occurs ventrally on each side of the genital capsule.

C. THE BRACHYPTEROUS MALES:

In this form, a considerable sclerite degeneration in the meso and the metathoracic regions is apparent, as a result of the considerable reduction of the fore wings and the hamulohalterae.

THE HEAD:

A comparatively large mouth tubercle (mt) is always present behind the preoral ridge.

THE THORAX:

All the meso and the metathoracic structures become greatly reduced. The scutellum is trapezoid-shaped in dorsal view, with the scuto-scutellar suture weak or incompletely developed; the scutellar ridge is entirely absent. The marginal ridge of the basisternum is slender and partly absent. The suspensorial sclerite is absent, and the metapleural ridge is dorsally reduced. The hamulohalterae if present, are atrophied and without setae or ridges.

THE ABDOMEN:

The glandular pouch and its associated setae are greatly reduced; the total length of the body is 12 times or more as long as the setae of the glandular pouch. The genital segment is similar to that of the macropterous males.

D. THE APTEROUS MALE:

This form is only represented by the males of Pseudochermes fraxini. The sclerite degeneration is most pronounced.

The body is spindle-shaped in the general appearance. The head is broadly fused with the thorax; the simple eyes are absent and the ocelli represented by small spots or tubercles. Almost all the thoracic features have disappeared, except for a short and vestigial pleural ridge on each segment. The legs are comparatively short and stout; the trochanter with a long apical seta, but apparently without any sensilla. The glandular pouch is entirely absent; the genital capsule is small and the anal opening minute.

(B) DESCRIPTION OF THE SPECIES OF ERIOCOCCIDAEGENUS ERIOCOCCUS:(18) ERIOCOCCUS ARAUCARIAE MASKELL (Plate XIX, figs. 36 and 37)

Macropterous forms only known; living specimens light brown in colour; these moderately robust, moderately large, with comparatively short antennae and moderately long legs. Mounted specimens 1078 - 1344 (1218) μ long, 308 - 364 (336) μ wide at mesothorax and 2016 - 2324 (2170) μ wing expanse.

Body setae: The antennae and legs with numerous, approximately 15 μ long fleshy setae and slightly longer hair-like ones; the body itself with hair-like setae only.

Head: Subtetrahedron; subtriangular in dorsal view and more or less rounded in front view; ventral preocular depression (vprd) hardly indicated in lateral view. Length from apex to postoccipital ridge 420 - 518 (462) μ ; from apex to neck 756 - 826 (798) μ ; width across the genae 980 - 1106 (1036) μ . The midcranial ridge cruciform; dorsal arm (dmcr) short, intimately joined to the ventral and the lateral arms at the apex of the head (fig. 36,B). Postoccipital ridge (por) strongly developed, with the lateral extremities sharply bent posteriorly and giving off a short sclerotization anteriorly. Dorsomedial part of the epicranium (dmep) narrow and slightly raised. Preocular (procr) and postocular ridges (pocr) well developed and widely separated; the latter ventrally articulates with a small additional ridge (addr); preoral ridge (pror) slender.

Eyes: The dorsal simple eyes (dse) projecting well beyond the outer margins of the head in dorsal view; their corneae comparatively large, 34 - 40 (38) μ in diameter and separated by 110 - 125 (116) μ , i.e. 2.9 - 3.4

PLATE XIX

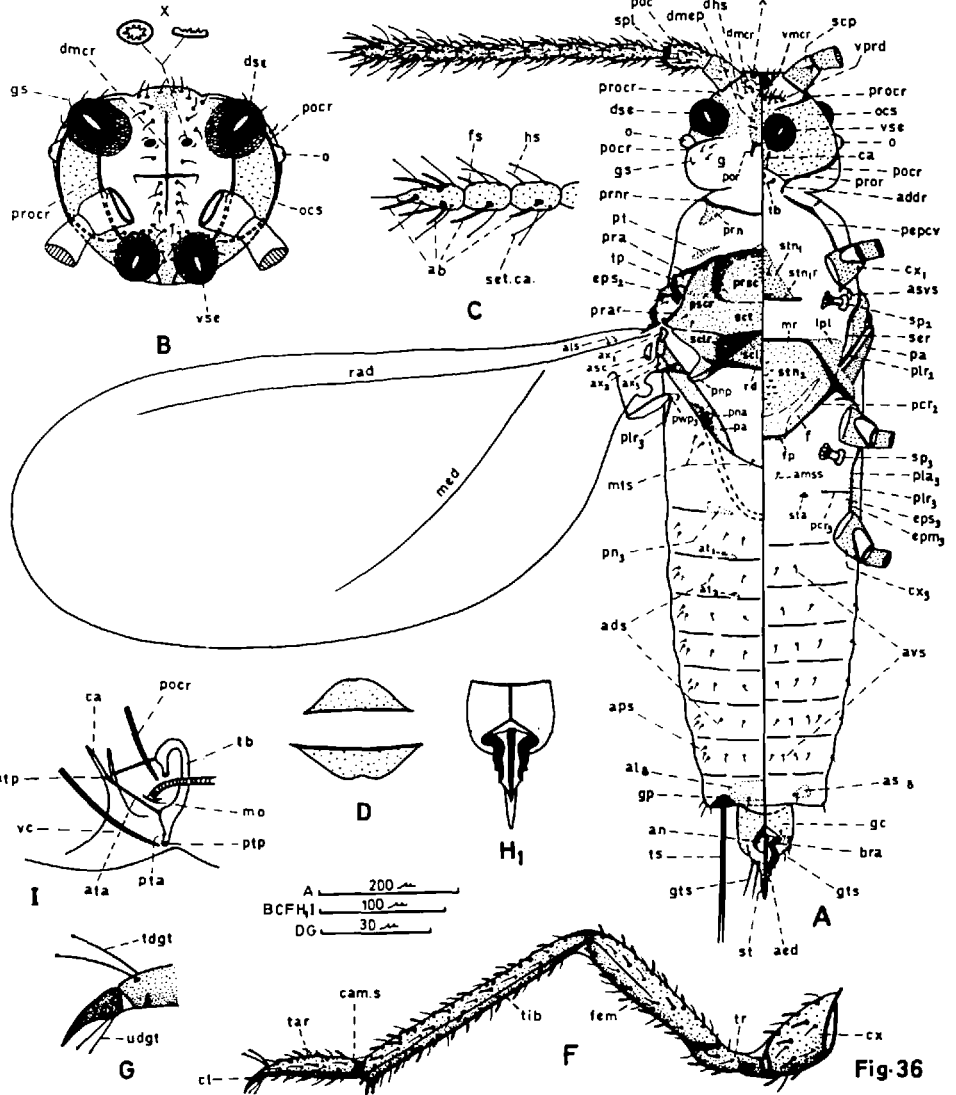


Fig. 36

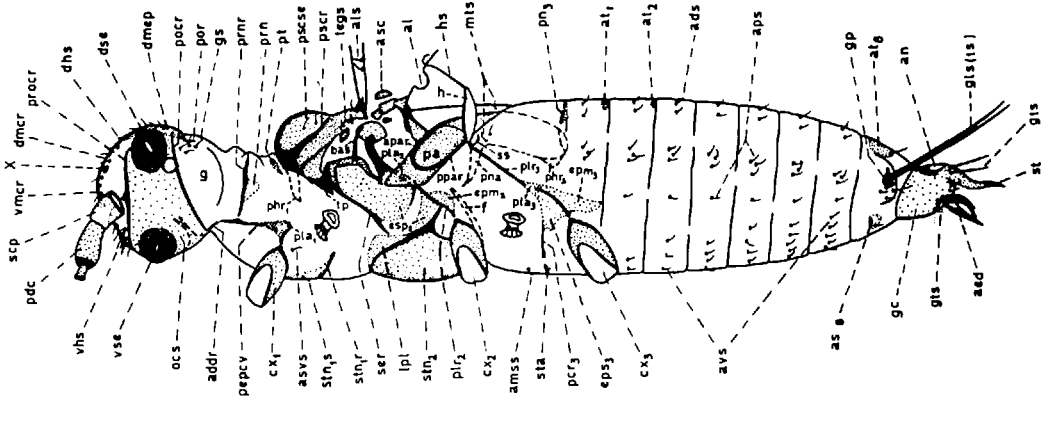


Fig. 37

200

(3.2) times their diameter apart. The ventral simple eyes (vse) smaller, their corneae 27 - 34 (31) μ in diameter and 21 - 24 (23) μ apart. The lateral ocelli (o) well developed, anteriorly attached to the postocular ridges. Ocular sclerites (ocs) weakly sclerotized. Cranial apophysis (ca) apically bifurcate. The anterior tentorial arms (ata) join the cranial apophysis separately; posterior tentorial pits (ptp) minute and tentorial bridge (tb) comparatively stout. Dorsal head setae (dhs) include 8 - 11 (9.1) h.s. on each side of the median line; each gena with 3 - 6 (4.3) hair-like genal setae (gs). Ventral head setae (vhs) on each side: The setae between the ventral eyes absent; 14 - 22 (17.8) h.s. forming with their partners of the other side a transverse band in the area of the ventral preocular depression; anteriorly, a row of 3 - 5 (4.1) h.s. longitudinally arranged on each side. A peculiar organ of obscure homology (X) always present on each side of the dorsal arm of the midcranial ridge near the apex of the head.

Antennae: Rather filiform; normally 10-segmented, with occasional fusion between two adjacent segments of the flagellum; 516 - 622 (564) μ long, i.e. as long as or slightly shorter than half the total length of the body, the ratio being 1:2.0 - 2.3 (2.2) and nearly as long as the hind legs, the ratio 1:1.0 - 1.2 (1.1). Scape (scp) 40 - 46 (42) μ long and 37 - 43 (40) μ wide at base; with 4 - 5 (4.3) h.s. Pedicel (pdc) 61 - 70 (67) μ long and 34 - 40 (37) μ wide; with 13 - 24 (16.8) f.s., 20 - 28 (26.0) h.s. and a sensillum placodeum (spl). Flagellum: Flagellar segments with wrinkled margins, about 24 μ wide, with the preterminal segments somewhat wider. Segment III club-shaped and longest of all, the ratio its length to the length of segment X 1.4 - 1.7 (1.5):1 and the ratio its width to its length 1:3.4 - 4.0 (3.8). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1:1.4-1.9(1.7) terminal segment pear-shaped. Segments V or VI to X always with a few apically knobbed, about 30 μ long capitate sensory

setae (set. ca.). The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
Length in μ (av.)	82 - 98 (89)	55-73 (64)	49-58 (55)	49-55 (52)	43-52 (49)	40-49 (45)	40-46 (45)	52-61 (58)
f.s. (av.)	14-19 (17.0)	11-22 (16.7)	12-19 (15.4)	13-18 (15.7)	12-20 (14.5)	10-17 (12.7)	6-10 (8.1)	1-4 (2.7)
h.s. (av.)	9-12 (10.7)	7-10 (8.7)	7-10 (8.4)	7-10 (9.1)	6-11 (9.2)	6-10 (8.1)	4-10 (7.1)	5-8 (6.3)
Set# ca. (av.)	0 0	0 0	0-2 (0.9)	1-3 (1.5)	1-4 (2.1)	2-4 (2.5)	2-5 (3.0)	3-6 (4.1)

Antennal bristles (ab) stouter and longer than the fleshy setae; segments VIII and IX each with a ventral bristle. The terminal segment with 3 bristles, the dorsal of which slightly shorter and nearer to the apex; terminal segment also with a lateral pair of much smaller bristles and one apical hair-like seta. Jancke (1955) recorded 2 bristles only occurring on the terminal segment.

Thorax: 517 - 585 (547) μ long. Prothorax: Comparatively short; pronotal ridges (pnrr) medially interrupted at a weakly sclerotized point; lateral pronotal sclerites (prm) and posttergites (pt) ill-defined. Proepisternum without any ridge-like sclerotization; propleural ridge short and propleural apophysis (plal) small. Prosternum (stnl) triangular, 58 - 76 (67) μ long; prosternal ridge (stnlr) 92 - 107 (101) μ long, with a small, crescent-like extension

antero-medially. Prothoracic setae: Medial pronotal setae usually absent although one seta was found in one specimen; lateral pronotal setae, posttergital and antespiracular dorsal, absent. Antespiracular ventral setae (asvs) always one on each side; prosternal setae (stnls) 0 - 1 (0.8) h.s.

Mesothorax: Prescutum (prsc) 70 - 79 (76) μ long and 131 - 156 (143) μ wide (ratio 1:1.8 - 2.0, av. 1.9); laterally and posteriorly bounded by the prescutal ridges (pscr) and the prescutal suture respectively. Scutum (sct) short and evenly sclerotized; 40 - 49 (43) μ long, i.e. the ratio lengths of prescutum to scutum 1.6 - 1.9 (1.8):1. Prealare (pra), prealar ridge (prar), triangular plate (tp), tegula, anterior and posterior notal wing processes well developed. Scutellum (scl) transverse, rectangular in dorsal view; 52 - 61 (58) μ long and 113 - 140 (128) μ wide, i.e. the ratios its length to its width 1:2.0 - 2.3 (2.2) and its length to the length of scutum 1.3 - 1.5 (1.4):1; the scutellum obliquely transversed on each side by a well developed scutellar ridge (sclr) dividing it into 3 triangular parts, the median of which being largest. Postalare (pa) well developed; anterior (apar) and posterior postalar ridges (ppar) anteriorly joined. Postnotal apophysis (pna) strong. Mesopleuron: Mesopleural ridge (plr2) continuous above the coxal articulation; mesopleural apophysis (pla2) and mesopleural wing process (pwp2) well developed; basalare (bas) narrow and slender. Subepisternal ridge (ser) distinct. Mesepisternum (eps2) weakly sclerotized and mesepimeron (epm2) small; lateropleurite (lpl) comparatively large. Mesosternum: Basisternum (stn2) 125 - 156 (140) μ long and 168 - 214 (189) μ wide; the marginal (mr), precoxal ridges (pcr2) and the furca (f) well developed. Mesothoracic spiracles (sp2) 21 - 24 (22) μ wide at opening, with a 37 - 43 (40) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 1 - 2 (1.6) h.s.; scutal setae 2 - 4 (2.9) h.s.; scutellar setae 1 - 2 (1.1). Tegular setae (tegs) 4 - 5 (4.2) h.s. Postmesostigmatal and basisternal setae absent.

Metathorax: Metapostnotal sclerites (pn3) well defined; metapostnotal ridge absent. Metapleural ridge (plr3) attenuated towards the small metapleural apophysis (pla3) and dorsally supporting a small pleural wing process(pwp3). Metepisternum (eps3) and metepimeron (epm3) distinct. Precoxal ridge (pcr3) and metasternal apophysis (sta) well developed. Metathoracic spiracle (sp3) identical with the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) always 3, one of which separated submedially; metapleural setae absent; anterior metasternal setae (amss) 0 - 2 (1.1) h.s. and posterior metasternal setae missing.

Wings: Hyaline; 868 - 994 (924) μ long and 378 - 434 (406) μ wide; axillary, additional sclerites and alar lobe (al) well developed; always with 2 hair-like alar setae (als). Hamulohalterae (h) 67 - 76 (73) μ long and 18 - 21 (19) μ wide; with a slender ridge and one apically hooked, 67 - 79 (76) μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1.0 - 1.1 (1.04):1.

Legs: Moderately long; the fore and the middle legs subequal, and the hind legs longest; the ratio length of the hind leg to the total body length 1:1.8 - 2.1 (2.0). Coxa (cx) about 46 and trochanter (tr) about 24 μ wide; the latter with the basal part shorter than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur (fem) about 37 μ wide; that of the/fore-leg usually longest and that of the middle leg shortest; the ratio width to length of the hind femur 1:4.2 - 4.8 (4.6). Tibia (tib) about 21 μ wide; with 2 apical strong spurs and 2 - 4 smaller spines; in fore leg the femur shorter than the tibia, the ratio their lengths being 1:1.29 - 1.33 (1.3). Tarsus (tar) about 18 μ wide; tarsal digitules (tdgt) apically knobbed, 24 - 27 (26) μ long. Claw (cl) broad at base, abruptly tapering to a pointed tip; 15 - 18 (17) μ long; with a pair of about 17 μ long, apically knobbed unequal digitules (udgt). The following table shows the length of the

leg segments and the number of setae on each:

		Fore leg	Middle leg	Hind leg
Coxa	length in μ	40-43 (41)	40-46 (42)	46-49 (47)
	f.s.	8-12 (9.6)	9-16 (11.8)	11-19 (13.6)
	h.s.	10-15 (12.4)	11-14 (12.2)	10-13 (11.8)
Trochanter	length in μ	58-64 (61)	61-70 (65)	64-73 (70)
	f.s.	3-5 (4.2)	4-8 (6.1)	5-9 (6.8)
	h.s.	6-9 (8.8)	6-11 (8.2)	6-11 (8.0)
Femur	length in μ	159-183 (168)	137-165 (150)	153-177(162)
	f.s.	22-31 (26.2)	19-28 (24.6)	23-29 (25.9)
	h.s.	29-39 (35.1)	26-31 (29.0)	26-33 (30.2)
Tibia	length in μ	207-244 (217)	214-250 (229)	226-256(238)
	f.s.	35-49 (44.0)	40-52 (48.2)	42-55(49.6)
	h.s.	42-61 (52.6)	44-63 (55.2)	46-67 (57.4)
Tarsus	length in μ	73-82 (76)	79-85 (82)	79-92 (83)
	f.s.	10-13 (11.8)	10-13 (11.4)	10-14 (11.2)
	h.s.	16-27 (22.2)	17-27 (22.4)	22-28 (24.4)
Total length of leg in μ		549-631 (573)	546-634 (593)	586-653 (619)

Abdomen: 327 - 479 (410) μ long and 281 - 334 (312) μ wide.

The tergites of segments I and II small; that of segment VIII large.

Sternites of segment VIII ill-defined. Ostioles absent. Abdominal

setae: Dorsal and ventral setae (ads & avs) in transverse rows;

pleural setae (aps) in lateral groups. The following table shows the

number of abdominal setae on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	2 - 3 (2.1)	(2)	(2)	(2)	(2)	(2)	(2)	*(1)
(aps)	(2.0)	3 - 4 (3.8)	3 - 4 (3.9)	3 - 4 (3.9)	(4.0)	(4.0)	4 - 5 (4.2)	*1+3-4 (3.3)
(avs)	-	2 - 3 (2.1)	2 - 3 (2.1)	2 - 4 (2.2)	3 - 4 (3.2)	3 - 4 (3.8)	3 - 4 (3.7)	1 - 2 (1.1)

* Slightly longer setae.

Glandular pouches (gp) small; the setae of the glandular pouch include a pair of 198 - 217 (207) μ long tail setae (ts), the ratio their length to the total length of the body being 1:5.4 - 6.3 (5.9).

Genital segment: The genital capsule (gc) 137 - 156 (143) μ long and 73 - 79 (76) μ wide, i.e. the ratios its length to its width 1.8 - 2.0 (1.9):1 and its length to the total body length 1:7.9 - 8.9 (8.5); the style (st) undulating in lateral view. The anal opening (an) large, 18 - 21 (20) μ in diameter. Ventrally, a median, longitudinal slender ridge is present, giving off two lateral branches extending towards the base of the aedeagus. The aedeagus (aed) strongly developed and ventrally sclerotized; also with latero-ventral heavy sclerotizations and a pair of small processes on each side. Setae of the genital segment (gts): Dorsally two setae about 61 μ long always present on each side near the base of the style; ventrally 5 - 6 (5.2) h.s. occur on each side of the genital capsule.

Material: 10 specimens examined, collected by myself on Araucaria excelsa, in Alexandria, Egypt, U.A.R., during the last week of June and the first week of July, 1961.

(19) ERIOCOCCUS ORARIENSIS HOY (Plate XX, figs. 38 and 39)

Winged forms only known; living specimens not available. The males moderately robust, comparatively small, with short antennae and short legs. Mounted specimens 812 - 938 (882) μ long, 224 - 266 (250) μ wide at mesothorax and 1652 - 1848 (1736) μ wing expanse.

Body setae: The antennae and the legs with fleshy and hair-like setae, about 12 and 18 μ long respectively; the body itself with slightly smaller hair-like setae only.

Head: Subtetrahedron; triangular in dorsal view and rather rounded in front view; ventral preocular depression hardly indicated in lateral view. Length from apex to postoccipital ridge 70 - 85 (76) μ ; from apex to neck 116 - 125 (122) μ ; width across the genae 156 - 165 (159) μ . The midcranial ridge cruciform; the dorsal arm (dmcr) short, joined to the lateral (lmcr) and the ventral arms (vmcr) at the apex of the head. Postoccipital ridge (por) strongly developed, with the lateral extremities bending posteriorly and giving off a short heavy sclerotization anteriorly. Dorsomedial part of the epicranium (dmp) narrow and slightly raised. Preocular (procr) and postocular ridges (pocr) well developed and widely separated; the latter ventrally articulates with a small additional ridge (addr). Preoral ridge slender.

Eyes: The dorsal simple eyes (dse) slightly projecting outside the lateral margins of the head; their corneae 15 - 18 (16) μ in diameter and both separated by 85 - 95 (89) μ , i.e. 4.7 - 6.0 (5.4) times their diameter apart. The corneae of the ventral simple eyes (vse) subequal in diameter and 18 - 24 (21) μ apart. Lateral ocelli (o) well developed, anteriorly attached to the postocular ridges. Ocular sclerites (ocs) large. Cranial apophysis apically bifurcate. Tentorial bridge stout.

PLATE XX

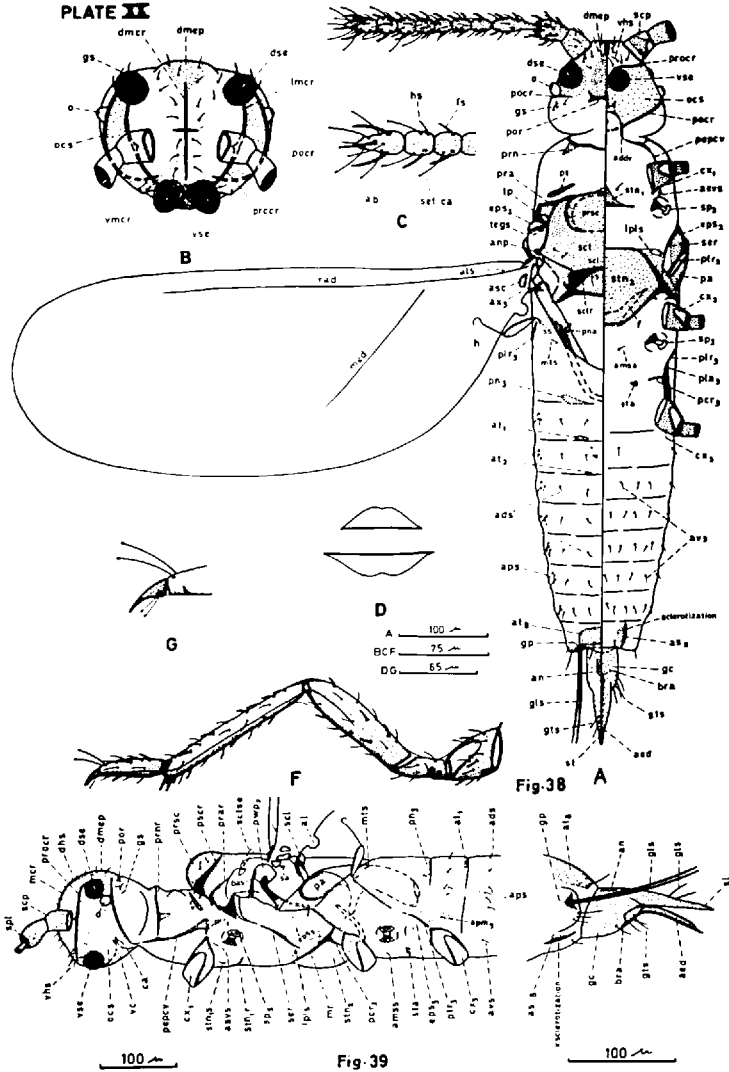


Fig. 39

Fig. 38

Dorsal head setae (dhs); 8 - 10 (9.8) h.s. present on each side of the median line anterior to the postoccipital ridge; each gena with 2 - 3 (2.7) genal setae (gs). Ventral head setae (vhs) on each side: The setae between the ventral eyes absent; 3 - 5 (4.1) h.s. in the area of the ventral preocular depression, forming with their partners of the other side a transverse band; anteriorly a longitudinal row of 2 - 3 (2.7) h.s. present on each side of the ventral arm of the mid-cranial ridge.

Antennae: Rather moniliform; normally 10-segmented; 329 - 354 (339) μ long, i.e. shorter than half the total length of the body, the ratio being 1:2.4 - 2.8 (2.6) and about as long as the hind legs, the ratio 1:1.1 - 1.2 (1.15). Scape (scp) 31 - 34 (32) μ long and 34 μ wide at base; always with 4 h.s. Pedicel (pdc) 43 - 46 (45) μ long and 27 - 31 (28) μ wide; with 4 - 10 (6.6) f.s., 8 - 13 (11.3) h.s. and a sensillum placodeum (spl). Flagellum: Flagellar segments 18 - 21 μ wide, with the preterminal segments becoming slightly wider. Segment III club-shaped and longest of all, the ratio its length to the length of the terminal segment 1.40 - 1.54 (1.5):1 and the ratio its width to its length 1:2.9 - 3.3 (3.2). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1:1.0 - 1.4 (1.2); terminal segment pear-shaped. Segments VIII, IX, X and sometimes VII carry a number of apically knobbed, about 30 μ long capitate sensory setae (set. ca). In the following table the lengths of the flagellar segments and the number of setae on each are given:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	58-61 (60)	27-31 (29)	24-31 (27)	21-27 (24)	24-31 (27)	24-31 (27)	24-31 (27)	40 (40)
f.s. (av.)	6-10 (7.7)	2-5 (3.1)	3-8 (6.0)	4-8 (5.8)	3-8 (5.8)	3-6 (3.9)	2-5 (3.3)	2-3 (2.1)
h.s. (av.)	3-6 (4.8)	3-5 (3.3)	3-5 (4.1)	2-4 (3.2)	3-7 (5.2)	3-8 (5.6)	5-8 (6.1)	2-5 (3.3)
Set. ca. (av.)	0 0	0 0	0 0	0 0	0-1 (0.2)	1-2 (1.3)	2-3 (2.3)	5-7 (5.6)

Antennal bristles (ab) well defined; segments VIII and IX each with one ventral bristle. Terminal segment with 3 slightly longer bristles, the dorsal of which nearer to the apex; segment X also with one apical hair-like seta.

Thorax: 350 - 403 (388) μ long. Prothorax: Pronotal ridges (prnr) with the usual weak interruption at the middle; lateral pronotal sclerite (prm) and posttergites (pt) small. Proepisternum without any ridge-like sclerotization. Prosternum (stnl) triangular, 18 - 31 (24) μ long; prosternal ridge (stnlr) with a small crescent-like antero-median extension, 67 - 79 (73) μ long. Prothoracic setae: Medial and lateral pronotal, posttergital and antespiracular dorsal setae absent. One hair-like antespiracular ventral seta (asvs) may be present (av. 0.4) and one prosternal seta (stnls) always present on each side of the median line.

Mesothorax: Prescutum (prsc) 49 - 58 (55) μ long and 79 - 89 (85) μ wide, the ratio being 1:1.4 - 1.7 (1.6); prescutal ridge (pscr) well developed and prescutal suture distinct. Scutum (sct) 46 - 52 (49) μ long, i.e. the ratio lengths of prescutum to scutum 1.0 - 1.3 (1.1):1. Prealare (pra), prealar ridge (prar), tegula, anterior and posterior notal wing processes well developed. Scutellum (scl) transverse, rectangular in dorsal view; 31 - 34 (33) μ long and 73 - 82 (79) μ wide, i.e. the ratios its length to its width 1:2.3 - 2.7 (2.4) and its length to the length of the scutum 1:1.4 - 1.6 (1.5); scutellar ridge distinct. Postalare (pa) with the anterior and posterior postalare ridges joined. Postnotal apophysis (pna) strong. Mesopleuron: Mesopleural ridge (plr2) continuous above the coxal articulation; mesopleural apophysis, mesopleural wing process (pwp2) and subepisternal ridge (ser) well developed; basalare (bas) slender. Mesepisternum (eps2) and mesepimeron well-defined; lateropleurite comparatively large. Mesosternum: Basisternum (stn2) 85 - 98 (92) μ long and 134 - 159 (150) μ wide; bounded by the marginal (mr) and the precoxal ridges (pcr2). Furca (f) well developed. Mesothoracic spiracles (sp2) 12 - 15 (14) μ wide at opening, with a 27 - 31 (29) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 1 - 2 (1.5) h.s.; scutal setae (sctse) 2 - 3 (2.2) h.s.; scutellar seta always one. Tegular setae (tegs) 2 - 3 (2.6) h.s. Each lateropleurite always with a small lateropleurital seta (lpls). Postmesostigmatal and basisternal setae absent. Metathorax: Metapostnotal sclerite (pn3) small; metapostnotal ridge absent. Metapleural ridge (plr3) attenuated towards the small metapleural apophysis. Metepisternum (eps3) and metepimeron (epm3) distinct. Precoxal ridge of metathorax (pcr3) and metasternal apophysis (sta) well developed. Metathoracic spiracles (sp3) similar to the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) 1 - 2 (1.7) h.s.; metapleural setae absent; one anterior metasternal seta (amss) always present, and posterior

metasternal setae absent.

Wings: Hyaline; 714 - 798 (756) μ long and 266 - 308 (280) μ wide; axillary, additional sclerites and alar lobe (al) well developed; always with one hair-like alar seta (als). Hamulohalterae (h) 49 - 58 (52) μ long and 15 - 18 (17) μ wide; with a slender ridge and one apically hooked, 49 - 67 (61) μ long seta, i.e. the ratio lengths of seta to hamulohaltera 1:0.9 - 1.1 (1.0).

Legs: Comparatively short and stout; the fore and middle legs of subequal length and shorter than the hind leg; the ratio length of the hind leg to the total body length 1:2.1 - 2.4 (2.3). Coxa and trochanter about 37 and 21 μ wide respectively; the basal part of the latter shorter than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. Femur about 31 μ wide; that of the middle leg shortest, and those of the fore and hind legs subequal; the ratio width to length of the hind femur 1:3.4 - 3.8 (3.6). Tibia about 18 μ wide; with 2 apical spurs and 2 - 3 smaller spines; in the fore leg the femur shorter than the tibia, the ratio their lengths being 1:1.1 - 1.3 (1.2). Tarsus about 15 μ wide; tarsal digitules apically knobbed, about 27 μ long. Claw broad at base and abruptly tapering towards a pointed tip; 12 - 15 (14) μ long; ungual digitules apically knobbed, about 15 μ long. The lengths of the leg segments and the number of setae on each are given in the following table:

		Fore leg	Middle leg	Hind leg
Coxa	length in μ	27-31 (29)	27-31 (29)	31-34 (32)
	f.s.	1-3 (2.1)	1-5 (2.9)	1-5 (3.1)
	h.s.	6-10 (7.5)	5-8 (6.4)	5-8 (6.2)
Trochanter	length in μ	40-46 (43)	43-49 (46)	46-49 (48)
	f.s.	0-1 (0.1)	0-1 (0.1)	0-1 (0.2)
	h.s.	3-6 (3.9)	3-6 (4.3)	4-5 (4.5)
Femur	length in μ	104-110 (107)	92-104 (98)	104-116 (110)
	f.s.	6-10 (7.8)	5-10 (8.1)	4-9 (6.2)
	h.s.	13-19 (15.8)	11-15 (13.5)	10-14 (11.8)
Tibia	length in μ	116-137 (128)	116-137 (128)	137-153 (143)
	f.s.	6-9 (7.9)	7-10 (8.2)	7-13 (9.1)
	h.s.	15-22 (18.8)	14-24 (20.4)	18-25 (21.3)
Tarsus	length in μ	49-52 (50)	49-52 (50)	49-55 (52)
	f.s.	3-5 (3.5)	2-5 (3.4)	2-5 (3.5)
	h.s.	10-13 (11.6)	10-14 (12.1)	10-14 (11.8)
Total length of leg in μ		348-384 (366)	342-384 (363)	384-421 (394)

Abdomen: 228 - 319 (281) μ long and 205 - 220 (213) μ wide. The tergites of segments I and II small; that of segment VIII large. The sternites of segment VIII bounded along their outer margins by a longitudinal heavily sclerotized strip. Ostioles absent. Abdominal setae: Dorsal and ventral setae (ads & avs) in transverse irregular rows; pleural setae (aps) in lateral groups. The following table shows the number of the abdominal setae on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	(2)	(2)	(2)	2 - 3 (2.1)	(2)	2 - 3 (2.1)	(2)	*(1)
(aps)	(2)	2 - 3 (2.4)	(3)	(3)	(3)	(3)	(3)	*1+ (2)
(avs)	-	(1)	2 - 3 (2.6)	4 - 5 (4.2)	4 - 5 (4.4)	4 - 5 (4.4)	4 - 5 (4.3)	(1)

* Slightly longer setae.

Glandular pouches (gp) small; setae of the glandular pouch (gls) include a pair of 119 - 137 (128) μ long tail setae (ts), i.e. the ratio their length to the total body length 1:6.0 - 7.9 (6.9).

Genital segment: The genital capsule (gc) rather elongate, 119 - 134 (128) μ long and 43 - 49 (46) μ wide, the ratio length to width being 2.6 - 3.0 (2.8):1 and the ratio its length to the total length of the body 1:6.2 - 7.8 (6.9). The style (st) rather straight in lateral view, with a pointed apex. The anal opening (an) large, about 12 μ in diameter. Aedeagus (aed) with a well sclerotized ventral margin and a sharply pointed tip. Setae of the genital segment (gts): Dorsally 2 comparatively long setae always present on each side of the style at about half its length. Ventrally 4 - 5 (4.6) similar setae occur on each side of the genital capsule.

Material: 10 specimens from two lots examined, all of which entirely agreed with each other. The specimens of one lot were collected by J. M. Kelsey, on Leptospermum scoparium, in Ashburton, New Zealand, on 10.6.1948; the specimens of the other collected by J. M. Hoy, on the same host plant, in Palmerston North, New Zealand, on 21.3.1956.

(20) ERIOCOCCUS BUXI (FONSC.) (Plate XXI, figs. 40 and 41)

The macropterous males only known; living specimens not available. The males moderately robust, comparatively small, with short antennae and moderately long legs. When mounted, 942 - 1050 (980) μ long, 266 - 294 (280) μ wide at mesothorax and 1862 - 2100 (2002) μ wing expanse.

Body setae: The antennae and the legs with about 18 μ long fleshy setae and somewhat longer hair-like ones; both types of setae hard to separate. The body itself with hair-like setae only.

Head: Subtetrahedron; triangular in dorsal and front views; ventral preocular depression hardly indicated in lateral view. Length from apex to postoccipital ridge 67 - 76 (70) μ ; from apex to neck 140 - 150 (144) μ ; width across the genae 174 - 183 (180) μ . The midcranial ridge (mor) cruciform; dorsal arm short, joining the lateral and the ventral arms at the apex of the head. The postoccipital ridge (por) well developed, laterally giving off two branches, one anteriorly and the other posteriorly. Dorsomedial part of the epicranium (dmep) slightly raised. Preocular (procr) and postocular ridges (pocr) well separated; the ventral part of the former atrophied. Preoral ridge slender.

Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head; their corneae 18 - 24 (21) μ in diameter and separated by 58 - 61 (59) μ , i.e. 2.4 - 3.3 (2.7) times their diameter apart. The ventral simple eyes (vse) of subequal diameter (21 - 24, av. 22 μ), and 18 - 21 (20) μ apart. The lateral ocelli (o) well developed, closely attached to the postocular ridges. Ocular sclerites large. Cranial apophysis apically truncate. Tentorial

PLATE XXI

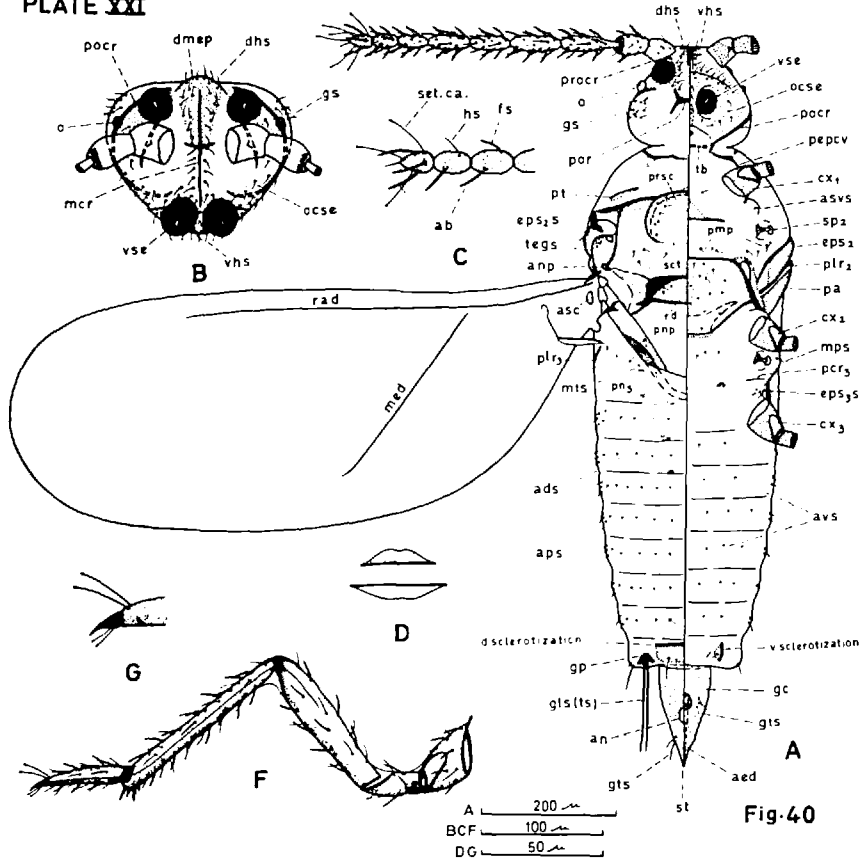


Fig.40

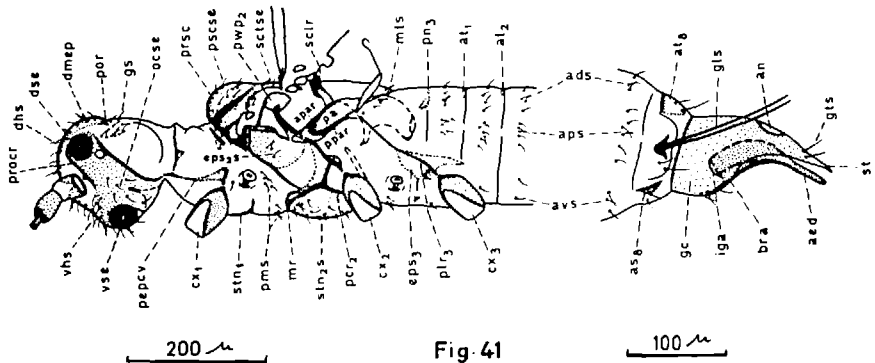


Fig.41

bridge (tb) stout. Dorsal head setae (dhs) on each side: 11-15 (12.8) h.s. anterior to the postoccipital ridge; each gena with 9 - 15 (11.8) genal setae (gs); setae of the ocular sclerites (ocse) 10 - 13 (11.6) h.s. latero-ventrally. Ventral head setae (vhs) on each side: 2 - 3 (2.6) h.s. in a longitudinal irregular row between the ventral eyes; 11 - 15 (13.2) h.s. in the area of the ventral preocular depression, forming with their partners of the other side a transverse band; anteriorly, 4 - 5 (4.2) h.s. in a row on each side of the ventral arm of the midcranial ridge.

Antennae: Rather filiform; 9-segmented; 458 - 506 (476) μ long, i.e. about as long as half the total body length, the ratio being 1:2.0 - 2.1 (2.05) and slightly shorter than the hind legs, the ratio 1:1.1 - 1.3 (1.2). Scape 37 - 40 (39) μ long and 34 - 37 (36) μ wide at base; always with 4 h.s. Pedicel 43 - 49 (46) μ long and 31 - 37 (34) μ wide; with 2 - 5 (3.5) f.s., 10 - 16 (13.3) h.s. and a sensillum placodeum. Flagellum: Flagellar segments 21 - 24 μ wide, with segment III somewhat wider and segment IX somewhat narrower. Segment III club-shaped and longest of all, the ratio its length to the length of the terminal segment 2.6 - 2.9 (2.8):1 and the ratio its width to its length 1:3.2 - 3.6 (3.5). Segments IV to VIII rather barrel-shaped, the ratio width to length of segment VIII being 1:1.5 - 1.9 (1.6); terminal segment pear-shaped, shortest of all and always with 5 - 6 apically knobbed capitate sensory setae (set. ca.), about 37 μ long. The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX
length in μ (av.)	79-89 (85)	73-82 (76)	49-64 (58)	61-67 (64)	37-43 (40)	37-43 (40)	31 (31)
f.s. (av.)	17-26 (22.1)	18-26 (22.5)	17-26 (20.5)	22-28 (24.5)	11-20 (16.3)	10-16 (13.3)	0 0
h.s. (av.)	5-9 (7.5)	5-8 (6.5)	3-5 (3.8)	4-8 (5.8)	3-6 (4.5)	4-6 (4.8)	0 0
set.ca. (av.)	0 0	0 0	0 0	0 0	0 0	0 0	5-6 (5.8)

Antennal bristles (ab) well defined, about 31μ long; segments VII and VIII each with a ventral bristle. Segment IX with three bristles near its base and one apical hair-like seta.

Thorax: 380 - 418 (403) μ long. Prothorax: Pronotal ridges medially interrupted by a weak sclerotization. Lateral pronotal sclerites and posttergites (pt) small. Proepisternum without any ridge-like sclerotization. Prosternum (stnl) triangular, 24 - 34 (27) μ long; prosternal ridge slender, 92 - 98 (95) μ long. Prothoracic setae: Medial and lateral pronotal, posttergital and antespiracular dorsal setae absent. One antespiracular ventral seta (asvs) always present and one prosternal seta usually present (av.0.8) on each side.

Mesothorax: Prescutum (prsc) 67 - 82 (76) μ long and 110 - 122 (116) μ wide, the ratio being 1:1.5 - 1.7 (1.6); laterally bounded by the prescutal ridges and posteriorly by the prescutal suture. Scutum (sct) 43 - 52 (46) μ long, i.e. the ratio lengths of prescutum to scutum 1.6 - 1.9 (1.7):1. Prealare, prealar ridge, tegula, anterior

and posterior notal wing processes (anp & pnp) well developed. Scutellum transverse, rectangular in dorsal view; 37 - 46 (40) μ long and 107 - 122 (116) μ wide, i.e. the ratios its length to its width 1:2.7 - 3.0 (2.9) and its length to the length of the scutum 1:1.1 - 1.2 (1.15); scutellar ridge (sclr) distinct. Postalare (pa) with the anterior and posterior ridges (apar & ppar) joined. Postnotal apophysis strong. Mesopleuron: Mesopleural ridge (plr2) continuous above the coxal articulation; mesopleural wing process (pwp2) well developed; basalare slender. Subepisternal ridge well developed. Mesepisternum (eps2) distinct and mesepimeron small. Lateropleurite comparatively large, with an oval membranous area. Mesosternum: Basisternum 92 - 110 (101) μ long and 174 - 189 (180) μ wide; antero-laterally and latero-posteriorly bounded by the marginal (mr) and the precoxal ridges (pcr2) respectively. The furca well developed. Mesothoracic spiracles (sp2) 15 - 18 (17) μ wide at opening, with a 27 - 31 (29) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae (pscse) 6 - 9 (7.6) h.s.; scutal setae (sctse) 5 - 7 (6.1) h.s.; scutellar setae 2 - 3 (2.8) h.s. Tegular setae (tegs) 7 - 9 (7.9) h.s. The anepisternum with 2 - 3 (2.8) mesepisternal setae (eps2s). Postmesostigmatal setae (pms) in two groups, 3 - 4 (3.4) h.s. latero-ventrally and 2 - 3 (2.6) h.s. medially; basisternal setae (stn2s) 10 - 15 (11.6) h.s. Metathorax: Metapostnotal sclerites (pn3) small; metapostnotal ridge absent. Metapleural ridge (plr3) attenuated as usual towards the small pleural apophysis. Metepisternum (eps3) and metepimeron distinct. Precoxal ridge of metathorax (pcr3) weakly developed and metasternal apophysis small. Metathoracic spiracles identical with the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) 4 - 5 (4.2) h.s.; metapleural setae (mps) 1 - 2 (1.6) h.s.; postmetastigmatal setae

(eps3s) 2 - 3 (2.6) h.s. Anterior metasternal setae 2 - 3 (2.4) h.s. and posterior metasternal setae usually absent, although one seta was found in one specimen.

Wings: Hyaline; 812 - 924 (868) μ long and 294 - 350 (322) μ wide; axillary, additional sclerites and alar lobe well developed; alar setae almost always absent and only one seta may occur (av.0.1). Hamulochalterae 58 - 67 (64) μ long and 15 - 18 (16) μ wide; with a slender ridge and one apically hooked, 52 - 67 (58) μ long seta, i.e. the ratio lengths of seta to hamulochaltera 1:1.0 - 1.1 (1.08).

Legs: Moderately long and stout; the fore and the middle legs of subequal length and shorter than the hind legs; the ratio length of the hind leg to the total length of the body 1:1.8 - 1.9 (1.85). Coxa and trochanter about 40 and 24 μ wide respectively; the basal part of the trochanter shorter than the distal and with 3 circular sensilla on each side; differentiated long apical setae absent. The femur about 31 μ wide; that of the middle leg shortest and that of the hind leg longest; the ratio width to length of the hind femur 1:4.9 - 5.2 (5.0). Tibia about 18 μ wide; with 2 apical spurs and 2 - 3 smaller spines; in the fore-leg the femur slightly shorter than the tibia, the ratio their lengths 1:1.1 - 1.2 (1.17). Tarsus about 18 μ wide; tarsal digitules apically knobbed, about 29 μ long. Claw broad at base and abruptly tapering to a sharply pointed tip; 12 - 15 (14) μ long; ungual digitules apically knobbed, 15 - 18 (16) μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	34-40 (37)	34-40 (37)	37-43 (40)
	f.s.	3 - 6 (4.2)	3 - 5 (4.6)	4 - 6 (5.1)
	h.s.	4 - 6 (5.2)	4 - 7 (5.5)	5 - 8 (6.6)
Troch- anter	length in μ	52-55 (54)	52-55 (54)	55-61 (58)
	f.s.	1 - 3 (1.8)	1 - 3 (1.6)	1 - 4 (2.2)
	h.s.	2 - 4 (2.6)	2 - 5 (2.9)	2 - 5 (3.2)
Femur	length in μ	134-150 (143)	122-134 (128)	143-159 (153)
	f.s.	7-12 (9.5)	6-10 (8.1)	7-13 (10.8)
	h.s.	13-19 (15.7)	10-17 (13.3)	12-21 (16.5)
Tibia	length in μ	162-177 (168)	174-186 (180)	186-195 (192)
	f.s.	17-25 (21.7)	20-26 (22.4)	22-30 (27.1)
	h.s.	19-34 (26.6)	23-39 (31.8)	27-41 (35.4)
Tarsus	length in μ	70-73 (72)	70-73 (72)	73-76 (75)
	f.s.	11-15 (12.6)	11-17 (13.1)	13-18 (16.2)
	h.s.	13-18 (15.5)	12-19 (15.9)	16-22 (18.8)
Total length of leg in μ		467-509 (491)	467-506 (488)	509-549 (528)

Abdomen: 304 - 380 (357) μ long and 251 - 289 (266) μ wide. The tergites of segments I and II small; that of segment VIII large, anteriorly bounded by a transverse stripe of heavy sclerotization. The sternites of segment VIII also bounded laterally by a longitudinal, similarly heavy sclerotization. Ostioles absent. Abdominal setae: The dorsal and the ventral setae (ads & avs) arranged in transverse irregular rows; pleural setae (aps) in lateral groups. The number of the abdominal setae on each side of the median line are given in the following table:

	I	II	III	IV	V	VI	VII	VIII
(ads)	4 - 6 (5.1)	4 - 5 (4.5)	4 - 5 (4.6)	4 - 5 (4.8)	4 - 5 (4.3)	2 - 4 (3.6)	2 - 3 (2.7)	*1+0-1 (0.4)
(aps)	6 - 7 (6.3)	5 - 7 (6.1)	6 - 7 (6.3)	6 - 7 (6.2)	5 - 7 (6.0)	5 - 6 (5.8)	5 - 6 (5.8)	*1+1-2 (1.8)
(avs)	-	1 - 2 (1.8)	2 - 3 (2.2)	2 - 3 (2.6)	2 - 3 (2.9)	2 - 3 (2.8)	2 - 3 (2.3)	(2)

* Slightly longer setae.

Glandular pouches (gp) small; setae of the glandular pouch (gls) include a pair of 107 - 122 (113) μ long tail setae (ts), i.e. the ratio their length to the total body length 1:7.7 - 9.8 (8.7).

Genital segment: The genital capsule (gc) comparatively large, 140 - 153 (146) μ long and 82 - 92 (85) μ wide, the ratio being 1.6 - 1.9 (1.7):1 and the ratio its length to the total length of the body 1:6.6 - 6.9 (6.7). The style (st) rather straight in lateral view, with a pointed apex. The anal opening (an) about 18 μ in diameter. Aedeagus (aed) well developed, with the ventral margin well sclerotized; internal genital aperture (iga) large. Setae of the genital segment (gts): Dorsally 2 long setae always present on each side of the style near its apex; ventrally 3 smaller setae always occur on each side of the genital capsule.

Material: 7 specimens examined, collected by N. S. Borchsensius, on Buxus sempervirens, in Abhasia, USSR, in 1932 (no exact date given).

GENUS OVATICOCCUS:(21) OVATICOCCUS AGAVIUM DOUGL. (Plate XXII, figs. 42 and 43)

Winged forms only known; these dark brown reddish, with the thorax slightly lighter. The males moderately robust, comparatively small, with moderately short antennae and moderately long legs. Mounted specimens 1050 - 1204 (1120) μ long, 308 - 350 (336) μ wide at mesothorax and 2128 - 2422 (2296) μ wing expanse.

Body setae: The antennae with about 12 μ long fleshy setae and about twice as long hair-like ones; the body itself and the legs with hair-like setae only, much smaller than those of the antennae.

Head: Subtetrahedron; triangular in dorsal view and more or less rounded in front view; ventral preocular depression (vprd) hardly indicated in lateral view. Length from apex to postoccipital ridge 107 - 125 (116) μ ; from apex to neck 159 - 177 (167) μ ; width across the genae 198 - 207 (201) μ . The midcranial ridge cruciform; its dorsal arm (dmcr) anteriorly continuous with the ventral arm (vmcr) and posteriorly fading out before reaching the postoccipital ridge; the lateral arms indicated by short, weak sclerotizations. The postoccipital ridge (por) well developed, laterally giving off two small branches, one anteriorly and the other slightly bent posteriorly. The dorso-medial part of the epicranium (dmep) slightly raised. Preocular (procr) and postocular ridges (pocr) well separated; preoral ridge slender.

Eyes: The dorsal simple eyes (dse) not projecting beyond the outer margins of the head in dorsal view; their corneae 15 - 18 (17) μ in diameter and both separated by 98 - 113 (107) μ , i.e. 5.3 - 7.4 (6.0) times their diameter apart. The ventral simple eyes (vse) equal or slightly larger, 15 - 21 (18) μ in diameter and 43 - 55 (49) μ apart. The lateral ocellus (o) vestigial and only represented by a small sclerotized spot on the ocular sclerite, attached to the postocular

PLATE XXXII

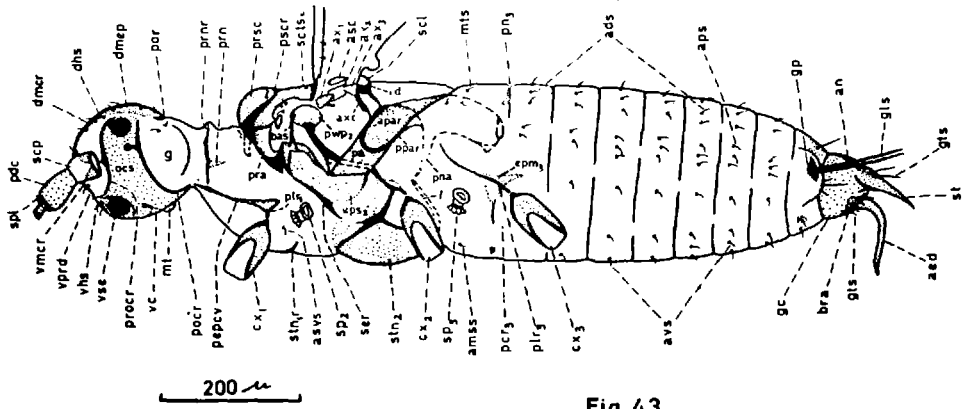
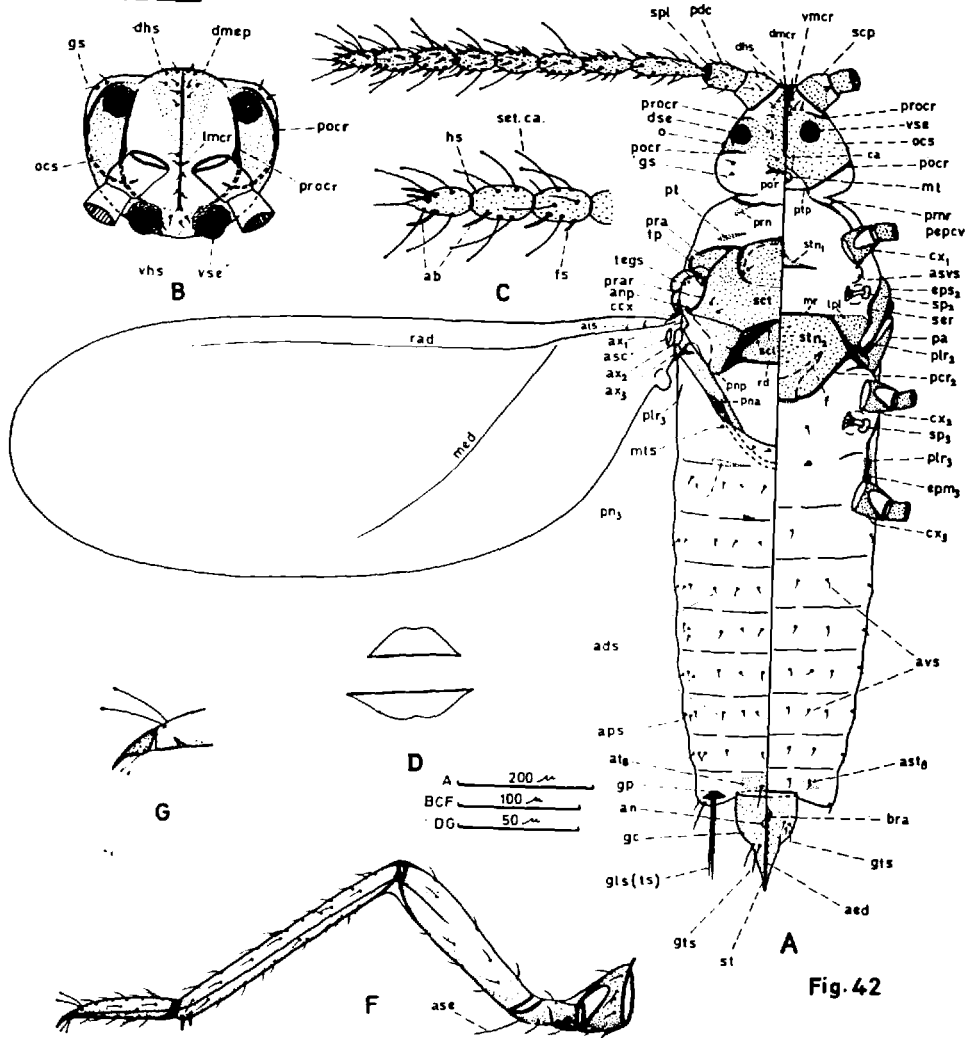


Fig. 43

ridge by means of a short sclerotized arm. Cranial apophysis (ca) apically bifurcate. Tentorial bridge stout. The mouth opening posteriorly situated on a small mouth tubercle (mt). Dorsal head setae (dhs): 6 - 9 (7.1) h.s. present anterior to the postoccipital ridge on each side of the median line; each gena with 2 - 3 (2.1) hair-like genal setae (gs). Ventral head setae (vhs) on each side: Setae between the ventral eyes absent; 2 - 4 (3.1) h.s. present in the area of the ventral preocular depression, forming with their partners of the other side transverse single or double rows; anteriorly 1 - 2 (1.8) h.s. on each side of the ventral arm of the midcranial ridge.

Antennae: Rather filiform; 10-segmented; 601 - 677 (637) μ long, i.e. as long as or slightly longer than half the body length, the ratio being 1:1.6 - 2.0 (1.8) and about as long as the hind legs, the ratio 1:1.0 - 1.1 (1.07). Scape (scp) 43 - 49 (46) μ long and 49 - 55 (52) μ wide at base; always with 4 h.s. Pedicel (pdc) 58 - 64 (61) μ long and 37 - 43 (40) μ wide; with 7 - 11 (8.4) h.s. and a sensillum placodeum (spl). Flagellum: Flagellar segment 27 - 31 (29) μ wide, with segments VIII, IX and sometimes VII inconsiderably wider. Segment III club-shaped and longest of all, the ratio its length to the length of the terminal segment 1.7 - 2.3 (1.9):1 and the ratio its width to its length 1:3.4 - 4.2 (4.0). Segments IV to IX rather barrel-shape; the ratio width to length of segment IX 1:1.4 - 1.8 (1.6). Terminal segment distinctly pear-shaped, with a narrowly constricted or even pointed apex. Segments VI to X and sometimes V also, with a number of apically knobbed, about 49 μ long capitate sensory setae (set. ca.). In the following table, the lengths of the flagellar segments and the number of setae on each are given:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	101-116 (110)	61-76 (67)	61-76 (66)	61-73 (66)	52-64 (58)	49-61 (55)	46-61 (55)	46-64 (58)
f.s. (av.)	2 - 7 (4.2)	4 - 7 (5.6)	5 - 10 (6.6)	4 - 12 (9.2)	6-11 (8.4)	5 - 11 (7.4)	3 - 6 (4.3)	2 - 5 (3.7)
(h.s.) (av.)	7-14 (11.2)	4-8 (6.0)	5 - 8 (6.1)	2 - 4 (3.2)	0 - 3 (1.3)	0 - 2 (1.0)	0 - 2 (1.1)	1 - 2 (2.0)
(sot.ca.) (av.)	0 0	0 0	0 - 1 (0.4)	2 - 4 (3.1)	3 - 4 (3.6)	3 - 5 (4.3)	3 - 6 (4.2)	3 - 5 (3.6)

Antennal bristles (ab) well defined and longer than the fleshy setae; segments VIII and IX each with one ventral bristle. Segment X with 3 bristles, the dorsal of which slightly shorter and nearer to the apex; terminal segment also always with one apical hair-like seta.

Thorax: 388 - 494 (448) μ long. Prothorax: Pronotal ridges (prnr) medially interrupted at a weakly sclerotized point. Lateral pronotal sclerites (prn) and posttergites (pt) small. Proepisternum without any ridge-like sclerotization. Prosternum (stnl) triangular, 34 - 46 (40) μ long; prosternal ridge (stnlr) slender, 92 - 107 (95) μ long. Prothoracic setae: Medial and lateral pronotal, posttergital and antepiracular dorsal setae absent. One antepiracular ventral seta (asvs) always present on each side; prosternal setae absent.

Mesothorax: Prescutum (prsc) 58 - 70 (64) μ long and 122 - 140 (131) μ wide, the ratio being 1:1.9 - 2.3 (2.0); laterally and posteriorly bounded by the prescutal ridge (pscr) and the prescutal suture respectively. Scutum (sct) 49 - 61 (52) μ long, i.e. the ratio

lengths of prescutum and scutum 1.1 - 1.4 (1.2):1. Prealare (pra), prealar ridge (prar), triangular plate (tp) and the mesopleural structures well developed. Scutellum (scl) transverse, rectangular in dorsal view; 61 - 70 (67) μ long and 113 - 131 (122) μ wide, i.e. the ratios length to width 1:1.6 - 2.0 (1.8) and its length to the length of the scutum 1.1 - 1.4 (1.3):1; scutellar ridge strongly developed. Postalare (pa) with the anterior (apar) and the posterior postalar ridges (ppar) anteriorly joined. Postnotal apophysis (pna) well developed. Mesopleuron: Mesopleural ridge (plr2) continuous above the coxal articulation; pleural wing process (pwp2) well developed; basalare (bas) slender. Subepisternal ridge (ser) distinct. Mesepisternum (eps2) and mesepimeron well defined. Lateropleurite (lpl) comparatively large. Mesosternum: Basisternum (stn2) 116 - 134 (125) μ long and 192 - 211 (201) μ wide; marginal (mr), precoxal ridges (pcr2) and furca (f) well developed. Mesothoracic spiracles (sp2) 21 - 24 (22) μ wide at opening, with a 43 - 49 (46) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae 0 - 1 (0.4) h.s.; scutal setae (sctse) usually 1 - 2 and occasionally 3 (av. 1.6 h.s.); scutellar setae 1 - 2 (1.9) h.s. Tegular setae (tegs) 2 - 3 (1.8) h.s. Postmesostigmatal, and basisternal setae absent. Metathorax: Metapostnotal sclerites (pn3) small and narrow; metapostnotal ridge absent. Metapleural ridge (plr3) attenuating near the middle in the usual manner; metapleural wing process missing. Metepisternum and metepimeron (epm3) small. Precoxal ridge of metathorax (pcr3) weak and metasternal apophysis small. Metathoracic spiracles (sp3) similar to the mesothoracic. Metathoracic setae on each side: Metatergal setae (mts) 3 - 4 (3.4) h.s.; metapleural setae absent. Anterior metasternal seta (amss) 0 - 1 (0.6) h.s.; posterior metasternal setae absent.

Wings: Hyaline; 910 - 1050 (994) μ long and 308 - 392 (350) μ wide; axillary, additional sclerites and alar lobe well developed;

always with 2 alar setae (als). The hamulohalterae and the suspensorial sclerites absent.

Legs: Moderately long and stout; the fore and the middle legs of subequal length and shorter than the hind legs; the ratio length of the hind leg to the total length of the body 1:1.5 - 1.8 (1.6). The coxa about 55 and the trochanter about 31 μ wide respectively; the basal part of the latter shorter than the distal and with 3 circular sensilla on each side; the trochanter with one, about 46 μ long differentiated apical seta (ase). The femur about 40 μ wide; that of the middle leg shortest and those of the fore and hind legs subequal; the ratio width to length of the hind femur 1:4.3 - 4.7 (4.5). The tibia about 24 μ wide; with 2 apical spurs; in fore-leg the femur slightly shorter than the tibia, the ratio their lengths 1:1.2 - 1.4 (1.3). Tarsus about 18 μ wide; tarsal digitules apically knobbed, 31 - 37 (34) μ long. Claw broad at base, abruptly tapering towards a sharply pointed tip; 21 - 27 (23) μ long; ungual digitules apically knobbed, 18 - 24 (21) μ long. In the following table the lengths of the leg segments and the number of setae on each are given:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	37-43 (39)	37-43 (39)	40-46 (42)
	h.s.	6-10 (7.6)	6-11 (8.1)	7-11 (9.2)
Troch- anter	length in μ	61-70 (64)	64-70 (67)	70-76 (73)
	h.s.	2-4 (2.8)	2-4 (3.0)	2-5 (3.4)
Femur	length in μ	174-189 (183)	153-171 (165)	174-186 (180)
	h.s.	11-18 (14.6)	10-16 (12.8)	11-16(13.6)
Tibia	length in μ	226-253 (238)	232-259 (244)	250-293(272)
	h.s.	29-38 (33.2)	30-42 (36.1)	32-46 (38.4)
Tarsus	length in μ	82-92 (85)	85-95 (89)	89-101 (95)
	h.s.	17-23 (19.2)	16-23 (19.6)	18-25 (21.2)
Total length of leg in μ		613-659 (631)	607-656 (625)	659-720(683)

Abdomen: 342 - 471 (410) μ long and 296 - 334 (319) μ wide. The tergites of abdominal segment I small; that of segment VIII large though weakly sclerotized. The sternites of segment VIII ill-defined. The ostioles absent. Abdominal setae: Dorsal (ads) and ventral setae (avs) arranged in transverse irregular rows; pleural setae (aps) in lateral groups. The following table shows the number of the abdominal setae on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	(3)	3 - 4 (3.4)	(3)	3 - 4 (3.1)	3 - 4 (3.1)	2 - 3 (2.9)	(2)	*(1)
(aps)	2 - 3 (2.3)	3 - 4 (3.1)	3 - 4 (3.6)	(4)	(4)	(4)	3 - 4 (3.7)	*1+ (2)
(avs)	-	1 - 2 (1.1)	1 - 2 (1.7)	2 - 3 (2.3)	2 - 3 (2.8)	2 - 3 (2.8)	2 - 3 (2.5)	(2)

* Slightly longer setae.

Setae of the glandular pouch (gls) include a pair of 116 - 140 (128) μ long tail setae (ts), the ratio their length to the total body length being 1:7.7 - 10.3 (8.8).

Genital segment: The genital capsule (gc) moderately large, 128 - 143 (134) μ long and 85 - 95 (89) μ wide, i.e. the ratio length to width 1.4 - 1.6 (1.5):1 and the ratio its length to the total length of the body 1:7.8 - 8.9 (8.4). The style (st) rather straight in lateral view, apically pointed. The anal opening (an) about 12 μ in diameter. The aedeagus (aed) tubular, with a short, strongly sclerotized basal rod (bra). Setae of the genital segment (gt): Dorsally 2 long setae always present on each side of the style near its base; ventrally, 4 - 6 (5.1) smaller setae occur on each side of the genital capsule.

Material examined: 10 specimens examined, obtained from the following two lots, both of which completely agreed with each other: (A) 5 specimens collected by K. Boratynski, on Agave decipiens, in Kew Gardens, England, on 27.6.1957. (B) 5 specimens collected by myself, on Agave franzosinii, also in Kew Gardens, England, during the last two weeks of June, 1964.

This species was also recorded by Dr. Boratynski on Agave parryi.

GENUS GOSSYPARIA:(22) GOSSYPARIA SPURIA (MOD.)

Macropterous and brachypterous forms of this species were available for study.

(A) The macropterous form (Plate XXIII, figs. 44 and 45)

The males moderately robust, comparatively large, with short antennae and short legs. When mounted 1442 - 1512 (1484) μ long, 392 - 420 (406) μ wide and 2520 - 2758 (2632) μ wing expanse.

Body setae: The antennae with numerous fleshy and few hair-like setae, about 37 μ long; the body itself and the legs with much shorter hair-like setae only.

Head: Subtetrahedron; triangular in dorsal view and more or less rounded in front view; ventral preocular depression absent in lateral view. Length from apex to postoccipital ridge 122 - 131 (127) μ ; from apex to neck 189 - 198 (194) μ ; width across the genae 238 - 250 (244) μ . The midcranial ridge well developed and cruciform; dorsal arm short, joining the lateral and the ventral arms at the apex of the head. Postoccipital ridge (por) strongly developed, laterally bending posteriorly and giving off a short, heavily sclerotized extension anteriorly. Dorsomedial part of the epicranium (dmep) narrow, weakly sclerotized. Pre and postocular ridges (procr & pocr) well separated; preoral ridge slender.

Eyes: The dorsal simple eyes (dse) slightly projecting beyond the outer margins of the head in dorsal view; their corneae 24 - 27 (26) μ in diameter and separated by 128 - 137 (134) μ , i.e. 5.0 - 5.6 (5.3) times their diameter apart. The ventral simple eyes (vse) equal to the dorsal in diameter and 37 - 40 (39) μ apart. The lateral

PLATE XXIII

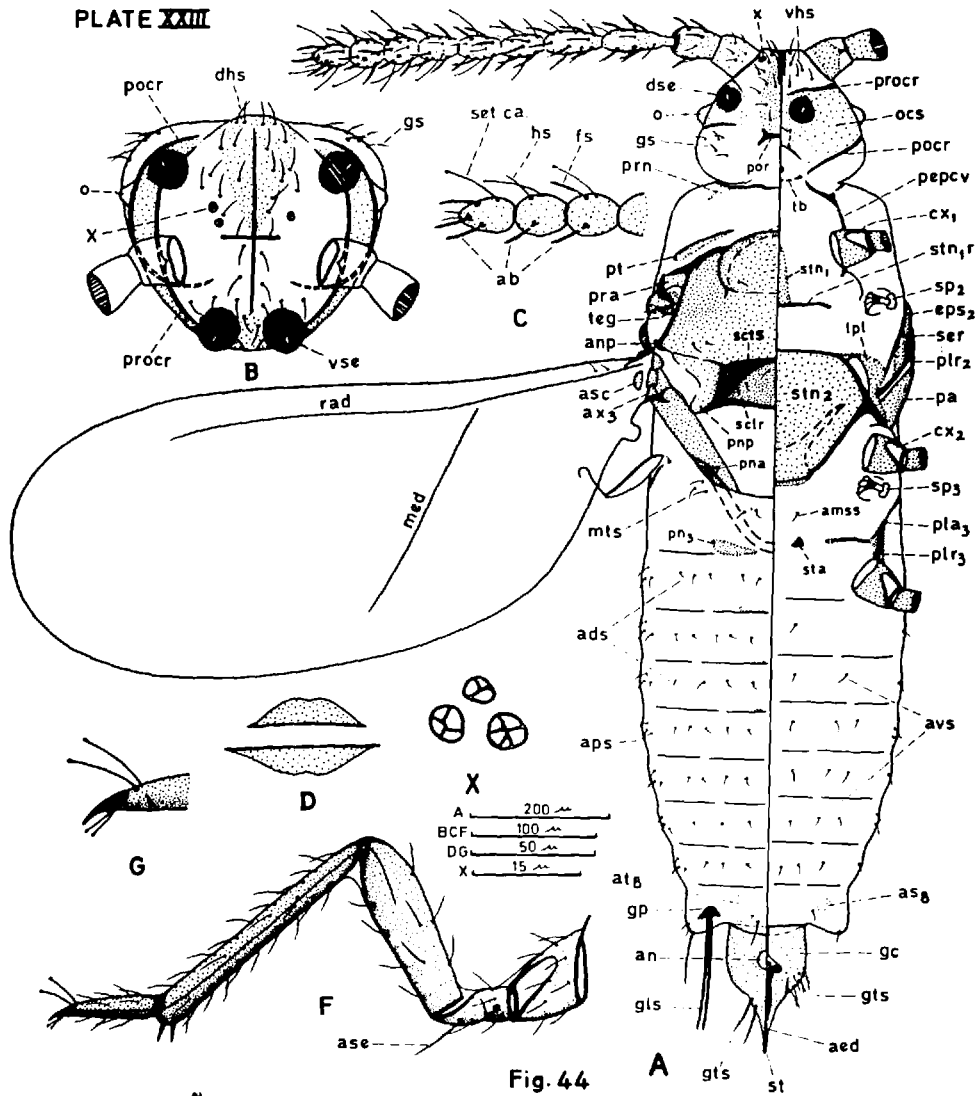


Fig. 44

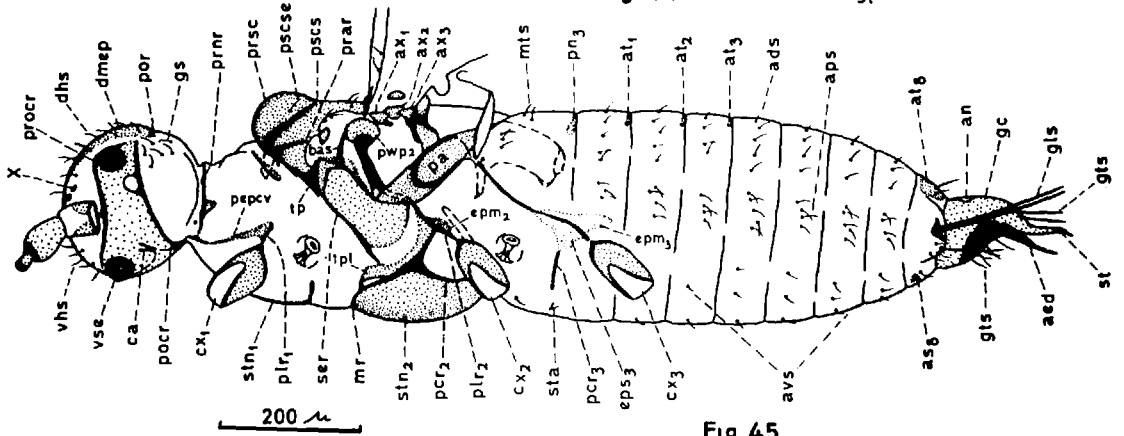


Fig. 45

ocelli (o) large, closely attached to the postocular ridge. Cranial apophysis (ca) apically bifurcate. Anterior tentorial arms join the cranial apophysis separately; tentorial bridge (tb) stout. Dorsal head setae (dhs): 10 - 14 (11.8) h.s. on each side of the median line, anterior to the postoccipital ridge; each gena with 4 - 6 (5.0) genal setae (gs). Ventral head setae (vhs): Setae between the ventral simple eyes absent; 3 - 5 (4.1) h.s. just anterior to the preocular ridges, forming with those of the other side a transverse irregular row; anteriorly, 2 - 3 (2.5) h.s. longitudinally arranged on each side of the ventral arm of the midcranial ridge.

One and sometimes two (av. 1.2) small bodies of unknown homology (X) occur dorsally on each side of the dorsal arm of the midcranial ridge, near the apex of the head.

Antennae: Rather moniliform; 10-segmented; 625 - 677 (653) μ long, i.e. somewhat shorter than half the length of the body, the ratio being 1:2.2 - 2.4 (2.3) and equal or slightly shorter than the hind legs, the ratio 1:1.0 - 1.2 (1.1). Scape 52 - 55 (54) μ long and 55 - 58 (57) μ wide at base; with 4 - 5 (4.5) h.s. Pedicel 67 - 70 (69) μ long and 49 μ wide; with 3 - 5 (4.0) f.s., 2 - 4 (3.0) h.s. and a sensillum placodeum. Flagellum: Flagellar segments IV to VII 31 - 37 (34) μ wide; segments III and X slightly narrower and segments VIII and IX slightly wider. Segment III club-shaped and longest of all, the ratio its length to the length of segment X being 1.7 - 1.9 (1.8):1 and the ratio its width to its length 1:3.1 - 3.6 (3.4). Segments IV to IX barrel-shaped, the ratio width to length of segment IX 1:1.2 - 1.5 (1.4). The terminal segment pear-shaped. Segments V to X and sometimes IV also, with a few apically knobbed, about 52 μ long capitate sensory setae (set. ca.). The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	95-98 (97)	82-85 (84)	61-67 (64)	61-70 (66)	58-64 (61)	49-55 (52)	49-55 (52)	52-58 (55)
f.s. (av.)	4-8 (6)	15-19 (17)	7-10 (8.5)	8-12 (10)	10-13 (11.5)	10-14 (12)	9-12 (10.5)	8-11 (9.5)
h.s. (av.)	3-4 (3.5)	3-5 (4)	2-3 (2.5)	1-3 (2)	1-2 (1.5)	1-2 (1.5)	1-2 (1.5)	1-2 (1.5)
Set.ca. (av.)	0 0	0-1 (0.5)	3-4 (3.5)	2-4 (3.0)	3-4 (3.5)	2-4 (3.0)	3-4 (3.5)	3-4 (3.5)

Antennal bristles (ab) subequal to the fleshy setae in length but distinctly stouter; segments VIII and IX each with one ventral bristle. Terminal segment with one dorsal preapical bristle, two lateral ones at a greater distance from the apex and two apical small setae.

Thorax: 585 - 623 (608) μ long. Pronotal ridges (prnr) medially interrupted at a weakly sclerotized point; lateral pronotal sclerites (prn) small. Posttergites (pt) narrow. Proepisternum without any ridge-like sclerotization. Prosternum (stnl) comparatively long and narrow, 82 - 85 (84) μ long; posteriorly bounded by a 119 - 125 (122) μ long prosternal ridge (stnlr). The prothoracic setae absent altogether.

Mesothorax: Prescutum (prsc) 89 - 98 (95) μ long and 171 - 174 (173) μ wide, the ratio being 1:1.8 - 2.0 (1.9); prescutal ridge well

developed and prescutal suture (pscs) distinct. Scutum 91 - 95 (94) μ long, i.e. the ratio lengths of prescutum to scutum 1:0.9 - 1.1 (1.0). Prealare (pra), prealar ridge (prar), tegular (teg), triangular plate (tp), anterior and posterior notal wing processes (anp & pnp) well developed. Scutellum transverse, rectangular in dorsal view; 70 - 73 (72) μ long and 159 - 168 (165) μ wide, the ratios length to width being 1:2.2 - 2.4 (2.3) and its length to the length of scutum 1:1.2 - 1.4 (1.3); scutellar ridge (solr) well developed. Postalare (pa) well developed, with the anterior and the posterior ridges anteriorly joined. Postnotal apophysis (pna) large. Mesopleuron: Mesopleural ridge (plr2) continuous above the coxal articulation, dorsally supporting the pleural wing process (pwp2). Basalare (bas) comparatively slender. Subepisternal ridge (ser) well developed. Mesepisternum (eps2) distinct and mesepimeron (epm2) small. Lateropleurite (lpl) large, with an oval membranous area. Mesosternum: Basisternum (stn2) 183 - 195 (189) μ long and 241 - 250 (247) μ wide; the marginal (mr), precoxal ridges (pcr2) and the furca well developed. Mesothoracic spiracles (sp2) 21 - 24 (23) μ wide at opening, with a 46 - 52 (49) μ long supporting bar. Mesothoracic setae on each side of the median line: One hair-like prescutal setae (pscse) always present; scutal as well as scutellar setae 2 - 3 (2.5) h.s. Tegular setae always 2. Postmesostigmatal and basisternal setae absent. Metathorax: Metapostnotal sclerites (pn3) ill-defined; Metapostnotal ridge absent. Metapleural ridge (plr3) attenuated as usual near the middle; dorsally supporting a small pleural wing process. Precoxal ridge (pcr3) strong and metasternal apophysis (sta) distinct. Metathoracic spiracles (sp3) identical with the mesothoracic. Metathoracic setae: 4 - 5 (4.5) metatergal setae (mts) and one anterior metasternal seta (amss) present on each side; metapleural and posterior metasternal setae absent.

Wings: Hyaline; 1064 - 1148 (1106) μ long and 420 - 490 (462) μ wide; axillary, additional sclerites and alar lobe well developed; 2 alar setae always present. Hamulohalterae 92 μ long and 24 - 27 (26) μ wide; with a slender ridge and a 52 - 58 (55) μ long apically hooked seta, the ratio its length to the length of the hamulohaltera being 1:1.6 - 1.8 (1.7).

Legs: Well developed, short and stout; the middle legs usually shortest and the hind legs longest; the ratio length of the hind leg to the total length of the body 1:2.1 - 2.2 (2.15). Coxa and trochanter about 64 and 37 μ wide respectively; the basal part of the latter shorter than the distal and with 3 circular sensilla on each side; the trochanter also with a differentiated long apical seta (ase). Femur about 46 μ wide; that of the middle leg shortest and those of the fore and the hind legs subequal; the ratio width to length of the hind femur 1:3.5 - 4.0 (3.8). Tibia about 24 μ wide; with 2 apical spurs; in fore leg the femur slightly shorter than the tibia, the ratio their lengths being 1:1.2 - 1.4 (1.3). Tarsus about 21 μ wide; tarsal digitules apically knobbed, about 37 μ long. Claw broad at base, abruptly tapering apically; 21 - 24 (23) μ long; ungual digitules also apically knobbed, about 18 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore-leg	Middle leg	Hind leg
	length in μ	55-61 (58)	55-61 (58)	58-64 (61)
Coxa	h.s.	8-12 (9.4)	8-11 (9.1)	10-14 (11.6)
	length in μ	73-76 (74)	73-76 (74)	76-79 (77)
Troch- anter	h.s.	4-6 (5.1)	4-5 (4.6)	4-6 (5.3)
	length in μ	159-186 (174)	146-165 (156)	162-183 (174)
Femur	h.s.	15-22 (18.5)	14-20 (16.8)	14-18 (15.9)
	length in μ	214-238 (229)	217-244 (232)	226-259 (247)
Tibia	h.s.	18-29 (24.4)	20-34 (27.6)	22-35 (28.8)
	length in μ	67-76 (73)	67-79 (74)	70-82 (76)
Tarsus	h.s.	10-12 (11.1)	10-13 (11.8)	11-15 (13.3)
Total length of leg in μ		589-659 (628)	580-647 (613)	613-689 (656)

Abdomen: 540 - 578 (560) μ long and 380 - 410 (395) μ wide. The tergites of segments I, II and sometimes III weak and narrow; that of segment VIII (at8) large. The sternites of segment VIII (as8) ill-defined. The ostioles absent. Abdominal setae in dorsal, ventral transverse irregular rows and pleural groups. The number of the abdominal setae on each side of the median line are given in the following table:

	I	II	III	IV	V	VI	VII	VIII
(ads)	5 - 6 (5.5)	4 - 6 (5.0)	4 - 5 (4.5)	4 - 5 (4.7)	3 - 4 (3.5)	(3)	(3)	*1+1-2 (1.5)
(aps)	3 - 4 (3.7)	3 - 4 (3.5)	4 - 5 (4.4)	4 - 5 (4.5)	4 - 5 (4.4)	(5)	4 - 5 (4.5)	**1+ (3)
(avs)	-	(1)	(2)	2 - 3 (2.5)	2 - 3 (2.7)	2 - 3 (2.6)	2 - 3 (2.7)	(1)

* A slightly longer seta.

** A considerably longer seta, about 90μ long.

The setae of the glandular pouch (gls) only include a pair of 168 - 177 (173μ) long tail setae, the ratio their length to the total length of the body being 1:8.1 - 9.0 (8.6).

Genital segment: The genital capsule (gc) moderately large, 177 - 183 (180μ) long and 110μ wide, i.e. the ratio length to width 1.6 - 1.7 (1.65):1 and the ratio its length to the total length of the body 1:8.1 - 8.3 (8.2); the style (st) undulating and apically pointed in lateral view. Anal opening (an) about 24μ in diameter. Aedeagus (aed) well developed, with a well sclerotized lateral margins and uniformly tapering towards a sharply pointed tip. Setae of the genital segment (gts): Dorsally two conspicuously long setae always present on each side near the base of the style; ventrally 7 - 9 (8.0) slightly smaller setae occur on each side of the genital capsule.

Material: 3 specimens only were available, collected by A. Dziedzicka, on Ulmus sp., in Mogila, Nr. Nowa Huta, Nr. Krakow, Poland, on 26.4.1963.

(B) The brachypterous form (Plate XXIV, fig. 46)

These males rather robust, with the abdomen slightly broader than the thorax; comparatively large, with short antennae and short legs. Mounted specimens 1274 - 1470 (1358) μ long, 336 - 378 (350) μ wide at mesothorax and 546 - 938 (686) μ wing expanse.

Body setae: The antennae with numerous fleshy and a few hair-like setae, about 31 μ long. The body itself and the legs with much shorter hair-like setae only.

Head: Subtetrahedron; triangular in dorsal view and rather rounded in front view; ventral preocular depression absent. Length from apex to postoccipital ridge 128 - 153 (140) μ ; from apex to neck 183 - 214 (192); width across the genae 226 - 244 (235) μ . The midoranal ridge well developed and cruciform; dorsal arm short, joining the lateral and the ventral arms at the apex of the head. Postoccipital ridge (pcr) laterally forked into anteriorly and posteriorly directed branches. Dorsomedial part of the epicranium (dmp) slightly raised. Pre and postocular ridges (procr & pocr) well separated; preoral ridge slender.

Eyes: The dorsal simple eyes (dse) slightly projecting beyond the outer margins of the head in dorsal view; their corneae 15 - 21 (18) μ in diameter and separated by 140 - 156 (150) μ ; i.e. 6.7 - 9.8 (8.2) times their diameter apart. The ventral simple eyes (vse) equal or slightly smaller than the dorsal, their corneae 12 - 18 (16) μ in diameter and 61 - 82 (70) μ apart. Ocellus (o) vestigial and only represented by a sclerotized spot, attached to the postocular ridge by means of a slender sclerotized arm. Cranial apophysis (ca) apically bifurcate. Tentorial bridge (tb) stout; anterior tentorial arms join the cranial apophysis separately (fig. 46, I). The mouth opening (mo) small, situated on a large mouth tubercle (mt) posteriorly. Dorsal head setae (dhs): 8-14(10.1) h.s. on each/

PLATE **XIV**

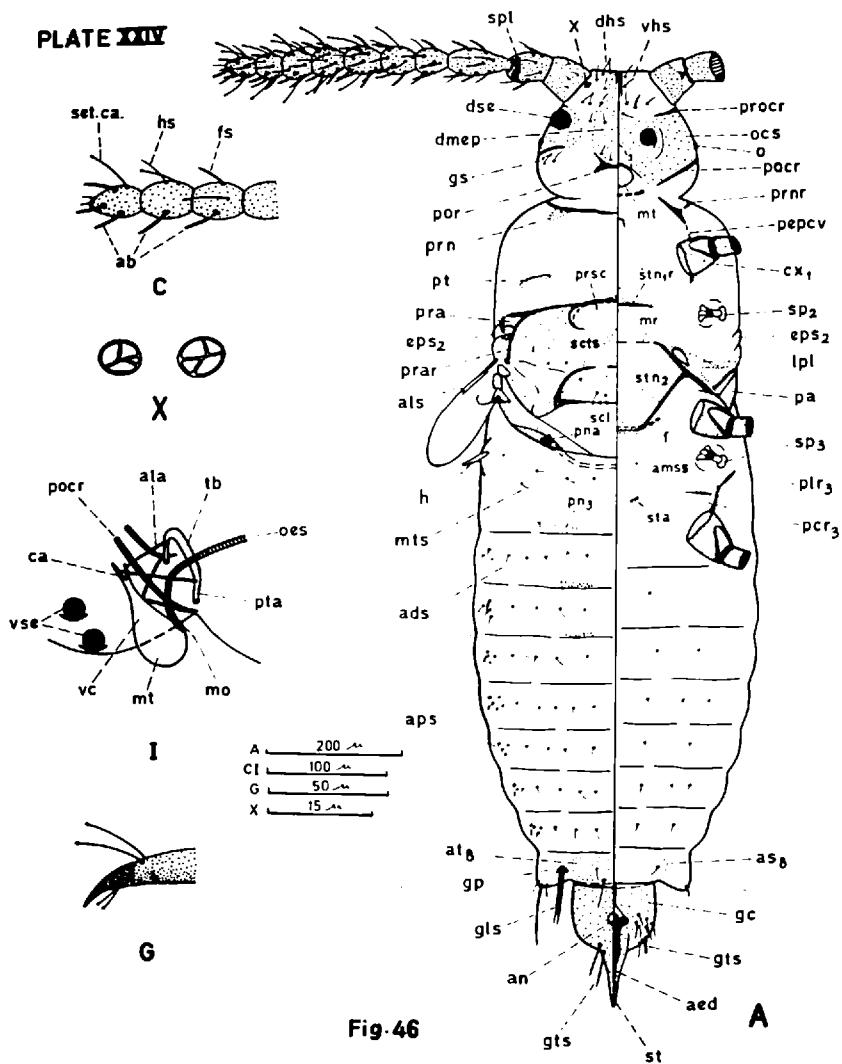


Fig. 46

side anterior to the postoccipital ridge; each gena usually with 2 - 4 and occasionally 1 or 5 (av. 2.9) genal setae (gs). Ventral head setae (vhs): The setae between the ventral eyes absent; 3 - 5 (4.2) h.s. just anterior to the preocular ridges, forming with those of the other side a transverse irregular row; anteriorly 1 - 2 (1.6) h.s. present on each side of the ventral arm of the midcranial ridge.

A small body of unknown homology (X) always present dorsally on each side of the dorsal arm of the midcranial ridge, near the apex of the head.

Antennae: Rather moniliform; 10-segmented; 491 - 583 (534) μ long, i.e. shorter than half the length of the body, the ratio being 1:2.3 - 2.7 (2.5) and slightly shorter than the hind legs, the ratio about 1:1.1. Scape 46 - 58 (52) μ long and 61-70 (64) μ wide at base; almost always with 4 and occasionally 5 h.s. (av. 4.2). Pedicel 58 - 67 (61) μ long and 46 - 52 (50) μ wide; with 1 - 4 (2.2) f.s., 3 - 7 (5.5) h.s. and a sensillum placodeum (spl). Flagellum: Flagellar segments III to IX 37 - 43 μ wide (segments VI, VII and sometimes VIII somewhat wider than the preceding segments); segment X 31 - 34 μ wide. Segment III club-shaped and longest of all, the ratio its length to the length of segment X 1.5 - 2.0 (1.8):1 and the ratio its width to its length 1:1.8 - 2.3 (2.1). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1:0.9 - 1.1 (1.0). Terminal segment pear-shaped. Segments VI to X and sometimes V also, with a few apically knobbed, about 43 μ long capitate sensory setae (set. ca.). The lengths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII	IX	X
length in μ (av.)	73-92 (82)	46-58 (49)	46-61 (58)	46-61 (55)	43-55 (49)	37-46 (43)	37-46 (40)	43-55 (46)
f.s. (av.)	7-15 (11.9)	7-11 (9.2)	8-16 (11.8)	12-17 (14.1)	13-17 (14.9)	7-14 (10.3)	8-12 (9.2)	4-8 (5.1)
h.s. (av.)	3-6 (5.1)	1-3 (2.1)	1-3 (1.9)	1-3 (1.1)	1-2 (1.2)	0-2 (0.8)	0-1 (0.5)	0-1 (0.4)
set.ca. (av.)	0 0	0 0	0-2 (1.1)	1-4 (1.9)	2-5 (3.2)	2-5 (3.1)	2-4 (2.6)	3-4 (3.6)

Antennal bristles (ab) well defined; segments VIII and IX each with one ventral bristle. Segment X with one dorsal preapical bristle, two lateral ones at a greater distance from the apex and two apical small hair-like setae.

Thorax: 372 - 471 (426) μ long. Pronotal ridges (prnr) medially interrupted at a weakly sclerotized point; lateral pronotal sclerites (prn) and posttergites (pt) small. Proepisternum without any ridge-like sclerotization. Prosternum narrow, 24 - 34 (27) μ long; prosternal ridge (stnlr) 79 - 92 (89) μ long. Prothoracic setae almost always absent but one medial pronotal, one lateral pronotal and one antespiracular dorsal seta were found on each side of one specimen.

Mesothorax: Prescutum (prsc) 43 - 52 (46) μ long and 122 - 143 (131) μ wide, the ratio being 1:2.5 - 3.2 (2.9); prescutal ridge slender and prescutal suture distinct. Scutum (sct) 31 - 55 (49) μ long, i.e. the ratio lengths of prescutum to scutum 1:0.7 - 1.4 (1.1).

The prealare (pra), prealar ridge (prar), tegula and triangular plate conspicuously degenerate. Scutellum (scl) trapezoid in dorsal view; 43 - 61 (55) μ long and 159 - 183 (168) μ wide, the ratios length to width 1:2.6 - 3.7 (3.1) and its length to the length of scutum 1.0 - 1.5 (1.1):1; scutoscutellar suture (scts) weakly developed and usually partly missing; scutellar ridge absent. Postalare (pa) with the anterior and the posterior ridges anteriorly joined. Postnotal apophysis (pna) greatly reduced. Mesopleuron: Mesopleural ridge continuous above the coxal articulation, dorsally supporting a small pleural wing process. Basalare extremely weak and slender. Subepisternal ridge atrophied and sometimes absent altogether. Mesepisternum (eps2) well-defined and mesepimeron small. Lateropleurite (lpl) comparatively large, with a small oval membranous area. Meso-sternum: Basisternum (stn2) 107 - 131 (119) μ long and 177 - 201 (186) μ wide; the marginal ridge (mr) usually partly absent anteriorly; the precoxal ridge slender and the furca (f) greatly reduced. Meso-thoracic spiracles (sp2) 18 - 24 (21) μ wide at opening, with a 46 - 52 (49) μ long supporting bar. Mesothoracic setae on each side: Prescutal setae absent; scutal setae 1 - 5 (2.9) h.s.; scutellar setae 1 - 3 (1.8) h.s. Tegular setae 0 - 1 (0.2) h.s. Postmeso-stigmatal and basisternal setae absent. Metathorax: Metapostnotal sclerites (pn3) narrow and ill-defined; metapostnotal ridge (pn3r) absent. Metapleural ridge (plr3) weak, attenuated near the middle as usual and dorsally reduced. Precoxal ridges of metathorax absent and metasternal apophysis (sta) vestigial. Metathoracic spiracles (sp3) similar to the mesothoracic. Metathoracic setae on each side of the median line: Metatergal setae (mts) 3 - 8 (4.7) h.s. and anterior metasternal setae (amss) 0 - 1 (0.9) h.s.; metapleural setae absent and posterior metasternal setae 0 - 1 (0.3).

Wings: Hyaline and greatly reduced; 126 - 308 (182) μ long and 42 - 140 (84) μ wide; axillary sclerites small; additional sclerite and alar lobe absent; one alar seta (als) almost always present and

occasionally absent (av. 0.8). Hamulohalterae (h) atrophied and sometimes absent altogether; when present 31 - 52 (40) μ long and 12 - 18 (15) μ wide; the hamulohalteral ridge and the seta absent.

Legs: Well developed, short and stout; the middle legs usually shortest and the hind legs longest; the ratio length of the hind leg to the total length of the body 1:2.2 - 2.4 (2.3). Coxa and trochanter about 64 and 37 μ wide respectively; the basal part of the latter shorter than the distal and with 3 circular sensilla on each side; the trochanter also with a long apical seta. Femur about 49 μ wide; that of the middle leg shortest and those of the fore and hind legs subequal; the ratio width to length of the hind femur 1:2.9 - 3.4 (3.1). Tibia about 31 μ wide; with 2 apical spurs; in fore leg the femur shorter than the tibia, the ratio their lengths being 1:1.1 - 1.2 (1.15). Tarsus about 27 μ wide; tarsal digitules apically knobbed, about 34 μ long. Claw wide at base, abruptly tapering apically; 21 - 24 (22) μ long; ungual digitules apically knobbed, about 18 μ long. The lengths of the leg segments and the number of setae on each are given in the following table:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	52-58 (55)	52-58 (55)	55-61 (58)
	h.s.	7-11 (9.5)	7-10 (8.9)	8-13 (11.7)
Troch- anter	length in μ	64-70 (67)	64-70 (68)	70-79 (73)
	h.s.	4-5 (4.5)	4-5 (4.4)	4-6 (5.1)
Femur	length in μ	143-168 (156)	134-153 (143)	140-168(153)
	h.s.	11-16 (13.1)	8-12 (10.4)	9-13 (11.8)
Tibia	length in μ	168-189 (180)	168-189 (180)	177-214(198)
	h.s.	16-22 (18.5)	15-23 (19.1)	14-21 (18.2)
Tarsus	length in μ	70-76 (72)	70-79 (74)	73-85 (79)
	h.s.	9-12 (10.7)	9-13 (11.2)	11-14 (12.5)
Total length of leg in μ		516-583 (549)	506-570 (540)	534-622(583)

Abdomen: 570 - 646 (608) long and 365 - 426 (395) μ wide. The tergites of segments I and II weak and narrow; that of segment VIII large. The sternites of segment VIII ill-defined. The ostioles absent. Abdominal setae in dorsal, ventral transverse irregular rows and pleural groups. The following table shows the number of the abdominal setae on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	3 - 7 (5.1)	3 - 6 (4.6)	3 - 5 (4.4)	3 - 6 (4.3)	3 - 5 (4.1)	3 - 5 (3.8)	2 - 4 (3.1)	*1+1-2 (1.4)
(aps)	3 - 4 (3.3)	3 - 5 (3.9)	3 - 5 (4.3)	3 - 5 (3.8)	4 - 5 (4.4)	3 - 4 (3.8)	3 - 4 (3.8)	**1+ (3)
(avs)	-	(1)	1 - 2 (1.9)	2 - 3 (2.7)	2 - 3 (2.9)	(3)	2 - 3 (2.9)	1 - 2 (1.1)

* A slightly longer seta.

** The longest body seta, 85 - 95 (89) μ long.

Glandular pouches (gp) comparatively very small; the setae of the glandular pouch (gls) only include a pair of comparatively short tail setae, 46 - 92 (73) μ long, i.e. the ratio their length to the total length of the body 1:15.2 - 26.3 (18.6).

The appearance and structure of the genital segment similar to that of the macropterous form; the genital capsule (gc) 162 - 192 (177) μ long and 113 - 131 (122) μ wide, the ratio 1.4 - 1.5 (1.45):1 and the ratio its length to the total length of the body 1:7.0 - 8.1 (7.7). Anal opening (an) 15 - 21 (18) μ in diameter. Setae of the genital segment (gts): Dorsally two long setae always present on each side near the base of the style (st); ventrally 8 - 12 (9.6) slightly smaller setae occur on each side of the genital capsule.

Material: 10 specimens examined, received in two lots as follows:
 1) 5 specimens collected by A. Dziejzicka, on Ulmus sp., in Krakow, Poland, during May, 1964.
 2) 5 specimens also collected by Dziejzicka, on Ulmus sp., in Moglia, Nr. Krakow, Poland, on 26.4.1963.

(23) GOSSYPARIA SALICICOLA BORCHS. (Plate XXV, figs. 47 and 48)

Brachypterous form only known. The males rather robust, with the abdomen slightly broader than the thorax; comparatively large, with short antennae and short legs. When mounted 1302 - 1442 (1373) μ long, 322 - 350 (336) μ wide at mesothorax and 532 - 980 (644) μ wing expanse.

Body setae: The antennae with numerous fleshy and a few hair-like setae, about 28 μ long. The body itself and the legs with much shorter hair-like setae only.

Head: Subtetrahedron; triangular in dorsal view and rather rounded in front view; ventral preocular depression absent in lateral view. Length from apex to postoccipital ridge 131 - 143 (137) μ ; from apex to neck 189 - 204 (195) μ ; width across the genae 223 - 244 (229) μ . The midcranial ridge cruciform; dorsal arm (dmcr) short, joining the lateral and the ventral arms (vmcr) at the apex of the head. Postoccipital ridge (por) laterally forked. Dorsomedial part of the epicranium (dmp) slightly raised. Preocular (procr) and postocular ridges (pocr) well separated; preoral ridge slender.

Eyes: The dorsal simple eyes (dse) slightly projecting beyond the outer margins of the head in dorsal view; their corneae 18 - 21 (20) μ in diameter and separated by 134 - 165 (146) μ , i.e. 6.3 - 8.5 (7.0) times their corneae apart. The ventral simple eyes (vse) equal or slightly smaller than the dorsal, 18 - 21 (19) μ in diameter and 73 - 95 (82) μ apart. Ocellus (o) vestigial and merely represented by a sclerotized spot, attached to the postocular ridge by means of a slender sclerotization. Cranial apophysis (ca) apically bifurcate. Tentorial bridge stout. The mouth tubercle (mt) large. Dorsal head setae (dhs): 10 - 15 (12.5) h.s. on each side anterior to the post-occipital ridge; each gena usually with 3 - 6 and occasionally 8

PLATE XXV

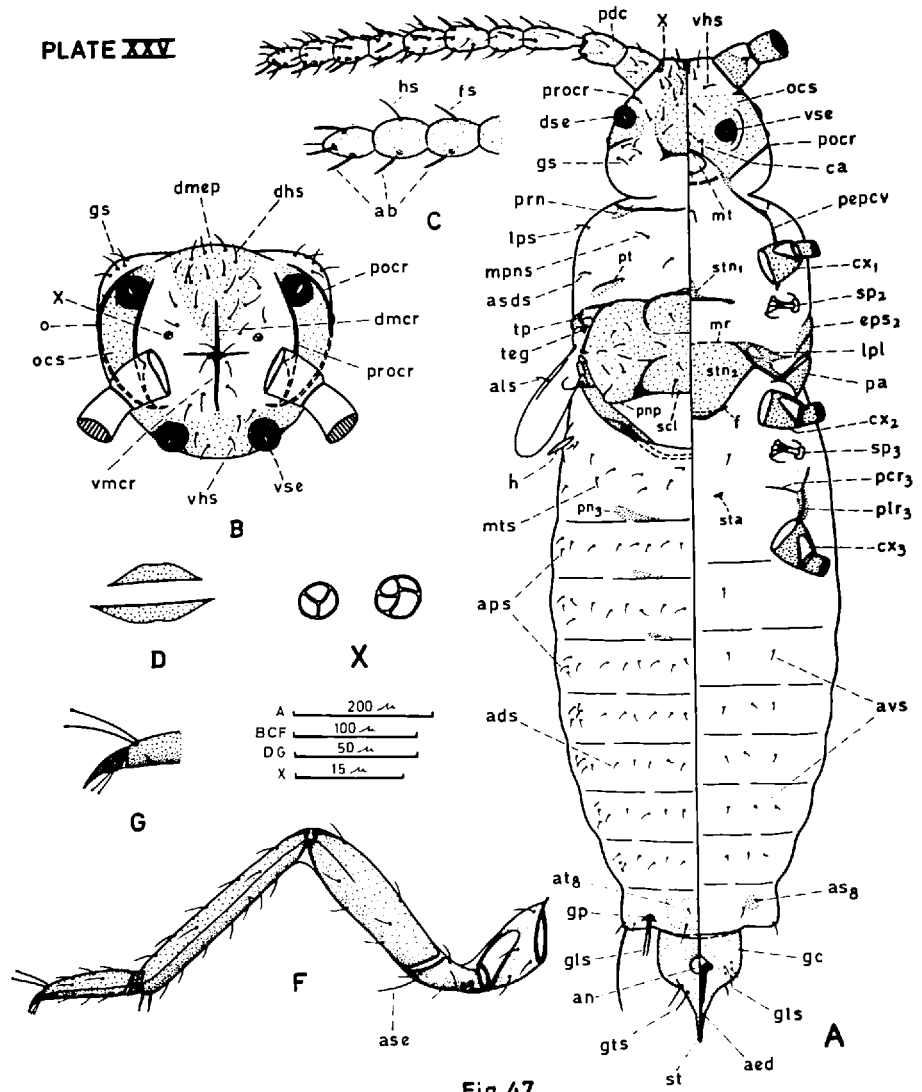


Fig.47

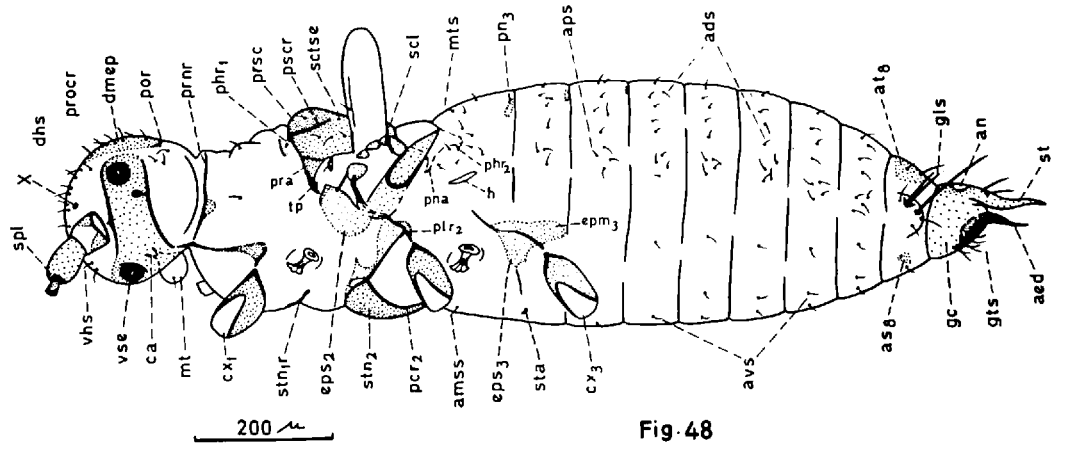


Fig.48

200 μm

(av. 4.7) genal setae (gs). Ventral head setae (vhs): Setae between the ventral eyes absent; 2 - 4 (2.8) h.s. just anterior to the pre-ocular ridges, forming with their partners of the other side a transverse irregular row; anteriorly 1 - 2 (1.5) h.s. present on each side of the ventral arm of the midcranial ridge. The mouth tubercle with 1 - 2 (1.6) h.s.

A small body of unknown homology (X) occurs dorsally on each side near the apex of the head.

Antennae: Rather moniliform; 10-segmented; 522 - 583 (549) μ long, i.e. shorter than half the body length, the ratio being 1:2.3 - 2.6 (2.5) and slightly shorter than the hind legs, the ratio 1:1.1 - 1.2 (1.13). Scape 46 - 52 (49) μ long and 55 - 61 (58) μ wide at base; always with 4 h.s. Pedicel (pdc) 61 - 67 (64) μ long and 43 - 46 (45) μ wide; with 1 - 2 (1.1) f.s., 2 - 3 (2.4) h.s. and a sensillum placodeum. Flagellum: Segment III - IX 34 - 40 μ wide and segment X 27 - 31 (29) μ wide. Segment III club-shaped and longest of all, the ratio its length to the length of segment X 1.7 - 2.1 (1.9):1 and the ratio its width to its length 1:2.2 - 2.5 (2.3). Segments IV to IX barrel-shaped, the ratio width to length of segment IX being 1:1.0 - 1.4 (1.2). Terminal segment pear-shaped. The apically knobbed sensory setae entirely absent on the antennae. The following table shows the lengths of the flagellar segments and the number of setae on each:

	III	IV	V	VI	VII	VIII	IX	X
Length In μ (av.)	76-92 (85)	46-61 (50)	52-67 (61)	49-64 (58)	49-61 (52)	40-49 (46)	37-46 (43)	43-46 (45)
f.s. (av.)	3-8 (5.1)	3-9 (6.2)	5-9 (7.4)	7-12 (9.5)	8-15 (10.8)	5-8 (7.1)	4-8 (6.2)	2-4 (2.8)
h.s. (av.)	2-6 (3.3)	2-4 (2.9)	1-2 (1.5)	1-2 (1.3)	1-3 (1.8)	0-1 (0.7)	1-2 (1.2)	0-1 (0.6)

Antennal bristles (ab) well-defined; segments VIII and IX each with one ventral bristle. Terminal segment with one dorsal preapical bristle, two lateral ones at a greater distance from the apex and one or two apical small hair-like setae.

Thorax: 403 - 464 (433) μ long. The thoracic structures, ridges and plates similar to G. spuria. Prosternum (stn1) and prosternal ridge 21 - 27 (24) and 82 - 95 (89) μ long respectively. Prothoracic setae on each side: Medial pronotal setae (mpns) 0 - 3 and occasionally 5 (av. 1.4) h.s.; lateral pronotal and antespiracular dorsal setae (lps) & asds) usually absent but 1 - 2 h.s. occasionally occur on either or both sides (averages 0.5 and 0.4 h.s. respectively). Antespiracular ventral and prosternal setae absent.

Mesothorax: Prescutum 52 - 64 (58) μ long and 119 - 137 (131) μ wide, the ratio being 1:1.9 - 2.6 (2.3). Scutum 24 - 40 (32) μ long, i.e. the ratio lengths of prescutum to scutum 1.3 - 2.6 (1.8):1. Scutellum (scl) 40 - 58 (52) μ long and 150-165 (156) μ wide, the ratios its length to its width 1:2.7 - 3.8 (3.0) and its length to the length of scutum 1.2 - 2.1 (1.6):1. Basisternum (stn2) 101 - 122 (110) μ long and 168 - 183 (177) μ wide. Mesothoracic spiracles (sp2) 18 - 21 (20) μ wide at opening, with a 49 - 55 (52) μ long supporting bar. Mesothoracic setae on each side: Prescutal seta

0 - 1 (0.3) h.s.; scutal setae 2 - 6 (3.3) h.s.; scutellar setae 1 - 3 (1.6) h.s. Tegular setae 0 - 1 (0.3). Postmesostigmatal and basisternal setae absent. Metathoracic setae on each side: Metatergal setae (mts) 6 - 14 (8.6) h.s.; one anterior metasternal seta always present; metapleural and posterior metasternal setae absent.

Wings: Hyaline and greatly reduced; 112 - 336 (168) μ long and 42 - 98 (56) μ wide; axillary sclerites small; additional sclerites and alar lobe absent: alar seta (als) 0 - 1 (0.6) h.s. Hamulohalterae (h) atrophied, 27 - 49 (37) μ long and 12 - 15 (14) μ wide.

Legs: Short and stout; the fore and the middle legs subequal in length and the hind legs longest; the ratio length of the latter to the total length of the body 1:2.1 - 2.3 (2.2). Coxa and trochanter about 64 and 40 μ wide respectively; the basal part of the latter shorter than the distal and with 3 circular sensilla on each side; the trochanter also with a differentiated long apical seta (ase). Femur about 49 μ wide; that of the middle leg shortest and those of the fore and hind legs subequal; the ratio width to length of the hind femur 1:3.3 - 3.5 (3.4). Tibia about 31 μ wide; with 2 apical spurs; in fore leg the ratio lengths of femur to tibia 1:1.17 - 1.24 (1.2). Tarsus about 24 μ wide; tarsal digitules apically knobbed, about 37 μ long. Claw 18 - 24 (21) μ long; ungual digitules also apically knobbed, about 18 μ long. The following table shows the lengths of the leg segments and the number of setae on each:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	49-55 (52)	49-55 (52)	52-58 (55)
	h.s.	5-9 (7.4)	5-10 (8.2)	6-11 (8.5)
Troch- anter	length in μ	64-67 (66)	64-70 (67)	67-73 (70)
	h.s.	3-4 (3.5)	3-4 (3.4)	3-5 (3.9)
Femur	length in μ	159-168 (165)	153-159 (156)	162-171 (168)
	h.s.	8-15 (12.1)	6-12 (9.5)	7-13 (11.2)
Tibia	length in μ	189-204 (198)	192-207 (201)	204-223 (217)
	h.s.	15-19 (16.8)	13-19 (17.1)	13-20 (17.6)
Tarsus	length in μ	76-82 (79)	79-89 (86)	85-92 (89)
	h.s.	7-10 (8.2)	7-11 (9.1)	8-12 (9.9)
Total length of leg in μ		558-595 (580)	558-595 (583)	592-634 (619)

Abdomen: 555 - 684 (623) μ long and 388 - 418 (410) μ wide. The tergites, sternites and arrangement of the abdominal setae similar to G. spuria; ostioles absent. In the following table the number of abdominal setae on each side of the median line are given:

	I	II	III	IV	V	VI	VII	VIII
(ads)	4 - 9 (6.3)	4 - 9 (6.5)	4 - 7 (5.7)	4 - 7 (5.6)	3 - 6 (4.8)	3 - 5 (4.1)	3 - 5 (3.9)	*1+ (1)
(aps)	3 - 4 (3.3)	4 - 5 (4.1)	4 - 5 (4.2)	4 - 5 (4.3)	4 - 5 (4.3)	4 - 5 (4.2)	3 - 4 (3.8)	**1+ (3)
(avs)	-	1 - 2 (1.1)	2 - 3 (2.2)	2 - 4 (3.1)	(3)	(3)	3 - 4 (3.1)	(1)

* A slightly longer seta.

** The longest body seta, 107 - 137 (116) μ long.

Glandular pouches (gp) very small; the setae of the glandular pouch (gls) only include a pair of comparatively short tail setae, 40 - 82 (64) μ long, the ratio their length to the total length of the body being 1:17.1 - 34.9 (20.8). The genital segment ^{identical with} ~~typical of~~ G. spuria; the genital capsule (gc) 146 - 171 (162) μ long and 113 - 122 (119) μ wide, the ratio length to width being 1.3 - 1.5 (1.4):1 and the ratio its length to the total body length 1:7.8 - 9.8 (8.5). Anal opening (an) 18 - 24 (22) μ in diameter. Setae of the genital segment (gts): Dorsally two relatively long setae always present on each side near the base of the style (st); ventrally 7 - 9 (7.8) smaller setae occur on each side of the genital capsule.

Material: 10 specimens examined, collected by G. Matesova on Salix sp., in Alma Ata, Kazakhstan, USSR, on 2.4.1951.

Remarks: This species although very closely related to the brachypterous males of G. spuria, can be mainly distinguished by the absence of the capitate sensory setae on the antennal segments; other minor differences are the acquisition of more numerous abdominal setae and longer anal lobe seta.

GENUS PSEUDOCHERMES:(24) PSEUDOCHERMES FRAXINI (KALT.) (Plate XXVI, fig. 49)

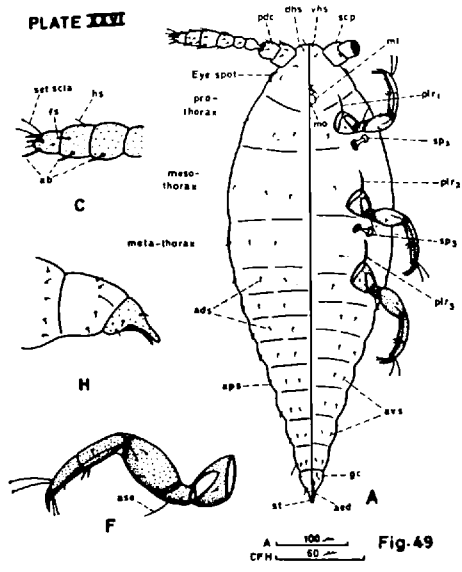
The apterous forms only known; these are degenerate, and appear like the nymphal forms. The males dorso-ventrally flattened, moderately robust and spindle-shaped, i.e. the body broadest at mesothorax and gradually becoming narrower posteriorly; the body ridges and sclerites absent or greatly reduced. A comparatively very small species, with very short antennae and legs; mounted specimens 518 - 658 (602) μ long and 196 - 238 (210) μ wide at mesothorax.

Body setae: The antennae with very few fleshy and hair-like setae, 9 - 12 μ long; the body itself with sparse, slightly smaller hair-like setae only.

Head: Intimately fused with the thorax; the head ridges entirely absent. The eyes represented by weakly sclerotized lateral spots, 89 - 95 (92) μ apart. The cranial apophysis (ca) vestigial, apically bifurcate. The mouth opening (mo) situated on a small, double-bulging mouth tubercle (mt) posteriorly. Dorsal head setae (dhs) 3 - 4 (3.8) and ventral head setae (vhs) 2 - 3 (2.8) h.s. on each side of the median line.

Antennae: Neither filiform nor moniliform, with segment VI distinctly widest of all flagellar segments; normally 8-segmented, but sometimes fusion between adjacent segments occurs; 146 - 174 (162) μ long, i.e. much shorter than half the body length, the ratio 1:3.5 - 3.9 (3.7), and slightly shorter than the hind legs, the ratio 1:1.1 - 1.2 (1.17). Scape (scp) 18 - 24 (20) μ long and 24 - 31 (28)

PLATE XXXI



A 100 — Fig. 49
 CPH 50 —

μ wide; with 2 - 3 (2.4) h.s. Pedicel (pdc) 18 - 27 (21) μ long and 21 - 24 (23) μ wide; with 1 - 2 (1.6) h.s. Flagellum: Segment III club-shaped, with a very narrow stalk; the ratio its length to the length of segment VIII being 1.2 - 1.8 (1.5):1, and the ratio width to length of segments III and VII 1:1.2 - 1.8 (1.4) and 1 - 1.2 (1.1):1 respectively. Segments V and VI becoming progressively wider, and segments VII and VIII decreasing in width.

The lengths, widths of the flagellar segments and the number of setae on each are given in the following table:

	III	IV	V	VI	VII	VIII
length in μ	21-27	15-21	18-24	18-21	18	15 - 18
(av.)	(25)	(17)	(20)	(19)	(18)	(17)
width in μ	15-18	15-18	18-24	21-24	18-21	15-18
(av.)	(17)	(17)	(21)	(23)	(20)	(16)
f.s.	0	0	1	1-2	1-2	0
(av.)	0	0	(1)	(1.2)	(1.2)	0
h.s.	0-1	0-1	1-2	0-1	1-2	0-1
(av.)	(0.2)	(0.4)	(1.8)	(0.2)	(1.8)	(0.4)

Antennal bristles (ab) well defined, about 15 μ long; segments VI and VII each with one ventral bristle. Terminal segment with 3 preapical bristles, a pair of capitate, about 24 μ long subapical sensory setae (set. scln) and one apical hair-like seta.

Thorax: The thoracic ridges and sclerites greatly degenerate. Pleural ridges of the thorax (plr1, plr2 & plr3) short and rudimentary. The spiracles (sp2 & sp3) each 9 - 12 (10) μ wide at opening, with 24 - 31 (27) μ long supporting bar. Prothoracic and mesothoracic

setae: 2 - 3 (2.5) dorsal, one pleural and one ventral hair-like setae present on each side of the median line. Metathoracic setae: 2 - 3 (2.7) dorsal and one pleural hair-like setae occur on each side.

Legs: Comparatively short and very stout; the fore and the middle legs subequal in length, the hind leg slightly longer; the ratio length of the hind leg to the total length of the body 1:2.9 - 3.4 (3.2). Coxa and trochanter about 31 and 18 μ wide respectively; the latter with the basal part shorter than the distal and with a differentiated long apical seta (ase). Femur about 28 μ wide; that of the middle leg shortest and those of the fore and hind legs subequal; the ratio width to length of the hind femur being 1:1.8 - 2 (1.9). Tibia about 18 μ wide; with 2 small spines; in fore-leg the ratio lengths of femur to tibia 1.4 - 1.5 (1.45):1. Tarsus about 18 μ wide; tarsal digitules apically knobbed, about 24 μ long. Claw broad at base and abruptly tapering apically, 15 - 18 (16) μ long; ungual digitules extremely fine, apically knobbed and about 15 μ long. The lengths of the leg segments and the number of setae on each are given in the following table:

		Fore-leg	Middle leg	Hind leg
Coxa	length in μ	24-31 (28)	24-31 (28)	27-31 (29)
	h.s.	2-3 (2.2)	2-3 (2.2)	2-3 (2.6)
troch- anter	length in μ	18-21 (19)	18-21 (19)	21-24 (22)
	h.s.	(1)	(1)	(1)
Femur	length in μ	49-55 (52)	49-55 (53)	49-55 (53)
	h.s.	1-2 (1.2)	1-2 (1.2)	1-2 (1.4)
Tibia	length in μ	34-37 (35)	34-37 (35)	37-40 (39)
	h.s.	0	0	0
Tarsus	length in μ	27-31 (29)	27-31 (29)	27-31 (30)
	h.s.	2-3 (2.4)	2-3 (2.2)	2-3 (2.2)
Total length of leg in μ		168-183 (180)	171-183 (180)	177-195 (189)

Abdomen: The abdominal tergites and sternites absent. The dorsal and ventral setae (ads & avs) in transverse rows; one pleural seta (aps) always present on each segment. The following table shows the number of dorsal and ventral setae on each side of the median line:

	I	II	III	IV	V	VI	VII	VIII
(ads)	1 - 2	1 - 2	2	1 - 2	2	1 - 2	1 - 2	1 - 2
(av.)	(1.5)	(1.8)	(2)	(1.8)	(2)	(1.8)	(1.8)	(1.8)
(avs)	-	1	2	2	2	2	1 - 2	1 - 2
(av.)	-	(1)	(2)	(2)	(2)	(2)	(1.5)	(1.5)

The ostioles as well as the glandular pouches entirely absent. The genital segment: The genital capsule (gc) comparatively very small, 37 - 40 (39) μ long and 31-34 (32) μ wide, i.e. the ratio length to width 1.2 - 1.3 (1.23):1 and its length to the total length of the body 1:14.1 - 17.0 (15.4); the style (st) rather straight in lateral view, apically rounded. Anal opening undetectable. Aedeagus (aed) ventrally sclerotized and tapering towards a pointed tip. Setae of the genital segment: The genital capsule (gc) always with one dorsal and two ventral setae on each side of the median line.

Material: 10 specimens examined, collected by K. Boratynski, on Ash trees (Fraxinus excelsior), in the gardens of Buckingham Palace, London on 20.10.1963.

Remarks: The mating behavior^u of this species was observed in the laboratory. The females covered with copious waxy secretion remain fixed usually deep in the crevices of the bark with their heads at the bottom of the crevices and their abdomina directed towards the surface. The male wandering about, somehow is capable of locating the position of the posterior end of the female ready for copulation, pushes its abdomen through the waxy covering and the copulation takes place. These observations may suggest that the females remain under their waxy covering until they ^{mate} ~~are fertilized~~ then migrate to another position to start laying the eggs; those ^{unmated} ~~unfertilized~~ appear to remain in their positions until they perish.

V. DISCUSSION

The present study of the male representatives of Pseudococcidae and Eriococcidae has revealed many interesting facts regarding their taxonomic status. Moreover, the material of Pseudococcidae, being fairly representative (20 spp. were considered), allowed for certain suggestions as to the classification within the family. As far as the Eriococcidae are concerned, the material although inadequate for similar suggestions (7 spp. only), was sufficient for a general characterization of the males of the family and for suggestions regarding the various degrees of morphological relationships between the studied species.

These conclusions were assessed by taking into consideration as many characters as possible, as listed in table I. The table includes all the species here studied and 3 others adequately described for the purpose of comparison by Giliomee (1961). The large number of species studied by Beardsley (1960, 62, 63, 64 and 65) could not be included in this table since his descriptions contain comparatively few of the characters here employed. The assessment of the relationships between the studied species was carried out by using the quantitative evaluation method adopted by Ghauri (1962) and followed by Giliomee (1964). In this method all the characters were regarded as being of equal importance, and those shared by any two species were counted, and the calculated numbers (shown in table II in the form of a matrix) were taken as indices of the degree of affinity. This method was found the most practical in the circumstances, although not the most satisfactory from the statistical point of view. The methods recently discussed by Sokal & Sneath (1963), in which a correlation coefficient is obtained for each pair of species, is more accurate, but involves the use of an

electronic computer for calculation and the development of a rather elaborate computer programme*.

The discussion therefore, will include the following aspects:

- (A) The taxonomic status of Pseudococcidae and Eriococcidae.
- (B) The taxonomic significance of the systematically important characters, and the levels at which they could be used.
- (C) The classification and interrelationships within each of these groups.
- (D) The relationships of the Pseudococcidae and Eriococcidae with other families of Coccoidea.

* This programme has only recently been developed in the Department of Zoology and Applied Entomology by Dr. G. Murdie, taking the advantage of the computing facilities available in the Imperial College. It was applied too late to include in the main part of the thesis, but the results of the two methods are discussed and compared in the appendix.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Size: (1) Small (about 1000 μ or less. (2) Intermediate. (3) Large (about 1250 μ long or more).

2 2 3 2 2 1 2 3 3 2 3 3 3 3 3 3 2 1 2 3 3 2 1 1 2 3 3 3 1

Fleshy setae: (1) Entirely absent. (2) Only on the antennae. (3) On the antennae and legs. (4) On the body itself, antennae and legs.

3 3 3 3 2 3 3 3 2 4 4 4 4 4 4 3 3 2 1 3 1 3 3 3 2 2 2 2 2

Derm pores: (1) Absent. (2) On thorax and abdomen only. (3) Present on head, thorax and abdomen.

3 3 3 3 3 3 3 2 2 3 3 3 3 3 3 3 2 3 3 1 1 1 1 1 1 1 1 1

HEAD:

In front view: (1) Subtriangular. (2) More or less rounded. (3) Dorso-ventrally flattened.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 3 3 1 1 1 1 2 2 1 2 2 2 2 3

In lateral view: Ventral preocular depression:

(1) Entirely absent. (2) Hardly indicated. (3) Well pronounced.

2 3 3 2 2 2 2 3 2 3 3 3 3 3 3 1 1 3 3 3 2 2 2 2 2 1 1 1 1

Dorsal arm of midcranial ridge: (1) Absent. (2) Indicated by heavy sclerotization. (3) distinct.

3 3 3 3 3 3 3 1 3 3 3 3 3 3 3 2 1 3 2 3 2 3 3 3 3 3 3 3 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

If present: (1) Posteriorly disappearing at or anterior to level of dorsal eyes.

(2) Disappearing behind the level of the dorsal eyes.

(3) Meeting or almost meeting the postoccipital ridge.

2 2 2 2 3 3 3 NC 3 3 3 3 3 3 2 2 NC 2 2 3 3 1 1 1 2 1 1 1 NC

Lateral arms of the midcranial ridge: (1) Absent. (2) Indicated by weak sclerotization.

(3) Well developed.

3 3 3 3 3 3 3 3 2 3 3 3 3 3 3 3 1 3 2 2 2 3 3 3 2 3 3 3 1

Relationship between the arms of the midcranial ridge:

(1) Dorsal arm separated.

(2) All arms joined forming a cruciform structure.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 NC 1 2 2 2 2 2 2 2 2 2 2 2 NC

Postoccipital ridge: (1)

Absent. (2) Its position only marked by heavy sclerotization. (3) Distinct, slender and U-shaped. (4) Slender and V-shaped. (5) Strongly developed and laterally forked.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 4 4 3 2 3 3 5 5 5 5 5 5 5 1

(1) Anteriorly not reaching the preocular ridges. (2)

Confluent with the preocular ridges.

1 1 2 1 2 2 2 2 2 1 1 1 1 1 2 1 1 1 2 2 2 1 1 1 1 1 1 1 NC

Pre and postocular ridges:

(1) Absent. (2) Widely separated. (3) Joined together by means of the interocular ridge.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 2 2 2 2 2 2 2 2 2 2 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

The ventral part of the preocular ridge, below the articular process: (1)

Entirely absent. (2) Ill defined. (3) Well marked by a heavy sclerotization. (4) Atrophied. (5) The ridge well developed ventrally.

3 3 3 1 1 1 1 2 3 2 2 2 2 2 2 1 1 2 5 5 5 5 5 4 5 5 4 4 NC

The dorsal part of the post-ocular ridge: (1) Reduced.

(2) Well-developed.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 2 NC

EYES:

Distance between dorsal eyes in relation to diameter of their corneae: (1) Simple eyes absent.

(2) Distance usually less than 3.5 times the diameter of corneae.

(3) Distance usually 3.5-6 times.

(4) Distance usually more than 6 times.

3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 4 1 3 4 3 4 2 3 2 4 3 4 4 1

Relative size of simple eyes:

(1) Absent. (2) Dorsal eyes smaller than the ventral. (3)

Both eyes subequal. (4) Ventral eyes smaller.

2 2 2 2 4 2 2 2 2 2 2 2 2 2 2 3 1 3 3 2 3 4 3 3 3 3 3 3 1

Lateral ocelli: Vestigial or merely represented by small sclerotized spots. (2) Well developed.

2 1 2 2 2 1 2 1 1 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27			
<u>Genal setae on each gena:</u>																														
(1) Absent. (2) 1-2 usually.																														
(3) Almost always 3. (4)																														
Varying number, 1-7. (5)																														
More than 7.	3	3	3	3	3	2	4	3	4	5	5	5	5	5	5	3	3	3	3	2	2	4	3	5	2	4	4	4	1	
<u>Dorsal ocular setae:</u> (1)																														
Absent. (2) Present.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1		
<u>Ventral ocular setae:</u> (1)																														
Absent. (2) Present.	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	2	1	1	1	1		
<u>Ventral head setae on each side:</u> (A) <u>Setae in a longitudinal row between the ventral simple eyes:</u> (1)																														
Absent. (2) Present or absent. (3) Always absent.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1	3	1	2	1	1	3	1	1	1	1		
(B) <u>Setae transversely arranged in the area of the ventral preocular depression or its position:</u> (1) Usually 5 or less. (2) Intermediate. (3) Usually 10 or more.																														
	2	2	2	2	2	2	3	2	3	3	3	3	3	3	3	2	2	1	2	2	2	2	1	3	1	1	1	1		
<u>Head disc pores:</u> (1) Absent. (2) Only present ventrally. (3) One pore usually present dorsally on each side. (4) 2 - 3 pores usually present dorsally. (5) 4 pores or more present dorsally. (6) Present dorsally and ventrally.																														
	4	4	5	4	3	3	3	1	3	4	4	4	4	4	3	5	4	1	2	6	1	1	1	1	1	1	1	1		
<u>Structures of obscure homology on the head:</u> (1) Absent. (2) One always present on each side. (3) More than one present.																														
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	3	3	3	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

ANTENNAE:

Normal number of segments:

(1) 8-segmented. (2) 9-segmented. (3) 10-segmented. 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 3 3 3 3 3 3 2 3 3 3 3 1

Length related to body length:

Comparatively: (1) Very short; the body more than 2.6 times as long. (2) Short; body 2-2.6 times as long. (3) Moderately long; body 1.5-1.9 times as long. (4) Long; body usually less than 1.5 times as long. 3 2 2 2 3 3 2 3 2 2 2 2 2 3 2 1 1 4 4 4 3 2 2 2 3 2 2 2 1

Length in relation to length of hind legs:

(1) Antennae much shorter; the hind legs more than 1.6 times as long. (2) Antennae slightly shorter; the hind legs 1.1-1.6 times as long. Both subequal. (4) Antennae longer. 2 2 2 2 2 3 2 2 3 2 2 2 2 3 2 2 1 4 4 4 3 2 2 2 3 2 2 2 2

Relative length of 3rd and terminal antennal segments:

(1) Both subequal. (2) Segment III slightly longer, usually 1.1-1.5 times as long. (3) Segment III 1.5-2.5 times as long. (4) Segment III more than 2.5 times as long. 1 2 2 1 1 1 2 2 1 2 2 2 3 3 2 1 1 2 3 3 1 2 2 4 3 3 3 3 2

Width of segment III in relation to its length:

(1) Length less than twice the width. (2) Length 2-3.3 times as wide. (3) Length 3.3 - 5.3 as wide. (4) Length more than 5.3 times as wide. 3 3 3 2 2 2 3 3 2 3 3 3 3 4 3 2 1 3 4 4 3 3 2 3 3 3 2 2 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Width of preterminal segment in relation to its length: (1)

Length less than twice the width.

(2) Length 2-3.7 times the width.

(3) Length more than 3.7 times the width.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 3 3 3 1 1 1 1 1 1 1 1

Shape of the terminal segment:

(1) More or less cylindrical,

i.e. of about the same width

throughout. (2) Pear-shaped,

i.e. wide at base and becoming

gradually narrower apically.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 2 2 2 2 2 2 2 2

Antennal setae:

Fleshy setae: (1) Absent.

(2) Present.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2 2

Hair-like setae on segments

IV to terminal: (1) Absent.

(2) Present.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2

Relative length of the antennal

and the body setae: (1) Subequal

or slightly longer than the body

setae. (2) Twice as long as

body setae or more.

1 1 1 1 1 2 1 2 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 2 2 2 1

Capitate, apically knobbed

sensory setae: (1) Absent.

(2) Two subapical setae present

on terminal segment only. (3)

5-6 setae on terminal segment

only. (4) Few setae present

on segments VII to X, and some-

times also on segments III to VI.

(5) Always present on segments

III to X and forming the majority

of the antennal setae.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 4 1 1 5 4 4 3 4 4 4 1 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
<u>Number of hair-like setae on the scape:</u> (1) 1 - 3 h.s.																												
(2) 4 h.s. almost always present.																												
(3) More than 4 h.s. present.	3	3	3	3	2	2	2	2	2	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	1
<u>Antennal bristles (ab) on terminal segment:</u> (1) 3 bristles only present. (2) 3 relatively large, and 2 much smaller.	1	1	1	1	2	1	1	1	2	1	1	1	1	2	1	1	1	1	2	1	2	1	1	1	1	1	1	
<u>The three large bristles:</u> (1) Slightly stouter than the antennal setae and hardly distinguishable. (2) Conspicuously stouter and easily separated.	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2
(1) The two lateral bristles about as long as those on the two preceding segments. (2) Approximately twice as long.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	
<u>Relative length:</u> (1) All of about the same length. (2) The dorsal bristle slightly shorter. (3) The dorsal bristle much shorter (about half as long).	2	2	2	1	2	2	3	2	2	2	1	2	2	2	1	2	2	1	1	1	2	2	1	1	2	1	1	
<u>Position:</u> (1) All three preapical, at about the same distance from the apex. (2) The lateral pair preapical and the dorsal bristle removed a great distance from the apex (nearly at half the segment's length.) (3) The dorsal bristle preapical and the lateral pair near the base of the segment. (4) All three near the base.	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	4	3	3	3	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Apical hair-like seta of the terminal segment: (1) Present.

(2) Replaced by 1-3 preapical sensilla basiconica.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 1 1 1 1 1 1 1 1

THORAX:

PROTHORAX:

Proepisternum: (1) Without ridge-like sclerotization. (2)

Dorsal margin ridge-like. (3)

Dorsal and ventral margins ridge-like.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 2 1 1 1 1 1 1 1 1

Shape of Prosternum: (1) Absent.

(2) Short, triangular plate.

(3) Comparatively long, triangular. (4) Triangular with the anterior apex forming a sclerotized ring. (5) A long and narrow plate. (6) A pair of separate plates.

3 3 3 3 3 4 3 3 5 3 3 3 3 3 3 2 2 3 6 2 3 3 3 3 5 5 5 1

Prosternal ridge: (1) Absent.

(2) Its position only marked by heavy sclerotization. (3)

A single ridge. (4) With antero-medial, crescent-like extension.

(5) Doubled.

3 3 5 3 3 3 3 3 3 3 3 3 3 3 2 2 3 3 3 3 4 4 3 3 3 3 3 1

Prothoracic setae on each side:

Medial pronotal setae: (1)

Usually absent. (2) 1 or 2.

(3) Usually more than 2.

2 2 2 2 1 2 2 3 2 2 2 3 3 3 3 3 1 1 1 1 1 1 1 1 1 1 1 1 2 2

Lateral pronotal setae: (1)

Absent. (2) Sometimes present.

(3) Present.

1 1 2 2 2 1 3 3 3 2 2 3 2 2 3 3 2 1 1 1 1 1 1 1 1 1 1 1 2 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Posttergital setae: (1)

Absent. (2) Sometimes present.

(3) Usually 1-3. (4) Usually

4-8. (5) Usually 8 or more. 1 1 1 1 1 1 1 3 1 4 4 5 5 5 4 3 4 1 1 2 1 1 1 1 1 1 1 1

Antespiracular dorsal setae:

(1) Absent. (2) Sometimes

present. (3) 1-4 setae

present. (4) Usually more than 4 setae.

3 3 3 3 3 3 3 3 3 2 1 3 3 3 3 4 4 1 1 1 3 1 1 1 1 1 1 1 2 1

Antespiracular ventral setae:

(1) Absent. (2) Absent or

present. (3) One seta always

present. (4) More than one seta present.

3 3 3 3 3 3 3 3 3 3 3 3 4 3 4 4 3 3 3 3 3 2 3 3 1 1 1 1 1

Prosternal setae: (1) Absent.

(2) Absent or present. (3)

1-3. (4) More than 3.

3 3 3 3 3 3 3 3 3 4 4 4 4 4 4 3 3 1 1 2 3 3 3 3 1 1 1 1 3

Prothoracic pores on each side:Medial pronotal pores: (1)

Absent. (2) Absent or present.

(3) Usually 1-4. (4) Usually

4 - 7. (5) Usually more than

7. 2 3 5 4 3 5 3 3 3 3 3 3 3 3 3 2 3 2 3 3 1 1 1 1 1 1 1 1 1

Lateral pronotal pores: (1)

Absent. (2) Absent or present.

(3) Present.

3 3 3 3 3 3 3 3 3 3 3 3 2 3 3 3 2 3 2 1 1 1 1 1 1 1 1 1

Posttergital pores: (1) Absent.

(2) Present.

1 1 2 1

Antespiracular dorsal pores: (1)

Absent. (2) Absent or present.

(3) 1-2. (4) Usually more

than 2. 4 4 4 4 3 3 3 2 3 3 3 3 2 4 3 3 4 1 1 1 1 1 1 1 1 1 1 1 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Prosternal pores: (1) Absent.

(2) Absent or present. (3)

Usually one in the middle. (4)

Usually one or more on each side.

4 4 4 4 4 3 4 1 4 4 2 4 2 2 4 2 4 4 4 4 1 1 1 1 1 1 1 1 1

MESOTHORAX:

Prescutum:

Appearance in dorsal view: (1)

Not differentiated. (2)

Transverse, rectangular, with well separated prescutal ridges.

(3) Triangular, with well

separated ridges. (4) Triangular,

with the prescutal ridges continuous medio-posteriorly.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 4 4 3 2 2 2 2 2 2 2 1

Relative length to width of

prescutum: (1) Width equal to length or slightly longer.

(2) Width 1.4-2 times the length. (3) Width more than

twice the length.

2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 NC 2 1 1 1 2 2 2 2 2 3 3 NC

Prescutal suture: (1) Absent.

(2) Distinct. (3) Replaced

by the continuous prescutal ridges.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 3 3 2 2 2 2 2 2 2 2 1

Scutum: (1) Not differentiated.

(2) Evenly sclerotized. (3)

With a distinct, median, longitudinal narrow membranous area.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 3 2 2 2 2 2 2 2 2 2 2 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Relative length of prescutum

to scutum: (1) Prescutum shorter than scutum. (2)

Prescutum 1-2 times as long as scutum. (3) Prescutum

2-4 times as long. (4)

Prescutum more than 4 times as long.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 NC 1 3 4 2 2 2 2 2 2 2 2 NC

Scutellum:

Appearance in dorsal view:

(1) Not differentiated.

(2) Pentagonal. (3) Pentagonal with a lateral additional ridge on each side. (4) Trapezoid-shaped; scutoscutellar suture partly absent. (5) Transverse, rectangular, with strongly developed scutellar ridges.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 3 2 5 5 5 5 5 4 4 1

Length of scutellum in relation

to its width: (1) Length usually less than half the width. (2) Length half the width or more.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 NC 2 2 2 2 1 1 1 2 1 1 1 NC

Length of scutellum related

to length of scutum: (1)

Scutellum about half as long.

(2) Scutellum slightly shorter.

(3) Scutellum longer than scutum.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 NC 2 3 3 3 3 2 2 3 2 3 3 NC

Triangular plate: (1)

Absent. (2) Comparatively small. (3) Large and well developed.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 3 3 3 3 3 3 3 3 2 2 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
<u>Mesothoracic setae on each side:</u>																													
<u>Prescutal setae:</u>																													
(1) Absent. (2) Absent or present. (3) Not more than 2. (4) Usually 2-4. (5) Usually more than 4.	4	5	4	3	4	4	5	4	5	5	5	5	5	5	5	4	1	4	4	5	3	3	3	5	2	3	1	2	1
<u>Scutal setae:</u>																													
(1) Usually 1-3. (2) Intermediate. (3) Usually 6 or more.	3	3	3	3	3	1	3	3	3	2	2	3	2	3	2	2	1	2	2	1	1	2	1	2	1	1	2	2	1
<u>Scutellar setae:</u>																													
(1) Present or absent. (2) Usually 1-2. (3) Usually 2-4. (4) Usually more than 4.	3	3	3	3	3	1	3	3	2	3	3	3	3	4	4	3	1	3	2	2	2	2	2	3	2	3	2	2	1
<u>Tegular setae:</u>																													
(1) Present or absent. (2) Usually 1-3. (3) Usually 3-5. (4) Usually more than 5.	2	2	2	2	3	2	3	2	3	4	3	4	4	4	2	2	1	2	3	4	3	3	2	4	2	2	1	1	1
<u>Mesepisternal setae:</u>																													
(1) Absent. (2) Present.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
<u>Postmesostigmatal setae:</u>																													
(1) Absent. (2) Present sublaterally only behind the spiracles. (3) Present sublaterally, submedially and medially.	2	2	2	2	2	2	2	2	3	2	3	3	3	3	3	2	2	3	2	2	1	1	1	3	1	1	1	1	1
<u>Lateropleurital setae:</u>																													
(1) Absent. (2) One seta always present.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
<u>Basisternal setae:</u>																													
(1) Absent. (2) Present.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Mesothoracic pores on each side: Postmesostigmatal pores:
 (1) Absent. (2) One pore always present in the middle.
 (3) One pore usually on each side.

1 1 1 1 3 3 3 1 3 1 1 2 1 3 1 1 1 1 3 1 1 1 1 1 1 1 1

METATHORAX:

Suspensorial sclerite: (1) Absent. (2) Present.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 1 1 1

Metapostnotal ridge: (1) Absent. (2) Comparatively weak. (3) Well developed.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 2 2 2 1 1 1 1 1 1 1 1

Metapleural ridge: (1) Dorsally reduced. (2) Well developed.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 1 1

Precoxal ridge of metathorax: (1) Absent. (2) Weak. (3) Well developed.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 3 2 2 2 3 3 2 2 3 2 2 1

Metasternal apophysis: (1) Undetectable. (2) Vestigial. (3) Well developed.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3 2 2 1

Metathoracic setae on each side: Metatergal setae: (1) Absent. (2) Usually 1-3. (3) Usually 3-5. (4) More than 5.

3 3 1 3 3 2 3 3 2 3 4 4 4 4 4 3 3 2 2 3 2 2 2 3 2 3 3 4 1

Metapleural setae: (1) Absent. (2) Present or absent. (3) Usually 1-2. (4) Usually 3-5. (5) More than 5.

1 1 1 2 2 1 2 3 3 3 4 5 5 5 5 4 5 2 1 3 3 1 1 3 1 1 1 1 1 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
<u>Anterior metasternal setae:</u>																													
(1) Absent. (2) Present or absent. (3) 1-2. (4) Usually 2-5. (5) More than 5.	3	4	4	4	3	1	4	3	4	4	4	5	5	5	5	4	4	3	3	3	3	3	3	4	2	3	3	3	1
<u>Postmetastigmatal setae:</u> (1) Absent. (2) Present.																													
	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
<u>Posterior metasternal setae:</u>																													
(1) Absent. (2) Absent or present. (3) 1-2 setae. (4) Usually more than 2 setae.	3	1	1	3	3	2	2	4	3	1	2	3	4	4	4	3	3	2	2	2	3	1	1	1	1	1	2	1	1
<u>Metathoracic pores:</u>																													
<u>Metatergal pores:</u> (1) Absent (2) Usually present.																													
	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1
<u>Metaspiracular pores:</u> (1) Absent. (2) Sometimes present. (3) Present.																													
	2	2	3	3	3	1	2	3	3	2	2	1	1	2	2	3	3	3	3	3	1	1	1	1	1	1	1	1	1
<u>Anterior metasternal pores:</u>																													
(1) Absent. (2) Sometimes present. (3) Present.	2	2	3	3	3	3	3	1	3	3	2	2	1	3	2	3	3	1	3	3	1	1	1	1	1	1	1	1	1
<u>Posterior metasternal pores:</u>																													
(1) Absent. (2) Sometimes present. (3) Present.	1	1	3	1	3	3	3	1	3	1	1	2	1	1	1	1	3	1	2	2	1	1	1	1	1	1	1	1	1
<u>Fore-wings:</u> (1) Absent. (2) Reduced. (3) Well developed.																													
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<u>Alar setae:</u> (1) Usually absent. (2) Usually 1-3. (3) Almost always 3. (4) Usually more than 3.																													
	3	4	3	3	3	3	4	3	3	3	3	3	4	4	2	4	NC	2	3	2	1	2	2	1	2	2	2	2	NC

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

If Wings well developed:

Circular sensoria: (1) Could not be detected and presumably absent. (2) 2-3. (3) Always 3. (4) 3-4.

2 2 2 2 2 2 4 3 4 2 2 4 4 4 2 2 NC 2 2 2 1 1 1 1 1 1 1 1 NC

Hamulohalterae: (1) Absent.

(2) Atrophied, without setae.
(3) Well developed, with one apically hooked seta.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 1 3 3 3 3 3 3 3 1 3 2 2 1

If well developed:

Length of seta in relation to length of hamulohaltera: (1)

Seta much shorter (hamulohaltera 1.9 times or more as long. (2)

Seta slightly shorter (hamulohaltera usually less than 1.9 times as long. (3) Both subequal.

2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 NC 2 2 1 1 3 3 3 NC 2 NC NC NC

LEGS:

(1) Fore-leg shortest. (2)

Middle leg shortest. (3) Both subequal.

1 1 1 1 3 3 1 1 1 1 1 1 1 1 1 1 1 3 2 2 1 3 3 3 3 2 2 3 3

Length of hind leg in relation to length of body: (1) Hind leg less than half the body length.

(2) Hind leg half or more the body length.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 1 2 2 1 1 1 1

Trochanter: (1) Basal part shorter than the distal. (2)

Basal part longer.

2 1 1 1 1 1 1 1 1 1

Apical seta of trochanter:

(1) Absent. (2) Present.

1 1 1 1 2 1 1 1 2 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 2 2 2 2 2

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Dorsal setae of segment VIII:

(1) Absent. (2) All subequal in length. (3) Include one seta (on each side), much longer than other abdominal setae.

2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 3 3 3 3 3 3 3 2

Pleural setae of segment VIII:

(1) All subequal in length. (2) Include one slightly longer seta. (3) Include one much longer seta (at least twice as long as other abdominal setae).

2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 3 1 1 1 1 2 2 2 2 3 3 3 2

Ventral setae of segment VIII:

(1) Absent. (2) Present or absent. (3) Usually one seta on each side. (4) More than one seta on each side.

1 1 2 1 1 1 2 1 1 1 4 1 4 4 4 1 1 1 1 1 3 3 3 3 3 3 3 3

Abdominal disc pores: (1) Absent.

(2) Only on segment I. (3) On segment I and on some of segments II to VII. (4) On segments I to VII.

4 4 4 4 4 4 3 4 3 4 3 4 4 3 3 4 4 2 4 4 1 1 1 1 1 1 1 1

If present: (1) Only present laterally. (2) Laterally and also dorsally on one or more segments. (3) Laterally and also ventrally on one or more segments. (4) Laterally and also dorsally and ventrally on one or more segment.

1 3 1 1 3 1 3 1 3 1 1 1 1 2 4 3 4 1 4 4 NC NC NC NC NC NC NC NC NC

Dorso-median transverse sclerotization of segment VIII: (1)

Absent. (2) Present.

1 2 1 1 1 1 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
<u>Ventral longitudinal sclerotization on each side of segment VIII: (1) Absent. (2) Present.</u>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	
<u>Glandular pouches and its setae: (1) Absent. (2) Only present on segment VIII. (3) Present on segments VII and VIII.</u>	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	1
<u>Glandular pouch setae of segment VIII: Include: (1) The terminal pair of tail setae only. (2) The tail setae and one about as long as the abdominal setae. (3) The tail setae and one of medium length. (4) The tail setae, two medium of unequal lengths and a short one.</u>	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	2	2	2	1	1	1	1	1	1	1	NC
<u>Tail setae of segment VIII in relation to body length: (1) Comparatively very short (the body more than 12 times as long). (2) Short (the body 8-12 times as long). (3) Moderately long (the body 5-8 times as long). (4) Long (the body usually less than 5 times as long).</u>	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	3	3	2	3	3	2	2	2	1	NC
<u>GENITAL SEGMENT:</u>																												
(1) Abdominal segment IX latero-ventrally forming a penial sheath; the latter is not fused with the 9th tergite + 10th segment and anteriorly bounded by a basal ridge on each side. Anal opening minute. (2) Same structure, with the basal ridges medially continuous. (3) Segments IX and X forming a genital capsule; the anal opening, in macrop-terous males comparatively large.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	3	3	3	3	3	3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Length of the genital segment
in relation to its width: (1)

Length less than 1.6 times as
width. (2) Length 1.6-2.1
times as width. (3) Length
more than 2.1 times as width.

1 1 2 1 2 1 2 2 1 2 2 2 1 2 2 2 2 1 2 1 2 2 3 2 1 2 1 1

Length of genital segment in
relation to total body length:

(1) Short (the body about 9
times as long or more). (2)
Intermediate. (3) Long (the
body about $7\frac{1}{2}$ times as long
or less).

1 1 1 1 1 1 2 1 1 2 2 3 2 1 1 1 2 2 1 1 1 2 3 3 2 2 2 2 1

Style, in lateral view: (1)

Apex curving upwards. (2)
Sinuating; apex pointed.
(3) Rather straight; apex
pointed. (4) Rather straight;
apex rounded.

1 1 1 1 1 1 4 4 1 1 1 4 1 1 1 4 4 4 4 3 2 3 3 3 2 2 2 4

Process of penial sheath:

(1) Absent. (2) Vestigial. (3)
Well pronounced.

3 3 3 3 3 3 2 1 3 1 1 1 3 2 1 3 3 2 1 2 1 1 1 1 1 1 1 1

Aedeagus: (1) Arising just behind
the basal ridges of the penial
sheath; comparatively short.
(2) Arising just behind the basal
ridges of the penial sheath;
comparatively long (i.e. anteriorly
bent and reaching the cavity of
abdominal segment VII before
curving posteriorly). (3)
Removed backwards and arising at
a large distance from the basal
ring of the genital capsule.

1 1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 3 3 3 3 3 3 3 3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

Dorsal setae of the genital segments on each side: (1)

One seta only present. (2)

2 setae, noticeably longer than the abdominal setae.

(3) 3 setae, subequal or slightly shorter than the abdominal setae. (4) More

than 3 setae, subequal to the abdominal.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 4 3 4 3 2 2 2 2 2 2 2 1

(A) TAXONOMIC STATUS OF PSEUDOCOCCIDAE AND ERIOCOCCIDAE:

On examining table I, it was immediately apparent that the pseudococcid and the eriococcid males exhibit a number of structural differences, comparable with those separating other families (e.g. Pseudococcidae and Coccidae), and thus justifying the recognition of the two groups as distinct families. This conclusion is in accordance with Ferris's (1937) concepts of classification, which were also adopted by Hoy (1962 - 63), the most recent student of Eriococcidae.

The characters distinctly separating the macropterous males of Pseudococcidae from those of Eriococcidae are listed in the following table (A):

	Pseudococcidae	Eriococcidae
(1) <u>Puparia:</u>	Fluffy, loosely felted, with no definite posterior opening.	Compact, closely felted, flattened, permanently split along the posterior edge.
(2) <u>Postoccipital ridge:</u>	Weak, slender, U or V-shaped.	Strongly developed, laterally forked.
(3) <u>Terminal antennal segments:</u>	Elongated; more or less cylindrical.	Barrel-shaped; the apical segment distinctly pear-shaped.
(4) <u>Proepisternum:</u>	With the dorsal margin (and sometimes also the ventral margin) heavily sclerotized and ridge-like.	Without any ridge-like sclerotization.

- | | | |
|--|---|--|
| (5) <u>Scutellum</u> , in dorsal view: | Pentagonal. | Transverse, rectangular. |
| (6) <u>Scutellar ridge</u> : | Absent. | Present. |
| (7) <u>Anterior and posterior post-alar ridges</u> : | Well separated. | Anteriorly joined. |
| (8) <u>Mesopleural ridge</u> : | Interrupted above the coxal articulation. | Continuous above the coxal articulation. |
| (9) <u>Trochanter</u> : | With the basal part longer than the distal one. | With the basal part shorter than the distal one. |
| (10) <u>Ungual digitules</u> : | With acute tip. | Apically knobbed |
| (11) <u>Penial sheath</u> : | Basal part short, not fused with the 9th tergite + the 10th segment; anterior margin of the slit-like opening close to the basal ridge. | Basal part long, fused with the 9th tergite + the 10th segment forming together cylindrical basal genital capsule; anterior margin of the slit-like opening removed far posteriorly. |
| (12) <u>Aedeagus</u> : | Arises ventrally just behind the basal ridge of the penial sheath. | Removed backwards and arises at a comparatively large distance from the basal ring of the genital capsule. |

The material studied also revealed that the two families can be separated by a number of other less well defined characters (listed in table B), the taxonomic significance of which may be confirmed as more information becomes available:

Table (B):

	Pseudococcidae	Eriococcidae
(1) <u>Tentorial bridge:</u>	Comparatively thin.	Rather stout.
(2) <u>Three large bristles of terminal antennal segment:</u>	All preapical, or the dorsal one removed a greater distance from the apex.	All near the base of the segment, or only the dorsal one preapical.
(3) <u>Claws:</u>	Rather long, slender, uniformly tapering to a pointed end.	Rather short and stout, broad at base and abruptly tapering to a pointed end.
(4) <u>Dorsal setae of Abdominal segment VIII:</u>	As long as other abdominal setae.	Include one conspicuously long seta on each side of the segment.
(5) <u>Glandular pouch of abdominal segment VIII:</u>	With a pair of long setae and one or more much shorter ones.	With only one pair of setae.
(6) <u>Dorsal setae of the genital segment:</u>	3 or more setae, subequal in length to the abdominal setae, occur on each side of the median line.	2 setae, much longer than the abdominal setae, are always present on each side.

There is also a number of supporting characters (listed in table C) whose presence or absence obtains in one of the two families, but whose alternative conditions occur in the other:

Table (C):

Characters	Pseudococcidae	Eriococcidae
(1) <u>Disc pores:</u>	Present, except in <u>Nairobi</u> group.	Always absent.
(2) <u>Dorsal arm of the midoranal ridge:</u>	Detached anteriorly from other arms, except in <u>Ceroputo</u> and <u>Nairobi</u> groups.	Joined with the lateral and the ventral arms at the apex of the head.
(3) <u>Pre and post-ocular ridges:</u>	Joined by interocular ridge, except in <u>Ceroputo</u> and <u>Nairobi</u> groups.	Widely separated; interocular ridge absent.
(4) <u>Cranial Apophysis:</u>	Apically truncate.	Apically bifurcate, except in <u>E. buxi</u> .
(5) <u>Anterior tentorial arms:</u>	Anteriorly fused before meeting cranial apophysis, except in <u>Ceroputo</u> and <u>Nairobi</u> groups.	Well separated throughout.
(6) <u>Relative lengths of prescutum and scutum:</u>	Prescutum shorter than scutum, except in <u>Ceroputo</u> and <u>Nairobi</u> groups.	Prescutum 1 - 2 times as long as scutum.
(7) <u>Median, longitudinal, membranous area of scutum:</u>	Present, except in <u>Ceroputo</u> and <u>Nairobi</u> groups.	Absent.

(8) <u>Trochantin:</u>	Present, except in <u>Nairobi</u> group.	Absent.
(9) <u>Metapostnotal ridge:</u>	Present, except in <u>Nairobi</u> group.	Absent.
(10) <u>Ostioles:</u>	Present or absent.	Absent.

THE APTEROUS MALES

This comparison between the apterous males of Pseudococcidae and Eriococcidae must be regarded as very provisional since it is based only on one representative of each family (S. sacchari and P. fraxini). They appear to indicate that some of the characters separating the macropterous males of the two families also differentiate the apterous forms; these are the characters related to the conditions of the trochanter, claw, unguis digitules, penial sheath and aedeagus. The other characters separating the wingless males are given in the following table:

Characters	Pseudococcidae	Eriococcidae
(1) <u>Appearance in dorso-ventral view:</u>	Oblong.	Spindle-shaped.
(2) <u>Sclerite degeneration:</u>	Comparatively less pronounced.	Well pronounced.
(3) <u>Disc pores:</u>	Present.	Absent.
(4) <u>Length of body/ length of hind legs:</u>	Body less than 2.5 times as long.	Body more than 2.8 times as long.

(5) <u>Length/width of hind femur:</u>	Length more than 3.5 times as width.	Length twice the width, or less.
(6) <u>Length of tibia/length of tarsus:</u>	Tibia more than 1.5 times the length of tarsus.	Tibia less than 1.5 times the length of tarsus.
(7) <u>Ostioles:</u>	Present.	Absent.
(8) <u>Pleural setae of abdominal segments VI, VII and VIII:</u>	Include one comparatively long seta (more than twice as long as other abdominal setae).	Pleural and other abdominal setae subequal in length.
(9) <u>Glandular pouches of segment VIII:</u>	Present.	Absent.

The differences between the two families will be compared with the differences separating other families of Coccoidea in chapter (D).

(B) TAXONOMIC SIGNIFICANCE OF THE CHARACTERS:

The taxonomically important characters of both Pseudococcidae and Eriococcidae (winged forms) are here discussed together, but the limited number of the available species of Eriococcidae make the significance and levels on which these characters may operate within this family more tentative than those of Pseudococcidae. These characters are also listed in tables III, V and VI.

General Appearance:

Although the appearance of the males does not seem to be strictly characteristic at any level, most Pseudococcidae are narrow and slender, whereas Eriococcidae are rather stout and robust; the hairy appearance of the species will be discussed later.

Size:

The size generally varies a great deal, even within the species themselves. Gilioee (1964) for example, showed that the host plant and the locality had a considerable influence on the size of Parthenolecanium corni (Bouche). No such host-determined differences have been found in P. citri, for which material from several host plants and localities was available. Some genera or species within certain genera are distinctly smaller than others (e.g. N. nipae is smaller than N. vastator; E. orariensis and E. buxi are smaller than E. araucariae). The size therefore, is considered to be of a limited significance at generic and specific levels only.

Chaetotaxy:

The presence or absence of fleshy setae on the various parts of the body was found of considerable importance, operating from the level of the groups of genera downwards to the species. The hairy appearance, which is generally due to the presence of the fleshy setae on the body itself, separates the Pseudococcus group. The other extreme, where the fleshy setae are entirely absent also separates groups (Nairobi) or genera (Centroccocus). In N. vastator the fleshy setae are absent on the legs, but in N. nipae present.

The dermal pores:

With the exception of the Nairobi group, the presence of the disc pores is a distinct character separating the two families studied; they are always present in Pseudococcidae and absent in Eriococcidae.

Within the former family their number and distribution also presents a wide range of variation, and can be utilized at most intrafamily levels.

THE HEAD:

The general shape of the head appears to be of certain taxonomic significance at family level, but some minor details also separate some genera. In Pseudococcidae the head is triangular in dorsal view, whereas in most Eriococcidae it is more or less rounded; in the genus Saccharicoccus, the head is dorso-ventrally flattened and the ventral preocular depression absent. The condition of the midcranial ridge operates at many levels; family Eriococcidae and some pseudococcid groups (Ceroputo and Nairobiia) are separated by having all the arms of the midcranial ridge joined together. The degree of development of the dorsal arm separates genera; it may be indistinct (Ferrisiana), or relatively short (e.g. Planococcus and Dysmicoccus), or long and meeting the postoccipital ridge posteriorly (e.g. Nipaeoccus and Pseudococcus). The weak development of the lateral arms separates groups of genera (Ceroputo and Nairobiia), genera (Trionymus) and species (E. huxi). The nature of the postoccipital ridge distinguishes the two studied families. The relationship between the antero-lateral extremities of this ridge and the preocular ridge separates genera and species of Pseudococcidae. The complete separation of the pre and postocular ridges separates the family Eriococcidae and two groups of Pseudococcidae (Ceroputo and Nairobiia). The dorsal reduction of the postocular ridge excludes the Saccharicoccus group. The relative size of the simple eyes is a useful character separating groups of genera, genera and species; in the Saccharicoccus, Ceroputo and Nairobiia groups of genera the dorsal and ventral eyes are subequal in diameter. Some genera (e.g. Planococcus, Pseudococcus and Centrooccus) are separated by having the dorsal eyes larger than the ventral, and

within some genera the individual species (N. vastator and E. araucariae) are characterized by the opposite condition. The vestigial state of the lateral ocelli appear to be characteristic of one group of Pseudococcidae (Nairobi) and one genus of Eriococcidae (Ovaticoccus). The apically truncate cranial apophysis separates Pseudococcidae and one species of Eriococcidae (E. buxi). The nature of the tentorial bridge is characteristic of each family, being rather slender in Pseudococcidae and comparatively stout in Eriococcidae. The presence of a mouth tubercle separates the genus Ovaticoccus.

The absence, presence, type and number of the head setae on the different areas provide taxonomically important characters operating on suprageneric, generic and specific levels; the presence of fleshy setae for example separates Pseudococcus group; the presence of dorsal ocular setae separates genus Dysmicoccus; the presence of setae between the ventral eyes excludes E. buxi.

The distribution of the head pores also separates groups of genera, genera and species; the presence of ventral head pores distinguishes the Ceroputo group; the complete absence of the head pores separates the genera Ferrisiana and Octococcus; the presence of 4 or more dorsal head pores is characteristic of two species, P. dioscoreae and S. sacchari.

The antennae afford a number of systematically important characters, at all taxonomic levels from the family down to the species. The shape of the terminal antennal segments, for example, separates the two families; the ratios of the relative length of the antennae and the individual segments, and the presence and distribution of the different types of setae operates on most intrafamily levels. The following have been utilized: the ratio of the length of antennae to the length of the body and to the length of the hind legs; the ratio of the length of the 3rd to the terminal segment; the ratio of

width to length of the 3rd and the preterminal segments; the presence or absence of the fleshy, the hair-like and the apically knobbed sensory setae; the number of setae on the scape; the number, nature, relative lengths and position of the antennal bristles of the terminal segments.

THE THORAX:

Prothorax:

The absence of ridge-like sclerotization along the margins of the proepisternum separates the family Eriococcidae; within Pseudococcidae the presence of this sclerotization along both dorsal and ventral margins of the proepisternum separates Ceroputo group of genera from all the other groups where only the dorsal margin is sclerotized. The shape of the prosternum and the varying number of the prothoracic setae and pores can be used as supplementary characters, separating genera and species. The absence of the prosternal ridge excludes the Saccharicoccus group of genera.

Mesothorax:

The shape of the prescutum separates groups of genera; in the Ceroputo and Nairobi groups, the prescutum is triangular in dorsal view. The medio-posterior continuation of the prescutal ridges isolates the Ceroputo group. The absence of the median, longitudinal, narrow membranous area of the scutum is characteristic of the family Eriococcidae and some groups of Pseudococcidae (Ceroputo and Nairobi). The shape and structure of the scutellum separates the two families. The following ratios were utilized, for their significance at the family and lower levels: length to width of prescutum; length of prescutum to length of scutum; length to width of scutellum; length of scutellum to length of scutum.

The conditions of the postalare and the mesopleural ridges are important characters separating the two families. The weak development of the basalare separates the Eriococcidae and some groups of Pseudococcidae (Ootococcus, Ceroputo and Nairobi). The presence of a large lateropleurite also separates Eriococcidae and some groups of Pseudococcidae (Saccharicoccus, Ceroputo and Nairobi). The incomplete development of the marginal ridge of the basisternum eliminates the Saccharicoccus group. The number and distribution of the mesothoracic setae and pores provide many characters separating species.

Metathorax:

The absence of the suspensorial sclerites is accompanied by the absence of the hamulohalterae and separates the genus Ovaticoccus. The absence of the metapostnotal ridge is an important feature characteristic of all Eriococcidae and also the Nairobi group of genera of Pseudococcidae. The relative length of the hooked seta to the length of the hamulohaltera can be used as a supporting character separating some genera. The number and distribution of the metathoracic setae and pores also provide useful characters at the generic and the specific levels.

The legs:

The legs, like the antennae, afford several characters operating at all levels. The two families can be separated by different conditions of the following structures: (A) the proportion between the basal and the distal parts of the trochanter; (B) the shape of the claw; and (C) the nature of the unguis digitules. The relative length of legs separates groups of genera; e.g. the Ceroputo group is isolated by having fore legs longer than the middle, and the

Saccharicoccus group has comparatively short legs (the hind pair being shorter than half the length of the body). The absence of the tarsal digitules separates groups of genera (Ceroputo and Nairobiia). The following characters were also found taxonomically important at the generic and specific levels: the presence of a long apical seta on the trochanter; the ratio of width to length of the hind femora; the ratio of the length of the femur to the length of the tibia in the fore-leg.

The abdomen:

A number of rather important characters are provided by the pregenital and genital segments of the abdomen separating families and intrafamily taxa. The complete absence of the ostioles is characteristic of Eriococcidae, but among Pseudococcidae the degree of their development, or their absence separates groups of genera, genera and species. The number and nature of certain abdominal setae separates the different categories: the constant presence of a dorsal, rather long seta on each side of segment VIII excludes Eriococcidae, and the entire absence of the dorsal setae on this segment characterises the Nairobiia group. The nature of the pleural setae of segment VIII, the number and distribution of the abdominal pores (within the Pseudococcidae) separates groups of genera, genera and species. Narrow areas of heavy sclerotization of abdominal segment VIII separate some species of Eriococcidae (E. orariensis and E. buxi).

The presence of two pairs of glandular pouches is a conspicuous character separating the Ceroputo group of genera. The number and length of the tail-forming setae of the glandular pouch operates at the levels of family and groups of genera. In Eriococcidae only one pair of these setae is present. In Pseudococcidae one or more additional setae originate in the pouch (Octococcus group has 3 additional setae); in the Ceroputo and Nairobiia groups the tail setae are comparatively short.

The structure of the genital segment clearly separates the two studied families. The number and size of the dorsal setae of the genital segment also separates families. Pseudococcidae are distinguished by having 3 or more setae, similar to those occurring on the abdomen, on each side of the median line, near the base of the style, while in Eriococcidae there is only one pair of rather long setae on each side of the median line. The following characters and ratios were also found of some taxonomic significance in separating groups of genera, genera and species: the structure of the basal ridge of the penial sheath; the relative length to width of the penial sheath or the genital capsule; the length of the genital segment to the total length of the body; the shape of the style; the presence or absence of the process of the penial sheath.

(C) CLASSIFICATION:I, FAMILY PSEUDOCOCCIDAE:

It is apparent that the material was of necessity, rather limited and unevenly representative. Nevertheless, it was possible to obtain some interesting results concerning suprageneric classification, although this division is purely tentative and some of the proposed groups of genera may be subject to further subdivision, expansion or any other modification that future findings may demand. Careful examination of table I showed that the studied species of Pseudococcidae could be divided, on the basis of the different conditions of 58 characters, into 6 distinct groups of genera. Some of these groups contain several genera (each represented by one or more species), and the characters shared within each of these groups were taken as an indication of the suprageneric level of significance of these characters. In other instances a single genus (even if represented by one species only) was found by comparison to be distinct enough to constitute the nucleus of a separate suprageneric taxon. The six groups of genera therefore, are not evenly represented; one group contains six genera, two groups two genera each, and the remaining three groups consist of only one genus each. In addition, the published descriptions of Puto yuccae and Rhizoecus falcifer, though incomplete for detailed comparison with my data, would certainly suggest two other groups of genera. The actual status and rank of all the recognized groups will be discussed later.

The 58 selected characters are listed in table III, which also shows their distribution among the groups. It will be noticed that alternative conditions of a few characters sometimes occur in the same group (thus only separating genera), but which separate the other groups. Underlined characters indicate their exclusive conditions for a particular group of genera; the total number of exclusive characters for each group is given at the end of the table.

TABLE III: Characters separating groups of genera of Pseudococcidae:

Characters	Groups					
	Plano- coccus (1)	Pseudo- coccus (2)	Sacchari- coccus (3)	Octo- coccus (4)	Ceroputo (5)	Nairobi (6)
<u>Disc pores:</u> (1) Absent. (2) Present.	2	2	2	2	2	<u>1</u>
<u>Fleshy setae:</u> (1) Absent on the body itself. (2) Present on the head, thorax and abdomen, giving the body a distinctive hairy appearance.	1	<u>2</u>	1	1	1	1
<u>HEAD:</u>						
<u>Ventral preocular depression:</u> (1) Entirely absent. (2) Well marked.	2	2	<u>1</u>	2	2	2
<u>Appearance in front view:</u> (1) Subtriangular or rounded. (2) Dorsoventrally flattened.	1	1	<u>2</u>	1	1	1
<u>Dorsal arm of midcranial ridge:</u> (1) Anteriorly detached from lateral and ventral arms. (2) All arms of the midcranial ridge joined.	1	1	1	1	2	2
<u>Lateral arms of midcranial ridge:</u> (1) Represented by weak sclerotization. (2) Well developed.	1&2	2	2	2	1	1
<u>Postoccipital ridge:</u> (1) U-shaped. (2) V-shaped.	1	1	<u>2</u>	1	1	1
<u>Anterior development of postoccipital ridge:</u> (1) Not reaching preocular ridges. (2) Confluent with preocular ridges.	1&2	1&2	1	1	2	2

	(1)	(2)	(3)	(4)	(5)	(6)
<u>Pre and postocular ridges:</u> (1) Widely separated. (2) Joined by means of the interocular ridge.	2	2	2	2	1	1
<u>Postocular ridge:</u> (1) Dorsally reduced. (2) Well developed.	2	2	<u>1</u>	2	2	2
<u>Lateral ocelli:</u> (1) Vestigial. (2) Large and well developed.	2	2	2	2	2	<u>1</u>
<u>Anterior tentorial arms:</u> (1) Separated. (2) Fused before merging into the cranial apophysis.	2	2	2	2	1	1
<u>Head setae on each side:</u>						
<u>Dorsal head setae:</u> (1) Usually 7 setae or less. (2) More than 7 setae.	2	2	2	<u>1</u>	2	2
<u>Ventral ocular setae:</u> (1) Absent. (2) Present.	1	<u>2</u>	1	1	1	1
<u>Ventral head setae in a transverse row or band anterior to the ventral eyes:</u> (1) Usually 5 setae or less. (2) More than 5 setae.	2	2	2	<u>1</u>	2	2
<u>Genal setae:</u> (1) 7 setae or less on each gena. (2) More than 7.	1	<u>2</u>	1	1	1	1
<u>Ventral head pores:</u> (1) Absent. (2) Present.	1	1	1	1	<u>2</u>	1
<u>Antennae:</u> (1) Comparatively short, the body 1.6 or more times as long. (2) Comparatively long, the body 1.5 or less times as long.	1	1	1	2	2	1
<u>Length of antenna in relation to length of hind leg:</u> (1) Subequal or antenna shorter. (2) Antenna longer.	1	1	1	2	2	1
<u>Relative length of 3rd and terminal antennal segments:</u> (1) Segment III less than 1.5 times as long; sometimes both subequal. (2) Segment III usually more than 1.5 times as the terminal.	1	1	1	1	<u>2</u>	1

	(1)	(2)	(3)	(4)	(5)	(6)
<u>Width of segment III related to its length:</u> (1) Length usually 5.3 times the width or less. (2) Length more than 5.3 times the width.	1	1	1	1	<u>2</u>	1
<u>Width of preterminal antennal segment to its length:</u> (1) Length usually less than 3.3 times the width. (2) Length 3.3 times the width, or more.	1&2	1	1	2	2	2
<u>Antennal setae:</u> (1) Comparatively short; less than twice as long as body setae. (2) Long; twice as long as body setae or more.	1&2	1	1	1	2	1
<u>Capitate, apically knobbed sensory setae:</u> (1) Absent. (2) Present.	2	2	2	2	<u>1</u>	2
<u>If present:</u> (1) Only on segment X. (2) Few on segments III to X, but other setae more numerous. (3) On segments III to X forming the majority of the antennal setae.	1	1	1	<u>2</u>	NC	<u>3</u>
<u>Number of hair-like setae on scape:</u> (1) 4 setae almost always present. (2) More than 4 setae present.	1&2	2	2	1	1	1
<u>THORAX:</u>						
<u>PROTHORAX:</u>						
<u>Proepisternum:</u> (1) Dorsal margin ridge-like. (2) Dorsal and ventral margins ridge-like.	1	1	1	1	<u>2</u>	1
<u>Prosternal ridge:</u> (1) Its position only marked by heavy sclerotization. (2) Distinct.	2	2	<u>1</u>	2	2	2
<u>Medial pronotal setae:</u> (1) Usually absent. (2) Present.	2	2	2	1	1	1
<u>Posttergital setae:</u> (1) Usually absent. (2) Present.	1&2	2	2	1	1	1

	(1)	(2)	(3)	(4)	(5)	(6)
<u>Antespiracular dorsal setae:</u> (1) Absent. (2) Present.	2	2	2	1	1	2
<u>Antespiracular ventral setae:</u> (1) One seta on each side. (2) 2 setae.	1	1	<u>2</u>	1	1	1
<u>Prosternal setae:</u> (1) 3 setae or less on each side. (2) More than 3 seta present.	1	<u>2</u>	1	1	1	1
<u>Antespiracular dorsal pores:</u> (1) Absent. (2) Present.	2	2	2	1	1	NC
<u>MESOTHORAX:</u>						
<u>Prescutal ridges:</u> (1) Well separated. (2) Posteriorly joined.	1	1	1	1	<u>2</u>	1
<u>Width to length of prescutum:</u> (1) Width less than 1.3 times the length. (2) Width 1.3 times the length, or less.	1&2	2	2	2	1	1
<u>Scutum: Median longitudinal narrow membranous area:</u> (1) Absent. (2) Present.	2	2	2	<u>2</u>	1	1
<u>Relative length of prescutum and scutum:</u> (1) Prescutum shorter. (2) Prescutum longer.	1	1	1	1	2	2
<u>Relative length of scutellum and scutum:</u> (1) Scutellum shorter than scutum. (2) Scutellum longer.	1	1	1	1	2	2
<u>Basalare:</u> (1) Comparatively weak and slender. (2) Rather stout.	2	2	2	1	1	1
<u>Lateropleurite:</u> (1) Comparatively narrow. (2) Large.	1	1	2	1	2	2
<u>Trochantin:</u> (1) Absent. (2) Present.	2	2	2	2	2	<u>1</u>
<u>Marginal ridge of basisternum:</u> (1) Absent. (2) Present.	2	2	<u>1</u>	2	2	2

	(1)	(2)	(3)	(4)	(5)	(6)
<u>Furca:</u> (1) Comparatively small. (2) Well developed.	2	2	<u>1</u>	2	2	2
<u>Postmesostigmatal setae:</u> (1) Absent. (2) Present.	2	2	2	2	2	<u>1</u>
<u>MEPITHORAX:</u>						
<u>Metapostnotal ridge:</u> (1) Absent. (2) Present.	2	2	2	2	2	<u>1</u>
<u>Alar setae:</u> (1) Absent. (2) Present.	2	2	2	2	2	<u>1</u>
<u>LEGS:</u>						
<u>Hind legs:</u> (1) Short; the body more than 2.2 times as long. (2) Long; the body less than 2.2 times as long.	2	2	<u>1</u>	2	2	2
<u>Femur:</u> (1) Front femur shortest. (2) Middle femur shortest.	1&2	1	1	2	2	1
<u>Tarsal digitules:</u> (1) Absent. (2) Present.	2	2	2	2	1	1
<u>ABDOMEN:</u>						
<u>Ostioles:</u> (1) Absent. (2) Present.	1&2	2	2	1	2	1
<u>Dorsal setae of segment VIII:</u> (1) Absent. (2) Present.	2	2	2	2	2	<u>1</u>
<u>Pleural setae of segment VIII:</u> (1) All of subequal length. (2) Include one slightly longer seta.	1&2	2	2	1	1	1
<u>If disc pores present:</u> (1) Only on segment I. (2) On segment I and other abdominal segments.	2	2	2	<u>1</u>	2	NC
<u>Glandular pouches and their setae:</u> (1) Only on segment VIII. (2) One set on each side of segments VII and VIII.	1	1	1	1	<u>2</u>	1

	(1)	(2)	(3)	(4)	323 (5)	(6)
<u>Setae of the glandular pouch of segment VIII:</u> (1) Include a pair of comparatively long tail setae and one much shorter seta. (2) Include a pair of tail setae, two of medium, unequal lengths and a short one.	1	1	1	<u>2</u>	1	1
<u>Length of tail setae related to total length of body:</u> (1) Short; body usually more than 5 times as long. (2) Long; body usually 5 times as long, or less.	2	2	2	2	1	1
<u>Basal ridge of the penial sheath:</u> (1) Medially interrupted and with a small projection. (2) Medially continuous; projection absent.	1	1	1	1	1	<u>2</u>
Total number of exclusive characters	0	4	8	5	8	9

In discussing the groups of genera, an attempt has been made to assess their primitive or specialized status, on the basis of the number of shared specialized and primitive characters, but this was found to be rather difficult. Theron (1958) discussed the matter with reference to the conditions of the more primitive Sternorrhynchan Homoptera and considered 3 main conditions as distinct specializations in Coccoidea: (1) sclerite degeneration, and consequently (2) the development of secondary ridges for reinforcing the desclerotized parts, (3) the absence of any of the primary ridges, or the reduction of other generalized structures.

When the groups of genera of the studied Pseudococcidae were compared with each other, the different structures showed varying degrees of development, and complying with the principles already set out by Theron (l.c.) and Gilioee (1964), the following conditions of the various characters were regarded as specialized:

(a) The presence of: ocular ridges (preocular, postocular and interocular); ridge-like sclerotization of the proepisternum; short and transverse scutellum; ostioles; basal ring replacing the basal ridge of the penial sheath.

The presence of the lateral arms of the midcranial ridge is considered as a secondary specialization since they are absent in primitive families (Margarodidae), but reappear in most specialized ones such as Coccidae and Diaspididae.

(b) The absence of: various sclerites (as an expression of sclerite degeneration); disc pores; dorsal and ventral arms of midcranial ridge; lateral ocelli; pronotal ridges; cervical sclerites; metapleural ridges; hamulohalterae; tarsal digitules; glandular pouches and their associated setae.

On the other hand, the following conditions were considered as being primitive:

(a) The strong development of: postoccipital ridge; distinct neck region; basalare.

(b) The presence of: more than 2 pairs of simple eyes; well separated anterior tentorial arms; prosternal or metasternal apophyses; large lateropleurites; more than one hamulohalteral seta; preapical denticle of the claw.

The presence of a small, narrow solerite identified as the trochantin (first mentioned by Giliomee, 1961, and noticed but not identified as such by Makel, 1942), and found in all Pseudococcidae here studied except N. bifrons, is interesting and must be considered as a primitive condition. It was not discussed at all by Theron, but Weber (1928) and Roberti (1946) found it in Aphis.

(c) The absence of: prosternal ridge; marginal ridge of the basis-ternum; metapostnotal ridge.

a. Groups of genera:

The proposed groups of Pseudococcidae are:

- I. The Nairobi group, represented by the genus Nairobi only, is the most specialized among the Pseudococcidae here studied. The exclusive characters of this group are:
- (1) The disc pores entirely absent.
 - (2) The lateral ocelli vestigial.
 - (3) Antennal segments III to X with a dominant number of capitate, apically knobbed sensory setae.
 - (4) The trochantin absent.
 - (5) The metapostnotal ridge absent.
 - (6) The basal ridges of the penial sheath ventro-medially continuous and their projections absent.
 - (7) The absence of the postmesostigmatal and the alar setae, and the abdominal dorsal setae of segment VIII.

The group exhibits a large number of specializations which include four of the above-listed exclusive characters (i.e. 1, 2, 6 and 7) as well as: (5) the reduction of the prosternal plates, (6) the weak development of the basalare, (7) the absence of the tarsal

digitules, and (8) the reduction of the setae of the glandular pouches.

It also features a few primitive conditions including: (1) the absence of the metapostnotal ridge (exclusive character No. 5), (2) the weak development of the lateral arms of the midcranial ridge, (3) the absence of the interocular ridges, (4) separated anterior tentorial arms, and (5) the absence of ostioles.

This group shares with the Eriococcidae the absence of three characters typical of Pseudococcidae (i.e. the absence of: disc pores, metapostnotal ridge and trochantin), and probably represents a link between these two families.

As far as the existing literature is concerned, none of the previously described genera could be assigned to this group.

II. The Ceroputo group, represented by two closely related genera, Ceroputo and Centrococcus, which share between them a large number of characters (103); this group is less specialized than Nairobi and shows the following exclusive conditions:

- (1) The ventral head pores present.
- (2) The 3rd antennal segment $1\frac{1}{2}$ or more times as long as the terminal segment.
- (3) The 3rd antennal segment more than 5.3 times as long as wide.
- (4) The capitate, apically knobbed sensory setae of the antennae entirely absent.
- (5) The dorsal and the ventral margins of the proepisternum heavily sclerotized and ridge-like.
- (6) The prescutal ridges posteriorly continuous.
- (7) The glandular pouches and their setae present on each side of abdominal segments VII and VIII.

The specializations of the group include two of the above-listed exclusive characters (i.e. 5 & 6) and: (3) the presence of a

ridge-like projection or sclerotized arm extending anteriorly from the postocular ridge, (4) the reduction of the scutum, (5) the weak development of the basalare, (6) the absence of the tarsal digitules, and (7) the short setae of the glandular pouches.

The primitive features are two of the exclusive characters (i.e. Nos. 1 & 7) and: (3) the weak development of the lateral arms of the midcranial ridge, and (4) the separation of the anterior tentorial arms.

The males of an unidentified species of Centrocooccus obtained from Australia (collected by O. W. Richards, in King's Park, Perth, W. Australia, on Mimosa sp., on 11.1.1966) were received too late for a detailed study, but microscopic examination of two mounted specimens leaves no doubt that this species is different from C. insolitus here studied, with which it is, however, certainly congeneric.

From the available generalized descriptions of the males of Phenacoccus aceris (Sign.) (Sulc, 1943), Heterococcus graminicola Morrison (Morrison, 1945), Phenacoccus piceae Loew (Jancke, 1955) and Phenacoccus gossypii Townsend & Ckll. (Beardsley, 1960, 1962), it appears that the genera Phenacoccus and Heterococcus also belong to this group. The descriptions indicate that all these species have glandular pouches and associated setae on each side of abdominal segments VII and VIII, which is the most distinctive exclusive character of the Ceroputo group of genera.

III. The Octococcus group, represented by one genus only, Octococcus. The studied species of this group (O. africanus) is fairly specialized and presumably closely related to the Planococcus group. As will be discussed later, however, it shares fewer characters with any species of the latter than those species do between themselves. It also exhibits a number of exclusive features justifying its isolation as a separate group. These exclusive features concern chaetotaxy and the

distribution of disc pores, namely: (1) dorsal head setae 7 or less on each side; (2) transverse band of ventral head setae include 5 or less setae on each side; (3) few capitate, apically knobbed sensory setae present on antennal segments III to X; (4) abdominal disc pores present on segments I and VIII only; and (5) setae of the glandular pouch include a pair of comparatively long tail-forming setae, two setae of medium, unequal lengths and a short one.

The specializations of the group are: (1) the absence of disc pores on the head and on abdominal segments II to VII; (2) the strong development of the lateral arms of the midcranial ridge; and (3) the presence of interocular ridges.

The primitive features are: (1) a large scutum, (2) strong basalare, and (3) long setae of the glandular pouches.

None of the previously studied species could be included in this group.

IV. The Saccharicoccus group, which also comprises only one genus, Saccharicoccus. The species studied (S. sacchari) represents a rather primitive group with the following exclusive characters:

- (1) The head and body dorso-ventrally flattened.
- (2) The ventral preocular depression entirely absent.
- (3) The postoccipital ridge V-shaped.
- (4) The postocular ridge dorsally reduced.
- (5) The prosternal ridge absent.
- (6) The antespircular ventral setae more than one on each side.
- (7) The marginal ridge of the basisternum absent medially.
- (8) The furca reduced.
- (9) The legs comparatively short; the body more than 2.2 times as long as the hind legs.

The specializations of the group are: (1) the strong development of the lateral arms of the midcranial ridge; (2) the presence of interocular ridges; and (3) the reduction of the furca.

The comparatively large number of primitive features include three exclusive characters (4, 5, 7) and: (4) large scutum, (5) strong basalare, (6) long setae of glandular pouches.

No other species could be assigned to the Saccharicoccus group.

V. The Pseudococcus group: Two genera, Pseudococcus and Dysmicoccus represent this group and share 93 characters. The group is one of the two most primitive among the material studied, and includes species with most characters in the generalized pseudococcid condition. It shows only one exclusive, but rather obvious character, i.e. the presence of fleshy setae on parts of the body itself (head, thorax and abdomen), usually giving the species a rather hairy appearance. The specializations of this group are: (1) lateral arms of midcranial ridge strongly developed, (2) interocular ridge present.

The primitive characters are: (1) scutum large, (2) basalare strong, (3) setae of the glandular pouches long.

The descriptions of Pseudococcus antrecolens Ferris; P. dorsispinosus Beard.; P. floriger Ferris; P. lycopodii Beard.; P. montanus Ehrhorn; P. straussiae Ehrhorn; P. comstocki (Kuwana); P. peleae Beard.; Dysmicoccus boninsis (Kuwana); D. brevipes (Ckll.), D. neobrevipes Beard. by Beardsley (1960, 1962, 1965) and those of Pseudococcus fragilis Brain; P. adonidum (L.); and "P. maritimus (Ehrhorn) type A & B" by Giliomee (1961) show that all these species have fleshy setae on one or more parts of the body itself, thus confirming the validity of the exclusive character in the other species of the two genera Pseudococcus and Dysmicoccus. According to Beardsley (l.c.), the males of Pedronia acanthocanda Beard., P. cibotii Beard., P. crypta Beard., P. hawaiiensis Ferris,

Claviccoccus tribulus Ferris, Phyllococcus oahuensis (Ehrhorn), Laminicoccus giffardi (Ehrhorn), Palmicola palmarum (Ehrhorn), and Nesococcus picturi (Ehrhorn) also have fleshy setae on the main parts of the body. The genera Pedronia, Claviccoccus, Phyllococcus, Laminicoccus, Palmicola and Nesococcus apparently ought also to be placed in the Pseudococcus group of genera.

VI. The Planococcus group, includes the remaining genera here studied (i.e. Planococcus, Planococcoides, Nipaecoccus, Maconelliococcus, Ferrisiana and Trionymus); these genera also exhibit the generalized conditions of almost all characters and represent one of the most primitive groups among the material studied. Pairs of genera within the group share a rather large number of characters (88-111) and the members of the group have 71 characters in common. It may be interesting to note that this group, unlike all the others here recognized, has no exclusive characters. The two specializations of the group (i.e. strong development of the lateral arms of the midcranial ridge and the presence of interocular ridge) and the three primitive conditions (i.e. large scutum, strong basalare and long setae of glandular pouches) are the same as in the Pseudococcus group, and the two groups, as will be discussed, are very closely related.

Beardsley's (l.c.) descriptions of Chorizococcus lounsburi (Brain) (= Trionymus lounsburi Brain), Trionymus multiductus Beard., T. rostellum Lobdell, T. danthoniae Morrison, Nipaecoccus nipae (Mask.), N. vastator (Mask.), N. longispinus Beard. and Antonina crawii Okl. indicate that all these species exhibit the generalized characters of Pseudococcidae and have no fleshy setae on the body itself, thus confirming the writer's conclusions regarding the general characteristics of Trionymus and Nipaecoccus in the other species of these genera and their inclusion in the Planococcus group. The descriptions also suggest that Chorizococcus and Antonina also belong to this group of genera.

Beardsley (1960) also described the males of Trionymus refertus Ferris and showed that they carry few fleshy setae on the head. For this reason, and to comply with the present definition of the groups, this species should be placed in Pseudococcus group. This would imply that it may not be congeneric with the other spp. of Trionymus, since the latter definitely belongs to the Planococcus group. In this respect it may be interesting to point out that this species was referred to Trionymus with some reservation, and Ferris (see Zimmerman, 1948) noted that certain characters of the females (presence of 4 conical setae in each anal lobe cerarius, complete absence of multilocular pores and very few and small tubular ducts) separate it well from any other species referred to Trionymus.

Other groups of Pseudococcidae:

Beardsley (1962) described the males of another two rather interesting pseudococcid species, Puto yuccae (Coquillett) and Rhizoecus falcifer Kunckel d'Herculais, both of which showed great structural diversities from the usual males here discussed. It is evident, in view of these descriptions, that neither species could be accepted in any of the recognized groups, and therefore the introduction of two additional ones, Puto and Rhizoecus respectively, seems to be inevitable. It must be remembered that the identity of these groups is based purely on the available information extracted from Beardsley's paper.

VII. The Puto group, which probably represents the most primitive extreme within Pseudococcidae. The group has the largest number of exclusive primitive characteristics, namely: (1) sclerite degenerat-

tion less pronounced; (2) a neck region well developed; (3) the presence of numerous disc pores ventrally on the head (about 12 on each side); (4) the presence of more than two pairs of simple eyes; (5) the ventral arm of the midcranial ridge posteriorly reaching the preoral ridges, and the lateral arms absent; (6) the presence of prosternal apophyses; (7) the hamulohalterae usually with more than one apically hooked seta; (8) the claw with a preapical dneticle and a pair of stout spine-like projections on the inner face, near its base.

The detailed description of the males of Puto antennatus Sign. by Reyne (1954) indicates that this species is definitely congeneric with P. yuccae, with which it shares almost all the above-listed exclusive characters (the presence of prosternal apophyses was not mentioned); Reyne's account of the males of Macrocerococcus superbus Leon. and his illustration of the head (dorsal view) also suggest the inclusion of the genus Macrocerococcus in this group.

The primitive nature of Puto sp. among Pseudococcidae is also supported by cytological studies (Hughes-Schrader, 1944).

VIII. The Rhizoecus group: Contrary to conditions in Puto, this group represents the most specialized extreme of the known males of Pseudococcidae. It exhibits the largest number of exclusive specialized characteristics, which include: (1) the head broadly joined to the thorax, the neck region being absent; (2) sclerite degeneration of the thorax more pronounced; (3) absence of a distinct midcranial ridge; (4) absence of the cervical sclerites; (5) absence of the lateral ocelli; (6) reduction of the medial pronotal ridges; (7) absence of the hamulohalterae; (8) absence of the metapleural ridge; (9) absence of the glandular pouches.

The Rhizoecus group also shows the following conditions which are regarded as primitive: (1) the absence of the preocular ridges;

(2) the presence of a pair of prosternal apophyses; and (3) the less pronounced sclerite degeneration of the abdominal segments.

According to Hambleton (1946), the genera Rhizoecus, Ripersiella, Geococcus and Pseudorthizoecus appear to be elements of a natural group within the mealybugs, to which he also added 4 new genera: Radicoccus (Radiococcus, misspelling), Breviococcus, Morrisonella and Neorthizoecus. This group was erected on the basis of certain female characters (geniculate antennae and nature of the anal ring) and on the fact that all these genera include ground-inhabiting species. Apart from Rhizoecus, no information about the males of this group is available, and it would be interesting if Hambleton's conception of this natural group could be confirmed on the basis of male characters also.

Relationships between the groups of Pseudococcidae:

The relationships between the groups of genera is illustrated in table IV which shows: (1) the number of characters shared by any pair of groups; (2) the number of characters exclusive to each of these pairs; and (3) the number of characters by which the pairs of groups differ from each other. These affinities are based on the total number of shared characters, since the specialized or primitive condition of most of these could not be determined with great certainty.

<u>Table IV: Relationships</u> <u>between the groups of genera.</u>	<u>Number of Characters.</u>		
	(A)	(B)	(C)
Pairs of groups	Shared	of which exclusive	Different- iating
Planococcus - Pseudococcus	44	0	4
Planococcus - Saccharicoccus	38	0	10
Planococcus - Octococcus	37	0	11
Planococcus - Ceroputo	25	0	22
Planococcus - Nairobiia	26	0	22
Pseudococcus - Saccharicoccus	42	0	14
Pseudococcus - Octococcus	36	0	21
Pseudococcus - Ceroputo	22	0	35
Pseudococcus - Nairobiia	24	0	33
Saccharicoccus - Octococcus	31	0	27
Saccharicoccus - Ceroputo	18	0	39
Saccharicoccus - Nairobiia	20	0	38
Octococcus - Ceroputo	32	4	25
Octococcus - Nairobiia	28	0	30
Ceroputo - Nairobiia	34	8	24

Examination of this table suggests that:

- (a) The Planococcus and Pseudococcus groups are the closest relatives, sharing the largest number of characters (44) and differentiated by the smallest (4).
- (b) Planococcus, Pseudococcus, Saccharicoccus and Octococcus groups seem to be rather closely related to each other; they exhibit the generalized typical pseudococcid condition and share a comparatively large number of characters (31 - 44).
- (c) The Ceroputo group is obviously the closest relative to Nairobiia, and vice versa; the two groups have the largest number of exclusive conditions (8), and share 34 characters, which is more than each of them shares with any other group.

These relationships, and taking into consideration the available published information, probably indicate that there are four major sections of Pseudococcidae:

- I. The Rhizoecus section which represents the most specialized extreme.
- II. The Ceroputo + Nairobiia section which ^{is} ~~are~~ less specialized.
- III. The Planococcus, Pseudococcus, Saccharicoccus and Octococcus section, which includes closely related and rather primitive groups.
- IV. The Puto section, which appears to represent the most primitive extreme of all.

It is difficult to ascribe any definite taxonomic status to these sections, but they may possibly deserve subfamily ranks, with further subdivision into tribes and subtribes based on the groups of genera suggested here; e.g. the very close relationships with only a few differentiating characters would suggest that the Planococcus and Pseudococcus groups probably represent two subtribes of the same tribe. However, further investigations of more widely representative material is required before more accurate conclusions could be made.

b. Genera:

In table V, 73 characters are listed, separating the genera in at least one of the three groups in which more than one genus was available for study. When a character can be used taxonomically within a particular group, it is marked "G" in the table; if it holds at the specific level only or at both generic and specific levels, the marks "S" or "GS" respectively are given; the mark "-" indicates that the character does not apply at all within the group.

Table V:List of characters separating genera.

Characters	Planococcus group	Pseudo- coccus group	Ceroputo group
1. Presence and position of fleshy setae on body.	GS	-	G
<u>HEAD:</u>			
2. Nature of ventral preocular depression.	GS	-	-
3. Nature of dorsal arm of midcranial ridge.	G	-	G
4. Degree of posterior development of dorsal arm.	G	G	G
5. Nature of the lateral arms of the midcranial ridge.	G	-	-

	Planococcus group	Pseudo- coccus group	Ceroputo group
6. Nature of the postoccipital ridge.	-	-	G
7. Condition of the postoccipital ridge anteriorly.	GS	G	-
8. Nature of the ventral rudiment of the preocular ridge.	G	-	-
9. Distance between the dorsal eyes related to their corneaes.	GS	-	G
10. Relative size of dorsal and ventral eyes.	S	-	G
11. Nature of attachment of ocellus to postocular ridge.	-	-	G
12. Number of dorsal head setae.	G	-	-
13. Number of genal setae.	GS	-	G
14. Number of dorsal ocular setae.	-	G	-
15. Presence of setae between ventral eyes.	-	-	G
16. Number of ventral head setae, transversely arranged in front of the ventral eyes.	G	-	G
17. Presence and position of head pores.	G	-	G
18. Number of disc pores, if present dorsally only on the head.	GS	GS	-
<u>ANTENNAE:</u>			
19. Relative length of antenna to body.	GS	S	-
20. Relative length of antenna to hind leg .	GS	S	-

	Planococcus group	Pseudococcus group	Ceroputo group
21. Relative length of 3rd and terminal segments.	GS	S	-
22. Width of segment III related to its length.	G	S	-
23. Presence of fleshy setae on antennae.	-	-	G
24. Relative length of antennal and body setae.	GS	-	-
25. Number of hair-like setae on scape.	G	-	-
26. Number of antennal bristles on terminal segment.	GS	S	G
27. Relative length of the two lateral bristles of terminal segment to those on preceding segments.	-	-	G
28. Relative lengths of the three large bristles of terminal segment.	G	GS	-
<u>THORAX:</u>			
29. Shape of prosternum.	GS	-	G
30. Nature of prosternal ridge.	GS	-	-
31. Number of medial pronotal setae.	GS	S	-
32. Number of lateral pronotal setae.	GS	GS	-
33. Number of posttergital setae.	G	S	G
34. Presence of prosternal setae.	-	-	G
35. Number of medial pronotal pores.	GS	-	-
36. Number of lateral pronotal pores.	-	S	G
37. Number of antespircular dorsal pores.	GS	S	-

	Planococcus group	Pseudococcus group	Ceroputo group
38. Number of prosternal pores.	GS	S	-
39. Relative length of prescutum to scutum.	-	-	G
40. Appearance of scutellum in dorsal view.	-	-	G
41. Presence of a membranous area on the lateropleurite.	-	-	G
42. Number of prescutal setae.	GS	-	G
43. Number of scutal setae.	S	S	G
44. Number of scutellar setae.	GS	S	-
45. Number of tegular setae.	GS	GS	G
46. Position of postmesostigmatal setae.	G	S	-
47. Number of postmesostigmatal pores.	G	S	G
48. Number of metatergal setae.	GS	S	G
49. Number of metapleural setae.	GS	S	G
50. Number of anterior metasternal setae.	GS	S	-
51. Number of posterior metasternal setae.	GS	S	-
52. Presence of metatergal pores.	G	S	-
53. Presence of metaspiracular pores.	GS	S	-
54. Presence of anterior metasternal pores.	GS	S	-
55. Presence of posterior metasternal setae.	GS	S	-
56. Number of alar setae.	GS	GS	G

	Planococcus group	Pseudococcus group	Ceroputo group
57. Number of circular sensoria on fore-wings.	G	S	-
58. Relative length of the hamulohalteral seta to length of the hamulohaltera.	G	-	G
59. Relative length of fore legs.	G	-	-
60. Presence of differentiated apical seta on trochanter.	GS	-	-
61. Relative length of fore and middle femora.	GS	S	-
62. Relative width of hind femur to its length.	G	-	G
63. Relative lengths of tibia and femur in fore legs.	G	-	-
<u>ABDOMEN:</u>			
64. Nature of ostioles.	GS	S	G
65. Number of ventral setae on abdominal segment VIII.	GS	S	-
66. Presence of disc pores on abdominal segments.	G	S	-
67. Position of abdominal pores.	GS	GS	-
68. Relative length to width of penial sheath.	GS	S	G
69. Relative length of genital segment to total length of body.	G	S	-
70. Appearance of style in lateral view.	G	S	-
71. Condition of process of penial sheath.	G	S	G
72. Comparative length of aedeagus.	G	S	-
73. Number of dorsal setae of the genital segment.	-	-	G

c. Species:

Table VI includes 57 characters separating the species in at least one of the three genera in which more than one species was available for study. The characters operating taxonomically within a particular genus are indicated by the mark "+", and those not operating by the mark "-". The table shows that the species of these genera could be separated by a large number of characters including differences in the development of various structures, the number and distribution of the setae and disc pores.

Table VI. List of characters separating species.

Characters	Planococcus	Nipaecoccus	Pseudococcus
1. Presence of fleshy setae on antennae and legs.	-	+	
<u>HEAD:</u>			
2. Nature of ventral preocular depression.	+	-	-
3. Anterior development of postoccipital ridge.	+	-	-
4. Distance between dorsal eyes in relation to diameter of their corneae.	+	+	-
5. Relative size of dorsal and ventral eyes.	-	+	-
6. Number of genal setae.	-	+	-
7. Number of head pores.	+	-	+

	Planococcus	Nipaecoccus	Pseudococcus
--	-------------	-------------	--------------

ANTENNAE:

8. Relative length to body.	+	-	+
9. Relative length to hind legs.	-	+	+
10. Relative lengths of 3rd and terminal segments.	+	-	+
11. Width of segment III related to its length.	-	-	+
12. Relative length of antennal and body setae.	-	+	-
13. Number of antennal bristles of terminal segment.	-	+	+
14. Relative size of the three large bristles on terminal segment to other setae.	-	+	-
15. Relative lengths of the three large bristles of the terminal segment.	-	-	+
16. Position of the dorsal bristle of terminal segment.	-	+	-

THORAX:

17. Shape of prosternum.	-	+	-
18. Nature of prosternal ridge.	+	-	-
19. Number of medial pronotal setae.	-	+	+
20. Number of lateral pronotal setae.	+	+	+
21. Number of posttergital setae.	-	-	+
22. Number of antespирacular dorsal setae.	-	-	+
23. Number of antespирacular ventral setae.	-	-	+
24. Number of medial pronotal pores	+	+	-
25. Number of lateral pronotal pores.	-	-	+

	Planococcus	Nipaeococcus	Pseudococcus
26. Presence of posttergital pores.	+	+	-
27. Number of antespирacular dorsal pores.	+	-	+
28. Number of prosternal pores.	-	+	+
29. Relative length of prescutum to its width.	-	+	-
30. Number of prescutal setae.	+	-	-
31. Number of scutal setae.	-	+	+
32. Number of scutellar setae.	-	+	+
33. Number of tegular setae.	-	+	+
34. Position of postmesostigmatal setae.	-	-	+
35. Number of postmesostigmatal pores.	-	-	+
36. Number of metatergal setae.	+	+	+
37. Number of metapleural setae.	-	+	+
38. Number of anterior metasternal setae.	+	+	+
39. Presence of postmetastigmatal setae.	-	-	+
40. Number of posterior metasternal setae.	+	+	+
41. Presence of metatergal pores.	-	-	+
42. Presence of metaspіracular pores.	+	+	+
43. Presence of anterior metasternal pores.	+	-	+
44. Presence of posterior metasternal setae.	+	-	+
45. Number of alar setae.	+	-	+

	Planococcus	Nipaeococcus	Pseudococcus
46. Number of circular sensoria on fore wings.	-	-	+
47. Presence of apical setae on trochanter.	-	+	-
48. Relative lengths of fore and middle femora.	+	-	+
<u>ABDOMEN:</u>			
49. Nature of ostioles.	-	+	+
50. Number of ventral setae on abdominal segment VIII.	+	-	+
51. Presence of disc pores on abdominal segments.	-	-	+
52. Position of abdominal pores.	+	+	+
53. Relative length to width of the penial sheath.	+	+	+
54. Relative length of genital segment to total length of body.	-	-	+
55. Lateral appearance of style.	-	-	+
56. Condition of process of penial sheath.	-	-	+
57. Comparative length of aedeagus.	-	-	+

(II) FAMILY ERIOCOCCIDAE:

A division of this family into groups of genera, similar to that of the Pseudococcidae cannot be suggested at the present stage. Only 7 species (representing 4 genera) belonging to this family were available, and it was not possible to assess correctly the significance of the morphological differences they exhibit. However, the distribution of the body setae and the structure of the genital segment appear to be most significant in the material studied. Inspection of table II shows that of the 3 spp. of Eriococcus, E. araucariae shares a comparatively large number of characters with E. orariensis (118), but each of these species has only 101 and 102 characters respectively, in common with E. buxi. This would suggest that the latter is less closely related to the other two species and would support ^{the view of} Borchsenius (1963) that E. buxi (the type species of Eriococcus) is not congeneric with the other species hitherto ascribed to the same genus.

On the other hand, the structure of the genital capsule indicates that the studied species could be grouped as follows:

- a) E. araucariae and Gossyparia spp., where the style is undulated and the base of the aedeagus distinctly sclerotized latero-dorsally.
- b) E. buxi, O. agavium and P. fraxini, where the genital capsule is comparatively short and the style rather straight.
- c) E. orariensis, where the genital capsule is conspicuously elongate (its length more than 2.5 times its width).

It should be emphasised, however, that the available material was quite inadequate and the above suggestions are very tentative indeed.

The genera and species of the family Eriococcidae studied here are merely separated by differences in chaetotaxy and the development of certain structures. These are listed in table I and will be used in the keys.

(D) RELATIONSHIPS OF PSEUDOCOCCIDAE AND ERIOCOCCIDAE WITH
OTHER COCCOIDEA

The division of the Coccoidea by Balachowsky (1937, 1942) into margaroids, lecanoids and diaspidoids, each with a distinct type of male, is generally accepted and supported by the results of the detailed morphological studies (Theron, 1958, 1962; Ghauri, 1962; Giliomee, 1961, 1964) as well as cytological investigations (Hughes - Schrader, 1944, 1948; Brown, 1959; Brown & McKenzie, 1962). The knowledge accumulated in the last few years, although still incomplete, has shown clearly the importance of the males for a better understanding of the relationships of the group at all the taxonomic levels.

According to Balachowsky's (l.o.) original designation, margaroids - the most primitive Coccoidea, comprise Ortheziidae and Margarodidae (including the aberrant species Steingelia gorodetskia); lecanoids comprise all the other families (including the monotypic family Phenacoleachidae), except Diaspididae and Phoenicococcoidea which constituted the diaspidoids. Balachowsky stressed that the diaspidoids represent a homogenous group fundamentally differing in the characters of the males and females from the other two groups. Theron (1958), who gave a detailed list of morphological characters separating the three types of males, and later also Giliomee (1961, 1964), both concluded however, that although the lecanoids are more specialized than the margaroids and less than the diaspidoids, they are nevertheless more closely related to diaspidoids than to margaroids.

As far as the relationships of Phenacoleachidae with other coccid families are concerned, Morrison and Morrison (1922) maintained that the sole species of this family, Phenacoleachia zealandica (Maskell) has a number of characteristics of Pseudococcidae "e.g. the kinds of pores, the character of the anal ring", and other character-

istics of Margaroididae "e.g. the number of antennal segments, the absence of differentiated tarsal digitules". At the same time it has certain characters refuting any relationship with either of these families "e.g. absence of dorsal ostioles disclaiming relationship with Pseudococcidae, and presence of anal ring with setae and pores and absence of abdominal spiracles, disclaiming affinity with Margaroididae". As already mentioned, Balachowsky included the Phenacoleachidae in the lecanoids (although admitting affinity to the margaroids mainly by the possession of 11-segmented antennae). Theron (1962) however, after detailed study of the males concluded that Phenacoleachia zealandica "ostensibly belongs to the margaroid group", showing a particularly close relationship to the aberrant margaroid Steingelia gorodetskia. He regarded them as annectant ^{forms} ~~genera~~ linking the primitive Margaroididae with the more specialized lecanoids. Gillomee (1964), on the basis of a simple numerical analysis of the characters available for comparison, was able to demonstrate that Steingelia apparently represents a link between Margaroididae and Coccidae, while Phenacoleachia a similar link between Margaroididae and Pseudococcidae. This suggestion was strongly supported by the recent discovery and description by Beardsley (1964) of the new second Phenacoleachia species, P. australis from Campbell Islands, which shows the presence of such pseudococcid features as "ostioles and cellular anal ring". These features tempted Beardsley to suggest that the Phenacoleachidae are definitely allied to the mealybugs and probably represent a primitive subfamily of Pseudococcidae. The males (apterous) also described by Beardsley, have two very distinctive pseudococcid characters (as shown in the present work) i.e. the presence of disc pores and of dorsal ostioles.

The study of males has therefore revealed that there appear to be at least two links between the primitive margaroids and the more specialized lecanoids. On the other hand, a close relationship between Asterolecaniidae (lecanoid) and diaspidoids was recently

suggested on the basis of cytological studies and of some characters of the female (Brown & McKenzie, 1962). Thus there may exist similar links between lecanoids and diaspidoids. There is no detailed information about the males of Asterolecaniidae, but their study may perhaps also support this suggestion.

Theron (1958), Ghauri (1962) and Giliomee (1964) each discussed the relationships of various groups of Coccoidea based on their own observations and on the information then available. Each contribution naturally allowed for more detailed and comprehensive comparisons and conclusions. For the present author, Giliomee's conclusions are of particular interest since he was dealing with the lecanoids, and included in his discussion not only Coccidae (the main object of his studies) but also males of 3 species of Pseudococcidae described in detail in his earlier paper (1961). Incidentally, his data on these species have been included here in the tables, calculations and discussion. Giliomee pointed out that the Coccidae are more specialized than Pseudococcidae since they generally share more characters with the highly specialized Diaspididae. Dealing with the lecanoid type of male, Giliomee found it necessary to introduce minor amendments to Theron's definition of the lecanoid type of male (these include the presence of the metasternal plates and the abdominal sclerites). The present study of Pseudococcidae and Eriococcidae has also revealed that two further minor amendments are necessary, i.e. regarding the presence of a distinct postoccipital ridge and of the metasternal apophyses.

It has already been established earlier in this discussion that the male characters indicate that Pseudococcidae and Eriococcidae represent two separate families. In an attempt to determine their affinities with other Coccoidea, it is now possible to consider 6 families for which adequate information on the males is now available, i.e. Margarodidae, Phenacoleachiidae, Pseudococcidae, Eriococcidae, Coccidae and Diaspididae. Steingelia, although a margarodid, is

treated separately because of its aberrant characters. Thirteen available characters were relevant for this purpose, and the distribution of their conditions within the families is shown in table VI. Each of the characters occur either in a specialised condition (marked "+") or a primitive one (marked "-").

Table VI: MALE CHARACTERS WHOSE CONDITIONS INDICATE AFFINITIES
WITHIN COCCOIDEA:

	Margarodidae	Steingelia	Phenacoleachidae	Pseudococcidae	Eriococcidae	Coccidae	Diaspididae
<u>Specialized conditions of the</u>							
<u>characters (+):</u>							
1. Disc pores absent.	-	-	+	+	+	+	+
2. Neck region absent.	-	-	-	-	-	-	+
3. Postoccipital ridge absent.	-	+	-	-	-	+	-
4. Interocular ridges present.	-	-	-	+	-	+	-
5. Tentorium absent.	-	-	-	-	-	-	+
6. Compound eyes absent.	-	+	+	+	+	+	+

	Margarodidae	Steingelia	Phenacoleachidae	Pseudococcidae	Eriococcidae	Coccidae	Diaspididae
7. Membranous area of scutum absent.	+	-	+	+	+	-	+
8. Scutellum short and transverse.	-	+	-	-	+	+	+
9. Median ridge of basisternum absent.	-	-	+	+	+	-	-
10. Metasternal sclerites absent.	-	-	-	+	+	-	-
11. Metasternal apophysis absent.	-	-	-	-	-	+	+
12. Ostioles present.	-	-	+	+	-	-	-
13. Penial sheath elongate.	-	-	-	-	-	+	+
Specialized conditions.	-	3	3	4	6	5	8
Primitive conditions.	12	10	8	6	7	6	5
Both conditions present.	1	-	2	3	-	2	-

Table VIA: The number of characters shared by, and separating each pair of families:

Sharing Separating	Margarodidae	Steingelia	Phenacoleach- idae	Pseudococcidae	Eriococcidae	Coccidae	Diaspididae
Margarodidae		9	8	6	7	5	5
Steingelia	3		7	5	8	9	6
Phenacoleachidae	2	4		9	9	4	5
Pseudococcidae	3	5	1		9	3	3
Eriococcidae	5	5	2	1		5	7
Coccidae	5	2	6	7	6		7
Diaspididae	7	7	6	7	6	4	

It should be noted that both conditions may obtain in certain families. At the bottom of the table are given the total number of occasions on which the specialized, primitive, and both conditions occur in each group. The proportion of the number of primitive to specialized conditions of the characters can be taken as indication to the primitive or specialized nature of the group, e.g. the primitive Margarodidae have no specializations, 12 primitive characters and one

in which both conditions occur. On the other hand the highly specialized Diaspididae show 8 specializations and 5 primitive conditions. This table is followed by another (Table VI A), prepared in the form of two half matrices, in which are given the total number of characters shared by each pair of groups (upper triangle of the matrix), and separating each pair (lower triangle). In this table the characters which occur in both conditions in either member of a pair are omitted, e.g. between Margarodidae and Steingelia, the character 7 in table VI (membranous area of scutum) which may be present or absent in Margarodidae, was not taken into consideration, and therefore only 12 characters are left for comparison.

It appears from these tables that the Eriococcidae are more specialized than the Pseudococcidae. They have 6 specializations (Table VI) and share a total number of 7 characters with the decisively more specialized Diaspididae (Table VIA), while the Pseudococcidae have only 4 specialized conditions and share only 3 characters with Diaspididae. It is also interesting to note that the structure of the genital segment suggests a closer relationship between Eriococcidae and Diaspididae than between the latter and Pseudococcidae.

From the same tables it appears that Giliomee was justified in assuming that the Coccidae are more specialized than Pseudococcidae. They have 5 specialized and 6 primitive features against 4 specialized and also 6 primitive in the latter, and comparison with Diaspididae shows that they share a total number of 7 characters with Coccidae but only 3 with Pseudococcidae.

Table VIA also indicates that Coccidae are closer to Eriococcidae (sharing 5 characters) than they are to Pseudococcidae (sharing only 3 characters). In the same way it also appears that the Eriococcidae are more closely related to the Pseudococcidae (sharing 9 characters) than they are to the Coccidae (sharing only 5 characters).

Table VI B is also derived from table VI and prepared in the form of a matrix. Here the relationships between the groups are expressed in fractions obtained by dividing the number of shared conditions by the total number of characters considered. Those characters occurring in either specialized or primitive conditions were counted as 1 unit, and if both conditions occurred in any of the

Table VI B:

	Steingelia	Phenacoleach- iidae	Pseudococcidae	Eriococcidae	Coccidae	Diaspididae
Margarodidae	0.73	0.73	0.62	0.58	0.50	0.42
Steingelia		0.62	0.50	0.62	0.77	0.46
Phenacoleachidae			0.88	0.77	0.46	0.46
Pseudococcidae				0.81	0.42	0.35
Eriococcidae					0.46	0.54
Coccidae						0.62
Diaspididae						

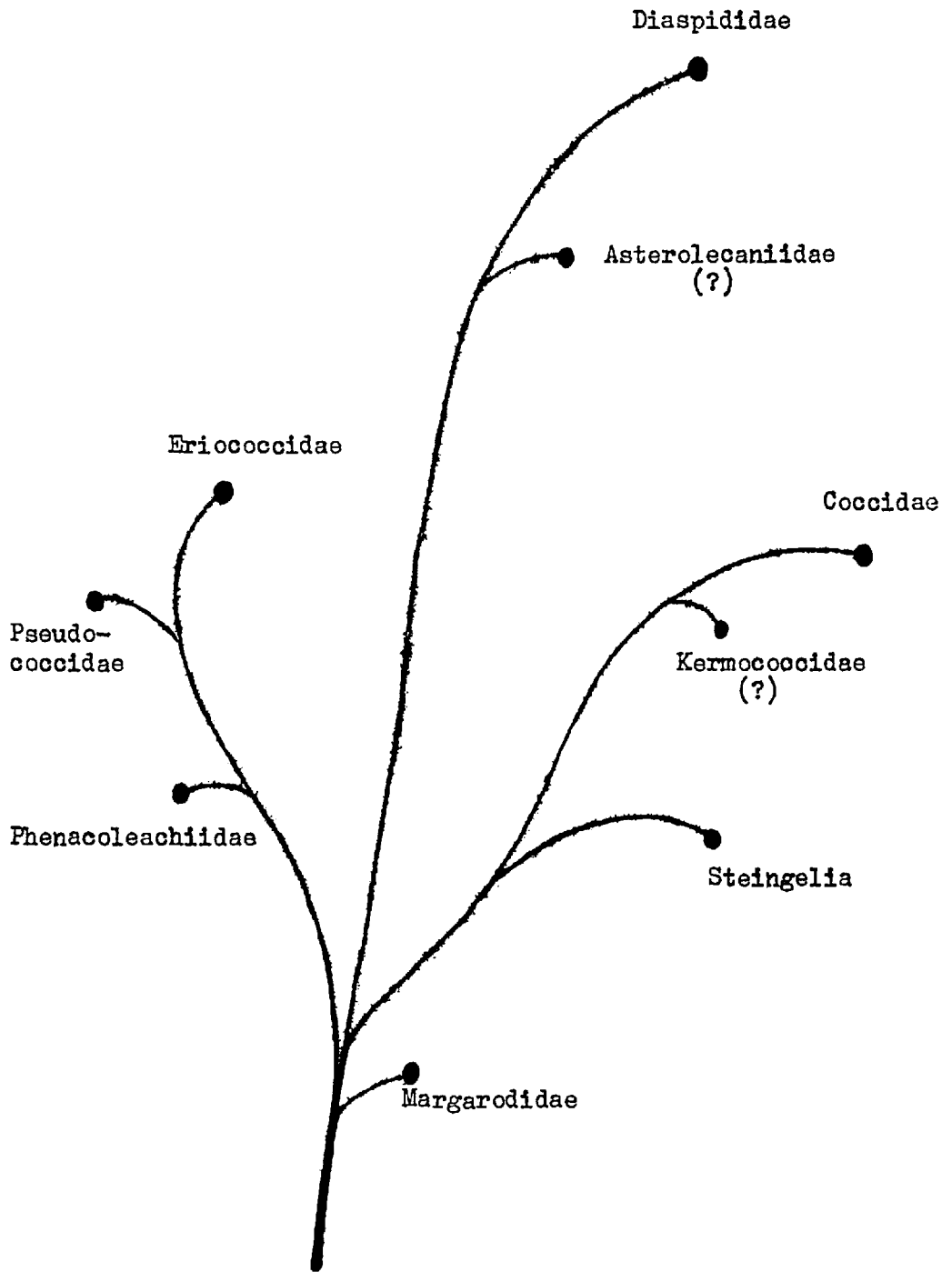
compared groups, they were both given a score of $\frac{1}{2}$ unit each, e.g. Margarodidae and Steingelia share 9 characters and are separated by 3, but in the former there is one character (No. 7) occurring in both conditions; the numbers thus corrected will be $9\frac{1}{2}$ shared and $3\frac{1}{2}$ separating. The number of the shared characters ($9\frac{1}{2}$) was divided by the total number of characters (13) and the result (0.73) was entered in the table as a measure of similarity. The values obtained vary

from 0 - 1 indicating no or complete similarity respectively, i.e. the higher the values are, the closer the relationship is.

From this table it is obvious that Steingelia and Phenacoleachiidae are similarly related to Margarodidae, and are closer to it than they are to each other. It is also apparent that Phenacoleachiidae are more closely related to Pseudococcidae than they are to Margarodidae, which would support the views of Beardsley. It also appears that Steingelia is closer to Coccidae than to the Margarodidae.

Giliomee (1964) discussed the taxonomic status of the family Kermococcidae, which Ferris (1937) placed in the family Eriococcidae, but which Balachowsky (1942) included as a subfamily in one family (Eriococcidae) together with Pseudococcinae and Eriococcinae. The description of the males of Kermococcus quercus (L.) by Borchsenius (1960) prompted Giliomee to assume that Kermococcidae are more closely related to Coccidae than to any other Coccoidea, on the basis of 6 characters shared by the two families. Further investigations on Kermococcidae are required before Giliomee's assumption can be supported since it was based on one species only, and since the present study revealed that some of the characters he used are also shared by Pseudococcidae (separate pre- and postocular ridges) and Eriococcidae (separate ocular ridges; short and transverse scutellum).

The results of the present work therefore (extracted from table VI B), as well as the conclusions of the earlier authors regarding the affinities of the different families of Coccoidea (including Asteroleoanidae), form the basis on which the following phylogenetic tree is tentatively suggested.



Primitive coccoid stock

VI. KEYS

The following keys are intended to separate the studied species and their supraspecific categories. Since the significance of some characters is still uncertain, the keys will include as many characters as possible, even more than actually necessary for this purpose. It should be noticed that the numbers of setae and disc pores given in these keys are always on one side only.

THE MACROPTEROUS MALES:(A) Key to the families Pseudococcidae and Eriococcidae:

Postoccipital ridge weak, slender, U or V-shaped. Tentorial bridge comparatively slender. Flagellar segments of the antennae, including the terminal, cylindrical and elongated. Dorsal margin of the proepisternum ridge-like. Scutellum pentagonal in dorsal view; its length half its width or more; scutellar ridge absent. Anterior and posterior postalar ridges well separated. Mesopleural ridge interrupted above the coxal articulation. Basal part of the trochanter conspicuously longer than the distal. Claw gradually tapering apically; unguis digitules not knobbed. Dorsal setae of abdominal segment VIII subequal in length to other abdominal setae; setae of the glandular pouch include a pair of long tail setae and one or more much shorter ones. Basal part of the penial sheath short, not fused with the 9th tergite + 10th segment. Anal opening minute. Aedeagus arising just behind the basal ridges of the penial sheath. Dorsal setae of the genital segment similar to other abdominal setae, always 3 or more. Derm pores present (except in Nairobia bifrons). The puparia fluffy and loosely felted PSEUDOCOCCIDAE.

___ Postoccipital ridge strongly developed and laterally forked. Tentorial bridge comparatively stout. Terminal flagellar segments of the antennae barrel-shaped, often as long as wide; the terminal segment distinctly pear-shaped. Proepisternum without any ridge-like sclerotization. Scutellum transverse, rectangular in dorsal view; its length less than half its width; with a well developed scutellar ridge on each side. Anterior and posterior postalar ridges anteriorly joined. Mesopleural ridge continuous above the coxal articulation. Basal part of the trochanter shorter than the distal. Claw broad at base, abruptly tapering apically; unguis apically knobbed. One of the dorsal setae on each side of abdominal segment VIII much longer than the others; setae of the glandular pouch include one pair of tail setae only. Basal part of the penial sheath long, fused with the 9th tergite + 10th segment and forming together a compact genital capsule. Anal opening large. Aedeagus arising at a comparatively large distance from the basal ring of the genital capsule. Dorsal setae of the genital segment considerably longer than other abdominal setae, always 2. Derm pores absent. The puparia compact, closely felted and rather flattened

..... ERIOCOCCIDAE.

FAMILY PSEUDOCOCCIDAE:

(B) Key to the groups of genera:

1. Dorsal, lateral and ventral arms of the midcranial ridge joined, forming together a cruciform structure. Pre and postocular ridges widely separated; interocular ridge absent. Anterior tentorial arms each apparently individually fused with the cranial apophysis. Penultimate antennal segment more than 3.7 times as long as wide. Prescutum triangular in dorsal view. Scutum without a median longitudinal narrow membranous area, and much shorter than either the

prescutum or the scutellum. Precoxal ridge of the metathorax weakly developed; metapleural wing process absent. Tarsal digitules absent. Setae of the glandular pouch include two long tail setae and a short one, subequal in length to the other abdominal setae; the tail setae comparatively short, the body being 5 times as long, or longer2

___ Dorsal arm of the midcranial ridge distinctly detached from the Y or T-shaped ridge formed by the lateral and the ventral arms. Pre and postocular ridges joined together by means of a well developed interocular ridge. Anterior tentorial arms anteriorly fused with each other before joining the cranial apophysis. Penultimate antennal segment less than 3.7 times as long as wide. Prescutum transverse, rectangular in dorsal view. Scutum with a distinct median longitudinal narrow membranous area, and longer than either the prescutum or the scutellum. Precoxal ridge of the metathorax well developed; with a small metapleural wing process. Tarsal digitules present. Setae of the glandular pouch include a pair of long tail setae and one or more setae conspicuously longer than other abdominal setae; the tail setae comparatively long, the body being less than 5 times as long3

2 (1) Disc pores absent. Lateral ocelli vestigial. Third and terminal antennal segments subequal in length (third not more than 1.1 times as long as terminal); the length of segment III less than 5 times its width. Antennal setae subequal in length to the body setae; capitate, apically knobbed sensory setae present on segments III to X. Proepisternum with only the dorsal margin ridge-like. Prescutal ridges well separated medially. Postmesostigmatal setae, alar setae and metapostnotal ridge absent. Fore-legs shortest. Ostioles absent. Dorsal setae of abdominal segment VIII absent. Glandular pouches and their setae only on abdominal segment VIII; the tail setae relatively short, the body being 8 or more times as

long. Basal ridges of the penial sheath medially continuous
 NAIROBIA.
 (Only one species, N. bifrons De Lotto).

___ Disc pores present. Lateral ocelli well developed. Third antennal segment longer than the terminal (1.4 or more times as long); the length of segment III more than 5 times its width. Antennal setae about twice as long as the body setae; capitate, apically knobbed sensory setae entirely absent. Proepisternum with dorsal and ventral margins ridge-like. Prescutal ridges continuous medially. Postmesostigmatal setae, alar setae and metapostnotal ridge present. Middle legs shortest. Ostioles present. Dorsal setae of abdominal segment VIII present. Glandular pouches and their setae on abdominal segments VII and VIII; the tail setae of segment VIII rather long, the body being less than 8 times as long. Basal ridges of the penial sheath medially separated
 CEROPUTO.

3 (1) Antennae comparatively long (the body 1.5 or less times as long); longer than the hind legs. Few capitate, apically knobbed sensory setae present on antennal segments III to X. Antespiracular dorsal setae and pores absent. Basalare weak and slender. Abdominal disc pores only present on segment I. Setae of the glandular pouch include a pair of long tail setae, two setae of medium, unequal lengths and a short one OCTOCOCCUS.
 [Only one species, O. africanus (Brain)]

___ Antenna comparatively short (the body 1.6 or more times as long); shorter than the hind leg, or both subequal in length. Capitate, apically knobbed, sensory setae only present on terminal antennal segment. Antespiracular dorsal setae and pores present. Basalare comparatively stout. Abdominal disc pores present on all

abdominal segments. Setae of the glandular pouch include a pair of long tail setae and one of medium length or short 4

4 (3) The head and the body dorso-ventrally flattened; ventral preocular depression entirely absent. Postoccipital ridge V-shaped. Postocular ridge dorsally reduced. Prosternal ridge absent. Two antespирacular ventral setae always present. Prescutal suture absent. The marginal ridge of the basisternum anteriorly absent. Furca comparatively small. Hind legs short, the body more than 2.2 times as long SACCHARICOCCUS.
 [Only one species, S. sacchari (Ckll.)].

___ The body cylindrical; ventral preocular depression present. Postoccipital ridge U-shaped. Postocular ridge well developed. Prosternal ridge distinct. Only one antespирacular ventral seta present. Prescutal suture well-defined. The marginal ridge of the basisternum well developed. Furca comparatively large. Hind legs long, the body less than 2.2 times as long 5

5 (4) Fleshy setae present on the body itself, giving the males a distinctive hairy appearance. Ventral ocular setae present. Genal setae more than 7, and prosternal setae more than 3 PSEUDOCOCCUS.

___ Fleshy setae absent on the body itself. Ventral ocular setae absent. Genal setae less than 7, and prosternal setae less than 3 PLANOCOCCUS.

(C) Key to the genera:I. Key to the Ceroputo group of genera:

Fleshy setae present on antennae and legs. Dorsal arm of midcranial ridge distinct. Setae between the ventral simple eyes absent. Terminal antennal segment with 3 preapical large bristles and 2 smaller ones; the preapical bristles about twice as long as those of the two penultimate segments. Prosternum represented by a pair of separate, small plates connected by the prosternal ridge. Prescutum 4 times or more as long as scutum. Scutellum laterally supported by a distinct additional ridge. Lateropleurite with an oval membranous area. Postmesostigmatal pores absent. Ostioles well developed. Aedeagus comparatively slender. More than 3 dorsal setae of the genital segment present Centrocooccus.
 [Only one species, C. insolitus (Green)].

____ Fleshy setae entirely absent. Dorsal arm of the midcranial ridge only marked by weak sclerotization. Setae between the ventral simple eyes present. Terminal antennal segment with only three well defined preapical bristles, subequal in length to those of the two penultimate segments. Prosternum triangular. Prescutum less than 3.5 times as long as the scutum. Scutellum without lateral ridges. Lateropleurite without membranous areas. Postmesostigmatal pores present at least on one side. Ostioles ill-defined. Aedeagus rather stout. 3 dorsal setae of the genital segment always present Ceroputo.
 (Only one species, C. pilosellae Sulc).

II. Key to the Pseudococcus group of genera:

Dorsal arm of the midcranial ridge disappearing before meeting postoccipital ridge; the latter anteriorly confluent with the preocular ridge. Dorsal ocular setae present. One dorsal head pore usually present. Tegular setae less than 4. Abdominal disc pores occur laterally and also dorsally and ventrally Dysnicoccus. (One species only, D. alazon Williams).

___ Dorsal arm of the midcranial ridge posteriorly meeting the postoccipital ridge; the latter not reaching the preocular ridges anteriorly. Dorsal ocular setae absent. More than one dorsal head pore present. Tegular setae more than 4. Abdominal disc pores present only laterally Pseudococcus.

III. Key to the Planococcus group of genera:

1. Style of the genital segment more or less straight and apically rounded in lateral view2

___ Style curving upwards and apically pointed in lateral view ...3

2 (1) Dorsal arm of midcranial ridge absent. Head disc pores absent. Antennal setae about twice as long as the body setae; the dorsal bristle of the terminal antennal segment slightly shorter than the lateral bristles. Posttergital setae present. Prosternal and postmesostigmatal pores absent; metatergal pores present. Abdominal disc pores only present laterally. The body 10 times or more as long as the penial sheath; the style comparatively broad. Aedeagus rather short, curving dorso-posteriorly..... Ferrisiana. [Only one species, F. virgata (Ckll.)].

___ Dorsal arm of midcranial ridge distinct. Head disc pores present. Antennal setae about as long as the body setae; the dorsal bristle of the terminal antennal segment much shorter than the lateral ones (about half as long). Posttergital setae absent. Prosternal and postmesostigmatal pores present; metatergal pores missing. Abdominal pores present laterally and also dorsally and ventrally. The body 8.5 times or less as long as the penial sheath; the style comparatively narrow. Aedeagus rather long, anteriorly curving from its basal rod and reaching the cavity of abdominal segment VIIMaconellicoccus.
 [Only one species, M. hirsutus (Green)]

3 (1) Dorsal arm of midcranial ridge posteriorly meeting the postoccipital ridge. One dorsal head pore only usually present. Antennal scape almost always with 4 hair-like setae. Postmesostigmatal pores present, at least on one side. Ostioles ill-defined or absent 4

___ Dorsal arm of midcranial ridge fading out well before meeting the postoccipital ridge. Two or more dorsal head pores present. Antennal scape with more than 4 hair-like setae. Postmesostigmatal pores absent. Ostioles well developed 5

4 (3) Lateral arms of midcranial ridge represented only by weak sclerotization. Preocular ridge with a well-marked ventral rudiment below the articular process. Genal setae more than 3. Prosternum long and narrow. Postmesostigmatal setae present in the median and the sublateral areas. Hamulohaltera 1.9 times or more as long as its apical seta. Femur of fore-leg shortest. All pleural setae of abdominal segment VIII subequal in lengthTrionymus.
 [Only one species, T. newsteadi (Green)]

___ Lateral arms of midcranial ridge well developed. Ventral rudiment of the preocular ridge absent. Genal setae 3 or less. Prosternum triangular. Postmesostigmatal setae only present sublaterally. Hamulohaltera 1.6 or less times as long as its apical seta. Femur of middle leg shortest. Pleural setae of abdominal segment VIII include one slightly longer seta Nipaecoccus.

5 (3) Ventral rudiment of the preocular ridge entirely absent. Third antennal segment 3.3 times or less as long as wide. The three large bristles of the terminal antennal segment of subequal lengths. In fore-leg, the tibia shorter than the femur.....Planococcoides. (Only one species, P. ireneus De Lotto).

___ Ventral rudiment of the preocular ridge distinct. Third antennal segment usually more than 3.3 times as long as wide. The dorsal bristle of the terminal antennal segment slightly shorter than the two lateral ones. In fore-leg, the tibia longer than the femur Planococcus.

(D) Key to the species:

I Key to the species of Pseudococcus:

1. Penial sheath distinctly triangular in dorsal view, with the style gradually tapering apically 2

___ Penial sheath subtriangular in dorsal view, the style being rather broad or truncate posteriorly 3

2 (1) Antennae short, the body being more than twice as long. Only one antespircular ventral seta present. One postmesostigmatal pore always present medially. Posterior metasternal seta less than 3.

~~no~~ Ventral setae of abdominal segment VIII absent. Abdominal pores only present laterally. Genital segment long, the body being less than 7 times as long. Aedeagus long, anteriorly reaching the cavity of abdominal segment VII, and evenly tapering posteriorly
P. citriculus Green

___ Antennae moderately long, the body being less than twice as long. More than one antespирacular ventral seta present. Posterior metasternal setae more than 5. Ventral setae of abdominal segment VIII at least 4. Abdominal pores present laterally and dorsally. The genital segment rather short, the body being more than 8 times as long. Aedeagus not reaching the cavity of abdominal segment VII, with the distal part broadened in lateral viewP. fragilis Brain.

3 (1) Posttergital setae 9 or more. Anterior metasternal setae more than 10. Metaspирacular and anterior metasternal pores absent. Penial sheath broad, its length less than 1.5 times its width; process of the penial sheath well pronounced; style apically truncate in dorsal view P. adonidum (L.).

___ Posttergital setae 6 or less. Anterior metasternal setae less than 9. Metaspирacular and anterior metasternal pores present. Penial sheath moderately narrow, its length more than 1.6 times its width; process of the penial sheath absent; apex of style broadly rounded in dorsal view 4

4 (3) Postmesostigmatal setae only present sublaterally. Ventral setae of abdominal segment VIII absentP. obscurus (Essig).

___ Postmesostigmatal setae present sublaterally and also medially. Ventral setae of abdominal segment VIII usually present.....
P. maritimus (Ehrhorn) "Type A".

II. Key to the species of Nipaecoccus:

Relatively small, 840 - 980 (896) μ long. Fleshy setae present on the legs. The dorsal simple eyes smaller than the ventral; the dorsal eyes more than 4 times their diameter apart. With less than 3 genal setae. Antennae as long as, or slightly longer than the hind legs. The antennal setae about twice as long as the body setae. Terminal antennal segment with 3 bristles only. Anterior apex of prosternum forming a weakly sclerotized ring. With 7 or more medial pronotal pores. Width of prescutum less than 1.4 times its length. Scutal setae less than 4. Metaspiracular pores and ostioles absent. Abdominal pores present only laterally N. nipae (Maskell).

___ Moderately large, 1148 - 1358 (1246) μ long. Fleshy setae absent on the legs. The dorsal simple eyes larger than the ventral; the dorsal eyes less than 4 times their diameter apart. Genal setae almost always 3. Antennae shorter than the hind legs. The antennal setae about as long as the body setae. Terminal antennal segment with 3 large and 2 smaller bristles. Anterior apex of prosternum without a sclerotized ring. With less than 5 medial pronotal pores. Width of prescutum 1.4 or more times its length. Scutal setae more than 5. Metaspiracular pores and ostioles present. Abdominal pores present laterally and also ventrally on one or more segments N. vastator (Maskell).

III. Key to the species of Planococcus:

1. Postoccipital ridge anteriorly confluent with the preocular ridges. Dorsal head pores 4 or more. Prosternal ridge double-barred. Posttergital pores present. Metatergal setae absent P. dioscoreae Williams.

___ Postoccipital ridge not reaching the preocular ridges anteriorly.
 Dorsal head pores less than 4. Prosternal ridge singular.
 Posttergital pores absent. Metaternal setae present 2

2 (1). Antennal segment III longer than the terminal. Middle femur slightly shorter than the front. A ventral pore present at least on one side of abdominal segment VII. Aedeagus comparatively broad P. kenyae (Le Pelley).

___ Antennal segment III shorter, or as long as the terminal. Middle femur slightly longer than the front. Ventral abdominal pores entirely absent. Aedeagus comparatively narrow..... P. citri (Risso).

FAMILY ERIOCOCCIDAE:

(E) Key to the genera:

1. Fleshy setae present on the legs. Prosternal setae present.
 Hamulohaltera subequal in length to its apically hooked seta.
 Trochanter without long, differentiated, apical setae Eriococcus.

___ Fleshy setae absent on the legs. Prosternal setae absent.
 Hamulohaltera, if present, 1.6 or more times as long as its apically hooked seta. Trochanter with a long apical seta 2

2 (1) Lateral arms of the midcranial ridge short and weak. Ocelli vestigial. Genal setae 3 or less. Unidentified disc-like structures absent on the head. With a small mouth tubercle. The body not more than twice as long as the antennae. Antespiracular ventral setae present. Scutellum slightly longer than scutum. Hamulohalterae and suspensorial sclerites entirely absent. The body less than twice as long as the hind leg. Pleural setae of abdominal segment VIII include one seta slightly longer than the others. Style rather straight in lateral view Ovaticoccus. (Only one species, O. agavium Dougl.).

___ Lateral arms of the midcranial ridge well developed. Ocelli large. Genal setae 4 or more. One or more disc-like structures present dorsally on each side of the midcranial ridge. Mouth tubercle absent. The body more than twice as long as the antennae. Antespiracular ventral setae absent. Scutellum shorter than scutum. Hamulohalterae and suspensorial sclerites well developed. The body more than twice as long as the hind leg. Pleural setae of abdominal segment VIII include one seta about twice as long as others. Style sinuated in lateral view Gossyparia. [Only one species, G. spuria (Mod.)].

(F) Key to the species of Eriococcus:

1. Ventral part of the preocular ridge reduced. Cranial apophysis truncate. With 12 or more dorsal head setae; setae of the ocular sclerites and the setae between the ventral eyes present. Genal setae more than 7. Antennae 9 - segmented; 3rd segment 2.5 or more times as long as the terminal; capitate sensory setae only present on the terminal segment. Lateropleurite with a distinct membranous area. Prescutal setae 6 or more; mesopisternal, postmesostigmatal and basisternal setae present. Metatergal setae 4 or more; metapleural and postmetastigmatal setae present. Tergite of abdominal segment VIII anteriorly bounded by differentiated heavy sclerotization. The body

7.7 or more times as long as the tail setae of the glandular pouches
 E. buxi (Fonsc.).

____ Preocular ridge well developed. Cranial apophysis bifurcate. With less than 12 dorsal head setae; setae of the ocular sclerite and the setae between the ventral eyes absent. Genal setae less than 7. Antennae 10-segmented; 3rd segment less than 1.8 times as long as the terminal; capitate sensory setae present at least on the three terminal segments. Lateropleurite without membranous areas. Prescutal setae 2 or less; mesepisternal, postmesostigmatal and basisternal setae absent. Metatergal setae 3 or less; metapleural and postmetastigmatal setae absent. Tergite of abdominal segment VIII without anterior heavy sclerotization. The body usually less than 7.7 times as long as the tail setae of the glandular pouches ... 2

2 (1) Comparatively small species, less than 1000 μ long. Dorsal and ventral simple eyes subequal in diameter; the former separated by 4.5 or more times their diameter. Structures of obscure homology absent on the head. Third antennal segment less than 3.4 times long as wide; terminal segment only with 3 antennal bristles. Scutellum slightly shorter than scutum. With a minute lateropleurital seta. Total length of the body usually more than 2.1 times the length of the hind legs. Sternites of abdominal segment VIII laterally bounded with longitudinal heavy sclerotization. Genital oapsule 2.6 or more times long as wide, and the body less than 7.9 times its length; style rather straight in lateral view E. orariensis Hoy.

____ Comparatively large species, more than 1000 μ long. The dorsal eyes larger than the ventral, and separated by less than 3.5 times their diameter. A body of unknown homology present on each side of the midcranial ridge. Third antennal segment 3.4 or more times long

as wide; terminal segment with 3 large and 2 smaller antennal bristles. Scutellum longer than scutum. Lateropleurital setae absent. Total body length less than 2.1 times the length of the hind legs. Sternites of abdominal segment VIII without differentiated heavy sclerotization. Genital capsule twice or less times as long as wide, and the body 7.9 or more times its length; style sinuating in lateral view E. araucariae Mask.

THE BRACHYPTEROUS MALES:

Key to the species of Gossyparia:

Capitate sensory setae entirely absent. Usually with 7 or more metatergal setae. The fore and the middle legs subequal in length ..
..... G. salicioola Borchs.

___ Capitate sensory setae present on the antennae. Usually with less than 7 metatergal setae. The middle legs shortest
..... G. spuria (Mod.).

THE APTEROUS MALES:

Only two species whose apterous male forms were studied, Saccharicoccus sacchari (Okl.) and Pseudochermes fraxini (Kalt.). While the macropterous males of the former were also studied, only the apterous form of the latter was available which is obviously degenerate. The comparison therefore would not serve any useful purpose.

VII. SUMMARY

- 1) The study of the males Coccoidea has revealed phylogenetic as well as taxonomic importance. Following the detailed work on males of the Diaspididae (Ghauri) and Coccidae (Giliomee), the males of 17 species (13 genera) of Pseudococcidae and 7 species (4 genera) of Eriococcidae have been studied, described and illustrated in the same detail. Except for Giliomee's work on 3 pseudococcid species, no such studies were hitherto carried out on these groups; Giliomee's data on his 3 species were also used in the present work.
- 2) The author collected the prepupae and pupae of 10 species in the field, and bred a further 2 species in laboratory cultures. The remaining specimens were obtained as gifts. The field collections permitted some biological observations, on mating behaviour etc.
- 3) In most cases 10 specimens of each species were examined in detail in order to assess the degree of individual variation, but in a few cases less than 10 specimens (3-8) were available.
- 4) A large number of the male characters (138 in all) were found to be taxonomically significant at all the taxonomic levels.
- 5) The definition of the lecanoid type of male given by Theron and slightly amended by Giliomee, requires further minor amendments concerning the presence of the postoccipital ridge and the metasternal apophyses. New terms for certain structures not occurring in the males of other families have also been introduced (the scutellar ridge and the topography of the derm pores).
- 6) 18 characters were found to separate sharply the males of Pseudococcidae and Eriococcidae. The number and morphological importance of these characters are comparable with those known to separate other families of Coccoidea, and the Pseudococcidae and Eriococcidae are therefore regarded as distinct families. On the basis of the female characters traditionally used, the taxonomic status of these two groups was controversial (tribes, subfamilies or families).

- 7) In most species only winged macropterous forms were present. In one species of Pseudococcidae macropterous and apterous forms were available; one species of Eriococcidae was represented by macropterous and brachypterous forms, and another one only by the apterous males.
- 8) Separate morphological discussion of the pseudococcid and the eriococcid males are given, and the differentiating characters pointed out.
- 9) The available material of Pseudococcidae allowed a tentative intrafamily classification, using a simple numerical method based on the number of characters shared by each pair of species. As a result, series of characters were found operating at different taxonomic levels, separating groups of genera, individual genera, and species.
- 10) The 20 available species of Pseudococcidae form 6 groups of genera, namely:
1. Nairobi group, including the genus Nairobi.
This group probably represent a link between the Eriococcidae and Pseudococcidae.
 2. Ceroputo group, comprising two closely related genera, Ceroputo and Centrococcus; published descriptions indicate that Phenacoccus and Heterococcus should also be included in this group.
 3. Octococcus group, with the genus Octococcus only.
 4. Saccharicoccus group, which also includes one genus only, Saccharicoccus.
 5. Pseudococcus group, represented by two genera, Pseudococcus and Dysmicoccus. Published work shows that Pedronia, Clavicoccus, Phyllococcus, Laminicoccus, Palmicola and Nesococcus should be also referred to this group.

6. Planococcus group, which includes Planococcus, Planococcoides, Nipaecoccus, Maconellicoccus, Ferrisiana and Trionymus. The inclusion of Chorizococcus and Antonina in this group was also suggested.
- 11) The status of these groups does not appear to be the same and they seem to represent 2 major taxa, Ceroputo and Pseudococcus.
- 12) The available information from literature, although incomplete, indicate that at least two other groups can be recognized within Pseudococcidae, namely:
1. Rhizococcus group, which is represented by the genus Rhizococcus and appears to be the most specialized.
 2. Puto group, including the genera Puto and Macrocerococcus, which appears to be the most primitive.
- 13) It is suggested therefore, that the Pseudococcidae can be divided into 4 major taxa or sections, probably of subfamily or supratribal rank:
- I. A Rhizococcus section, which is the most specialized and represented by Rhizococcus group.
 - II. A Ceroputo section, which is rather specialized and includes Ceroputo and Nairobi groups.
 - III. A Pseudococcus section, which is rather primitive, and includes the Planococcus, Pseudococcus, Octoococcus and Saccharicoccus groups.
 - IV. A Puto section, which is the most primitive and represented by the Puto group only.
- 14) Available information on the males of Trionymus refertus Ferris showed that it is not congeneric with other species of Trionymus (which belongs to the Planococcus group), but represent a member of a genus belonging to the Pseudococcus group.
- 15) The limited material of Eriococcidae did not allow a similar classification of the family but it suggested that:

- A. E. buxi is not congeneric with E. araucariae or E. orariensis.
- B. There is a certain similarity between E. araucariae and Gossyparia spp. on the one hand, and between E. buxi, O. agavium and P. fraxini on the other, leaving E. orariensis isolated.
- 16) The relationships between other families of Coccoidea on which adequate information on the males is now available were discussed and assessed by numerical analysis of specialized and primitive characters.
- 17) Giliomee's suggestion that Steingelia represents a link between Margarodidae and Coccidae, and Phenacoleachia a similar one between Margarodidae and Pseudococcidae, is fully supported, but both Steingelia and the Phenacoleachiidae appear to be more closely related to Margarodidae than to each other.
- 18) The Phenacoleachiidae are more closely related to Pseudococcidae than to Margarodidae. Beardsley's suggestion that they probably represent a primitive subfamily within Pseudococcidae appears to be justified.
- 19) The Eriococcidae are closely related to Pseudococcidae, the former being more specialized and showing certain affinities with Coccidae; both Eriococcidae and Pseudococcidae are less specialized than Coccidae.
- 20) A tentative phylogenetic tree of the discussed families of Coccoidea is suggested.
- 21) Keys to the families, groups of genera, genera and species were constructed.
- 22) In an appendix the results of multivariate methods of numerical taxonomy are presented and compared with the results obtained by the traditional taxonomic methods.

VIII. EXPLANATION OF FIGURES

The following lettering is uniform in all figures:

- (A) General dorso-ventral view of the body.
- (B) Front view of the head.
- (B₁) Lateral view of the head.
- (C) Terminal 3 antennal segments showing the antennal bristles, few sensory setae, one fleshy and one hair-like setae.
- (D) Mesoprephragma (anterior view) and mesopostphragma (posterior view).
- (E) Disc pores.
- (F) Hind leg.
- (G) Hind claw and distal end of tarsus showing the tarsal digitules (if present) and the claw digitules.
- (H) Lateral view of the genital segment.
- (H₁) Ventral view of the genital segment.
- (I) Tentorium and cranial apophysis.
- (X) Structures of obscure homology.

IX. LIST OF ABBREVIATIONS

a	= finger-like apodeme	avp	= abdominal ventral pores
ab	= antennal bristles	avs	= abdominal ventral setae
addr	= additional ridge	ax ₁	= first axillary sclerite
adp	= abdominal dorsal pores	ax ₂	= second axillary sclerite
ads	= abdominal dorsal setae	ax ₃	= third axillary sclerite
aed	= aedeagus	axc	= axillary cord
al	= alar lobe	bas	= basalare
als	= alar setae	bra	= basal rod of aedeagus
amsp	= anterior metasternal pores	brps	= basal ridge of penial sheath
amss	= anterior metasternal setae	bs	= sensilla basiconica
an	= anus	ca	= cranial apophysis
anp	= anterior notal wing process	ccx	= costal complex of wing veins
ap	= articular process	cl	= claw
apar	= anterior postalar ridge	cx	= coxa
app	= abdominal pleural pores	cam.s	= campaniform sensillum
aps	= abdominal pleural setae	dhp	= dorsal head pores
as	= abdominal sternite	dhs	= dorsal head setae
asc	= additional sclerite	dmcr	= dorsal arm of midcranial ridge
asdp	= antespирacular dorsal pores	dmep	= dorsomedial part of epicranium
asds	= antespирacular dorsal setae	dos	= dorsal ocular setae
ase	= differentiated apical seta	dse	= dorsal simple eyes
asvs	= antespирacular ventral setae	epm2	= mesepimeron
at	= abdominal tergite	epm3	= metepimeron
ata	= anterior tentorial arms	eps2	= mesepisternum
		eps3	= metepisternum
		eps2s	= mesepisternal setae
		eps3s	= postmetastigmatal setae
		f	= furca
		fem	= femur
		fp	= furcal pit

fs	= fleshy setae	ocs	= ocular sclerite
g	= gena	ocse	= setae of ocular sclerite
gc	= genital capsule	ost	= ostiole
gls	= setae of glandular pouch	pa	= postalare
gp	= glandular pouch	pcr ₂	= precoxal ridge of mesothorax
gs	= genal setae	pcr ₃	= precoxal ridge of metathorax
gts	= setae of genital segment	pdc	= pedicel
h	= hamulohaltera	pepcv	= proepisternum + cervical sclerite
hr	= hamulohalteral ridge	phr ₁	= mesoprephragma
hs	= hair-like setae	phr ₂	= mesopostphragma
iga	= internal genital aperture	pla ₁	= propleural apophysis
ior	= interocular ridge	pla ₂	= mesopleural apophysis
lmcr	= lateral arm of midcranial ridge	pla ₃	= vestigial metapleural apophysis
lpl	= lateropleurite	plr ₁	= propleural ridge
lpls	= lateropleurital setae	plr ₂	= mesopleural ridge
lpp	= lateral pronotal pores	plr ₃	= metapleural ridge
lps	= lateral pronotal setae	pmp	= postmesostigmatal pores
mcr	= midcranial ridge	pms	= postmesostigmatal setae
med	= media	pmsp	= posterior metasternal pores
mo	= mouth opening	pmss	= posterior metasternal setae
mpnp	= medial pronotal pores	pn ₃	= metapostnotal sclerite
mpns	= medial pronotal setae	pna	= postnotal apophysis
mps	= metapleural setae	pn ₃ ^r	= posterior notal wing process
mr	= marginal ridge	pocr	= metapostnotal ridge
mt	= mouth tubercle	por	= postocular ridge
mtp	= metatergal pores	ppar	= postoccipital ridge
mts	= metatergal setae	pr	= posterior postalare ridge
o	= ocellus	pra	= projection of basal ridge
		prar	= prealare
		prn	= prealar ridge
			= lateral pronotal sclerite

prnr	= pronotal ridge	set.ca	= capitate sensory setae
pro	= process of penial sheath	set.scla	= subapical sensory setae
procr	= preocular ridge	sp2	= mesothoracic spiracle
pror	= preoral ridge	sp3	= metathoracic spiracle
pros	= setal sensilla of process of penial sheath	sp1	= sensillum placodeum
prsc	= prescutum	sp2p	= mesospiracular pores
ps	= penial sheath	sp3p	= metaspiracular pores
pscr	= prescutal ridge	ss	= suspensorial sclerite
pscs	= prescutal suture	st	= style
pscse	= prescutal setae	sta	= metasternal apophysis
pt	= posttergite	stn ₁	= prosternum
pta	= posterior tentorial arm	stn ₂	= mesosternum (basisternum)
ptdp	= posttergital pores	stn ₁ p	= prosternal pores
ptp	= posterior tentorial pit	stn ₁ r	= prosternal ridge
pts	= posttergital setae	stn ₁ s	= prosternal setae
pwp2	= mesopleural wing process	stn ₂ s	= basisternal setae
pwp3	= vestigial metapleural wing process	sts	= minute sensilla of style
rad	= radius	tar	= tarsus
rd	= posterior marginal fold of notum	tb	= tentorial bridge
sa	= subalare	tdgt	= tarsal digitule
scl	= scutellum	teg	= tegula
sclr	= scutellar ridge	tegs	= tegular setae
scls	= scutellar setae	tit	= tibia
scp	= scape	tn	= trochantin
sct	= scutum	tp	= triangular plate
sots	= scutoscutellar suture	tr	= trochanter
sctse	= scutal setae	ts	= tail setae
sens.	= circular sensoria	udgt	= unguis digitules
ser	= subepisternal ridge	vc	= ventral cavity
		vhp	= ventral head pores
		vhs	= ventral head setae
		vmcr	= ventral arm of midcranial ridge
		vos	= ventral ocular setae
		vprd	= ventral preocular depression
		vse	= ventral simple eyes
		x	= structure of obscure homology

X. REFERENCES

- 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.
- _____ 1942. Essai sur la classification des cochenilles (Homoptera - Coccoidea). Annls Éc. natn. Agric. Grignon, 3: 34 - 48.
- _____ 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.
- _____ 1962. Descriptions and notes on male mealybugs (Homoptera: Pseudococcidae). Ibid. 18: 81 - 98.
- _____ 1963. Notes on Hawaiian Pseudoccus, with a description of a new endemic species (Homoptera : Pseudococcidae). Ibid. 18: 229 - 234.

- _____ 1964. Insects of Campbell Islands (Homoptera : Pseudococcidae). Pacif. Insects, 7 : 238 - 252.
- _____ 1965. The males of Antonina crawii Cockerell (Homoptera: Pseudococcidae). Proc. Hawaii. ent. Soc. 19 : 47 - 49.
- _____ 1965. Notes on the Pineapple mealybug complex, with descriptions of two new species (Homoptera : Pseudococcidae). Ibid. 19 : 55 - 68.
- BERIESE, A. 1893. Le Cocciniglie Italiane viventi sugli agrumi. Parte I. I Dactylopius. Riv. Patol. veg., Padova, 2 : 70 - 109, 129 - 193.
- BLAIRE, C. 1958. Morphology and life history of Pseudococcus newsteadi Green. Unpublished manuscript in the library of the Dept. of Zool. and Appl. Ent., Imp. Coll., London.
- BORCHSENIUS, N. S. 1948. Review of palearctic soft scales of the genus Macrocerucoccus Leon. (Coccoidea, Pseudococcidae). (In Russian.) Ent. Obozr. 30: 31 - 39.
- _____ 1949. Fauna USSR: Homoptera, Pseudococcidae. (In Russian.) Zool. Inst. Akad. Nauk SSSR. : 383 pp.
- _____ 1957. Fauna USSR: Homoptera 9. Suborder mealybugs and scales (Coccoidea), family Coccidae. (In Russian.) Ibid. 66 : 494 pp.
- _____ 1958. On the evolution and phylogenic interrelations of Coccoidea (Insecta, Homoptera). (In Russian.) Zool. Zh. 37: 765 - 780.

_____ 1960. Fauna USSR: Homoptera 8. Suborder mealybugs and scales (Coccoidea), families Kermococcidae, Asterolecaniidae, Lecanoidiaspididae, Aclerdidae. (In Russian.) Zool. Inst. Akad. Nauk SSSR. 77 : 283 pp.

_____ 1963. Keys to the fauna USSR. Practical key for the identification of coccids of cultivated plants and forests in USSR. (In Russian.) Ibid. 81 : 311 pp.

BRAIN, C. K. 1915. The Coccidae of South Africa - I. Trans. R. Soc. S. Afr. 5 : 1 - 130.

_____ 1920. The Coccidae of South Africa - IV. Bull. ent. Res. 10: 95 - 128.

BROWN, S. W. 1959. Lecanoid chromosome behaviour in three more families of the Coccoidea (Homoptera). Chromosoma 10 : 278 - 300.

BROWN, S.W. and MCKENZIE, H.L. 1962. Evolutionary patterns in the armored scale insects and their allies (Homoptera: Coccoidea: Diaspididae, Phoenicococcidae, and Asterolecaniidae). Hilgardia 33 : 141 - 170.

BURMEISTER, H. 1835. Scharlachlause. Schildlause. Coccina. (Gallinsecta l.). Hand. Ent. 2 : 61 - 83.

COCKERELL, T. D. A. 1893. Notes on some Mexican Coccidae. Ann. Mag. nat. Hist. (Ser. 6), 12 : 47 - 53.

_____ 1899. Tables for the determination of the genera of Coccidae. Can. Ent. 31 : 273 - 279, 330 - 333.

- COMSTOCK, J. H. 1881. Report of the entomologist. Rep. U.S. Dep. Agric. 1880 : 276 - 349. Reprinted in the Bull. Cornell Univ. agric. Exp. Stn 372 : 425 - 500, 1916.
- COSTA, O. G. 1828. Prospetto di una nuova divisione metodica del genere Coccus Lin. Lam. ec. Napoli, Dalla Tipografia Trani : 8pp.
- COTTIER, W. 1936. A redescription of Pseudococcus cocotis Maskell, including a description of the male (Hem.). Proc. R. ent. Soc. Lond. (Ser. B) 5: 25 - 31.
- DE GREER, C. 1776. Mémoires pour servir à l'histoire des insectes. (Huitième memoire. Des Gallinsectes.) 6 : 433 - 452.
- DOUGLAS, J. W. 1885. Notes on some British Coccidae. (No. 1). Entomologist's mon. Mag. 22 : 157 - 160.
- DZIEDZICKA, A. 1961. Studies on morphology and biology of Gossyparia spuria (Mod.) (Homoptera, Coccoidea). Fragm. faun. 9 : 203 - 219.
- EZZAT, Y. M. 1956. The thoracic sclerotization of coccid adult males as a promising taxonomic character (Coccoidea). Bull. Soc. ent. Egypte, 40 : 357 - 363.
- EZZAT, Y. M. & McCONNEL, H. S. 1956. A classification of the mealybug tribe Planococcini (Pseudococcidae, Homoptera). Bull. Md. agric. Exp. Stn A - 84 : 108 pp.

FERNALD, M. E. 1903. A catalogue of the Coccidae of the world.
Bull. Mass. agric. Exp. Stn 88 : 360 pp.

FERRIS, G. F. 1937. Atlas of the scale insects of North America.
 Ser. I. Stanford University Press, Stanford. 8 pp. +
 Serial numbers 1 - 136.

_____ 1942. Ibid. Ser. IV. Stanford University Press,
 Stanford. Serial Numbers 385 - 448.

_____ 1950. Ibid. Ser. V. The Pseudococcidae (Part 1).
 Stanford University Press, Stanford. 278 pp.

_____ 1957. A brief history of the study of the Coccoidea.
Microentomology, 22 : 39 - 57.

_____ 1957. Notes on some little known genera of the Coccoidea
 (Homoptera). Microentomology, 22 : 59 - 79.

GHAURI, M. S. K. 1962. The morphology and taxonomy of the male scale
 insects (Homoptera : Coccoidea). British Museum (Nat. Hist.),
 London. 221 pp.

GILLOMERE, 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.

_____ 1964. Morphology and taxonomy of adult males of the family
 Coccidae (Homoptera: Coccoidea). Ph.D. thesis, University
 of London.

- GRAY, J. E. 1828. Spicilegia Zoologica. Original figures and short systematic descriptions of new and unfigured animals. Treutel, Wurtz and Co., London. 12 pp.
- GREEN, E. E. 1922. The Coccidae of Ceylon, V: Dulae and Co., London. 345 - 472.
- GUILDING, L. 1829. An account of Margarodes, a new genus of insects found in the neighbourhood of ant's nests. Trans. Linn. Soc. Lond. 16 : 115 - 119.
- HALL, W. J. 1928. Observations on the Coccidae of Southern Rhodesia, I. Bull. ent. Res. 19 : 271 - 292.
- HAMBLETON, E. J. 1946. Studies of hypogeic mealybugs. Revue Ent. 17 : 1 - 77.
- HANDLERSCH, A. 1908. Die fossilen Insekten und die Phylogenie der rezenten Formen. W. Engelmann, Leipzig. 1430 pp.
- HOY, J. M. 1962. Eriococcidae (Homoptera : Coccoidea) of New Zealand, Bull. N.Z. Dep. scient. ind. Res. 146 : 219 pp.
- _____ 1963. A catalogue of the Eriococcidae (Homoptera : Coccoidea) of the world. Ibid. 150 : 260 pp.
- HUGHES - SCHRADER, S. 1944. A primitive coccid chromosome cycle in Puto sp. Biol. Bull. mar. biol. Lab. 87 : 167 - 176.
- _____ 1948. Cytology of coccids (Coccoidea - Homoptera). Adv. Genet. 2 : 127 - 203.

- JAKUBSKI, A. W. 1952. Czerwiec Polski ongi i dzis. Polish cochineal in the past and today. (In Polish.) Rocznik Polskiego Towarzystwa Naukowego na Obczyźnie, London. 1951 - 1952 : 49 - 66.
- _____ 1965. A critical revision of the families Margarodidae and Termitococcidae (Hemiptera, Coccoidea). British Museum (Nat. Hist.), London. 187 pp.
- JANCKE, G. D. 1955. Zur Morphologie der Männlichen Cocciden. Z. angew. Ent. 37 : 265 - 314.
- KAWECKI, Z. 1965. On the suitable term for the second pair of wings in male scale insects (Homoptera, Coccoidea). Frustula ent. 7 : 1 - 4.
- KRECKER, F. 1909. The eyes of Dactylopius. Z. wiss. Zool. 93 : 73 - 89.
- KUWANA, I. 1923. Descriptions and biology of new or little known coccids from Japan. Bull. imp. Pl. Quarant. Stn Yokohama, 3 : 1 - 67.
- LATREILLE, P. A. 1825. Gallinsectes. Gallinsecta. In Familles naturelles du règne animal. Bailliere, Paris. 249 - 430.
- LELLAKOVA - DUSKOVA, F. 1965. Quadraspidiotus marani Zahr., the morphology of the developmental stages in the male (Homoptera, Coccoidea, Diaspididae). Sb. ent. Odd. nar. Mus. Praze, 62 : 202 - 209.
- LEONARDI, G. 1920. Monografia delle cocciniglie Italiane. Stab. Tip. Ernesto della Torre, Portici. 555 pp.

- LINNAEUS, C. (Linne, C. von). Insecta Hemiptera. Coccus.
Syst. Nat. (Ed. 10) 1 : 455 - 457.
- MACDOUGALL, R. S. 1926. Pseudococcus comstocki Kuw., as an enemy
of the Banana (Musa cavendishii). Bull. ent. Res. 17 : 85 -
90.
- MAKEL, M. 1942. Metamorphose und Morphologie des Pseudococcus
Männchens mit besonderer Berücksichtigung des Skelettmuskel-
systems. Zool. Jb. 67 : 461 - 512.
- MASKELL, W. M. 1894. Remarks on certain genera of Coccidae.
Entomologist 27 : 44 - 46, 93 - 95, 166 - 168.
- 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.
- _____ 1945. The mealybug genus Heteroococcus Ferris, and some of
its relatives. J. Wash. Acad. Sci. 35 : 38 - 55.
- MORRISON, H. and MORRISON, E. 1922. A redescription of the type
species of the genera of Coccidae based on species originally
described by Maskell. Proc. U.S. natn. Mus. 60 : 14 - 17.
- NEWSTEAD, R. 1894. Observations on Coccidae. Entomologist's mon.
Mag. 5, Ser. 2 : 204 - 207.
- _____ 1903. Monograph of the Coccidae of the British Isles. II.
Ray Soc. Publs, 270 pp.

- PESSON, P. & BIELENIN, I. 1966. Gigantococcus nouveau genre de cochenille Margaroidae pour Icerya maxima Newstead 1914. Icerya corticalis Vayssiere 1926, redescription de l'espèce Africaine Gigantococcus maximus (Newstead). Annls Soc. ent. Fr. 2 : 219 - 251.
- PUTNAM, J. D. 1879. Biological and other notes on Coccidae. I. Pulvinaria innumerabilis. Proc. Davenport Acad. Sci. 2 : 293 - 346.
- RAO, S. R. 1943. A note on the discovery of apterous males in the pink mealybug of sugarcane, Trionymus sacchari Ckll. Curr. Sci. (India), 12 : p. 208.
- REAUMUR, M. D. 1740. Mémoires pour servir à l'histoire des insectes. Pierre Mortier, Amsterdam, 4 : 1 - 104.
- REYNE, A. 1954. A redescription of Puto antennatus Sign. (Homoptera, Coccoidea), with notes on Ceroputo pilosellae Sulc and Maurocerococcus superbus Leon. Zool. Meded. Leiden, 32 : 291 - 324.
- ROBERTI, D. 1946. Monografia dell Aphis (Dorsalis) frangulae Koch. Parte I. Morfologia, Anatomia, Istologia. Boll. R. Lab. Ent. agr. Portici, 6 : 125 - 312.
- RUTHERFORD, A. 1914. Some Ceylon Coccidae. Bull. ent. Res. 5 : 259 - 268.
- SCHRÖDER, C. 1925. Handbuch der Entomologie. 3 : 117 - 306.

- SIGNORET, V. 1868. Essai sur les Cochenilles (Homoptères - Coccides), 1 & 2. Annls Soc. ent. Fr. (Sér. 4) 8 : 503 - 528, 829 - 876.
- SNODGRASS, R. E. 1935: Principles of insect morphology. McGraw-Hill Book Co., Inc., New York and London. 677 pp.
- SOKAL, R. R. & SNEATH, P. H. A. 1963. Principles of numerical taxonomy. W. H. Freeman and Co., San Francisco and London. 359 pp.
- ŠUIC, K. 1943. Zevni morfologie, metamorfosa a běh zivota cervce Phenacoccus aceris Sign. Acta Soc. Sci. nat. moravo - siles. 15 : 1 - 52.
- _____ 1944. Zevni morfologie, metamorfosa a běh zivota cervce Peukinococcus n.gn. piceae Loew. Ibid. 16 : 1 - 50.
- _____ 1945. Zevni morfologie, metamorfosa a běh zivota cervce Nipaecoccus n.gn. nipae Maskell. Ibid. 17 : 1 - 48.
- TAKAHASHI, R. 1931. Descriptions of some new Formosan Coccidae (Rhynchota). Bull. ent. Res. 22 : 211 - 220.
- TARGIONI TOZZETTI, A. 1868. Introduzione alla seconda memoria per gli studii sulle Cocciniglie, e catalogo dei generi e delle specie della famiglia dei Coccidi. Atti Soc. ital. Sci. nat. 11 : 694 - 738.
- THERON, J. G. 1958. Comparative studies on the morphology of male scale insects (Hemiptera : Coccoidea). Annale Univ. Stellenbosch, 34 (A) : 71 pp.

_____ 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 und Darm der schwarzen
Blattlaus Aphis fabae Scop. Zoologica, Stuttg. 28 : 120 pp.

_____ 1930. Biologie der Hemipteren. J. Springer, Berlin,
11 : 517 pp.

_____ 1935. Der Bau der Imago der Aleurodinen. Zoologica,
Stuttg. 33 : 71 pp.

_____ 1935. Aphidina. Blattläuse (= Aphidoidae). Biologie
Tiere Dtl. 3 : 209 - 355.

WESTWOOD, J. O. 1840. Synopsis of the genera of British insects,
in An introduction to the modern classification of insects,
1 : 158 pp.

WILKEY, R. F. & MCKENZIE, H. L. 1961: Systematic status of the
Pseudococcus martimus - malaccarum complex of mealybugs.
(Homoptera : Coccoidea : Pseudococcidae). Bull. Calif.
Dep. Agric. 50 : 245 - 249.

ZIMMERMAN, E. C. 1948. Insects of Hawaii. University of Hawaii
Press, Honolulu, 5 : 464 pp.

XI. APPENDIX

On the suggestion of Dr. K. Boratynski, the advantage of the computing facilities (IBM 7090 computer) available at Imperial College was taken, and the data obtained in this study (138 characters for 29 species) were subjected to the more elaborate statistical analysis by some methods of numerical taxonomy. In their book on the subject, Sokal & Sneath (1963, p. VIII) define the numerical taxonomy as "the evaluation by numerical methods of the affinity or similarity between taxonomic units and the employment of these affinities in erecting a hierarchic order of taxa"; it "aims to develop methods which are objective and repeatable both in evaluation of taxonomic affinity and in the erection of taxa". They pointed out that assessment of the degrees of affinity of the taxa (expressed as a coefficient of similarity) should be based on a large number of characters (at least 60) to assure objectivity and repeatability. All these characters should be treated as of equal taxonomic value and the equivalence of all the characters is one of the basic assertions of numerical taxonomy. The relationships between taxa thus calculated is "phenetic", i.e. based on overall resemblance and is free of subjective phylogenetic speculation. But the authors believe that numerical methods may open up a wide field in the exact measurement of evolutionary rates and may provide a more critical approach to phylogenetic problems (pp. VIII, 57 and chapter 8).

The method employed in the main part of this thesis contains also an element of objectivity in the fact that all the characters were treated as being equivalent; the assessment of the degree of similarity was based on simple counting of the characters shared by each pair of species. But this method does not take into consideration which of the characters are shared by various species; moreover, a certain amount of subjective selection of characters was used in the grouping of taxa. For example the separation of Planococcus and Pseudococcus groups of genera was based on one exclusive character, i.e. the absence or presence of fleshy setae on the main parts of the body.

The comparison of these results with those obtained by more accurate calculation of coefficient of similarity between each pair of species, was thought to be of interest.

It should be pointed out that the application of numerical taxonomy is still in experimental stage, and the exact value of the various suggested methods for satisfactory classification is to be further investigated. A number of papers have been published, in which numerical taxonomy was utilized. In Entomology it was applied by Stroud (1953) for Termites; Sokal (1958) and Sokal & Michener (1958) for the classification of Hoplitis complex of Bees; Rohlf (1963) for Mosquitoes; Sheals (1964) for Acarina.

The computer programmes were available for two methods of statistical analysis, which were used for my data:

(I) The Principal Component (vector analysis) method, using the BIGMAT programme developed by M. Elson and R. E. Funderlic of Central Data Processing Facility, Oak Ridge, Tennessee, U.S.A. and available at the Imperial College computer unit (Share pamphlet). This programme generates first a Covariance matrix calculated from

$$\sum_{i=1}^N (X_{ij} - \bar{X}_j)(X_{ih} - \bar{X}_h)$$

which basically is a coefficient of similarity; and then the subroutine BIGMAT Fortran IV matrix eigensystem solver calculates eigenvalues (latent roots) and eigenvectors (latent vectors) of real symmetric matrices and can operate up to a matrix limit of 235 X 235. The "normal" analysis (Q-technique) which ordinales the species (OTU's) was used.

(II) The Taxon analysis method as described by Sokal and Sneath (1963, p. 195 and 296), with clustering by the weighted pair-group method using Spearman's sums of variables method (WPGM) (p.309). This method uses the correlation coefficients between each pair of OTU's based on standardized characters and calculated by the computational formula:

$$r_{jk} = \frac{\sum_{i=1}^n X_{ij} X_{ik} - \frac{1}{n} \left(\sum_{i=1}^n X_{ij} \right) \left(\sum_{i=1}^n X_{ik} \right)}{\left\{ \left[\sum_{i=1}^n X_{ij}^2 - \frac{1}{n} \left(\sum_{i=1}^n X_{ij} \right)^2 \right] \left[\sum_{i=1}^n X_{ik}^2 - \frac{1}{n} \left(\sum_{i=1}^n X_{ik} \right)^2 \right] \right\}^{\frac{1}{2}}}$$

This programme was developed in the Department of Zoology, Imperial College, by Dr. G. Murdie specially for the purpose of these studies. The author, who is not very familiar with the statistical methods involved, is grateful to Dr. Boratynski for his guidance and to Dr. Murdie for developing the Taxon programme.

The method based on taxonomic distance coefficient, which in some cases was shown to give better results, could not be applied since the appropriate computer programme was not ready in time.

Procedure:

The 29 species included in this study are listed on the right side of the dendrogram of Fig. (A), and the order of numbering corresponds to the degree of relationships and the classification suggested by the analysis in the main part of this thesis. Family Pseudococcidae include the first 21 species and family Eriococcidae species 22 - 29. Species 1 - 9 = Planococcus group of genera; species 10 - 15 = Pseudococcus

group; species 16 & 17 = Sacchariooccus group; species 18 = Octococcus group; species 19 & 20 = Ceroputo group, and species 21 = Nairobi group.

The 138 characters taken into consideration are the same as those listed in Table I (see Discussion, p. 280). Their different state conditions were expressed in numerical code ranging from 1 to 5, but in most cases only 2 - 3 conditions were used. The better the structure is developed the higher the value given, e.g. the absence of a certain ridge was given 1, its weak development 2 and its strong development 3; if the absence of setae or pores on a particular part of the body was given the value of 1, the presence of 1 - 3 setae was given 2, and 4 - 6 for example will be 3, and 6 - 10 will be 4; the small size (e.g. body) was given 1, intermediate 2, and large 3. These conditions were punched on to the cards for processing on the IBM 7090 Fortran IV electronic computer available at Imperial College.

In the Principal Component method, the computer generates covariance matrix but prints only the diagonal values, the sum of which (Trace) represents the amount of total variance (Fig. I).

22.592	
24.392	
38.492	
24.992	
34.292	
54.492	
28.892	
45.092	
37.992	
25.792	
33.592	
46.692	
52.092	
54.292	
44.592	
54.392	
73.592	
95.592	
101.792	
123.492	
210	1017.14
Total variance (Trace)	

Fig. I. Trace of 20 spp. of Pseudococcidae.

The BIGMAT calculates any desired number of latent roots (eigenvalues) and the corresponding latent vectors (eigenvectors); as usual 10 were calculated, but only the first three were used for plotting (Fig. II).

EIGENVECTOR CORRESPONDING TO 2.9913983E-02 (= Latent root)

2.4015854E-02 7.8226104E-03 -1.2951852E-03 -3.5644727E-02 5.6835338E-02 1.2530954E-01 -5.9564865E-02 7.6450016E-03
 1.0492194E-02 -1.5792798E-01 -2.2388528E-01 -2.6562484E-01 -3.1658460E-01 -3.1533943E-01 -2.4942465E-01 -8.2955210E-02

2.9370538E-01 4.4043477E-01 3.1838629E-01 4.2360780E-01

EIGENVECTOR CORRESPONDING TO 1.6239042E-02

-2.2098002E-01 -2.3159923E-01 -3.0908342E-01 -2.7586103E-01 -2.8919946E-01 -3.6976436E-01 -1.2965085E-01 1.3466497E-01
 -1.5214205E-01 1.3926755E-02 1.6055679E-01 1.9671679E-01 2.3084065E-01 2.2135791E-01 1.9066565E-01 -2.0218696E-02
 3.1300302E-02 1.8158900E-01 2.5952574E-01 3.7738265E-01

EIGENVECTOR CORRESPONDING TO 1.1523669E-02

-7.8359791E-02 5.4741075E-02 8.2461756E-02 -9.1954241E-02 1.5812027E-02 -4.1155443E-03 4.8177828E-02 -3.4256143E-01
 1.0589229E-01 7.5402325E-02 1.6064501E-02 4.6854463E-02 1.3160295E-02 1.0158375E-01 -1.1463530E-02 -2.1068075E-01
 -2.5461197E-01 2.7366196E-01 6.4068813E-01 -4.8073832E-01

the first three

Fig. II. Latent vectors corresponding to ~~10~~ latent roots for 20 spp. of Pseudococcidae. The actual values of the co-ordinates for plotting are calculated by multiplying each eigenvector by the square root of the corresponding latent root.

Each latent root represents an axis which is perpendicular to all the other axes, and the latent vectors represent the co-ordinates on these axes, thus locating the species in the N-multiple superspace. The value of the latent root, expressed as a percentage of the sum of diagonal values, gives the amount of variance (Trace) accounted by each root. This amount is the highest for the first root and gradually decreasing in

the other roots. The first three (29.41%, 15.96% and 11.33%, respectively) account for 56.7% of total variance, and these were used for plotting (the remaining 7 roots account for 6.71%, 6.12%, 5.27%, 3.89%, 3.70%, 3.40% and 2.87%, respectively). The values of the co-ordinates are calculated by multiplying the eigenvalues by the square root of the corresponding latent root of each species. For the purpose of plotting an integral number was added to the latent vectors of each latent root to eliminate negative values, and in this case 6, 5 and 6, respectively were added to the three roots. Table 1 shows the data for the pseudococcid species prepared for plotting.

The 3-dimensional block diagrams of the first three vectors were made separately for (1) all forms of Pseudococcidae and Eriococcidae studied, (2) Pseudococcidae and Eriococcidae excluding the apterous males, and (3) Pseudococcidae only (Figs. 1, 2 and 3, respectively). In these diagrams the space was divided by horizontal planes. The first vector (axis) was represented by one side of the square base (horizontal, I in Figures), the third by the other side (III, oblique in the Figures), and the second vector by the vertical axis (II). For the purpose of easier reference to the actual location of the species, each side of the base (and other planes) was divided into 3 sections marked A, B, C for axis I, and a, b, c for axis III. The resulting 9 squares are defined by the reference to the appropriate sections on the sides; the vertical position is referred to as "level" above which the species is located. This way of plotting was suggested by Dr. K. Boratynski.

In the Taxon programme the usual correlation coefficient matrix is generated (each diagonal value = 1), and a series of clustering cycles are made. After each cycle, a new correlation coefficient matrix is recalculated. In the employed weighted pair-group method (WPGM) only the two most highly correlated stems are allowed to join at each clustering cycle. Members of a cluster include either the individual species or the smaller clusters to form another cluster of a higher rank. The growing

Table 1: Data of the species of Pseudococcidae prepared for plotting:

Latent root	I	II	III
% of variance (Trace)	29.41%	15.96%	11.33%
Integral number added to make the latent values positive.	+6	+5	+6
Species	Latent values		
1) <i>P. citri</i>	6.42	2.18	5.16
2) <i>P. kenyae</i>	6.13	2.05	6.59
3) <i>P. dioscoreae</i>	5.98	1.06	6.89
4) <i>P. ireneus</i>	5.38	1.48	5.02
5) <i>N. vastator</i>	6.98	1.32	6.17
6) <i>N. nipae</i>	8.17	0.29	5.96
7) <i>M. hirsutus</i>	4.97	3.35	6.52
8) <i>F. virgata</i>	6.13	6.72	2.32
9) <i>T. newsteadi</i>	6.18	3.06	7.14
10) <i>P. obscurus</i>	3.27	5.18	6.81
11) <i>P. "maritimus A"</i>	2.13	7.05	6.17
12) <i>P. citriculus</i>	1.41	7.51	6.50
13) <i>P. adonidum</i>	0.52	7.94	6.14
14) <i>P. fragilis</i>	0.55	7.82	7.09
15) <i>D. alazon</i>	1.69	7.43	5.88
16) <i>S. sacchari</i>	4.56	4.74	3.74
18) <i>O. africanus</i>	11.08	5.40	3.27
19) <i>C. pilosellae</i>	13.62	7.31	8.94
20) <i>C. insolitus</i>	11.51	8.31	12.87
21) <i>N. bifrons</i>	13.33	9.81	0.84

clusters join the more remote relatives at a lower point of similarity (or correlation coefficient). The dendograms of Figs. A, B, C, D and E are prepared to illustrate the values of correlation coefficient at which the OTU's or their groups are joined together.

Results:

The results of the Principal Component analyses are shown in Figs. 1, 2 and 3. In Fig. 1, in which all species were considered (including the apterous forms), the macropterous forms are situated in the upper part of the diagram, and except S. sacchari (16) above the third level, while the two apterous forms (S. sacchari, 17 and P. fraxini, 29) near the base, below the second level. This is attributed to the fact that these males, unlike the apterous males of other families (e.g. Diaspididae, Ghauri 1962) are greatly degenerate and have lost most of their morphological structures. They show considerable differences as compared with the macropterous forms even of the same species. It has been decided therefore to exclude these two species, and another set of calculations for the macropterous males only was made; the results are illustrated in Fig. 2. The two diagrams are virtually identical as far as the relative position of the species are concerned, except for S. sacchari (16) whose position is closer to Planococcus group (spp. 1 - 9). The relative position of the species, as shown in Fig. 2, will be discussed in greater detail since it appears to illustrate the relationships more clearly. Pseudococcidae (1 - 21) are well separated from Eriococcidae (22 - 29) by a vertical plane passing diagonally across the base through the near left and the far right edges of the block diagram. The Pseudococcidae are situated beyond this plane and the Eriococcidae in front of it. Nairobi (21) lies in the plane near Eriococcidae. Pseudococcus group (10 - 15) occupy space (Ab) on the "ground floor level"; Planococcus group (1 - 9) space (Aa) on the "first floor level" except F. virgata (8) which occupies space (Ab) on the same floor. The position of Saccharicoccus (16) indicates that it is probably more closely related

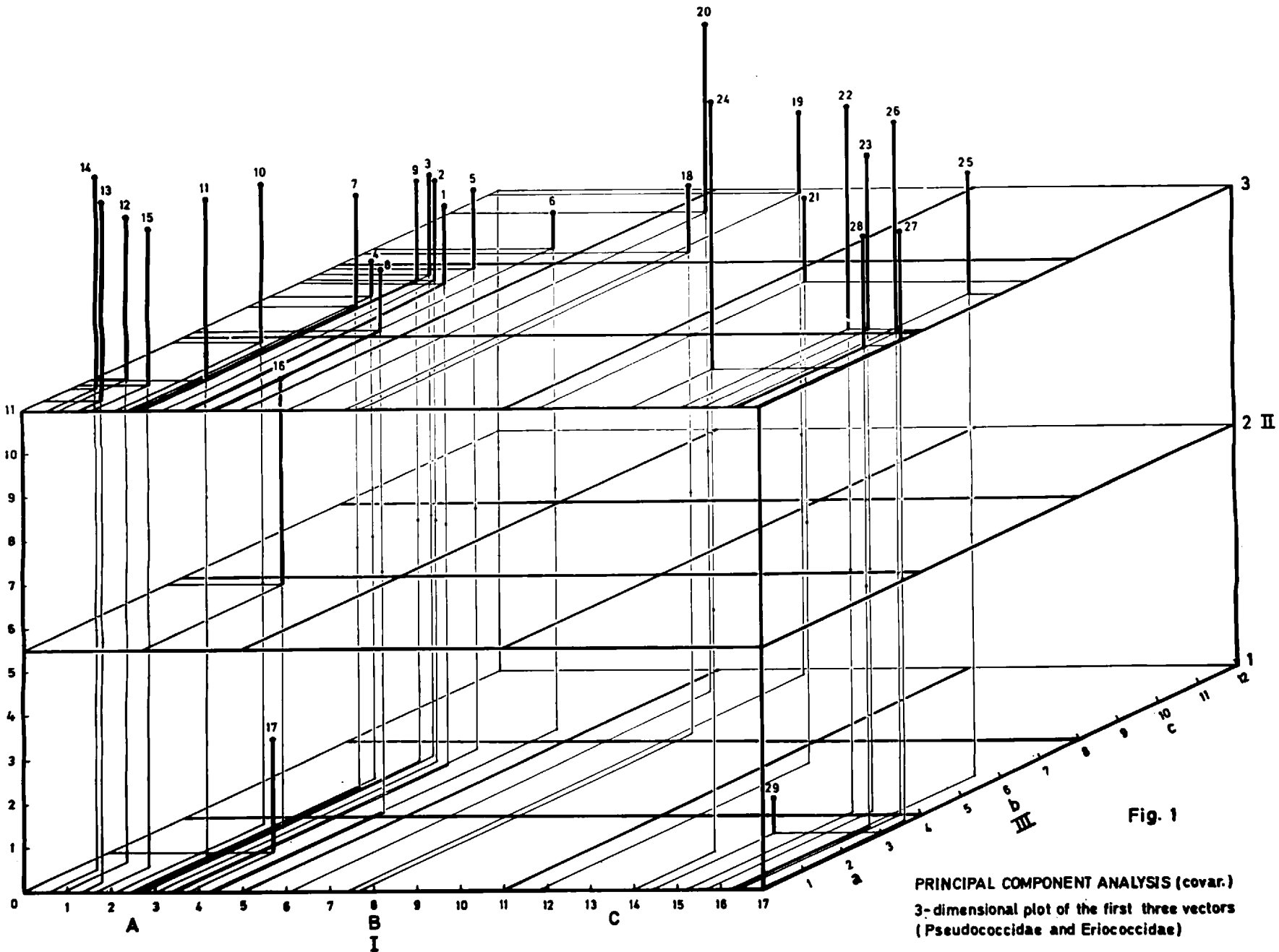


Fig. 1

PRINCIPAL COMPONENT ANALYSIS (covar.)
 3-dimensional plot of the first three vectors
 (Pseudococcidae and Eriococcidae)

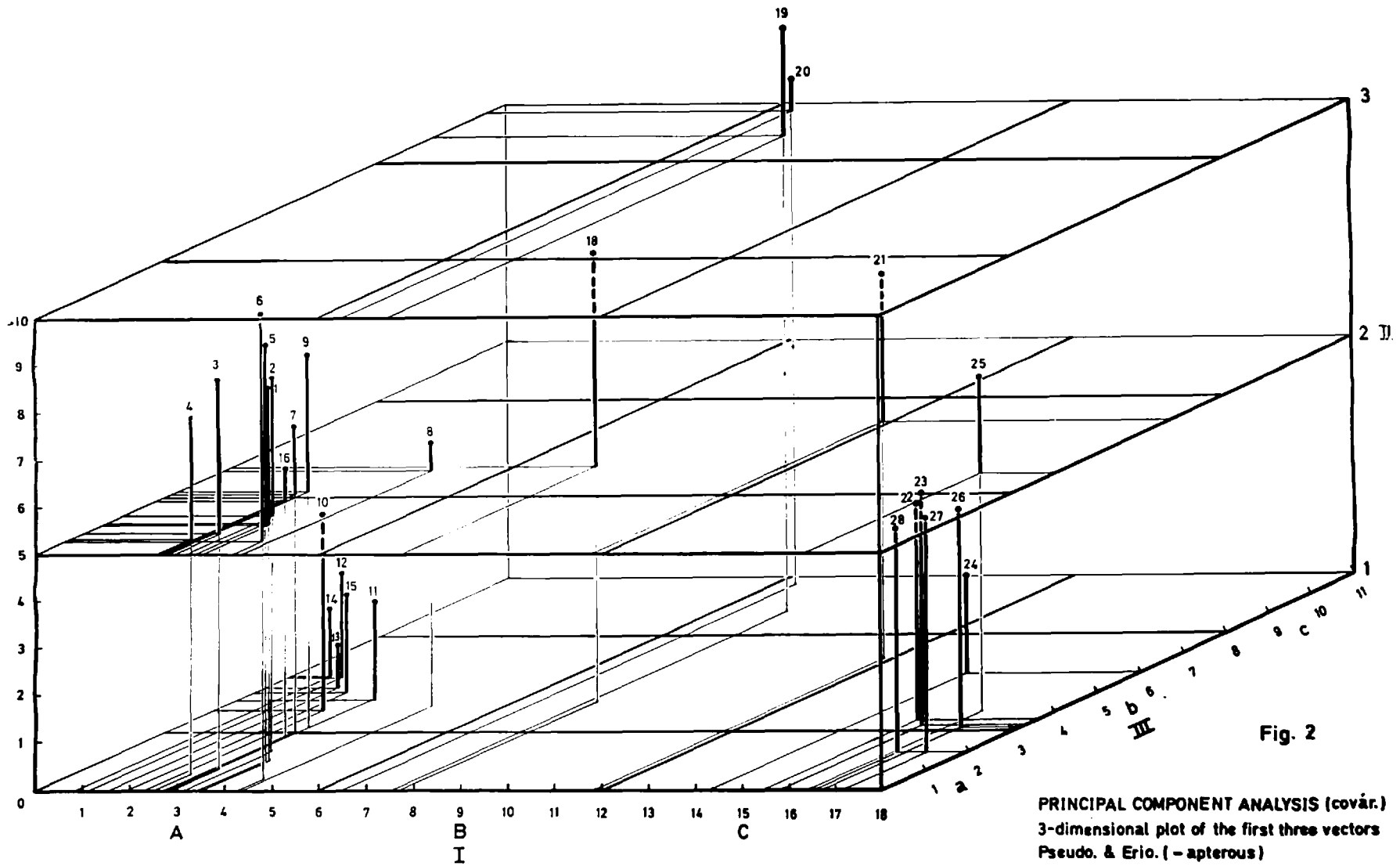


Fig. 2

PRINCIPAL COMPONENT ANALYSIS (covár.)
 3-dimensional plot of the first three vectors
 Pseudo. & Erio. (-apterous)

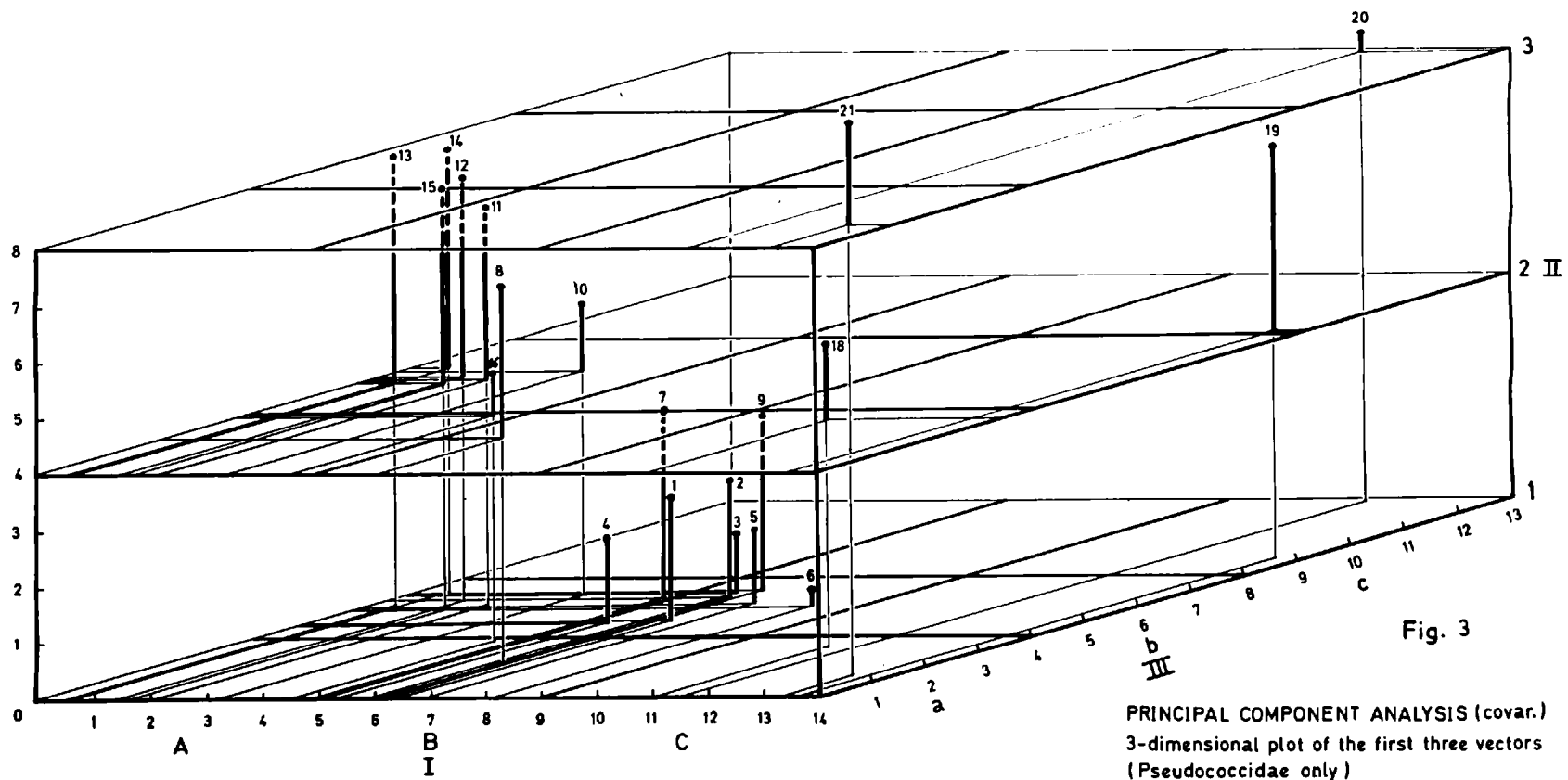


Fig. 3

PRINCIPAL COMPONENT ANALYSIS (covar.)
 3-dimensional plot of the first three vectors
 (Pseudococcidae only)

to Planococcus group than F. virgata (8). All these species however, are concentrated in the left hand corner of the block diagram forming a rather close group of genera. Octococcus (18) occupies a solitary position in the near left upper part of space (Bb) of the second floor, and Ceroputo and Centrocooccus (19 and 20) are closely approximated in space (Bc) of the third floor. The Eriococcidae form a fairly compact group in the spaces (Ca) and (Cb) on the ground floor, with O. agavium (25) isolated on the second level in space (Cb). Nairobi (21) is situated in the same space (Bb, second level) as Octococcus (18), but very near the right margin and close to Eriococcidae. The diagram of Pseudococcidae alone (Fig. 3) shows similar relationships, only with differences regarding the position of the groups; in this diagram F. virgata (8) is also removed from Planococcus group.

The results of the Taxon analyses are basically in accord with those of the Principal Component. The dendrogram of Fig. (A) also shows that the apterous males of S. sacchari (17) and P. fraxini (29) are highly correlated. In Fig. (B), where both species were excluded, it is apparent that the two brachypterous forms of Gossyparia (27 and 28) are the most closely related (with a similarity coefficient 0.97), i.e. more than the macropterous (26) and the brachypterous (27) forms of G. spuria. This again indicates the considerable differences apparently resulting from the conditions of the wings. This dendrogram shows that F. virgata (8) is far removed from Planococcus group and is closer to Pseudococcus group. When a phenon line was drawn at the correlation coefficient point of 0.45, the six groups of genera suggested for Pseudococcidae were distinctly separated (except for the position of F. virgata). It was also possible to draw another phenon line at 0.2 correlation coefficient, which roughly separates the two suggested major taxa or sections, i.e. Planococcus, Pseudococcus and Saccharicoccus on the one hand, and Ceroputo and Nairobi on the other (leaving Octococcus isolated). These dendrograms illustrate the most noteworthy conclusion. They indicate that Octococcus, Ceroputo and Nairobi groups of genera have greater

phenetic affinity with Eriococcidae than with Pseudococcidae. It was already suggested that N. bifrons (21) ostensibly represents a link between the two families. But when a third programme was run excluding this species, similar results were obtained (Fig. C). When the state conditions of most characters were reduced so that almost all characters had only 2 - 3 states, the results were still not much different (Fig. D). The dendogram of Fig. (E) is only concerned with Pseudococcidae, where the relationships between the species are amplified and where no substantial differences occurred.

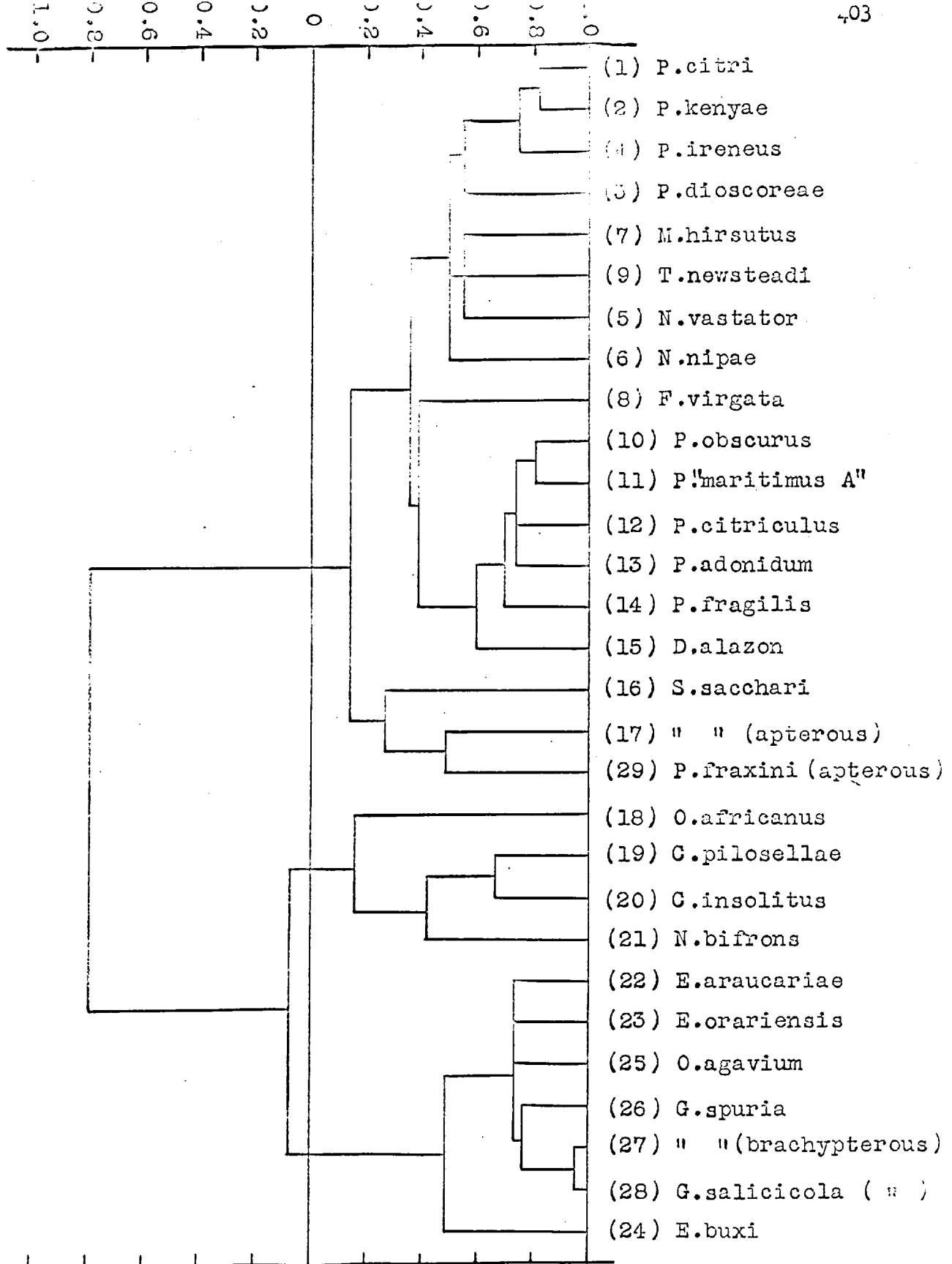


Fig.(A). Dendrogram of all species studied(Pseudococcidae + Ericococcidae, including the apterous) computed from a correlation matrix and clustered by the (WPGM).

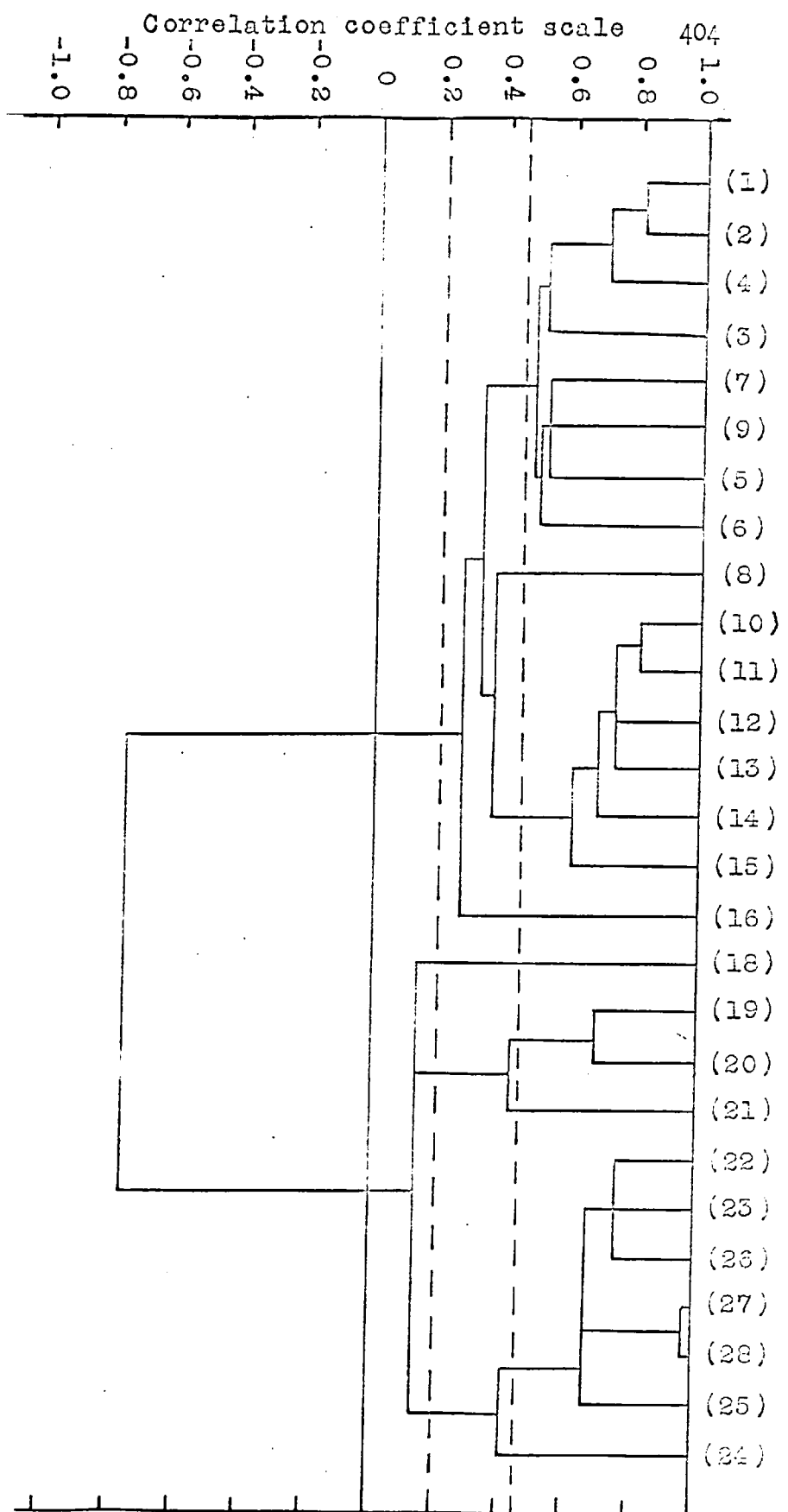


Fig.(B).Dendrogram of the species of Pseudococcidae and Eriococcidae(excl. apterous males), clustered by (WPGM).

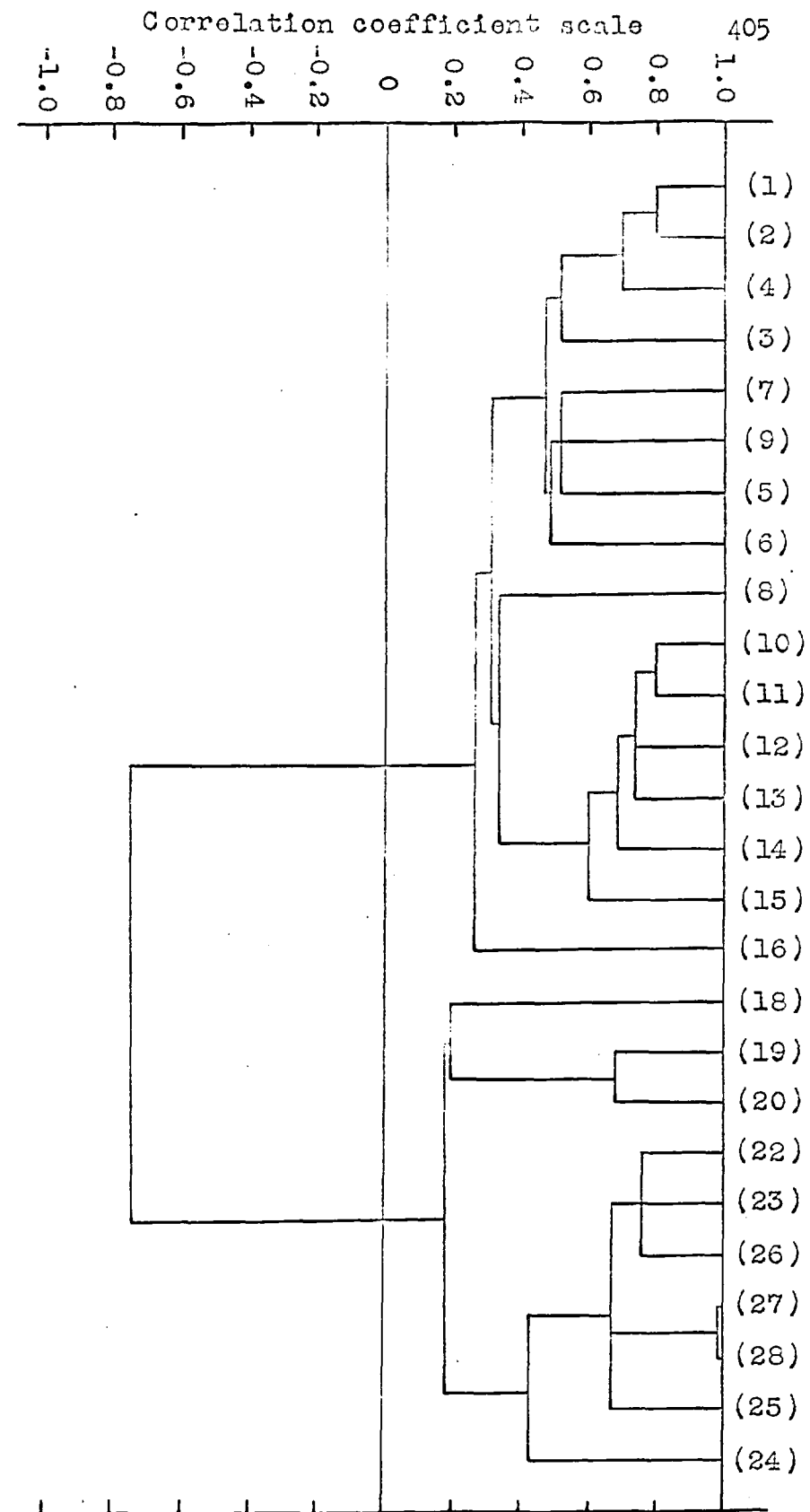


Fig.(C).Dendrogram of the spp. of Pseudococcidae and Eriococcidae (excl.apterous males & Nairobia), clustered by (WPGM).

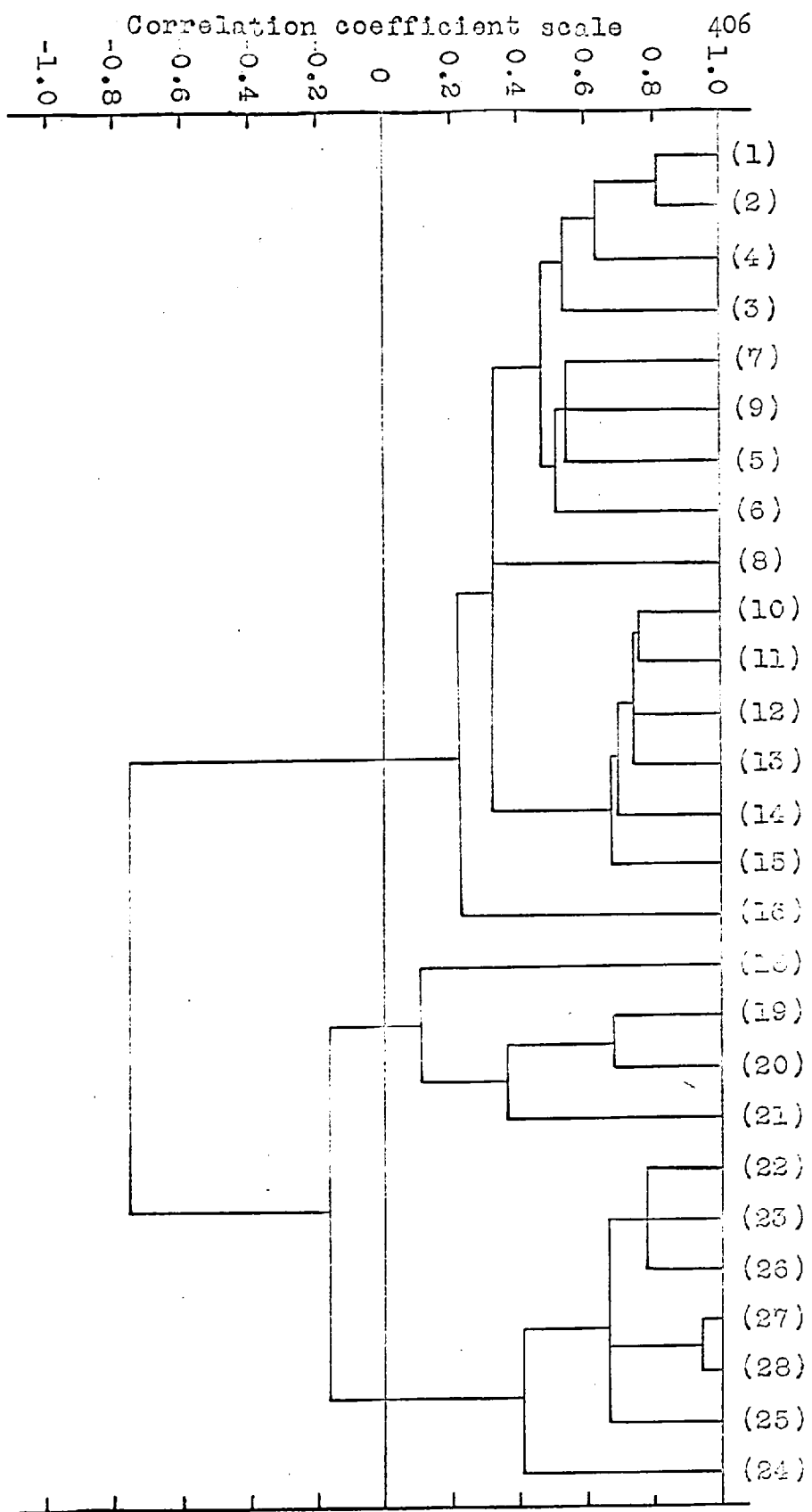


Fig.(D).Dendrogram of the spp. of Pseudococcidae and Eriococcidae (excl. apterous males, with state characters reduced), clustered by the (WPGM).

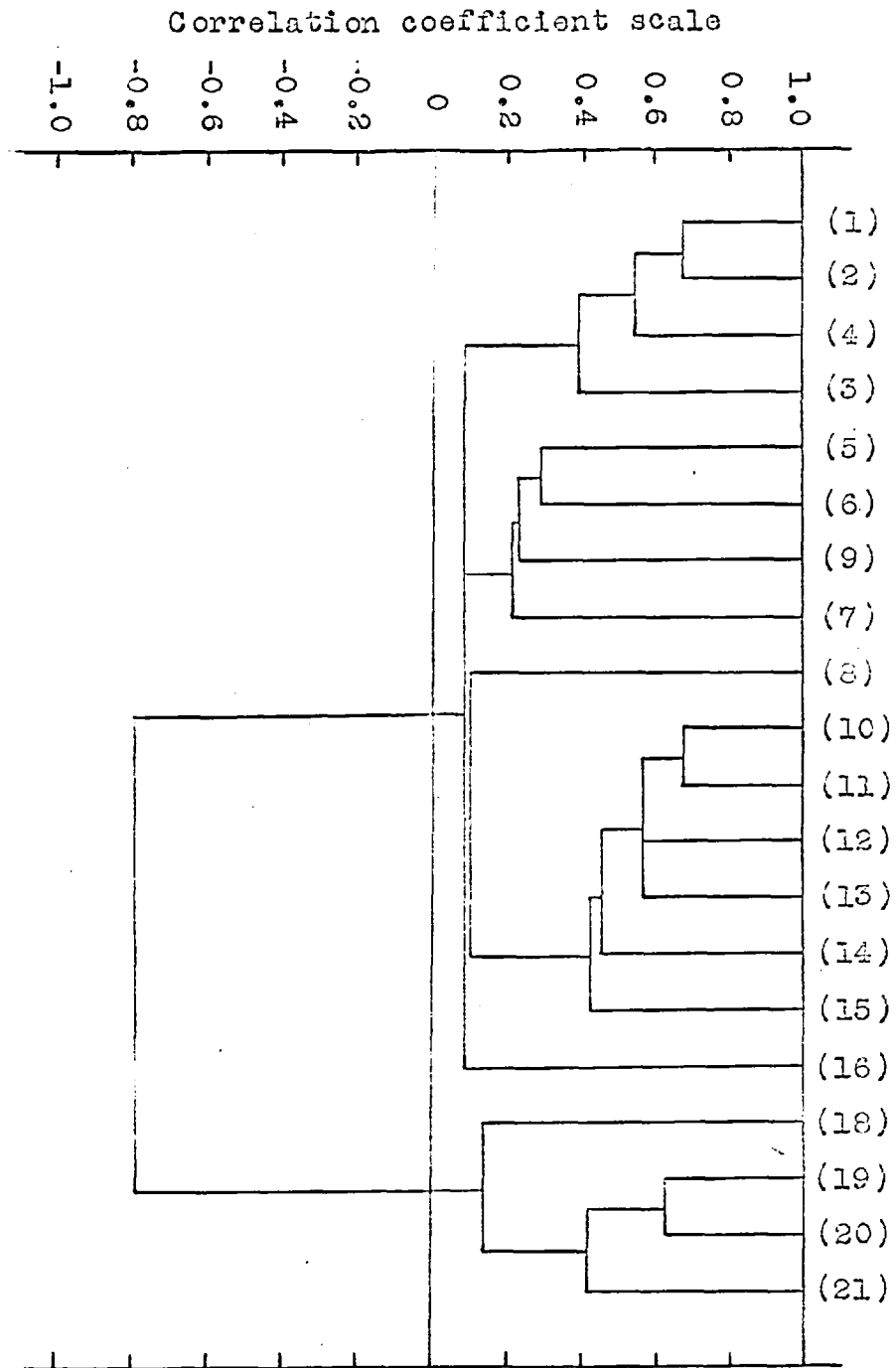


Fig. (E). Dendrogram of the species of Pseudococcidae only (excl. apterous males), clustered by the (WPGM).

DISCUSSION

The results of the two computational methods and that employed in the first part of this thesis show a good deal of agreement, although nevertheless revealed some differences:

- (1) The separation of families Pseudococcidae (1 - 21) and Eriococcidae (22 - 29), with Nairobiia (21) occupying an intermediate position is confirmed by the Principal Component analysis, but not by the Taxon method; the latter indicates closer affinity of the members of Ceroputo section (19 - 21) with Eriococcidae than with the remaining Pseudococcidae.
- (2) The subdivision of the groups of genera of Pseudococcidae into Pseudococcus (1 - 18) and Ceroputo (19 - 21) sections is again confirmed by the Principal Component analysis and, with one exception (Ootococcus, 18), also by the Taxon. My inclusion of this genus in the Pseudococcus section was based on the lack of specializations of some apparently more important morphological characters. The Principal Component places it in somewhat marginal position but near this section, which forms a fairly compact cluster. The Taxon on the other hand joins it with the more specialized Ceroputo section (19 - 21), although at rather a low level of similarity.
- (3) As far as the grouping of genera is concerned, I recognized 6 groups of genera, i.e. Planococcus (1 - 9); Pseudococcus (10 - 15); Saccharicoccus (16); Ootococcus (18); Ceroputo (19, 20); Nairobiia (21). This conclusion and the results of the numerical methods, differ in two respects:
 - I. The Principal Component analysis does not place F. virgata (8) in Planococcus group of genera (1 - 9), but near Pseudococcus group (10 - 15); the Taxon leaves it out as a possible nucleus of a separate group.

II. Saccharicoccus (16) is incorporated into Pseudococcus group (10 - 15) in the Principal Component diagrams, which does not suggest that it may form a separate group; but the Taxon dendograms confirm my designation.

(4) Regarding the composition of the genera, this appears to be better represented by the Taxon than by the Principal Component methods, and in the former the exclusion of Eriococcidae resulted in better agreement with the accepted concept of the genera. The Taxon dendogram of Fig. (E) clearly groups together the species of Nipaecoccus (5 & 6) and of Pseudococcus (10 - 14). On the other hand Planococcoides (4) was joined to two species of Planococcus (1 & 2) before the third species (3) of this genus was admitted. The Principal Component analysis (both with the two families, Fig. 2 and with Pseudococcidae only, Fig. 3) imply closer relationships between the three species of Planococcus than to Planococcoides; but it places one species of Nipaecoccus (N. vastator, 5) closer to Planococcus (especially P. dioscoreae, 3) than to the other species of Nipaecoccus (N. nipae, 6).

With regard to D. alazon (15) the Taxon separates it from the five species of Pseudococcus (10 - 14), but the Principal Component places it closer to four species of Pseudococcus (11 - 14) than the fifth species (10) of this genus.

Although the material of Eriococcidae is not representative, it can be also noticed that all methods confirm that E. buxi (24) does not seem to be congeneric with either E. araucariae or E. orariensis (22 & 23). On the other hand, while the Principal Component methods tend to isolate O. agavium (25) from the rest of Eriococcidae, the Taxon analysis places it within the main cluster of the family.

Both methods, especially the Taxon, confirm a high degree of similarity between the two brachypterous forms of Gossyparia (27 & 28), even greater than between the macropterous and brachypterous forms of the same species (26 & 27).

It could be concluded that the Principal Component method probably gives better results as far as the general grouping and classification of the higher taxa are concerned. The Taxon analysis on the other hand demonstrates more accurately the actual relationships between the species.

The application of the numerical methods in Entomology has been hitherto confined to members of one genus or a genus complex. The present work appears to be the first in which these methods have been utilized on the higher levels. The material in this study is unevenly representative, but the results seem to suggest that these methods can be useful even for such haphazard samples of taxa if a detailed study of the characters is made. From my experience, the time, however, seems to be the most striking factor involved. By using the traditional methods (after the data for the species were obtained), it took me well over 4 months of detailed investigation, comparison, study of the various features and counting the number of characters shared by each pair of species. By using the computer programmes the diagrams were ready within a week. I agree that a taxonomist experienced in a group would be able to devise perhaps a better classification in a much shorter time, using a few selected relevant characters. As far as Coccoidea are concerned, the attempt to classify them on the basis of the male characters is a new venture.

REFERENCES

- ROHLF, F. J. 1963. Classification of Aedes by numerical taxonomy methods (Diptera: Culcidae). Ann. ent. Soc. Am. 56 : 798 - 804.
- SHEALS, J. G. 1964. The application of computer techniques to Acarine taxonomy: a preliminary examination with species of the Hypoaspis - Androlaelaps complex (Acarina). Proc. Linn. Soc. Lond. 176,1 : 11 - 21.
- SOKAL, R. R. 1958. Quantification of systematic relationships and of phylogenetic trends. Proc. Xth Int. Congr. Ent. 1 : 409 - 415.
- SOKAL, R. R. and MICHENER, C. D. 1958. A statistical method for evaluating systematic relationships. Kans. Univ. Sci. Bull. 38 : 1409 - 1438.
- SOKAL, R. R. and SNEATH, P. H. A. 1963. Principles of numerical taxonomy. W. H. Freeman & Co., San Francisco and London. 359 pp.
- *STROUD, C. P. 1953. An application of factor analysis to the systematics of Kalotermes. Syst. Zool. 2 : 76 - 92.

* Paper not seen, but only known from other references.
