

THE FAUNA OF INDIA

THE FAUNA OF INDIA
AND
THE ADJACENT COUNTRIES

HOMOPTERA

APHIDOIDEA

Part 5

SUBFAMILY DREPANOSIPHINAE

By

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EDITOR'S PREFACE

The role of aphids as insect-vectors of plant viruses, their polymorphism, host alteration and many other features have attracted the attention of scientific community on a global basis. India and its adjacent region is now known to possess at least 20 percent of the world's aphid fauna (4000 species) including many an endemic taxa. "Fauna of India on Aphidoidea" has been planned to be published in several parts, of which four volumes dealing with General Introduction to the group and subfamily Chaitophorinae (Part 1, 1980) subfamily Lachninae (Part 2, 1982), subfamily Pemphiginae (Part 3, 1980) and subfamily Phloemyzinae, Anoeciinae and Hormaphidinae (Part 4, 1988) have so far been published. Dr. A. K. Ghosh, a leading aphidologist of this country and author of the earlier four volumes, has now been joined by Dr. F. W. Quednau from Canada who is one of the world authorities on the Drepanosiphinae. These two scientists have now further contributed to our knowledge on Indian Aphidoidea. While this study on the aphids of the subfamily Drepanosiphinae presents the state of art on the subject, it also reveals the dearth of information on biology, an area which could be taken up by young researchers to fill up the gaps.

I am sure the present volume, like the ones in past will be most useful treatise on Aphidoidea of the region. I record my deep sense of appreciation for this significant contribution.

24th October, 1990
Calcutta

Prof. MOHAMMAD SHAMIM JAIRAJPURI
Director
Zoological Survey of India

AUTHOR'S PREFACE

The present volume, the fifth in the series of 'Fauna of India : Aphidoidea' deals with the subfamily. Drepanosiphinae. The members of this subfamily is widely distributed and the regional fauna is composed of 55 species under 31 genera ; at least seven of these genera and 34 species appear to be endemic. However, detailed biological information on many of these species are still wanting.

The present volume has been jointly written by the authors and the collections available at the disposal of one of us (FWQ) helped to compare each of the species recorded from the region with those from other areas of the world. We are indebted to all our colleagues who have been most generous in sending their material for comparison.

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10th October, 1990

A. K. GHOSH
F. W. QUEDNAU

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ABBREVIATIONS

The following abbreviations have been used in the text :

BMNH : British Museum (Natural History), London ; C.U. : Department of Zoology, University of Calcutta, Calcutta ; IARI : Indian Agricultural Research Institute, Delhi ; K.U. : Department of Zoology, Kalyani University, Kalyani, West Bengal, India ; N.Z.C. : National Zoological Collections, ZSI ; ht_2 : second segment of hind tarsus ; p.t. : processus terminalis ; Z.S.I. ; Zoological Survey of India, Calcutta.

INTRODUCTION

The aphids of the subfamily Drepanosiphinae practically remained unknown in the Indian region till 1900. The first record was published by Buckton (1899) when he described *Therioaphis trifolii* as a new species under the name *Chaitophorus maculatus*. Due to extensive exploration in India during the last three decades, nearly 54 species, mostly endemic (about 75 percent) are now known from India and adjacent countries, the largest number of species being known from Northeast India. Record of Drepanosiphinae from Bangladesh and Sri Lanka still appear to be very meagre.

No comprehensive account of Drepanosiphinae of India and adjacent countries has been published till date except for the Drepanosiphinae of Eastern India and Bhutan (Raychaudhuri et al. 1980). Intensive survey in the region where typical hosts plants of Drepanosiphinae are known to occur, can reveal more species but above all can provide valuable information on the biology of many a little known species.

Subfamily DREPANOSIPHINAE

[Neophyllaphidinae, Lizeriinae, Phyllaphidinae, Saltusaphidinae and Drepanosiphinae of Remaudière & Stroyan 1984].

Body 1.0 to 4.5 mm long, sometimes with dorsal and lateral processes, head of apterae may be fused with prothorax or normal. Antennae usually 6-segmented, sometimes of 5 segments and very short ; processus terminalis 0.10—10.5 x as long as base of last antennal segment, secondary rhinaria in alatae usually confined to segment III, round, oval or annular, primary rhinaria usually fringed. Eyes of apterae may be of three facets (*Neophyllaphis*), triommatidia may be absent (*Saltusaphis*, *Machilaphis*), but usually multifaceted and large. Rostrum rather short, usually with a wish-bone shaped arch supporting base of second rostral segment ; ultimate rostral segment from very short and blunt to elongate stiletto-shaped, less than half to longer than second segment of hind tarsus, usually with accessory hairs. Dorsal hairs variable, sometimes spiny and capitate, in some cases inconspicuous. Wax

plates may be variably present on head, thorax and abdomen (*Euceraphis*, *Phyllaphis*) or may be absent. Siphunculi pore-like or cylindrical, but usually short, truncate, seldom with reticulation, but often with spinulose striae and sometimes hairs (of abdominal tergite 6) appended to the base. Cauda usually knobbed, sometimes crescent-shaped or blunt and pointed. Subanal plate bilobed. Legs normal or modified (front coxae and or femora, or front and middle femora and tibiae, enlarged for leaping) ; tibiae usually spinulose, apical tibial hairs often modified as spines (rostral organ); tarsi spinulose, first tarsal segments with 5—7 ventral hairs and often with a pair of dorsal hairs ; empodial hair usually flattened, occasionally setiform. Wing venation normal, sometimes radial sector of forewings obsolete and hindwings with only one oblique. Veins may be dark bordered in some members. First instar larvae usually with 3, 4 or 5-segmented antennae, compound eyes (rarely only triommatidium), siphunculi and spinulose tarsi.

Males are normally winged, sometimes apterous ; oviparae usually apterous and exhibit modified anal segment and in some genera possess two posterior ventro-lateral wax-gland plates, which are used to secrete wax on the surface of winter egg during oviposition (Stroyan, 1977).

In some genera of Drepanosiphinae, apterae viviparae are not known ; the genera having both the apterous and the alatae morph may produce alatae only in a particular generation or may have apterae restricted only to a few species.

The subfamily has been previously known as Callipterinae but as *Callipterus* Koch, 1855, is considered a junior homonym of *Callipterus* Agrassiz, 1846 (not aphid), the replacement name of *Callipterus* Koch becomes *Callaphis* Walker, 1870, and many authors used Callaphididae as a family group name (Börner, 1952, Shaposhnikov, 1964 ; Stroyan, 1977), but Eastop (1966) correctly suggested the next available name (as a subfamily, instead of a family group name) “Drepanosiphinae” an emendation of Drepanosiphiden Herrich Schaffer in Koch, 1857. Quednau (1954) largely on the basis of the characters of first instar larvae proposed under the family Callaphididae four subfamilies viz. Phyllaphidinae, Callaphidinae, Therioaphidinae and Saltusaphidinae. Eastop and van Emden (1972) recognised, under one subfamily

name Drepanosiphinae [following Eastop (1965)], two tribes—Drepanosiphini (Syns. Phyllaphidinae and Callaphidinae) and Saltusaphidini. Later, Eastop (1977) recognised 9 tribes, viz. Phyllaphidini, Macropodaphidini, Drepanosiphini, Lizeriini, Neuquenaphidini, Mindarini, Neophyllaphidini, Thelaxini and Saltusaphidini under the subfamily Drepanosiphinae. However, Stroyan (1977) mentioned that there is no straight forward way of subdividing the genera of Drepanosiphinae (=his Callaphididae) into groups and it seems better to treat all the genera under one subfamily, without subdivision. However Remaudier & Stroyan (1984) proposed again distinct subfamilies for the groups formerly recognized as tribes by Eastop, a procedure which is not followed here for practical reasons. Some groups however have been designated as *Myzocallis* group, *Calaphis* group etc., following Higuchi (1972).

Heie (1982) suggested that the Drepanosiphidae (Drepanosiphinae, Phyllaphidinae, Chaitiphorinae) apparently became predominant in the beginning of Tertiary period.

All members of Drepanosiphinae are monoecious, oligophagous and mostly associated with trees of Fagaceae, Ulmaceae, Aceraceae and Betulaceae or its more primitive members, also with Coniferae and Epicardiaceae and herbaceous plants like Graminae, Cyperaceae, Juncaceae. Papilionaceae have become more recent acquisitions. Gall formation by any member of the subfamily is not known. Monoecious habit is considered a primitive character in this group and host plant alternation has apparently never evolved (Eastop, 1966). The group is distributed worldwide and members mostly lead holocyclic life cycles but in many genera the life cycle remains unknown.

Some of the genera of Drepanosiphinae are apparently Oriental (*Neocalaphis*, *Paracallipterus*, *Machilaphis*, *Shivaphis*, *Tinocallis*, *Dasyaphis*, *Taoia*, *Tiliaphis*, *Tinocalloides*, *Takecallis*, *Yamatocallis* etc.). Some are restricted to Tasmania, Australia & New Zealand (*Sensoriaphis*, *Ceriferella*) or to Neotropical region (*Lizerius*, *Neuquenaphis*) while a large number of genera remain Palaearctic or Nearctic in distribution. Eastop (1977) listed a total of 446 species under 53 genera and 9 tribes for the subfamily from the World including 4 species of Mindarini.

In the region under study, till 1960, only 4 species under three genera were known but due to extensive survey work carried out during the last 25 years, 54 species under 31 genera have been recorded so far, representing nearly 6.5 percent of the total aphid fauna ; a large number of species 41/54 appears to be endemic to the area and of the 31 genera only 8 are known to be widely distributed while the rest are Oriental and eastern Palaearctic in distribution. Only a small percentage (9/54) have been known also in the sexual forms and most of these species are endemic in origin. The total species complex when analysed exhibits a distribution range extending from 'terai' vegetational belt in the plains to c 3060 m. The maximum abundance of species has been recorded between c 1500—2000 m., specially during the months of November to January. The subtropical region appears to be the most favoured niche for the Drepanosiphine aphids in the area and the distribution pattern within the region indicates largest concentration of species in Northeast India (35) followed by Northwest India (19), South India (4) and Central Indian region (1) (Chakrabarti, 1981).

Only four species of Drepanosiphine aphids are known to be attacked by aphidiid parasitoids of the genera *Betuloxys*, *Lipolexis* and *Trioxys*, of which two parasitoids have been described as new species.

However, Mackauer (1965) recorded aphidiid parasitoids of the genera *Praon*, *Dycristulus*, *Aphidius*, *Falciconus*, and *Trioxys* from European Drepanosiphinae and of these, members of *Praon*, *Aphidius* and *Trioxys* appear to be wide-spread in Drepanosiphine hosts. Mackauer (1965) utilising parasitological data further opined that Chaitophorinae (=Chaitophoridae), Drepanosiphinae (=Callaphididae) and Aphidinae (=Aphididae) are of monophyletic origin and within Drepanosiphinae, *Drepanosiphum*-like aphids should be regarded as primitive group (rather than highly evolved group) as evidenced from occurrence of *Dycristulus planiceps* (Marshall) and *Falciconus pseudoplatani* (Marshall) which are genetically distinct from other parasitoids of Drepanosiphinae. Fulmek (1957) has given an account of other parasitological records of Drepanosiphine aphids e.g. Diptera, Chalcididae, Cynipidae and Proctotipidae, besides Braconidae, and Mackauer (1968) provided a host-parasitoid (of Aphidiid parasites) index of Drepanosiphinae.

Few Drepanosiphinae are known to be involved in transmission of plant viruses (Eastop, 1977). Myrmecophily is well known in some groups like Lizeriini.

Taxonomic works containing the regional fauna of Drepanosiphinae include Chakrabarti & Raychaudhuri (1975) : Northeast India and Bhutan ; Cottier (1973) : New Zealand ; Eastop : East Africa (1958), West Africa (1961), Australia (1966) ; Heie (1982) : Scandinavia ; Higuchi (1972) : Japan ; Nevsky (1929) : Central Asia ; Nieto-Nafria & Mier Durante (1984) : Spain ; Paik (1965) : Korea ; Quednau (1954) : Central Europe ; Richards (1965) : Canada ; Shaposhnikov (1964) : European USSR ; Stroyan (1977) : England ; Szelegiewicz (1968) : Poland ; Takahashi (1931) : Formosa ; Tao (1964) : China.

Richards has also published world reviews of the genera *Tinocallis* (1967), *Myzocallis* (1968), *Tuberculatus* (1968) and Saltusaphidinae (1971) ; Quednau (1974) has dealt with Lizeriini and provided keys to the species of two genera viz. *Lizerius* Blanchard and *Paoliella* Theobald ; Quednau (1954) dealt with the classification of the group based on first instar larvae of 43 genera. He reared 51 of the 67 species of Drepanosiphinae (=Callaphididae) investigated and also provided keys to the genera based on larval characters. Thus the most extensive information on larvae and use of larval characters in generic separation can be found in Quednau (op. cit).

Key to the Genera

(by F. W. Quednau)

1. Apical tibial hairs not differentiated. Rudimentary gonapophyses 2 or 4, never 3. Base of second rostral segment with or without sclerotic stiffening. Frontal tubercles absent or very weakly developed. If dorsal wax pore plates are developed, then ocular tubercle absent. First tarsal segments without dorsal hairs. Ovipara with subventral wax pore plates. On Combretaceae, Lauraceae, Cyperaceae and others

- Apical tibial hairs more or less strongly differentiated as spines, at least on fore tibia. Rudimentary gonapophyses 2, 3, or 4. Base of second rostral segment always with sclerotic stiffening. Frontal tubercles often developed. Ocular tubercle developed. First tarsal segments seldom without dorsal hairs. Siphunculi on abdominal tergite 6. Larvae with polyfacetted eyes. On Fagaceae, Betulaceae, Magnoliaceae, Ulmaceae, Aceraceae and others 5
2. First instar larvae with 3-lensed eyes. In adults ocular tubercle well developed. Siphunculi on abdominal tergite 5. Base of rostral segment not heavily sclerotized 3
- First instar with polyfacetted eyes. Ocular tubercle not developed. Siphunculi on abdominal tergite 6. Base of rostral segment 2 with heavy sclerotic stiffening 4
3. Stigma in fore wing almost reaching to apex of wing, media once-branched. In alatae between mesothoracic lobes a membranous zone (foramen). Empodial hairs setiform with weakly expanded apices. Fore femora of alatae often enlarged and saltatorial. Abdomen often with long finger-like spinal processes, and processes may also occur on head and thorax. In apterae dorsum of body never sclerotic. On Com-
bretaceae .. *Paoliella* Theobald
- Stigma in fore wing normal, not extending to apex of wing, media twice branched. In alatae mesothoracic lobes closed. Empodial hairs flabellate with expanded apices. Fore femora normal. Body without spinal processes, but processes sometimes developed laterally and on posterior margin of abdominal tergite 8. In apterae dorsum of body may be sclerotised. On various plant families .. *Taiwanaphis* Takahashi

4. Second antennal segment longer than first. Processus terminalis shorter than base of antennal segment VI. Accessory sensoria not separated from primary rhinarium. Dorsum with 6 rows of weakly sclerotic plates containing wax gland pores developed as minute rings and also as cribri-form discs arranged in chains or circles, appendages also with wax gland pores. Legs normal. Rostrum reaching to middle coxae, apical segment slender. Dorsal hairs pointed, one pair of spinal, pleural and marginal hairs present on each segment, but marginal hairs as two pairs on thoracic nota and abdominal tergites 6 and 7. Empodial hairs setiform. Siphunculi mere pores. On abdominal tergites 7 and 8 marginal and spinal sclerites consolidated. On *Machilus* *Machilaphis* Takahashi

- Second antennal segment shorter than first. Processus terminalis longer than base of antennal segment VI. Accessory sensoria separated from primary rhinarium. Dorsal setae very numerous, short flabellate, only on posterior tergites rod-shaped, a few short flabellate hairs also present on the lateral margins of head between antennal sockets and anterior margin of the eyes. Dorsum provided with numerous small sclerites and sclerotic bands containing almost invisible wax gland pores in clusters. Fore and middle legs with femora enlarged. Rostrum not reaching to middle coxae, apical segment short. Empodial hairs flabellate. Siphunculi cylindrical. Abdominal tergite 8 bilobate .. *Saltusaphis* Theobald

5. Rudimentary gonapophyses 3. Alatae with fore femora enlarged. Siphunculi cylindrical, sometimes swollen, with flange, as long as head or longer. On Aceraceae. (*Drepanosiphum*—group) 6
- Rudimentary gonapophyses 2, 4 or fused. Alatae with fore femora normal. Siphunculi at most as long as cauda, of various shapes 7

6. Accessory sensoria closely attached to primary rhinarium of antennal segment VI. Secondary rhinaria narrow elliptical. Siphunculi reticulated at apex *Yamatocallis* Matsumura
- Accessory sensoria in part separated from primary rhinarium of antennal segment VI. Secondary rhinaria oval. Siphunculi not reticulated at apex *Drepanosiphum* Koch
7. Embryo and first instar with dorsal body hairs in 6 or more longitudinal rows, on the thoracic tergites lateral hairs in two pairs, second antennal segment with more than 1 hair, antennal segment III mostly with at least 3 (rarely 2) hairs. Fore coxae normal. Alatae without spinal fingerlike processes. Radial sector in fore wing mostly complete (rarely absent). First tarsal segments with 0-2 dorsal hairs. Empodial hairs flabellate. Anal plate rounded, indented or bilobed. On Betulaceae. (*Calaphis*—group) 8
- Embryo and first instar with dorsal body hairs in 4 longitudinal rows (pleural hairs absent), on the thoracic tergites lateral hairs in one pair, second antennal segment always with 1 hair, antennal segment III never with more than 1-2 hairs. Fore coxae often enlarged. Alatae often with spinal fingerlike processes. Radial sector in fore wing often missing or rudimentary. First tarsal segments with 2 dorsal hairs. Empodial hairs variable. Anal plate mostly deeply incised. On Fagaceae. (*Myzocallis*—group) 12
8. Dorsal body hairs sparse, not in clusters, on abdomen lateral hairs one pair on each tergite. Anal plate bilobed. First tarsal segments without dorsal setae. On Betulaceae 9
- Dorsal body hairs in clusters on sclerotic bands or small scleroites, lateral abdominal hairs 3-5 pairs or more on each tergite. Anal plate rounded or shallowly indented. First tarsal segments with dorsal hairs.

- Antennal segment VI with one hair at the base and processus terminalis a little shorter than the base. Sometimes wax gland pores developed as cribriform discs on some abdominal tergites. On Betulaceae *Clethrobius* Mordvilko
9. Processus terminalis subequal to base of antennal segment VI which is bearing 1 hair only. Apterae without secondary rhinaria. Front of head in apterae with a short rectangular prominence on ventral side. Antennal segment III in embryo with 2 hairs .. 10
- Processus terminalis shorter or longer than the base of antennal segment VI, when processus terminalis is shorter, then base is bearing at least 2 hairs. Apterae with secondary rhinaria. Antennal segment III in embryo with 3 or more hairs. Femora and tibiae often with long hairs 11
10. Cauda elongate with a constriction at about midlength (in alatae sometimes without constriction), and with a pair of hairs attached just basad of the constriction. Anal plate deeply cleft. In the aptera tergites mutually separated, scabrous or variolose, and sometimes sclerotized and bearing minute wax gland pores *.Neobetulaphis* A. N. Basu
- Cauda triangular without constriction. Anal plate bilobed. In the apterae abdominal tergites 2-6 fused, mostly smooth and without wax gland pores *.Betulaphis* Glendenning
11. Viviparae alate. Processus terminalis 2-3 times as long as base of antennal segment VI. Ventral side of head in alatae with a broad black transverse band and with epicranial suture. Siphunculi straight without hair attached. In alatae lateral processes of abdominal tergites 4 and 5 often fingerlike, and if abdominal sclerotic bars are developed then wax gland pores as cribriform discs present around spinal and pleural hairs. Cauda with a short, rounded knob *.Betacallis* Matsumura

—Viviparae alate and apterous. Processus terminalis subequal to or shorter than the base of antennal segment VI. Ventral side of head in alatae pale and without epicranial suture. Siphunculi bent with 1 hair attached. In alatae lateral processes on abdominal tergites 4 and 5 not fingerlike, and dorsum without wax gland pores and without sclerites. Cauda elongate with a slender knob

Taoia Quednau

12. Fore coxae of alatae normal. Head without epicranial suture. Dorsal body hairs of adults, at least on the abdomen, laterally in clusters and in the spinopleural region more than 2 pairs of hairs per tergite. In the embryo and first instar spinal hairs not laterally displaced. Siphunculi cylindrical. Apical rostral segment slender. Dorsal wax gland pore elements, if occurring on the sclerites, minute or absent, Radial sector well developed. Ovipara without subventral wax pore plates. On *Quercus*

13.

—Fore coxae of alatae elongate or more or less enlarged. Head often with epicranial suture. Dorsal body hairs of adults in clusters or in single pairs per abdominal tergite. In the embryo spinal abdominal hairs often laterally displaced. Siphunculi and apical rostral segments of various shapes. Dorsum sometimes with well developed wax gland pore plates. Radial sector often incomplete or missing. Ovipara sometimes with a pair of subventral wax pore plates. On Juglandaceae, Ulmaceae, Betulaceae, Tiliaceae, Papilionaceae, Gramineae and other plant families

17

13. Alate viviparae without spinal fingerlike processes on head, thorax and abdomen. Siphunculus often fused with lateral sclerite of abdominal tergite 6

14.

—Alate viviparae with fingerlike spinal processes at least on abdominal tergites 1-2, sometimes also fingerlike processes on head and thorax developed. Siphunculus

rarely fused with lateral sclerite of abdominal segment 6. Antennae subequal to length of body. Processus terminalis up to 2 times as long as base of antennal segment VI. Dorsal body hairs pointed or capitate. Sometimes minute wax gland pore elements on sclerotic parts of body

.Tuberculatus Mordvilko

14. Processus terminalis longer than the base of antennal segment VI. Lateral hairs of pronotum 1 pair. Viviparae apterous and alate. Dorsal setae in apterae and alatoid nymphs capitate, smooth

15

—Processus terminalis subequal to or shorter than the base of antennal segment VI. Lateral hairs of pronotum in 3 pairs or in clusters. Dorsal hairs in apterae and alatoid nymphs of various shapes, with rough or spinulose surface. Apical rostral segment acute or stiletto-shaped

16

15. Vertex with 2 pairs of posterior discal hairs. Cauda bladder-like, apical part not separated by a constriction, bearing hairs on the under side. Abdominal sclerites scabrous. Pleural hairs few or absent. Dorsal sclerotisation incomplete in pleural and marginal body region. Apical rostral segment obtuse

.Globulicaudaphis Hille
Ris Lambers

—Vertex with posterior discal hairs in clusters. Cauda with well separated knob. Abdominal sclerites spinulose. Pleural hairs numerous. Dorsal sclerotisation confined to pairs of marginal sclerites on abdominal tergites 1 and 4 and a continuous transverse band on tergite 5, or dorsum of abdomen is provided with pairs of marginal and spinal sclerites and numerous pleural sclerites, of which the spinal sclerites may be fused in the alate morph. Apical rostral segment acute

Myzocallis Passerini subgenus
Dryomyzus Hille Ris Lambers

16. Viviparae alate. Vertex and thoracic nota with a pale median line contrasting with adjacent dark sclerotic areas. Abdomen

with pairs of spinal sclerites which are partially fused to form horseshoe-shaped blotches. Dorsum without blister-shaped spinal and marginal papillae. Hairs in alatoid nymphs of various lengths, blunt, capitate or with incrassate apices, in alatae short, blunt, pointed or weakly capitate. Cauda knobbed

.*Hoplocallis* Pintera

—Viviparae alate and apterous. Abdominal tergites with transverse sclerotic bars that are broken into spinal, pleural and marginal portions, but separated in the middle of the body. In apterae head and pronotum almost fused. Small blister-like papillae in clusters on spinal and marginal sclerites. Dorsal hairs in alatoid nymphs and apterae predominantly spine-like, tinged and on strongly tuberculate bases, in alatae also mixed with thinner ones, all pointed and with spinulose surface. Apical part of cauda not separated by a constriction

.*Serratocallis* Quednau
& Chakrabarti

17. Lateral abdominal hairs of alatae, apterae and alatoid nymphs in clusters or at least in 3 pairs on each tergite. Processus terminalis shorter than the base of antennal segment VI

18

—Lateral abdominal hairs of alatae, apterae and alatoid nymphs single, 1 pair on each tergite, spinal hairs in 1 or 2 pairs per tergite. Processus terminalis of various lengths. First instar with antennae of 4, rarely of 5 segments

20

18. Viviparae alate. Head without epicranial suture. Dorsal body hairs of alatae thin and pointed, up to 4 times as long as the basal diameter of antennal segment III. First instar with antennae of 3 segments, having spinal hairs of abdominal tergite 1 laterally displaced and cauda with several hairs. On *Juglans*

19

—Viviparae alate and apterous. Head with epicranial suture. Dorsal body hairs stout and with bifurcate or dentated apices. Dorsum with one pair each of broad sclerotic marginal and spinopleural sclerites, in the apterae thoracic nota almost fused with head to form a carapace. First instar with antennae of 4 segments, having spinal hairs of abdominal tergites 5 and 7 laterally displaced and cauda with 2 hairs. On *Ulmus*

.Indiochaitophorus Verma

19. Body of all stages with dark marginal and spinopleural sclerotic bars. Siphunculi sclerotised, attached to lateral sclerite of abdominal segment 6. Lateral body hairs of alatoid nymph pointed. Costal field in fore wing black. Anal plate deeply incised

Panaphis Walker

—Body of all stages mostly pale or with only spinopleural sclerites developed. Siphunculi not sclerotized, with a few hairs appended. Lateral body hairs of alatoid nymphs capitate. Costal field in fore wing hyaline. Anal plate indented

Chromaphis Walker

20. Dorsal body hairs of apterae and alatoid nymphs stout, capitate, with spinulose surface. Spinal hairs of first instar and sometimes in adults laterally displaced. Frons in alatae with a slight protrusion. Ovipara with subventral wax pore plates. On Betulaceae

21

—Dorsal body hairs of apterae and alatoid nymphs, if stout and capitate, with smooth surface

..

..

22

21. Lateral abdominal hairs 2-3 on each side. Secondary rhinaria round to oval. On the abdomen, pleural hairs often present, and spinal hairs of tergites 1 and 2 often on bulging ridges or low elevations. Tergite 8 with 3 or more hairs. Radial sector developed or reduced in varying degrees, sometimes absent

.Pterocallis Passerini

- Lateral abdominal hair only 1 on each side. Secondary rhinaria narrow oval to narrow elliptical. On the abdomen, pleural hairs mostly absent, and spinal hairs usually not on elevations, and if 1 pair per tergite, then often displaced laterally on tergites 3, 5 and 7. Tergite 8 with 2 hairs. Radial sector always very short or absent *.Mesocallis* Matsumura
22. Rostrum elongate, reaching far beyond fore coxae, apical segment slender, longer than its greatest basal width 23
- Rostrum reaching a little beyond fore coxae, apical segment about as long as its greatest basal width. Fore coxae moderately to greatly enlarged. Dorsal integument and appendages provided with wax gland pores. Wing veins not heavily bordered. On Bamboo 28
23. Dorsal integument without extended fields of wax gland pores developed as cribriform discs or biscuit-shaped compound structures. Appendages without wax gland pores. Processus terminalis shorter or longer than base of antennal segment VI. Viviparae alate 24
- Dorsal integument provided with extended fields of specialised wax gland pore elements, also appendages with wax gland pores. Processus terminalis shorter than base of antennal segment VI. Dorsal hairs thin, pointed, spinal hairs of abdominal tergite 7 sometimes laterally displaced. Secondary rhinaria narrow elliptical. Fore coxae moderately to greatly enlarged 27
24. Fore coxae somewhat enlarged, elongated, their margins not visible when pronotum is viewed from above. Siphunculi cylindrical with a hair of tergite 6 appended to the apex. Dorsum of abdomen with segmentally separated spinopleural sclerites. Lateral abdominal sclerites in alatae each bearing a small, raspberry-like process. Dorsal body hairs pointed in

alatae, capitate in apterae and larvae, spinal hairs of abdominal tergite 7 laterally displaced. Viviparae alate. On Rosaceae

.*Tinocalloides* A. N. Basu

—Fore coxae greatly enlarged, their margins visible when pronotum is viewed from above. Siphunculi mostly without a hair appended. Lateral abdominal processes rounded, smooth at apex. Dorsal body hairs in apterae and alatoid nymphs with incrassate apices, mostly capitate, seldom bifurcated or dentated

25

25. Head often with epicranial suture and without transverse black band on ventral side. Stigma of abdominal segment 1 built into base of lateral processus. Secondary rhinaria very narrow elliptical to annular or transversely linear. Viviparae alate. First instar always without pleural hairs. Knob of cauda short, globular. Alatae with mammiform or fingerlike spinal processes, at least on abdominal tergites 1 and 2. Lateral abdominal hairs of tergites 5-7 much reduced in size and not on processes

26

—Head in alatae mostly without epicranial suture and often provided with a black transverse band on ventral side. Stigma of abdominal segment 1 widely separated from lateral processus. Secondary rhinaria elliptical, also present in the aptera. Viviparae apterous and alate or alate only. Dorsal body setae mostly blunt or capitate and often longer than the basal diameter of antennal segment III, mostly placed on conical processes. Spinal hairs at least on abdominal tergites 5 and 7 displaced laterally. First instar very rarely with pleural hairs. Lateral hairs of abdominal tergites 5-7 not much shortened and sometimes on processes. Knob of cauda elongate. On Papilionaceae

.*Therioaphis* Walker

26. All stages with spinal abdominal hairs of only tergite VII laterally displaced. Thoracic nota in alatae without spinal processes. Head with epicranial suture. Dorsum of

body without dark sclerites and without wax gland pores. Alatoid nymph and alatae on the abdomen with spinal and lateral wartlike processes. On *Dalbergia*.

Pseudotinocallis n.g.
Ghosh & Quednau

—All stages with spinal abdominal hairs of tergites 3, 5 and 7 laterally displaced. Thoracic nota in alatae often with spinal processes. Head with and without epicranial suture. Dorsum of abdomen in alatae often with small dark sclerites or sclerotic bands, sometimes containing wax gland pores. Alatoid nymph and apterae with dorsal body hairs with incrassate apices (capitate, seldom bifurcate or dentated), placed on cone-shaped elevations or processes. In alatae abdomen with a varying number of more or less fingerlike spinal processes on tergites 1-4. Siphunculus seldom with a hair appended. Wings often with veins bordered or with dark spots at apices of veins. On Ulmaceae, Magnoliaceae, Lythraceae, Sapindaceae and Papilionaceae

Tinocallis Matsumura

27. Secondary rhinaria narrow linear. Alatae with short globular lateral processes on abdominal tergites 1-5 provided with wax gland pores developed as cribriform discs. Fore coxae elongate, rather small. Viviparae alate. Wing veins weakly bordered with brown. On *Dalbergia*

Chuansicallis Tao

—Secondary rhinaria narrow oval. Alatae without processes on spinal and lateral abdominal sclerites. Dorsal integument provided with numerous compound wax gland pore elements resembling biscuits. Fore coxae little or greatly enlarged. Viviparae alate or apterous and alate. Wing veins more or less heavily bordered with brown. Alatae sometimes with a triangular spinal elevation on abdominal tergite 8 (subg. *Sinishinaphis* Zhang & Zhong). On *Celtis*, *Osmanthus*.

Shivaphis Das

28. Clypeus without nose-like processus. Frontal tubercles and empodial hairs variously developed. Larvae with lateral abdominal hairs all of same length 29
- Clypeus with nose-like processus. Frontal tubercles weakly developed. Empodial hairs flabellate. Radial sector complete 30
29. Empodial hairs thin and pointed. Frontal tubercles small, frons concave, epicranial suture absent or rudimentary. Antennal segment VI with 2-5 hairs at the base and processus terminalis shorter than base. Radial sector incompletely drawn. Head, thorax and abdomen with spinal and lateral hairs thin and pointed, surrounded by many cribriform discs, not on sclerites. Siphunculi poriform or mammiform with many wax gland pores and with hairs appended
- Neocranaphis* n.g.
Ghosh & Quednau
- Empodial hairs flabellate. Frontal tubercles undeveloped, frons produced in the middle, with epicranial suture. Antennal segment VI with 1 hair at the base and processus terminalis subequal to base. Radial sector complete. Abdomen of nymphs and alatae with longitudinal rows of one pair of spinal sclerites on each tergite and lateral sclerites in alatae with low elevations. Dorsal body hairs short, stiff and pointed. Dorsal sclerites scabrous and with minute wax gland pores in clusters. Siphunculi very short cylindrical, sometimes with a hair appended. Abdominal tergite 8 with a spinal processus bearing 2 hairs
- Cranaphis* Takahashi
30. Processus terminalis shorter than the base of antennal segment VI. Epicranial suture developed. All stages with spinal and lateral hairs single, one pair each on each tergite, these hairs pointed, surrounded by many cribriform discs, in the alatae sometimes on sclerotic spots. Larvae with lateral abdominal setae all of same length. Siphunculi short cylindrical without a hair appended
- Subtakecallis*
Raychaudhuri & Pal

—Processus terminalis subequal to the base of antennal segment VI ; with or without epicranial suture. All stages with lateral hairs single, but spinal and pleural hairs may be doubled on abdominal tergites 1-7, these short, pointed in the alatae, in the larvae mostly long, capitate, but on abdominal tergites 6-7 the lateral hairs often short and pointed. in alatae sometimes spinal abdominal hairs on dark sclerites. Siphunculi cylindrical, sometimes with a hair appended

Takecallis Matsumura

Genus 1. *Betacallis* Matsumura, 1919

1919. *Betacallis* Matsumura, S., *Trans. Sapporo. nat. Hist. Soc.*, 7 : 110 ; Higuchi, H. 1972. *Ins. Matsum.*, 35 (2) : 50 ; Raychaudhuri, D.N., Chakrabarti, S., Basu, R.C., and Ghosh, A.K., 1980. *In* Aphids of North East India and Bhutan, 281. Type species : *Betacallis alnicolens* Matsumura.

Morphology.—Body pale, 2.1—3.3 mm long. Head with well developed antennal tubercles, smooth, bearing a broad dark band on the ventral side. Antennae 6-segmented, always longer than the length of body ; processus terminalis distinctly longer (1.8—2.4×) than base of segment VI ; secondary rhinaria transversely oval, restricted to segment III ; primary rhinaria ciliated ; hairs on flagellum short, acute or acuminate at apices, shorter than basal diameter of antennal segment III. Eyes with ocular tubercles. Rostrum may reach hind coxae, or not even reach midcoxae, ultimate rostral segment may be just equal to or distinctly longer than the second segment of hind tarsus, with 8—12 accessory hairs. Abdomen pale, sometimes with irregular bands or a patch in presiphuncular area or with a dark band on posterior tergites, marginal lobes processus-like and gradually become longer up to 5th tergite, each bearing a hair. Hairs on the dorsum of abdomen fine, arranged in two parallel longitudinal rows in the spinal region, pleural hairs not shorter than the spinal ones ; 7th tergite with 6 hairs ; 8th tergite with 8—12 hairs, these always elongate. Siphunculi dark, sometimes pale at very base, truncate but longer than wide, usually with the marginal hair on 6th tergite placed very near to base. Cauda knobbed with many fine hairs. Subanal plate weakly divided with 8—10 hairs on each lobe. Gonapo-

physes 2, rarely 3. Legs with apices of tibiae and whole of tarsi spinulose ; apical tibial hairs differentiated into 4 spines, first tarsal segments with 5—7 ventral hairs and without any dorsal hairs ; empodial hairs flattened. Wing-veins dark or normal but dark at apices ; forewings with media twice-branched, radial sector strongly curved ; hind wings with both obliques.

Apterae unknown. Embryos with dorsal hairs long and capitate ; pleural hairs present ; marginal hairs single, but duplicated in thoracic region ; spinal hairs arranged in two parallel longitudinal rows ; siphuncular pore evident.

Discussion.—The genus is known by a group of 6 species from China (one species), Japan (two species) and India (three species). It is easily recognised by the ventral cephalic band and pale slender body. The Japanese species have been described in detail by Takahashi (1961) and Higuchi (1971), who also provided a key to the species. Higuchi (op. cit) considered *Betacallis* as a member of *Symydobius* group, resembling in many respect the members of *Myzocallis* group, but separated by the presence of pleural abdominal hairs in the embryos. Quednau (1954) also included *Betacallis* under the subfamily Phyllaphidinae, tribe Phyllaphidini and subtribe Symydobiina. R.C. Basu, M.R. Ghosh and Raychaudhuri (1974) have given an account of the genus from eastern India.

Biology.—All the species of the genus are known from alate viviparous females. While both the species from Japan are recorded from plants of Betulaceae during the months of June–August, the three species in India have been collected from plants of Betulaceae, Rosaceae, Fagaceae and Juglandaceae, during December–February. As both adults and nymphs have been recorded from these hosts, it can be presumed that some members of the genus have acquired new host plants in the region even when plants of Betulaceae are common. At least two species of parasitoid of the genera *Toxares* and *Trioxy*s are known from *Betacallis* in India.

Distribution.—India ; Japan ; China.

Type species.—*Betacallis alnicolens* Matsumura, 1919. Location of types not known.

*Key to the species of Betacalis Matsumura**Alate viviparous females.*—

1. Dorsal cephalic hairs $1.25-1.60\times$ as long as basal diameter of antennal segment III, the latter with 26-40 secondary rhinaria. Vertex often with a black longitudinal stripe. Ultimate rostral segment $1.10-1.20\times$ as long as second segment of hind tarsus. Wax gland pores defined as cribriform discs on abdominal tergites 4 and 5. 8th tergite with 9-10 hairs upto 0.100-0.133 mm long. Media of forewing with narrow brown bordering. On *Quercus*

querciphaga Basu,
Ghosh, Raychaudhuri

—Dorsal cephalic hairs subequal to basal diameter of antennal segment III, the latter with 18-22 secondary rhinaria. Vertex without black longitudinal stripe. Ultimate rostral segment $1.30-1.70\times$ as long as second segment of hind tarsus. Wax gland pores on abdominal tergites 4 and 5 ill defined. Media of forewing not bordered with brown.

2

2. Ultimate rostral segment long, slender about $1.5-1.7\times$ as long as second segment of hind tarsus. Abdomen with narrow irregular bands over tergites 4 and 5. Siphunculi longer than width at base. 8th tergite with 8 hairs. On *Prunus* spp.

prunicola Basu, Ghosh,
Raychaudhuri

—Ultimate rostral segment shorter, $1.30-1.40\times$ as long as second segment of hind tarsus. Abdomen pale or with quadrate sclerotic patch over tergites 4 and 5. Dorsal cephalic hairs $0.43-0.60\times$ as long as basal diameter of antennal segment III. Siphunculi as long as width at base, pale at basal half. 8th tergite with 9-10 hairs. On *Quercus* (*Betula alnoides*)

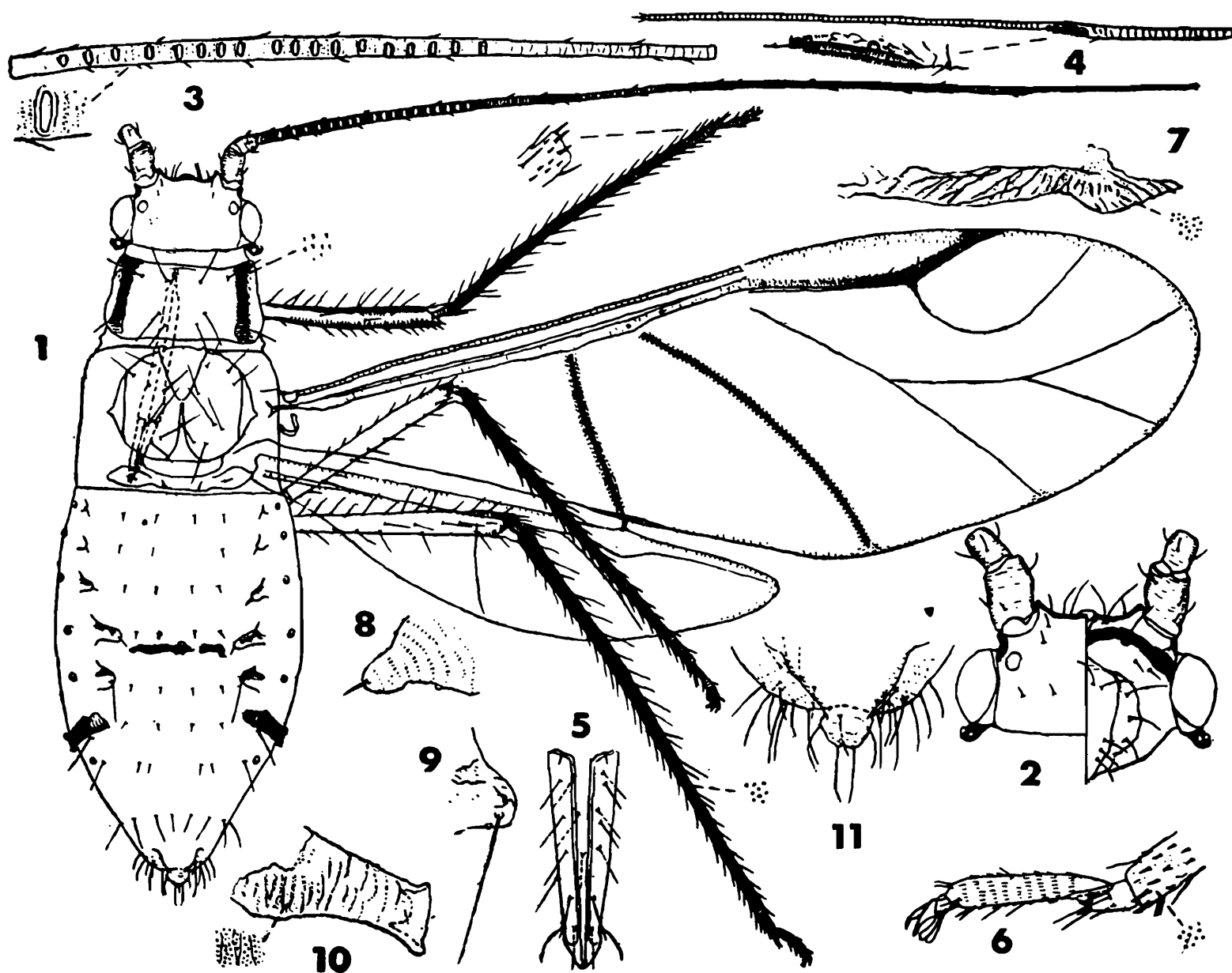
sikkimensis Basu,
Ghosh, Raychaudhuri

1. *Betacallis prunicola* Basu, Ghosh, Raychoudhuri

(Figs. 1-11)

1973. *Betacallis prunicola* Basu, R. C., Ghosh, A. K. Raychaudhuri, D. N., *Proc. Zool. Sac. Calcutta*, 26 : 93.
 1980. *Betacallis prunicola* Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 282.

Alate viviparous female.—Body 1.9-2.2 mm long with 0.7-0.9 mm as maximum width. Head smooth with median prominence weakly developed ; frons dark brown, as well as a narrow transverse stripe on ventral side of head between inner margin of eyes ; ocular tubercles black ; dorsal cephalic hairs fine, 0.033-0.53 mm long, $0.66-1.1\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, $1.3\times$ as long as the body, brown to dark except on the two basal segments, apical third of segment III, basal half of segment IV and processus terminalis which are pale ; segment III with 16—19 strongly transverse secondary rhinaria distributed over 0.66-0.75 portion, specially in pigmented area ; hairs on flagellum, sparse, shortend fine, 0.010 mm long, $0.2-0.3\times$ as long as the basal diameter of antennal segment III, processus terminalis $1.3-1.4\times$ as long as the base of antennal segment VI. Rostrum reaches midcoxae, ultimate rostral segment rather long, $1.5-1.7\times$ as long as the second segment of hind tarsus and bears 8 accessory hairs. Pronotum pale bearing two lateral brownish longitudinal stripes. Abdominal dorsum pale, each of 4th and 5th tergites with a dark brown transverse sclerotic spinopleural band that is irregular in outline and often broken but sometimes entire, each of tergites 2-5 bears a pair of single spinal, pleural and marginal hairs ; marginal tubercles, processes scabrous, those on tergites 1 and 2 being pale and small, the others longer and brownish ; hairs on anterior processes 0.02-0.03 mm long $0.6-0.7\times$ as long as the basal diameter of antennal segment III, those on the others (4th and 5th) up to 0.130-0.135 mm long, $3.2-3.5\times$ as long as the mentioned diameter, hairs on anterior abdominal tergites short, with acute apices, the longest one 0.023-0.030 mm long, up to $0.7-0.8\times$ as long as the basal diameter of antennal segment III ; marginal hair on 6th tergite (0.130 mm) not appended to the base of siphunculi ; 8th tergite with 8 long, fine hairs, up to 0.100 mm long, $2.0-2.2\times$ as long as the mentioned diameter. Siphunculi dark, constricted before the thick apical flange, nearly



Betacallis prunicola R. C. Basu, A. K. Ghosh & Raychaudhuri. 1-11 alate vivipara : 1, body ; 2, head ; 3, antennal segment III ; 4, antennal segment VI ; 5, apical rostral segment ; 6, hind tarsus ; 7, spinopleural sclerite of abdomen ; 8, lateral process of abdominal tergite III ; 9, lateral process of abdominal tergite V ; 10, siphunculus ; 11, cauda and anal plate.

twice as long as its width at the middle. Cauda pale, constricted at the base bearing 5 long fine hairs. Subanal plate pale, weakly indented, legs pale on basal segments, margins of fore-femora dark brown, other femora pale ; tibiae and tarsi dark brown ; hairs on legs acute or acuminate, longest one on hind tibia up to $3.0\times$ as long as the diameter of the middle of hind tibia ; apical part of tibiae and tarsi finely spinulose, apical tibial hairs short and thick ; first tarsal segments with 6 ventral hairs. Wing vena-

tion normal, forewings with pterostigma, cubital veins bordered brown, radial sector strongly curved ; hind wings with both obliques.

Colour.—Light yellowish green with dark marking on the abdomen and dark wing veins.

Measurements in mm.—

	Length	Width	Antenna				
1.	2.08	0.69	—				
2.	1.93	0.65	—				
3.	2.20	0.69	2.63				
	Ant. segments				urs.	ht ₂	Siph.
	III	IV	V	VI			
0.89	—	—	—	—	0.16	0.11	0.12
0.82	0.57	—	—	—	0.16	0.10	0.12
0.89	0.68	0.48	(0.20 + 0.37)		0.16	0.11	0.12

(1,2, ex *Prunus cerasus*, Shillong, Meghalaya, India, 31.xii.1969, C.U. Coll. 3, ex *Prunus* sp. Basar, Arunachal Pradesh, India 19.ii.1973, N.Z.C.).

Alatoid Nymph.—Body pale, 1.4 mm long with 0.69 mm as maximum width. Head pale, dorsal cephalic hairs up to 0.06 mm long $1.3\times$ as long as basal diameter of antennal segment III. Antennae 6-segmented $1.3\times$ as long as the body, pale on basal segments, dark on apical half of segments III-V and on processus terminalis. Rostrum reaches mid-coxae, ultimate rostral segment slender, $1.35\times$ as long as second segment of hind tarsus. Abdominal dorsum pale, without any sclerotic patch ; hairs on the dorsum of abdomen arising from tuberculate bases, 6 per segments on tergite 1-6., all hairs thick, acuminate to expanded at apices (0.06-0.08 mm long) ; 8th tergite with at least 6 thick long hairs. Siphunculi small, dark. Cauda not developed. Legs pale with bases of tibiae and whole of tarsi dusky, apical tibial hairs not differentiated.

Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antennae	
1.4		0.69		1.8	
Ant. segments				urs.	ht ₂
III	IV	V	VI		
0.46	0.38	0.32	(0.17+0.32)	0.14	0.12

(ex *Prunus* sp. Basar, Arunachal Pradesh, India 14.ii.1973, coll. A. K. Ghosh, N.Z.C.).

Embryo.—Not available.

Material examined.—Three alate viviparous females (paratypes) from *Prunus cerasus*, Shillong, Meghalaya, India, 31.xii.1969. Coll. R. Basu (C.U. Coll.) 2 alate viviparous females and one alatoid nymph from *Prunus* sp., Basar, Siang District, Arunachal Pradesh, India, 14.ii.1973 coll. A. K. Ghosh (N.Z.C.).

Discussion.—The species has often been misidentified as *B. odaiensis* Takahashi (Ghosh, A. K. et al., 1970) but can be separated from the former by long slender ultimate rostral segment and shorter cephalic hairs and absence of dark longitudinal stripe on vertex and pronotum, besides host association.

Distribution.—India : Arunachal Pradesh, Meghalaya, West Bengal ; China : Omeishan.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India and in National Zoological Collections (N.Z.C.), Zoological Survey of India, Calcutta, India.

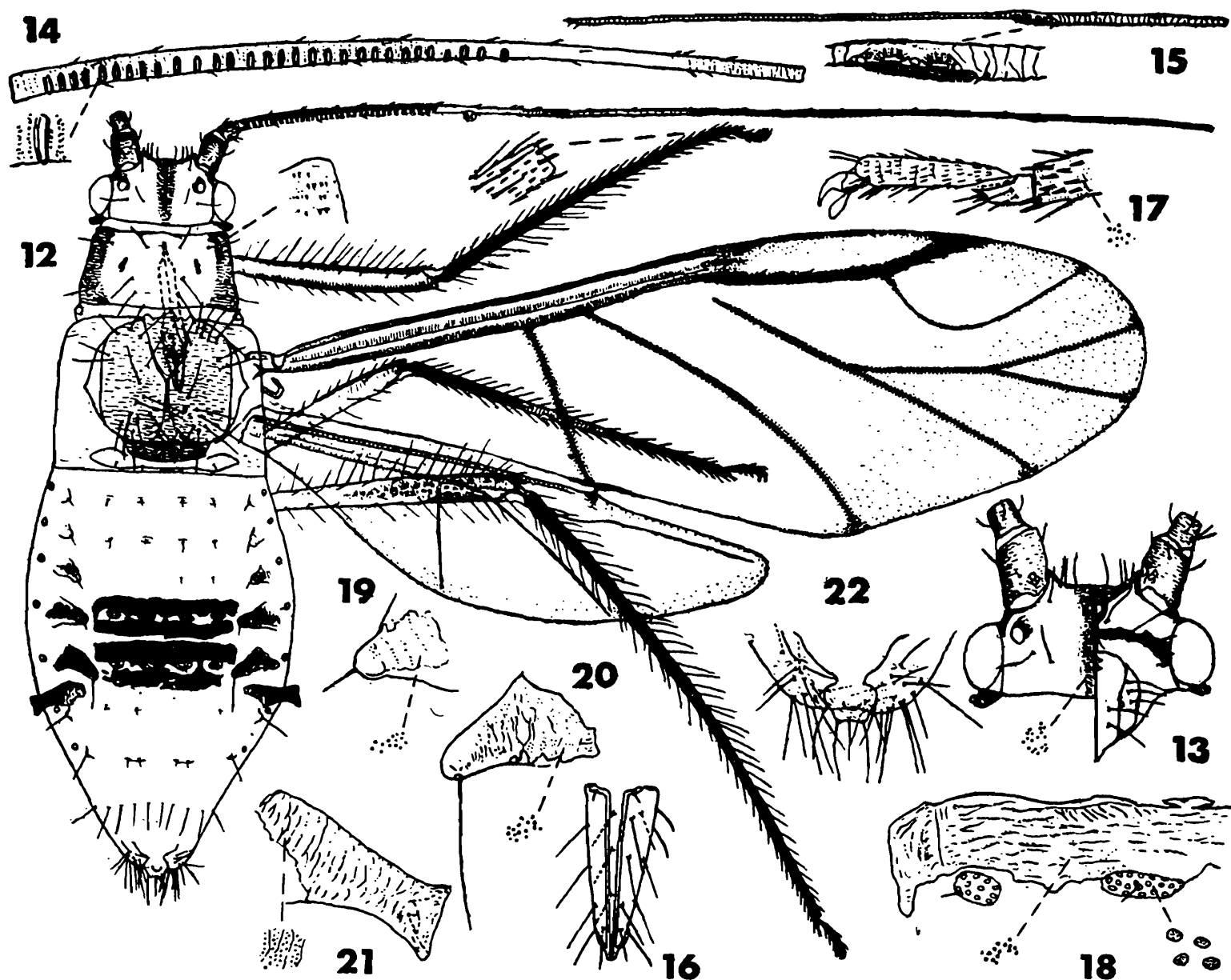
2. *Betacallis querciphaga* Basu, Ghosh & Raychaudhuri (Figs. 12-22)

1968. *Betacallis odaiensis*, Ghosh, A. K., and Raychaudhuri, D. N. *Proc. zool. Soc. Calcutta*, 21 : [misid.]

1974. *Betacallis querciphaga* Basu, R. C., Ghosh, M. R. and Raychaudhuri, D. N., *Orient Insects*, 8 : 237.
1975. *Betacallis querciphaga*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 28 : 77.
1980. *Betacallis querciphaga*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 282.

Alate viviparous female.—Body 2.4-3.3 mm long with 0.9-1.3 mm as maximum width. Head pale, nearly smooth, with a transverse dark band along frons, another broader transverse sclerotic dark brown band on ventral side of head across the inner margins of eyes and a third longitudinal stripe on vertex ; ocular tubercle black ; dorsal cephalic hairs (6) fine 0.083-0.086 mm, $1.25-1.30\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, $1.4-1.6\times$ as long as the body ; segments I and II brown to dark brown, flagellum brown to dark brown, partly pale on apical part of segment III ; segment III with 26-40 transverse secondary rhinaria ; hairs on flagellum short, sparse, longest one on segment III, 0.016-0.020 mm long, $0.25-0.40\times$ as long as the basal diameter of antennal segment III ; processus terminals $1.7-2.2\times$ as long as the base of antennal segment VI. Rostrum reaches midcoxae, ultimate rostral segment stout, $1.1-1.2\times$ as long as second segment of hind tarsus, bearing 10-14 accessory hairs. Prothorax with dark brown lateral margins. Abdominal dorsum pale, bearing dark paired, irregular spino-pleural sclerotic, transverse bands on 4th and 5th tergites, provided with cribriform wax gland pores ; marginal processes scabrous, present on each of tergites 1-6, these on 1st-3rd and 6th tergite small, pale or brownish, but the ones on 4th and 5th tergite large, dark, sclerotic ; the marginal processes bearing a single hair each ; the hair on short marginal processus of 6th tergite nearly appended to the base of siphunculi ; each of 1st-6th abdominal tergites with a pair of spinal and a pair of pleural hairs, which are acute, 0.05-0.66 mm long, up to equal to the basal diameter of antennal segment III and arising from low tubercular bases ; 7th tergite with 6 long fine hairs of which the marginals are longest (0.115 mm) ; 8th tergite bearing 9-10 fine hairs, 0.100-0.115 mm long up to $1.75-2.6\times$ as long as the basal diameter of antennal segment III. Siphunculi dark brown to black with a thick apical flange up to

1.5× as long as the maximum width at base. Cauda distinctly knobbed with 5-6 hairs. Subanal plate weakly bilobed, each lobe with 13-15 hairs. Legs long, basal segments pale, femora at least on dorsal surface pigmented brown, tibiae and tarsi light to dark brown; apical part of tibiae and tarsi finely spinulose; apical tibial hairs differentiated as thick spines, first tarsal segments with 6 ventral hairs. Wing venation normal; forewings with



Betacallis querciphaga R. C. Basu, M. R. Ghosh & Raychaudhuri. 12-22, alate vivipara: 12, body; 13, head; 14, antennal segment III; 15, antennal segment VI; 16, apical rostral segment; 17, hind tarsus; 18, spinopleural sclerite of abdomen with wax gland pores; 19, lateral process of abdominal tergite III; 20, lateral process of abdominal tergite V; 21, siphunculus; 22, cauda and anal plate.

pterostigma, media and cubital veins bordered brown ; all wing veins ending in dusky spots.

Colour.—Light greenish yellow with dark bands on abdomen and dark legs and pigmented wing veins.

Measurements in mm.—

	Length	Width	Antenna			
1.	3.10	1.24	4.27			
2.	2.76	1.04	—			
3.	3.17	1.13	4.25			
	Ant. segments			urs	ht ₂	Siph
III	IV	V	VI			
1.44	0.93	0.78	(0.30+ 0.61)	0.16	0.14	0.19
1.38	0.84	0.70	—	0.16	0.14	0.19
1.44	0.96	0.82	(0.31+ 0.61)	0.18	0.14	0.19

(1,2, ex vagrant on Cherry tree, Kalimpong, West Bengal, India, 27.xii.68 ; 3, ex undet. host, Gangtok, Sikkim, India, 23.xii.67, C.U. Coll.).

Alatoid nymph.—Body 2.76 mm long with 1.16 mm as maximum width, pale except at apices of antennal segments and tarsi which are brown. Antennae 6-segmented, flagellum imbricated, hairs on flagellum short capitate, longest one on antennal segment III 0.02 mm long, 0.25× as long as the basal diameter of the segment. Ultimate rostral segment 1.2× as long as second segment of hind tarsus and bears 12-13 accessory hairs. Dorsal hairs stout, capitate, longest one on head 0.138-0.140 mm long, 1.6-1.7× as long as basal diameter of antennal segment III ; marginal hairs duplicate on thoracic segments, single on abdominal tergites 1-7 ; spinal and pleural hairs arranged in rows of 4 on 1st-7th tergites, these are 0.117 mm-0.164 mm long, up to 2.0× as long as basal diameter of antennal segment III ; all dorsal hairs arising from tuberculate bases, which become conspicuous on abdominal dorsum ; 8th tergite with 9-10 hairs, with subacute to capitate apices, 0.130-

0.164 mm long. Siphunculi with thick apical flange, pale brown. Legs stout, apices of tibiae and whole of tarsi spinulose.

Colour.—Pale in life.

Measurements in mm.—

	Length		Width	Antenna		
	2.76		1.16	?		
	Ant. segments			urs.	ht ₂	Siph.
III	IV	V	VI			
0.74	0.58	0.55	—	0.15	0.13	0.12

(ex undet. host, Gangtok, Sikkim, India, 23.xii.1967, coll. M. R. Ghosh, PLK 764).

Material examined.—Two alate viviparous females, from Cherry tree (vagrant), Kalimpong, West Bengal, India, 27.xii.1968, coll. M. R. Ghosh ; one alate viviparous female and one alatoid nymph indet. host, Gangtok, Sikkim, India, 23.xii.1967, coll. M. R. Ghosh (C. U. Coll.); one alate viviparous (vagrant) female on Bamboo, Shillong, Meghalaya, from *Quercus* sp. old Barapani, Meghalaya, India, 3.ii.1974, coll. A. K. Ghosh (N.Z.C.).

Discussion.—Many of the earlier records of *Betacallis odaiensis* Takahashi (till 1973-74) can now be referred to either *prunicola* or *querciphaga* ; the present species differs from *odaiensis* in having shorter dorsal cephalic hairs besides in the colouration of head, pronotum and wing veins. It appears that the alate viviparae occur during October-February in hilly areas of North-East India but the record in July from Meghalaya suggests a second although minor population emergence.

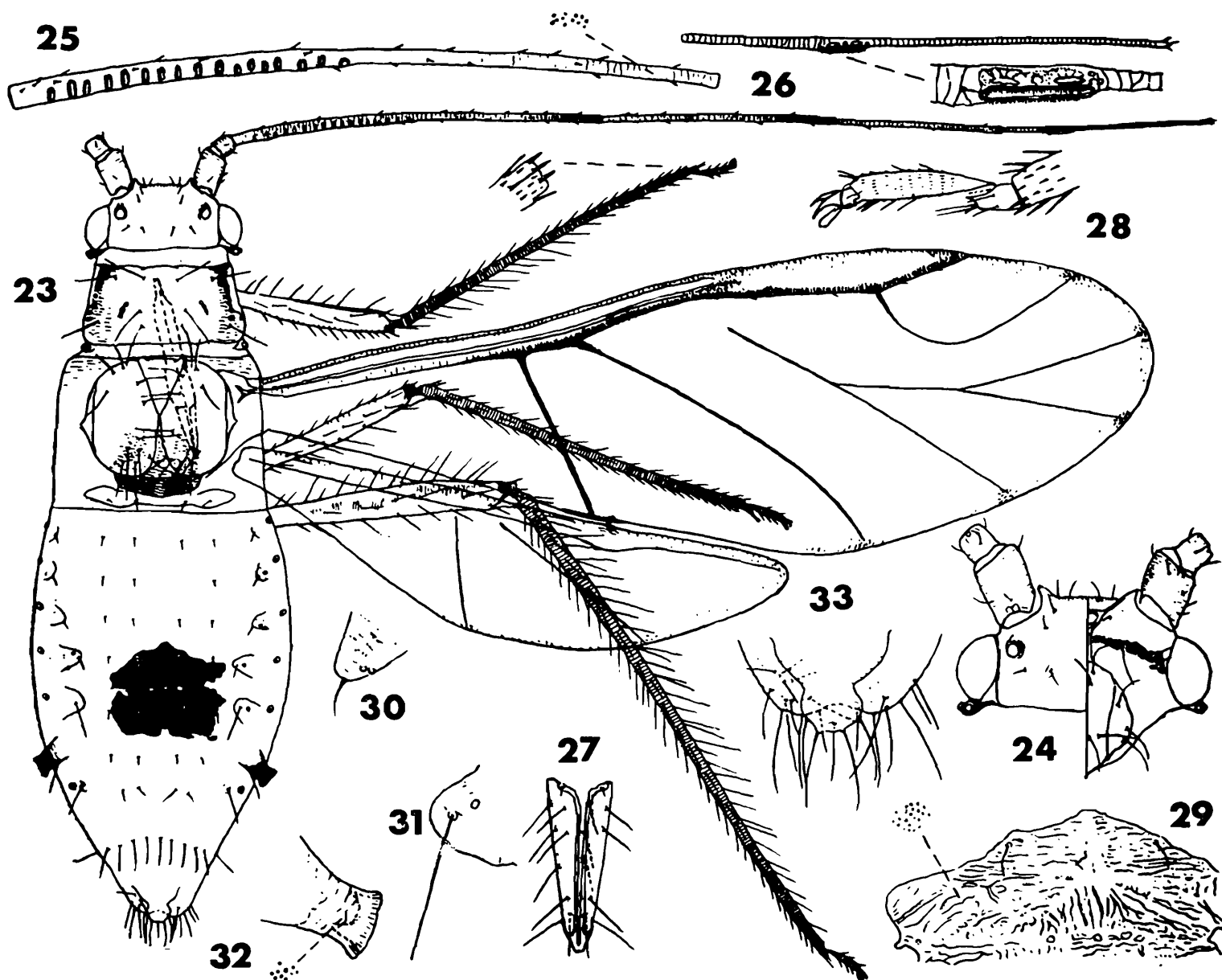
Distribution.—India : Meghalaya, Sikkim, West Bengal.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

3. *Betacallis sikkimensis* Basu, Ghosh & Raychaudhuri (Figs. 23-33)

1974. *Betacallis sikkimensis* Basu, R. C., Ghosh, M. R. and Raychaudhuri, D. N., *Orient. Insect*, 8 (2) ; 234.
- 1978 (1975), *Betacallis sikkimensis*, Chakrabarti, S., and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 25 : 77.
1980. *Betacallis sikkimensis* Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan* : 283.

Alate viviparous female.—Body elongate, 2.40-3.15 mm long with 0.93-1.2 mm as maximum width. Ventral side of head with a distinct dark transverse band touching inner margins of the eyes ; frons pale, scabrous medially, with smooth lateral prominence ; dorsal cephalic hairs fine, acute or acuminate, up to 0.026 mm long, at most $0.43-0.50\times$ as long as the basal diameter of antennal segment III. Antennae long, slender, 6-segmented, brown to variably dark brown, $1.4-1.5\times$ as long as the body ; flagellum more distinctly imbricated from apical 0.60 portion of segment III, apicad ; segment III with 18-22 elongate oval ciliated secondary rhinaria restricted to basal half of the segment ; hairs on flagellum short, stiff, acute, the longest one on segment III 0.010-0.016 mm long, $0.20-0.33 \times (0.50 \times)$ as long as basal diameter of the segment ; processus terminalis $1.6-1.9\times$ as long as base of segment VI. Rostrum reaches near midcoxae, ultimate rostral segment $1.3-1.4\times$ as long as second segment of hind tarsus and bears 8-12 accessory hairs, prothorax brownish laterally. Abdominal dorsum pale bearing a median consolidated dark brown patch over 4th and 5th tergites, sometimes broken medially, hairs on the dorsum of abdomen sparse ; 1st-7th tergites each bearing 6 hairs, 2 spinal, and 2 pleural hairs besides one marginal hair on each side arising from distinct processus, specially on 1st-5th segments ; abdominal sclerites provided with minute wax gland pores ; spinal and pleural hairs on anterior tergites 0.050-0.066 mm long, marginal hairs up to 0.130 mm long, these being $1.0-1.3\times$ and $2.6\times$ as long as the basal diameter on antennal segment III ; 8th tergite with 9-10 long fine hairs, longest one 0.100-0.109 mm long, $2.0-2.2\times (2.8-3.0\times)$ as long as the mentioned diameter. Siphunculi short, truncate dark brown except for the pale bases and nearly smooth. Cauda knobbed bearing 5-6 stout hairs up to 0.100 mm



Betacallis sikkimensis R. C. Basu, M. R. Ghosh & Raychaudhuri. 23-33 alate vivipara: 23, body; 24, head; 25, antennal segment III; 26, antennal segment VI; 27, apical rostral segment; 28, hind tarsus; 29, spinopleural sclerite of abdomen; 30, lateral process of abdominal tergite III; 31, lateral process of abdominal tergite V; 32, siphunculus; 33, cauda and anal plate.

long. Subanal plate bilobed, each lobe with 7-8 hairs. Legs with femora pale except for dark ventral margin of fore femur; tibiae brown to dark brown specially near spinulose apices; apical tibial hairs differentiated into 4 thick spines; other tibial hairs stiff, acute, quite long but becoming shorter apicad; tarsi spinulose, first tarsal segments bearing 6, 6, 6 hairs. Wing venation normal, veins dark with dusky tips but not bordered with brown; radial sector strongly curved.

Colour.—Pale with dark patch as abdomen.

Measurements in mm.—

	Length	Width		Antenna		
1.	2.8	1.05		4.05		
2.	2.4	0.83		3.70		
3.	2.8	1.10		4.20		
	Ant. segments			urs.	ht ₂	Siph
III	IV	V	VI			
1.46	0.87	0.71	(0.30+ 0.50)	0.16	0.12	0.11
1.32	0.83	0.61	(0.27+ 0.47)	0.15	0.11	0.10
1.38	0.09	0.71	(0.30+ 0.50)	0.15	0.11	0.10

(1, 2, 3, ex *Quercus* sp., Gangtok, Sikkim, 23.xii.1971, C. U. Coll.).

First instar nymph.—Not available.

Material examined.—Five alate viviparous females (holotype and 3 paratypes), from *Quercus* sp. Gangtok, Sikkim India, 23.xii.1971, Coll. M. R. Ghosh (C. U. Coll.).

Discussion.—This species appears to be restricted to Sikkim—Himalaya and is distinctive in having distinct sclerotic pattern, moderately long ultimate rostral segment and many hairs on 8th tergite. The length of dorsal hairs on abdomen and their ratio to basal diameter of antennal segment III appear to be erroneous in the original description.

Distribution.—India : Sikkim.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 2. *Betulaphis* Glendenning, 1926

1926. *Betulaphis* Glendenning, R., *Can. Ent.*, **58** : 96 ; Higuchi, H., 1972. *Ins. matsum.*, **35** (2) : 52 ; Stroyan, H.L.G., 1977, *Handbk. Ident. Br. Insect.*, **II**, 4 (a) : 88 ; Heie, Ole, E., 1982. *Fauna ent. scand.*, **11** : 41. Type species : *Betulaphis occidentalis* Glendenning = *Aphis quadrituberculata* Kaltenbach.

Morphology.—Body small to medium sized, 1.4-2.2 mm long. Head without distinct frontal tubercles but may appear to have two pairs of low prominences, each with capitate hairs. Antennae 6-segmented, distinctly shorter than the body ; apterae without secondary rhinaria ; alatae with transversely oval, ciliated secondary rhinaria only on segment III ; hairs on flagellum shorter than basal diameter of antennal segment III ; processus terminalis subequal to base of antennal segment VI. Eyes with distinct ocular tubercles. Rostrum short, reaches forecoxae, sometimes upto base of hind coxae, ultimate rostral segment shorter than or just equal to second segment of hind tarsus and bears 0-9 accessory hairs. Dorsal hairs typically 6-8 per segment, blunt to capitate, in some fundatrices dorsal hairs on anterior tergites may be very small, hardly discernible, capitate dorsal hairs may also be provided with strongly tuberculate bases, dorsal hairs in alatae long and fine. Abdominal dorsum sclerotic, scabrous, with obsolete segmentation, often 1-6 tergites consolidated into a carapace. Sometimes minute wax pores may be present on one or more tergites. Siphunculi truncated, smooth or imbricated with distinct apical flange, with a hair present near the base. Cauda bluntly obtuse, triangular or tongue-shaped, in alatae rounded, with 8-12 hairs. Subanal plate deeply bilobed, each lobe with 8-10 hairs. Rudimentary gonapophyses 2. Subgenital plate with 8 hairs on anterior margin and 8-10 hairs on posterior margin. Legs with scattered spinules near apices of tibiae ; apical tibial hairs weakly differentiated ; tarsi spinulose ; first tarsal segment with 5-6 ventral hairs and without dorsal hairs. Empodial hairs flattened. Wing venation normal.

Embryos with short dorsal hairs but marginal hairs may sometimes be long ; spinal and pleural hairs fine or capitate, marginal hairs always with capitate apices. Dorsal hairs are arranged in 6 longitudinal rows. Siphunculi evident.

Males apterous, with small secondary rhinaria on segment III to base of segment VI. Oviparae apterous (Stroyan, 1977) with post-siphuncular segments forming an elongate ovipositor ; 8th tergite may bear upto 18 hairs. Subanal plate not bilobed. Both males and oviparae with dark black dorsal bands, sometimes fused into a solid sclerotic patch specially on 4th-6th tergites. Hind tibiae in oviparae hardly swollen, with 30-60 pseudosensoria, of variable size.

Discussion.—The genus was described from North America in 1926 but subsequently a number of species were described from other regions. Higuchi (1972) listed 6 species under the genus viz. *arctosetis* Richards, 1961 from Baffin Islands and Alaska, *aureus* Richards, 1961, from Canada, *japonica* Takahashi, 1961, from Japan, *pelei* Hille Ris Lambers, 1952 from Greenland, *quadrituberculata* (Kaltenbach, 1843) from Europe, North America and New Zealand and *viridis* Richards, 1972 from Canada. He however omitted *brevipilosa* Börner 1940 from Europe (= *helvetica* Hille Ris Lambers, 1947 = *viridis* Richards), *hissarica* Narzikulov, 1962, from asiatic U.S.S.R. and a subspecies, *intermedia* Börner, 1952, of *quadrituberculata* from Europe. As such this genus was known by 7 species and one subspecies. Only recently *longicornis* Quednau and Chakrabarti, 1980, was described from India ; the record of *hissarica* Narz., from India further extended the distribution range of the species. The genus is considered as a member of *Symydobius* group by Higuchi (1972) and appears close to *Calaphis* Walsh, and *Neobetulaphis* Basu, but can be separated by triangular cauda, two rudimentary gonaphyses, etc. Quednau (1954) considered the genus under subtribe Phyllaphidina and not under Symydobina, due to presence of rastral setae, 6 rows of dorsal setae and leaf-feeding habit of 1st instar nymph.

Biology.—The members of this genus appear to be autoecious on plants of Betulaceae ; holocyclic life cycle of some species (e.g. *quadrituberculata*) has also been known. In Denmark, fundatrices hatch during May and become adult at the end of May or early June ; both apterous and alate fundatrices are found which produce only apterae ; sexuales can be noted during September-November (Heie, 1982). In Indian region both apterae and alate viviparae have been collected in the month of June, while in Japan, viviparae have been recorded during June-August.

Distribution.—India , Japan ; U.S.S.R. ; Europe ; Greenland ; North America ; New Zealand.

Type species.—*Betulaphis occidentalis* Glendenning 1926=*Aphis quadrituberculata* Kaltenbach, 1843.

Cotypes.—Canadian National Collection, Ottawa.

Key to the species of Betulaphis Glendenning

Apterous viviparous females :

Lateral lobes of thorax and abdominal tergites 1-5 spinulose, Antennae about 0.5 × as long as body. Siphunculi densely spinulose. Ultimate rostral segment as long as or shorter than second segment of hind tarsus

.hissarica Narzikulov

—Lateral lobes of thorax and abdominal tergites 1-5 smooth. Antennae almost as long as body. Siphunculi scabrous. Ultimate rostral segment 0.159 mm long, longer than second segment of hind tarsus

longicornis Quednau & Chakrabarti

Alate viviparous females :

Antennae about 0.65 × as long as body. Siphunculi spinulose. Abdomen with paired irregularly shaped brown, spinopleural sclerites on abdominal tergites 1-7, and also marginal sclerites on abdominal tergites 1-5. Ultimate rostral segment subequal to second segment of hind tarsus

.hissarica Narzikulov

—Antennae about 0.95 × as long as body. Siphunculi imbricated. Abdomen pale except for dusky marginal processes on tergites 2-5. Ultimate rostral segment 0.159 mm long, longer than second segment of hind tarsus

.longicornis Quednau & Chakrabarti

4. *Betulaphis hissarica* Narzikulov
(Figs. 34-51)

1962. *Betulaphis hissarica* Narzikulov, M. N., Fauna Tadzhik S. S. S. R. (Dusjambe) 9 : 202.

Apterous viviparous female.—Body 1.7-1.9 mm long with 0.82-0.96 mm as maximum width. Frontal hairs capitate, 0.060-0.073 mm long up to $2.8-3.1 \times$ as long as basal diameter of antennal segment III, discal hairs 0.050-0.060 mm long of similar nature as those on frons, all arising from elevated bases, anterior ventral hairs with capitate apices. Venter of head spinulose. Antennae 6-segmented, $0.40 \times$ as long as the body ; segment I with one thick and two fine hairs ; segment II with 3 thick and one fine hair, these being 0.016-0.023 mm long and with acuminate or slightly capitate apices ; flagellum imbricated ; hairs on flagellum sparse stout, erect and with blunt or slightly capitate apices, of similar length as those on basal segments and up to $0.70 \times$ as long as the basal diameter of antennal segment III ; processus terminalis subequal to base of segment VI. Rostrum reaches near hind coxae, ultimate rostral segment equal to second segment of hind tarsus and bears 3-4 hairs besides the preapical ones. Thoracic tergites membranous with distinct segmentation, spinulose on prothorax and lateral areas of meso- and metathorax ; thoracic hairs capitate, 0.040-0.050 mm long, up to $3.0 \times$ as long as the basal diameter of antennal segment III. Abdominal tergites 2nd-5th consolidated ; each abdominal tergite with 6-8 capitate hairs, tergites 6-8 usually with only 6 hairs each ; spinal hairs on anterior tergites 0.030-0.040 mm long, marginal hairs up to 0.066 mm long, these being $2.5-3.5 \times$ as long as the basal diameter of antennal segment III ; spinal and marginal hairs of tergites 6-7 up to 0.083 mm long ; 8th tergite with spinals 0.100 mm and marginal 0.050-0.066 mm long ; abdomen coarsely spinulose on lateral sides. Siphunculi 0.065 mm long, pale, flared at apex and distinctly spinulose over entire surface. Cauda pale brown, triangular, spinulose and bears 10-11 hairs. Subanal plate bilobed, each lobe with 8-9 fine hairs. Gonochaetae 10-12. Legs pale with tarsi dark ; hairs on femora and tibiae blunt, acute or capitate, longest one on hind tibiae nearly equal to middle-width of the tibiae ; apical tibial hairs not differentiated but with acute apices ; first tarsal segments with 6 ventral hairs and without any dorsal hair ; empodial hairs flabellate.

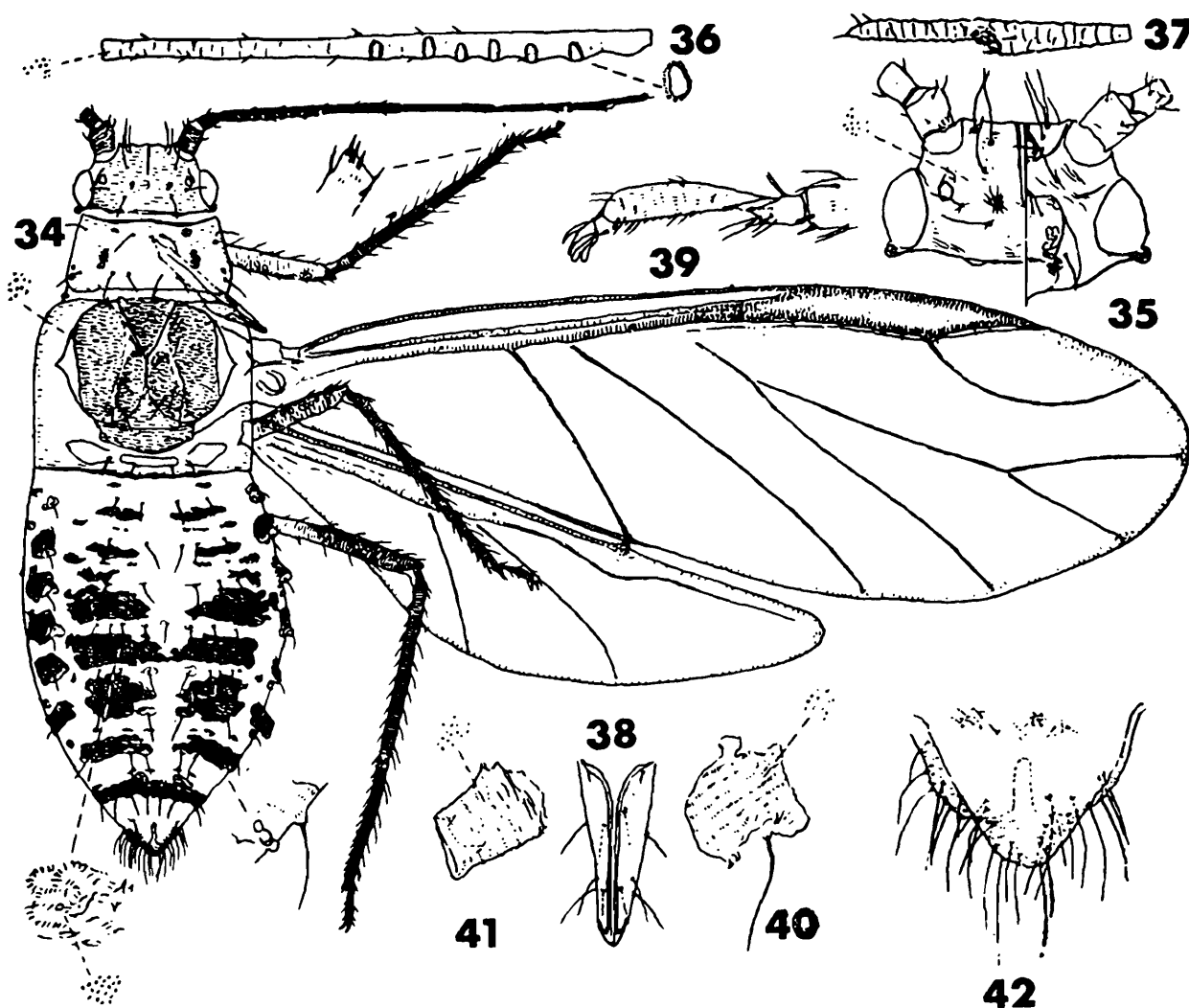
Measurements in mm.—

	Length	Width	Antenna
1.	1.9	0.96	0.75
2.	1.7	0.82	0.22

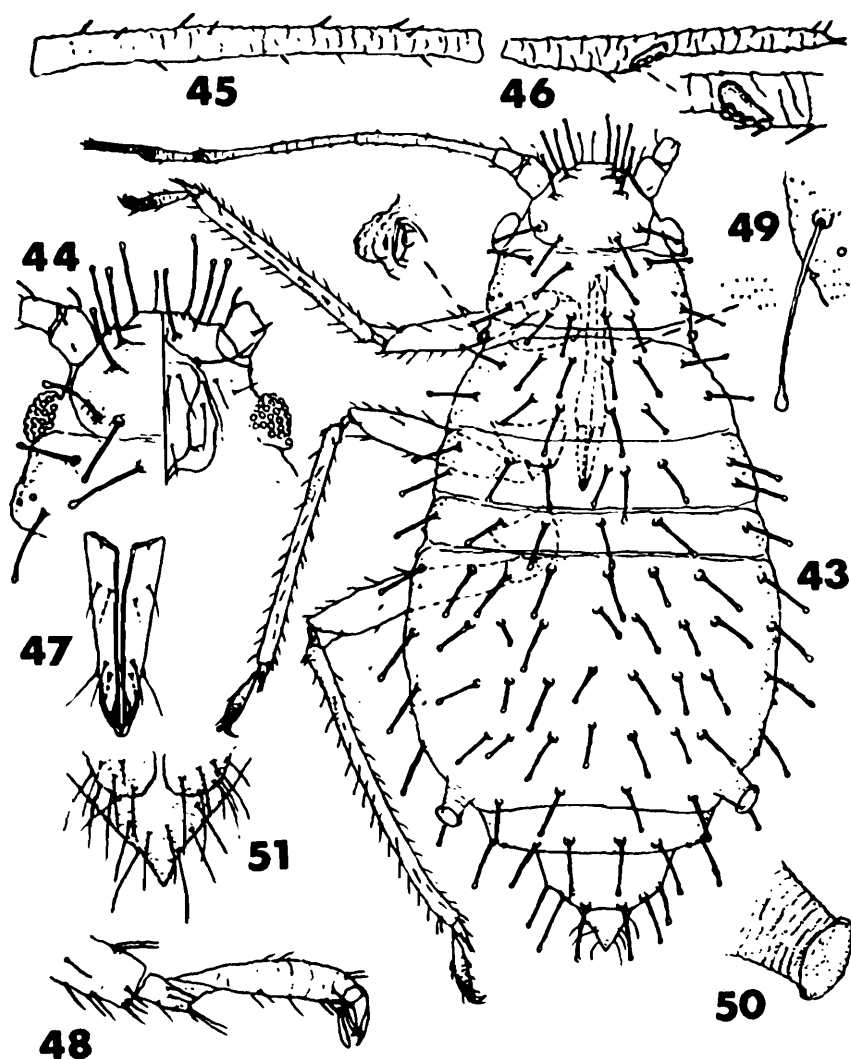
Ant. segments				urs.	ht ₂
III	IV	V	VI		
0.22	0.10	0.10	(0.07+0.07)	0.10	0.10
0.22	0.10	0.09	(0.09+0.07)	0.11	0.12

(1, 2, ex *Betula alnoides* Ghangaria, U.P., 30.v.1980, K.U. Coll.).

Embryo.—Pale. Dorsal hairs capitate, 0.013-0.020 mm long ; frontal hairs upto 0.023 mm long ; hairs on posterior region not differentiated from other dorsal hairs. Siphunculi pore-like.



Betulaphis hissarica Narzykulov. 34-42, alate vivipara : 34, body ; 35, head ; 36, antennal segment III ; 37, antennal segment VI ; 38, apical rostral segment ; 39, hind tarsus ; 40, lateral process of abdominal tergite III ; 41, siphunculus ; 42, cauda and anal plate.



Betulaphis hissarica Narzykulov. 43-51, apterous vivipara : 43, body ; 44, head ; 45, antennal segment III ; 46, antennal segment VI ; 47, apical rostral segment ; 48, hind tarsus ; 49, lateral hair of abdominal tergite IV ; 50, siphunculus ; 51, cauda and anal plate.

Alate viviparous female and oviparous female.—These forms were not known and are being described by S. Chakrabarti (Kalyani University) from India.

Material examined.—Two apterous viviparous females from *Betula alnoides*, Gangaria, Uttar Pradesh, India, 30.v.1980, coll. A. Mondal (K.U. Coll. : No. 904).

Discussion.—This species was originally described from Tadzhikistan (U.S.S.R.). It is similar to *B. longicornis* Quednau & Chakrabarti in having an elongate apical rostral segment and long capitate

dorsal hairs arising from tuberculate bases in the apterous morph, but differs in the ratio of length of antennae to body and by a shorter ultimate rostral segment and in retaining at least partially, the segmentation of the body.

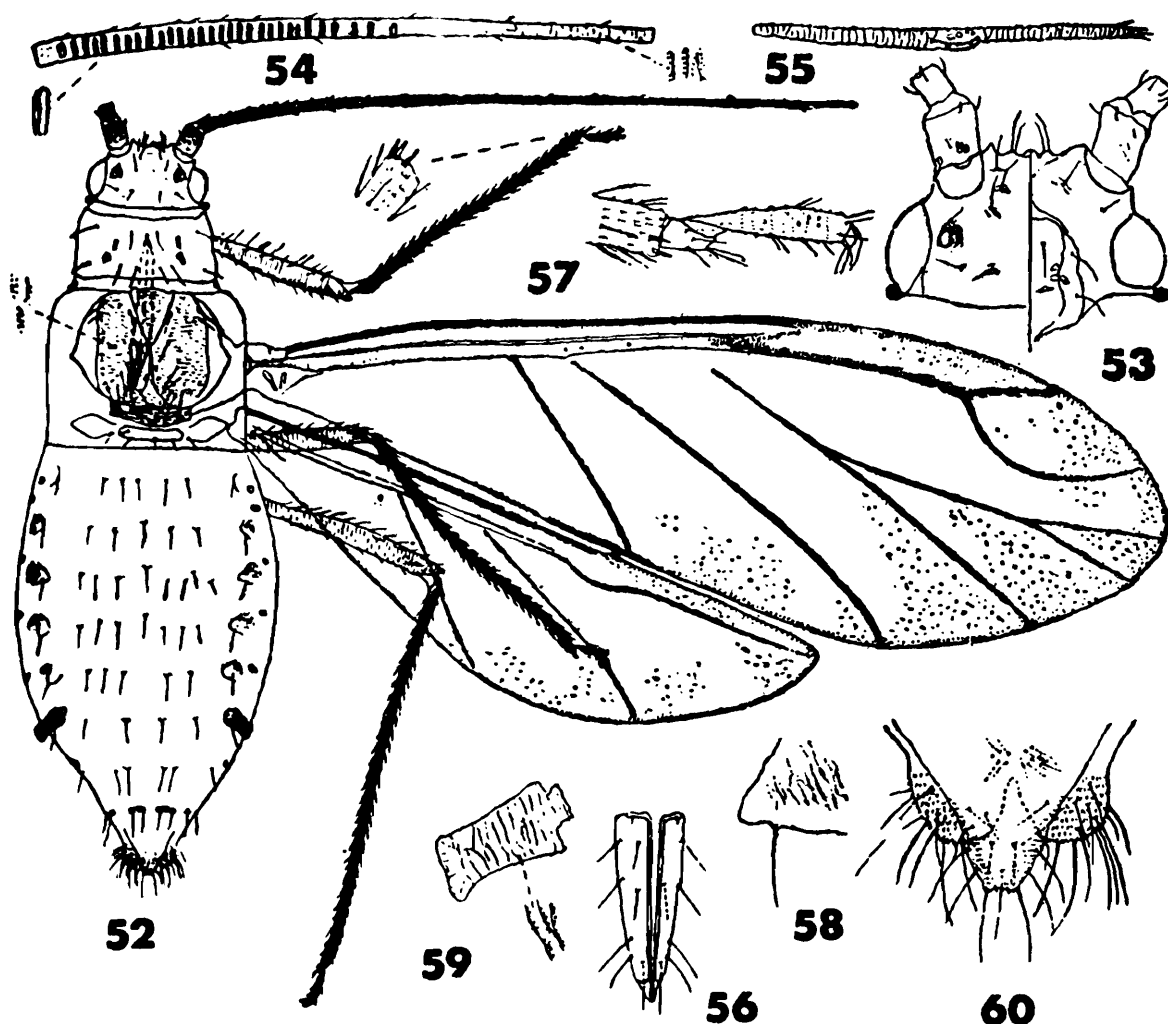
Distribution.—India : Uttar Pradesh , Central Asia.

Types.—Probably in the Institute of Zoology, Tadzhikistan Academy of Science, U.S.S.R.

5. *Betulaphis longicornis* Quednau & Chakrabarti (Figs. 52-69)

1980. *Calaphis sensoriata*, Raychaudhuri, D.N., Chakrabarti, S., Basu, R.C. and Ghosh, A.K. *In* Aphids of North East India and Bhutan, 284 (misid).
1980. *Betulaphis longicornis* Quednau, F.W. and Chakrabarti, S., *Can. Ent.*, **112** : 8.
1984. *Betulaphis longicornis*, Agarwala, Basant K. and Ghosh, A.K., *Rec. zool. Surv. India Misc. Publ. Occ. Paper*, **50** : 25.

Apterous viviparous female.—Body pale yellow 2.3-2.9 mm long with 1.10-1.24 mm as maximum width. Frontal hairs capitate, discal hairs on vertex 0.104-0.117 mm long, up to $2.50-2.75\times$ as long as the basal diameter of antennal segment III and arising from weakly elevated bases. On ventral side of head, hairs capitate and pointed, anterior two pairs on elevations which appear fused to from a low trapezoidal prominence. Antennae 6-segmented, a little shorter than the body ; flagellum pale yellow with tips of segments III-V and processus terminalis dusky ; hairs on flagellum blunt or capitate, up to 0.020 mm long, at most $0.33\times$ as long as basal diameter of antennal segment III ; secondary rhinaria absent ; primary rhinaria ciliated ; processus terminalis $0.75-0.80\times$ as long as base of antennal segment VI. Rostrum reaches between hind coxae, ultimate rostral segment $1.3\times$ as long as second segment of hind tarsus and bears 8-9 accessory hairs. Meso- and metanotum membraneous, without apparent separation. Abdominal tergites with 6-10 hairs arranged in a transverse row all arising from strongly conical bases or low eleva-



Betulaphis longicornis Quednau & Chakrabarti. 52-60, alate vivipara : 52, body ; 53, head ; 54, antennal segment III ; 55, antennal segment VI ; 56, apical rostral segment ; 57, hind tarsus ; 58, lateral process of abdominal tergite III ; 59, siphunculus ; 60, cauda and anal plate.

tions, 0.117-0.216 mm long, $2.25-3.50\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 6 hairs of similar nature. Siphunculi membranous, long, tapering and flared apically. Cauda tongue-shaped, rounded at apex and bears 9-10 hairs. Subanal plate bilobed, each lobe with 8-10 hairs. Gonochaetae 10. Legs pale ; hairs on femora bluntish, acute or capitate ; rostral organ indistinct ; apices of tibiae and whole of tarsi spinulose ; first tarsal segments with 5-6 ventral hairs and without any dorsal hairs ; empodial hairs flabellate.

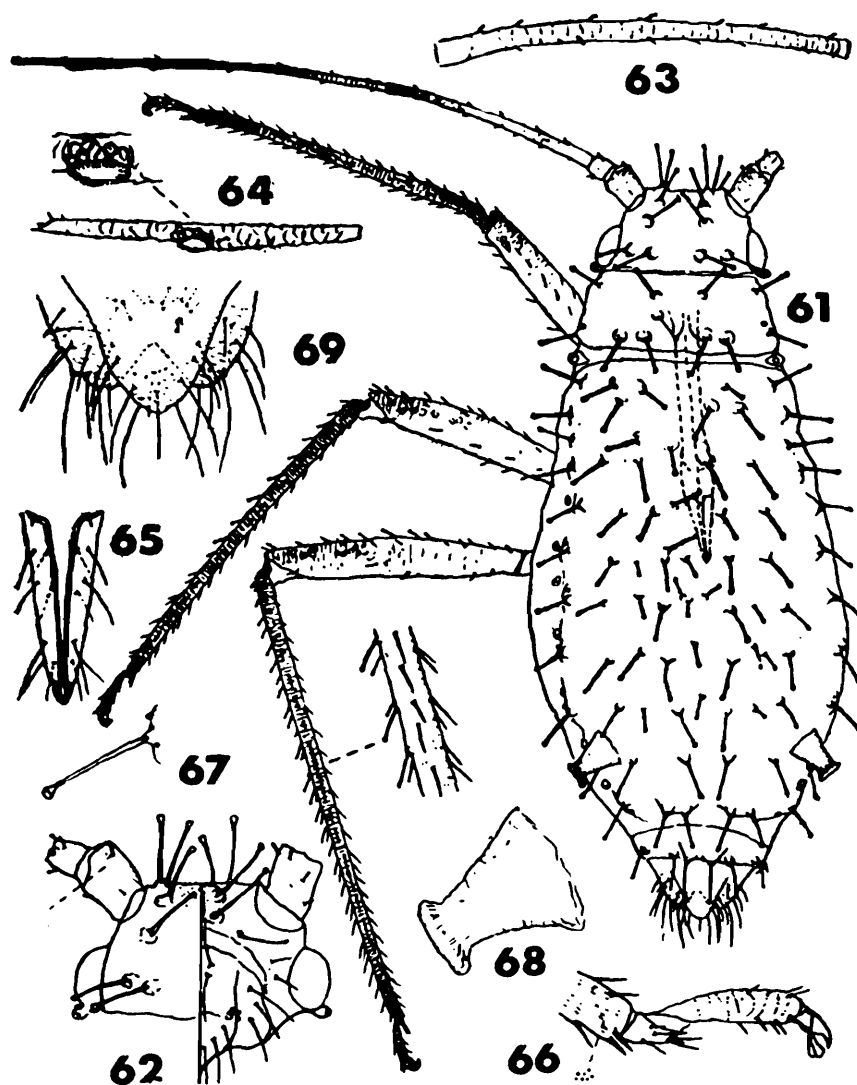
Colour.—Yellow in life.

Measurements in mm. :

	Length	Width	Antenna			
1.	2.55	1.10	2.14			
2.	2.30	1.11	2.20			
3.	2.90	1.24	2.51			
	Ant. segments			urs	ht ₂	Siph.
III	IV	V	VI			
0.70	0.45	0.44	(0.22 +0.18)	0.18	0.14	0.13
0.82	0.45	0.44	(0.22 +0.16)	0.18	0.15	0.13
0.87	0.55	0.48	(0.25 +0.18)	0.18	0.16	0.14

(1, 2, 3, ex *Betula* sp., Valley of Flowers, U.P., 12.vi.1978, K. U. Coll.).

Alate viviparous female.—Body pale with dark antenna, 2.89-3.17 mm long with 0.96 mm as maximum width. Dorsal cephalic hairs fine, up to 0.060-0.066 mm long, 1.2-1.6× as long as the basal diameter of antennal segment III. Antennae subequal to or longer than the body, dark except on basal segments which are yellow ; hairs on the flagellum acute, longest one on segment III up to 0.003 mm long, at most 0.33× as long as the basal diameter of the segment ; segment III with 27-34 narrow, elliptical, ciliated, secondary rhinaria distributed over basal 0.60 portion ; processus terminalis 0.66× as long as base of segment VI. Rostrum reaches near midcoxae, ultimate rostral segment a little longer than second segment of hind tarsus and bears 8-9 accessory hairs. Abdominal dorsum pale, bearing 6-10 hairs in each segment, the longest one 0.10-0.13 mm long, upto 2.5× as long as the basal diameter of the segment ; marginal hairs one pair on each tergite arising from small cone-shaped infuscated processus on tergites 1-5 ; 8th tergite with 8 hairs. Siphunculi cylindrical, sclerotic. Cauda tongue-shaped, without constriction, bearing about 11 hairs. Subanal plate deeply bilobed, each lobe with 13-15 hairs.



Betulaphis longicornis Quednau & Chakrabarti. 61-69, apterous vivipara : 61, body ; 62, head, 63, antennal segment III ; 64, antennal segment VI ; 65, apical rostral segment ; 66, hind tarsus ; 67, lateral hair of abdominal tergite IV ; 68, siphunculus ; 69, cauda and anal plate.

Gonochaetae 12. Minute wax gland pores present in clusters on pigmented part of the body. Legs with tibial hairs pointed; first tarsal segments with 6 ventral hairs and without any dorsal hair. Wing venation normal.

Colour.—Not recorded.

Measurements in mm. :—

Length	Width	Antenna
2.89	0.96	3.0

III	Ant. segment		VI	urs	ht ₂
	IV	V			
0.91	0.67	0.55	(0.24 +0.15)	0.18	0.15

(ex *Betula* sp. Valley of Flowers, U.P., 12.vi.1978 ; K. U. Coll.)

Embryo.—(after Quednau & Chakrabarti, 1980) : Dorsal hairs elongate with capitate apices becoming longer on frontal region and also on posterior spinal region. On abdomen, marginal hairs one pair per tergite. Antennae 4-segmented. Siphunculi pore-like. Ultimate rostral segment without accessory hairs.

Material examined.—4 apterous viviparous females and one alate viviparous female from *Betula* sp., Valley of Flowers, Uttar Pradesh, India, 12.iv.1978, Coll. D. Bhattacharya, (K. U. Coll. No. 608).

Discussion.—The species appears close to *B. hissarica* Narzikulov but the fusion of tergites in the apterae, long antennae and ultimate rostral segment, shape of cauda and nearly smooth siphunculi help to distinguish this species from the former. The species appears to be widely distributed on Betulaceae in Himalaya from Arunachal Pradesh in the east to the Valley of Flowers and adjacent hill areas of Uttar Pradesh in the West ; most of the collections were made during February-March, but the record of its occurrence in Arunachal Pradesh in November and in Garhwal Himalaya in June indicate the possibility of a wider range.

Distribution.—India : Arunachal Pradesh, West Bengal, Uttar Pradesh.

Types.—In the collections of Entomology Laboratory, Department of Zoology University of Calcutta, India (Holotype and one Paratype) ; Department of Zoology, Kalyani University, Kalyani, India (Paratypes) ; Canadian National Collections, Ontario, Canada (Paratypes).

Genus 3. **Chromaphis** Walker, 1870

1870. *Chromaphis* Walker, F., *Zoologist*, 2 (5) : 2001 ; Baker, A.C. 1920, *Bull. U.S. Dep. Agric.*, 826 : 27 ; Palmer, Miriam, 1952, Aphids of the Rocky Mountain Region, 67 ; Richards, W.R. 1965, *Mem. ent. Soc. Can.*, 44 : 26 ; Stroyan, H.L.G., 1977, *Handbk. Ident. Br. Insects*, II 4 (A) : 51 ; Heie, Ole, E., 1982, *Fauna ent. Scand.*, 11 : 47. Type species : *Lachnus juglandicola* Kaltenbach.

Morphology. : Body small to medium size, 1.5-2.7 mm long. Head smooth, frons with median protruberance ; hairs on frons and disc short, mostly pointed at apices. Antennae 6-segmented, 0.45-0.60×as long as the body ; secondary rhinaria semioval to elongate, non-ciliated, present on segments III (-IV) ; primary rhinaria ciliated ; hairs on flagellum 0.25—0.70×as long as the basal diameter of antennal segment III ; processus terminalis 0.15-0.50×as long as the base of antennal segment VI. Eyes with distinct ocular tubercles. Rostrum reaches near mid-coxae, ultimate rostral segment 0.6-0.8×as long as second segment of hind tarsus and bears few accessory hairs. Pronotum with 2 pairs of spinal hairs besides anterior lateral and posterior lateral hairs. Abdominal dorsum pale, sometimes with pale-brown sclerites ; hairs on the mid-dorsum fine, acute, 2-6 on 1st-7th tergite, besides 2-6 hairs on marginal lobe ; 8th tergite with 8-18 hairs. Siphunculi conical, truncate, with a distinct flange, with 2-3 hairs of 6th tergite appended to the base. Cauda with a distinct knob, bearing many fine hairs. Subanal plate slightly indented. Rudimentary gonapophyses 2. Legs normal, tibiae spinulose on apical portion, apical tibial hairs differentiated into 3-4 spurs ; rastral organ well developed in forelegs ; first tarsal segments with 5 ventral and 2 dorsal hairs, the median ventral one appearing short and peg-like ; empodial hairs flattened. Wings with radial sector absent or faint on basal portion ; bases of media and cubitus may be dusky ; hind wings with 2 obliques.

First instar nymph with pairs of very short spinal hairs arranged in longitudinal rows and a pair of long marginal hairs on each segment except on head, pronotum and 8th tergite, where spinal hairs are also long ; pleural hairs absent. Antennae 3-segmented, segment III with both primary rhinaria. Siphunculi evident.

Males alate, decidedly smaller than viviparae with head, thorax and spinal sclerites, when present, dark, each dorsal sclerite with 2 hairs. Antennae 6-segmented with secondary rhinaria on segments III, IV and V and sometimes on base of segment VI. Genitalia distinct.

Oviparae apterous, smaller than viviparae, nearly similar in size to the males. Abdominal dorsum with segmental sclerites on 3-6. Hind tibiae swollen, bearing 7-35 pseudosensoria.

Discussion.—Two species are now recognised under this genus, viz., *juglandicola* (Kaltenbach, 1843) from Europe, Atlas mountain in Africa, N. W. Himalaya in India and introduced to North America and *hirsutustibis* Kumar and Lavigne, 1970, from India. Quednau (1954) and Richards (1965) recognised the genus as nearest to *Panaphis* (*Callaphis* Walker), from which it differs in having 6 hairs on supra-anal plate and absence of dark dorsal plates in the first instar nymph ; Richards (1965) however questioned about validity of this type of differences being acceptable for generic separation. The host-plant association indicates its evolution on plants of Juglandaceae over widely separated areas.

Biology.—These aphids usually feed on under surface of leaves of *Juglans* and lead autoecious holocyclic life cycle. When occurring in large number, members of this genus can cause damage to young foliage and fruits. All viviparae as noted are alate and only oviparae are apterous. In North America, alate viviparae appear between July to September and sometimes in large numbers. In India sexuales of *juglandicola* have never been recorded (known only from Europe).

In Indian region, both the species have been noted during May-June and again in October, but sexual forms of *hirsutustibis* were only collected during May-June.

Distribution.—India ; Central Asia ; Middle East ; Europe , Africa ; North America.

Type species.—*Lachnus juglandicola* Kaltenbach, 1843. Location of types not known.

Key to the species of *Chromaphis* Walker*Alate viviparous females*

Dorsal body hairs 2.5-4.0 × as long as the basal diameter of antennal segment III. Hind tibiae with longest hairs 4-5 × as long as the apical width of tibia. With 6-8 spinopleural hairs on each of the anterior abdominal tergites. In the late summer forms spinopleural bars on abdominal tergites 4 and 5. Antennal segment III 0.67-0.58 mm and IV 0.15-0.33 mm long. Wing veins with dark bordering near apices. On *Aleurites*

hirsutustibis
Kumar & Lavigne

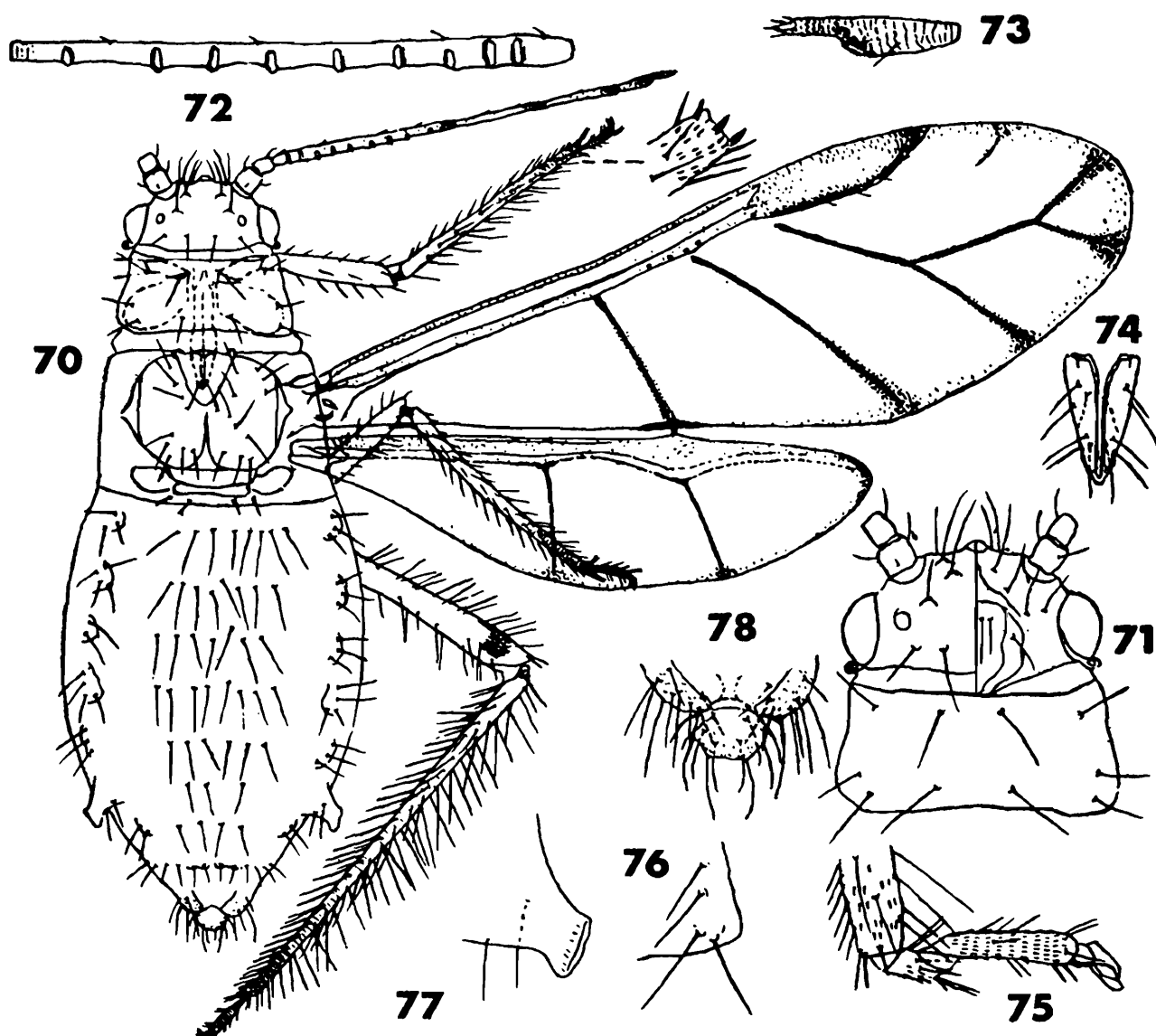
—Dorsal body hairs 1.50-2.0 × as long as the basal diameter of antennal segment III. Hind tibiae with longest hairs 2-2.5 × as long as the apical width of tibia. Abdomen with paired spinals on tergites 1-5. In the late summer forms a pair of small spinal sclerites on abdominal tergites 4 and 5. Antennal segment III 0.33-0.40 mm and VI 0.18-0.20 mm long. Wing veins without dark markings near apices.

juglandicola
(Kaltenbach)

6. *Chromaphis hirsutustibis* Kumar & Lavigne
(Figs. 70-88)

1970. *Chromaphis hirsutustibis* Kumar, Rabindra and Lavigne, Robert, *Pan Pacif Entomol.*, 46 : 120.
 1973. *Chromaphis hirsutustibis*, Quednau, F.W., *Can. Ent.*, 105 : 226.
 1978. *Chromaphis hirsutustibis*, Chakrabarti, S., *Entomon*, 3 : 295.
 1980. *Chromaphis hirsutustibis*, Basu, R.C., and Raychaudhuri, D.N., *Rec. zool. Surv. India, Misc. Publ. Occ. Paper*, 18 : 37.
 1984. *Chromaphis hirsutustibis*, Agarwala, Basant K., and Ghosh, A.K., *Rec. zool. Surv. India. Misc. Publ., Occ. Paper* 50 : 25.

Alate viviparous female.—Body pale 2.30-2.34 mm with 1.05-1.68 mm as maximum width. Frontal tubercles undeveloped ; epicranial suture absent ; dorsal cephalic hairs fine, wavy, frontal ones may be upto 0.100 mm long, thrice as long as the basal diameter of antennal segment III ; vertex with 2 pairs of anterior and 2 pairs of posterior discal hairs, similar in length to those on frons, all discal hairs arising from small flat elevations. Antennae 6-segmented, little over half as long as the body ; apices of antennal



Chromaphis hirsutustibis Kumar & Lavigne. 70-78, alate vivipara : 70, body ; 71, head and pronotum ; 72, antennal segment III ; 73, antennal segment VI ; 74, apical rostral segment ; 75, hind tarsus ; 76, lateral process of abdominal tergite IV ; 77, siphunculus ; 78, cauda and anal plate.

segment III and IV and whole of segment V and VI imbricated, rest smooth ; segment III with 9-25 elliptical secondary rhinaria arranged in a row ; segment IV with 0-3 similar rhinaria ; hairs on flagellum acute stiff, upto 0.011 mm long $0.50\times$ as long as the basal diameter of antennal segment III ; processus terminalis half as long as base of segment VI. Rostrum reaches between fore-and mid-coxae, ultimate rostral segment shorter than second segment of hind tarsus and bears 6-8 accessory hairs. Pronotum with 2 pairs of spinal and 4-5 lateral hairs on each side ; hairs on mesonotum arranged in cluster, on metanotum in two pairs. Abdo-

minal dorsum pale, sometimes with dark spinopleural transverse sclerotic bars on 4th and 5th tergites ; dorsal abdominal hairs long, fine, acute, arranged in a transverse row on each tergite ; marginal hairs 2-6 on each lobe which appear like low processes ; hairs on anterior tergites upto 0.130 mm long and $4.0\times$ as long as the basal diameter of antennal segment III, on posterior tergites these become shorter and one on 8th tergite up to 0.065 mm long or $2.0\times$ as long as the mentioned diameter. Siphunculi short, pale, smooth with 2 marginal hairs of 6th tergite appended. Cauda short, spinulose with a globular knob. Subanal plate shallowly indented. Rudimentary gonapophyses indistinct. Legs pale bearing many long fine hairs, longest one on femora $3.0-4.0\times$ as long as basal diameter of antennal segment III, on tibiae $5.0\times$ as long as the width at the middle of tibiae ; forecoxae slightly enlarged, foretibiae with rastral organ well developed ; tarsi spinulose, first tarsal segment with 5 ventral and 2 dorsal hairs. Wing venation normal, tips of wings distinctly bordered with brown.

Colour.—Yellow with sclerotic patches on abdomen.

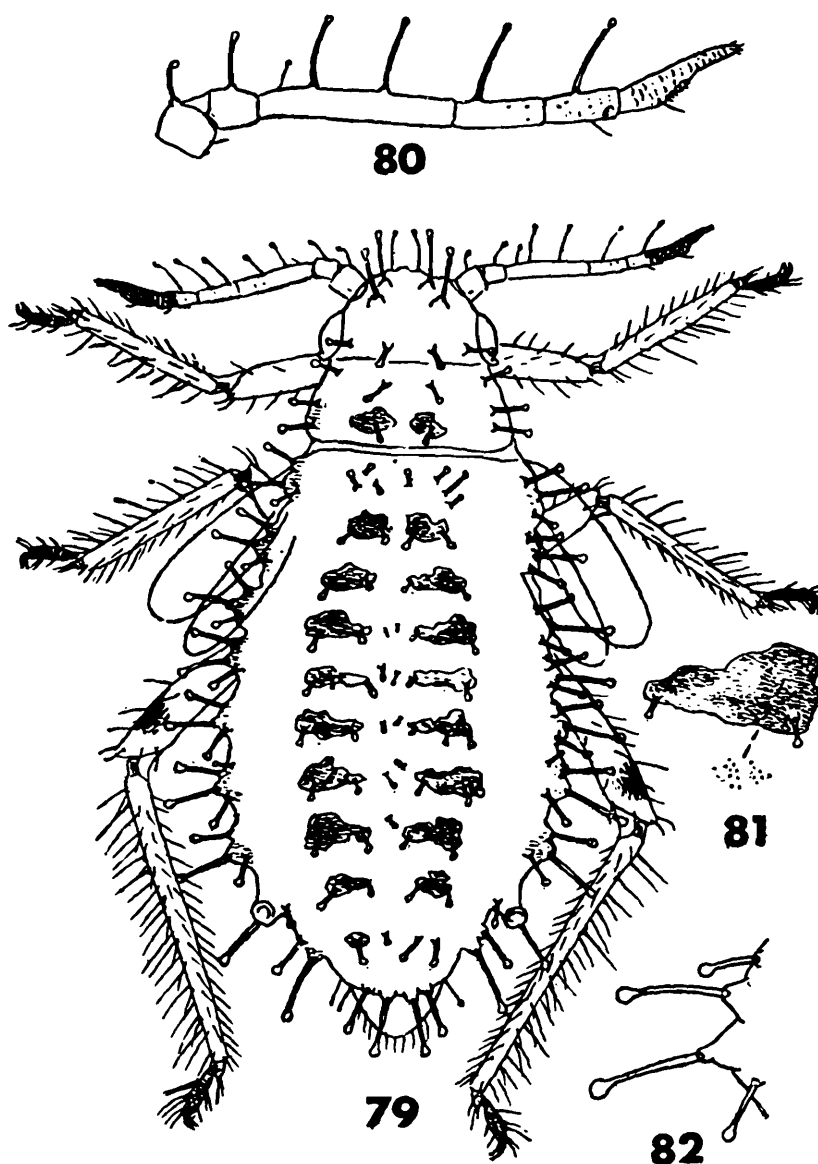
Measurements in mm.—

Length		Width		Antenna	
1.	2.34		1.08		1.38
2.	2.30		1.05		1.10
		Ant. segments			
III	IV	V	VI	urs	ht ₂
0.65	0.24	0.20	(0.110 +0.43)	0.085	0.110
0.46	0.23	0.16	(0.100 +0.40)	0.070	0.109

(1, 2, ex *Juglans regia*, Hanumanchati, U.P., 30.v.1981, K. U. Coll.).

Alatoid nymph.—Body pale 1.68 mm long. Frons distinctly convex, discal hairs stout, capitate, arising from tuberculate bases, up to 0.060 mm long, $2.0-3.0\times$ as long as the basal diameter of antennal segment III. Flagellum with spinulose imbrication on apical part ; hairs on flagellum thin, capitate, up to 0.053 mm long, longer than the basal diameter of segment III. Rostrum

hardly reaches midcoxae, ultimate rostral segment 0.066-0.076 mm long bearing 4-6 accessory hairs. Abdominal dorsum pale, membranous or provided with pairs of spinopleural dark sclerotic blotches, bearing 4 or more short capitate spinopleural hairs. Marginal hairs 2-4 on each lobe arising from distinctly cone-shaped bases, these hairs being up to 0.066-0.073 mm long and those on 6th tergite appended to the base of siphunculus, 8th tergite with about 6 thick capitate hairs arising from tuberculate bases, and sometimes a few additional short ones with acute apices. Siphunculi pale, short flared at apex with thick apical rims. Subanal plate rounded. Legs pale; tarsi spinulose; first tarsal segments with only 5 ventral hairs, second tarsal segment 0.09 mm long.



Chromaphis hirsutustibis Kumar & Lavigne. 79-82, alatoid nymph : 79, body ; 80, antenna ; 81, spinal sclerite of abdomen ; 82, lateral lobe of abdominal tergite IV.

First instar.—(from Quednau, 1973). Spinal and marginal hairs single ; pleural hairs absent ; spinal hairs short, inconspicuous, marginal hairs elongate, capitate, those on thorax shorter than the ones on abdomen. Antennae 3-segmented, with the following chaetotaxy : 1+1, 1, 3. Ultimate rostral segment with 6-7 accessory hairs. Cauda with 6 hairs.

Alate male.—(after Chakrabarti, 1978). Body 1.6 mm long with 0.96 mm as maximum width. Antennae less than $0.50\times$ as long as body, 6-segmented, pale ; antennal segment III with 31, IV with 5-6, V with 3 and base of segment VI with 0-2 secondary rhinaria ; longest hair on antennal segment III $0.75\times$ as long as the basal diameter of the segment ; processus terminalis $0.36\times$ as long as base of segment VI. Abdominal dorsum with brown marginal sclerites on tergites 1-5 and similar smaller and paler sclerites on tergites 7 and 8 besides paired spinal sclerites on tergites 1-3 and a transverse sclerotic band on each of 7th and 8th tergites ; dorsal hairs $1.5-2.5\times$ as long as the basal diameter of antennal segment III. Siphunculi short, 0.003 mm long. Cauda 0.046 mm long with 15 hairs. Male genitalia with distinct opercula and penis.

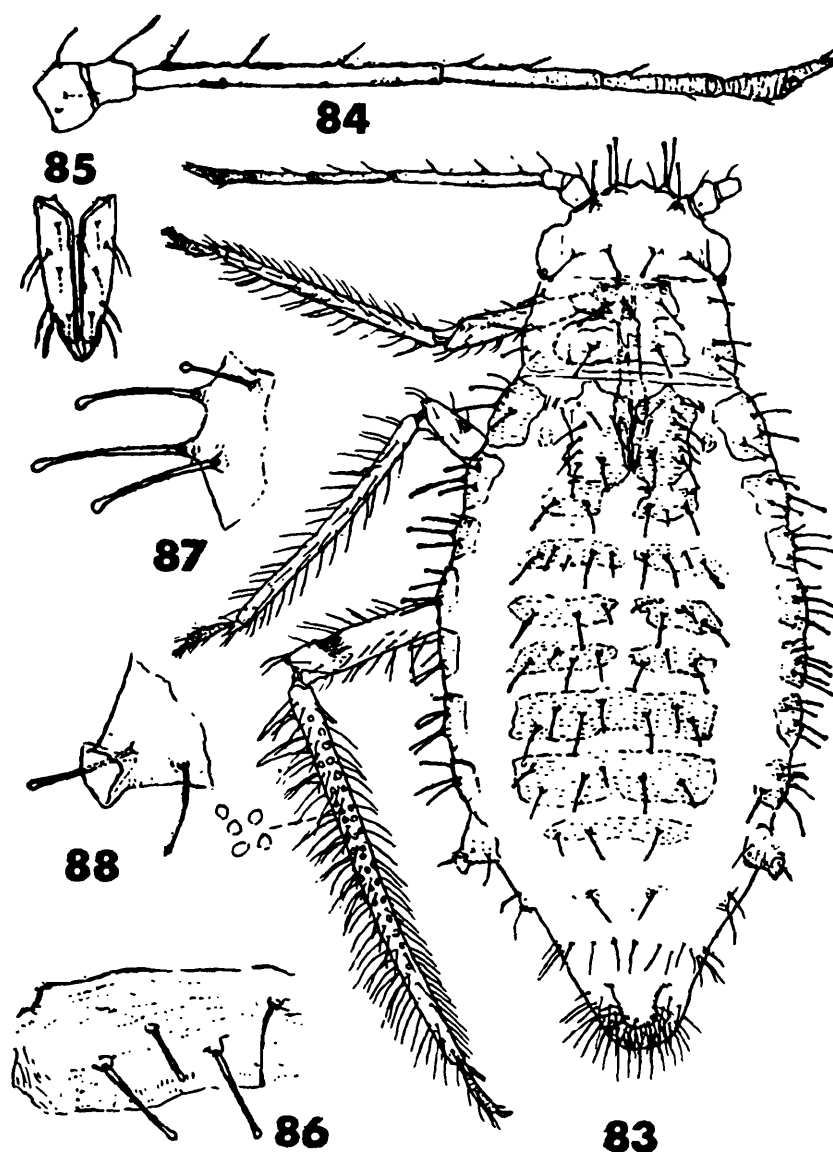
Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
1.61		0.96		1.88	
Ant. segments				urs	ht ₂
III	IV	V	VI		
0.50	0.24	0.23	(0.09+0.04)	0.078	0.097

(ex Yellow Pan Trap, Nainital, 23.v.1969, K.U. Coll.).

Apterous oviparous female.—Body pale 1.45-1.66 mm long. Frontal and discal hairs capitate, 0.057-0.083 mm long arising from elevated bases. Antennae $0.45\times$ as long as the body ; hairs on antennal segment III 0.030-0.038 mm long $1.3-1.6\times$ as long as the basal diameter of the segment, stiff, pointed. Apical rostral segment $0.92\times$ as long as second segment of hind tarsus and bears



Chromaphis hirsutustibis Kumar & Lavigne. 83-88, ovipara : 83, body ; 84, antenna ; 85, apical rostral segment ; 86, spinal sclerite of abdomen ; 87, lateral lobe of abdominal tergite II ; 88, siphunculus.

9 accessory hairs. Abdominal dorsum with weakly sclerotic mutually free spinopleural bars that are divided in the middle on tergites 1-3 and bear 6-9 capitate hairs as longer cephalic hairs on tergites 1-5; marginal hairs on tergites 3-5 on weakly sclerotic plates, longest hair up to 0.091 mm long; on abdominal tergites 7 and 8 hairs pointed. Hind tibiae slightly swollen and bearing 45-50 pseudosensoria. Cauda weakly knobbed. Anal plate rounded. Otherwise as in the alate viviparous female.

Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
1.66		0.68		0.76	
Antennal segments				urs	ht ₂
III	IV	V	VI		
0.28	0.15	0.11	0.07+0.03	0.102	0.110

(ex *Juglans regia*, Govindghat, Garhwal, U.P., 15.ix.1983, Kalyani Univ. Coll.).

Material examined.—Three alate viviparous females and one alatoid nymph from *Juglans regia*, Hanumanchati, Uttar Pradesh, India, 30.v.1981, coll. S.P. Maity (K.U. Coll. 1036) and one ovipara from *Juglans regia*, Govindghat, Garhwal, UP., India, 15.x.1982, coll. P. K. Medda (K.U. Coll. 1666).

Discussion.—The species originally described from two alate viviparae and one alatoid nymph on *Juglans regia* in Simla Hills, Himachal Pradesh, was subsequently described in more detail by Quednau (1973). Quednau's (op. cit) description was based on a large collection from India (North West Himalaya) and Nepal on *Juglans regia* and also on *Aleurites moluccana*. The long anterior discal hairs, long tibial hairs, dark spots at tips of wing veins and greater number of dorsal hairs, etc. help to separate the species from *C. juglandicola*. The occurrence of viviparae and sexuales on both *Juglans* and *Aleuroites* indicates the possibility of having autoecious holocyclic life cycles on both of these plants.

Distribution.—India : Himachal Pradesh, Uttar Pradesh.

Types.—In the collection of British Museum (Nat. Hist, London ; 4 paratypes are reported to be in the collection of Dr. R. Kumar, U.S.A.)

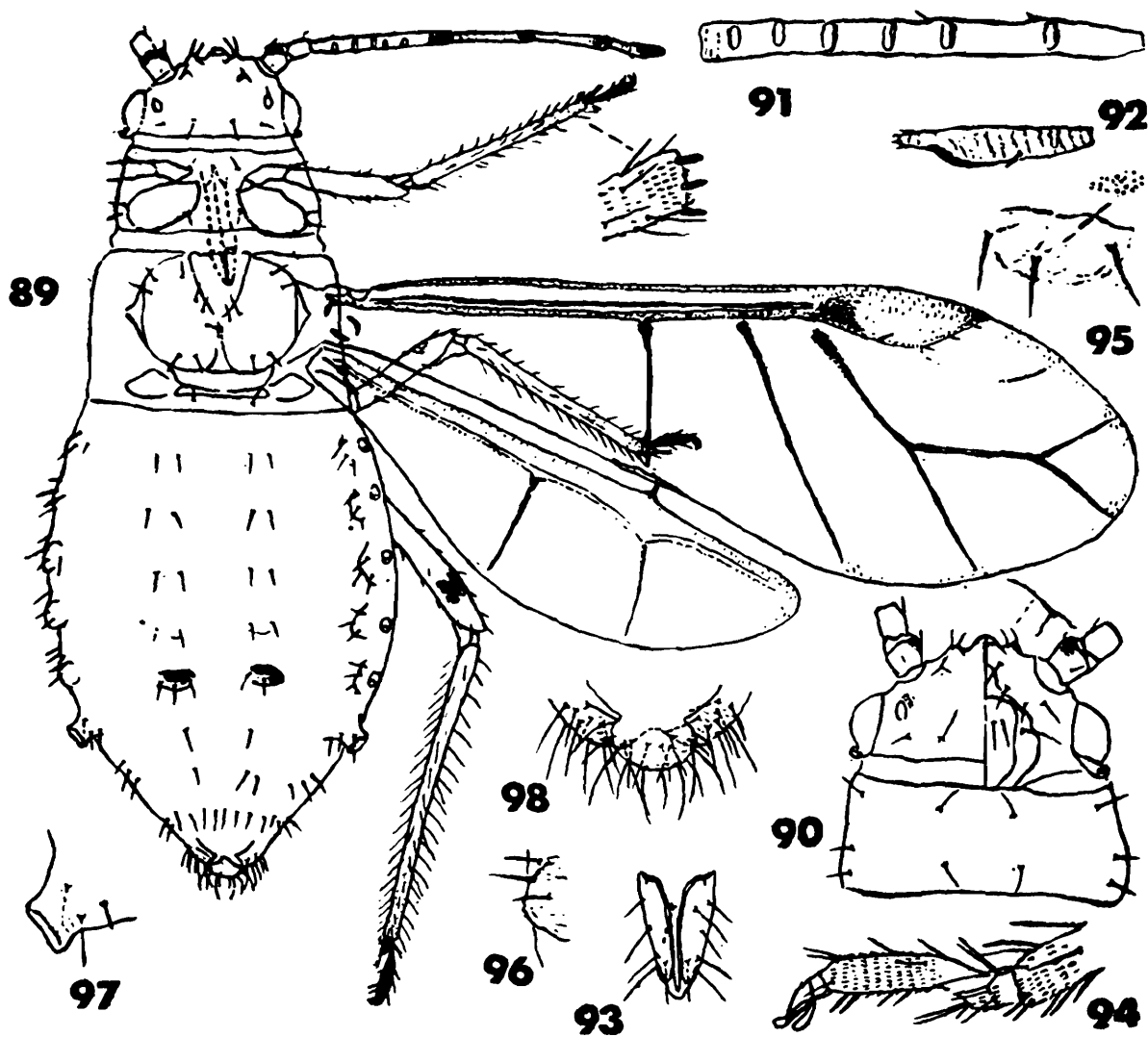
7. *Chromaphis juglandicola* (Kaltenbach) (Figs. 89-108)

1843. *Lachnus juglandicola* Kaltenbach, J.H., *Monog. Fam. Pflanzenläuse*, Aachen, 151.

1854. *Callipterus juglandicola*, Koch, C.L., *Die Pflanzenläuse*, Nürnberg, 224.
 1870. *Chromaphis juglandicola*, Walker, F., *Zoologist*, 5 : 2000.
 1881. *Pterocallis juglandicola*, Buckton, G. B., *Monog. British Aphides* 3, London, 32.
 1965. *Chromaphis juglandicola*, Richards, W.R., *Mem. ent. Soc. Can.*, 44 : 27.
 1971. *Chromaphis juglandicola*, Bhalla, O.P., *Himachal J. Agric. Res.*, 1 : 51.
 1984. *Chromaphis juglandicola*, Agarwala, Basant K., and Ghosh, A.K. *Rec. zool. Surv. India. Misc. Publ., Occ. Paper*, 50 : 25.

Alate viviparous female.—Body 1.8-2.11 mm long with 0.72-0.82 mm as maximum width. Frontal tubercles poorly developed. Epicranial suture absent. Median ocellus visible when head is viewed from above. Frontal hairs fine, arising from small papillate bases, up to 0.033-0.040 mm long, $1.3-1.4\times$ as long as the basal diameter of antennal segment III ; anterior and posterior discal hairs fine, similar to those on the frons. Antennae 6-segmented, about half as long as the body ; segment III with 7-10 elliptical or narrow oval secondary rhinaria arranged in a row, other segments without secondary rhinaria ; hairs on the flagellum acute, 0.006-0.010 mm long, hardly $0.3\times$ as long as the basal diameter of antennal segment III ; flagellum smooth on segment III and basal part of IV, the rest imbricated ; processus terminalis $0.20-0.25\times$ as long as the base of segment VI. Rostrum reaches little beyond forecoxae, ultimate rostral segment distinctly shorter (up to $0.80\times$) than second segment of hind tarsus and bears 6-10 accessory hairs, besides preapicals. Pronotum with 2 pairs of spinal, and 3 pairs of marginal hairs. Abdominal dorsum pale ; hairs on the dorsum of abdomen consisting of paired spinals (2 or 3 pairs) on tergites 1-5 and on 7th tergite ; 6th tergite with one pair of spinals ; 8th tergite with at least 8 hairs ; marginal hairs on abdominal tergites present in cluster of 3-4 on each lobe ; dorsal hairs 0.033-0.040 mm long, $1.3-1.5\times$ as long as the basal diameter of antennal segment III. Siphunculi pale, smooth, short, without flange, with 2-3 hairs appended. Cauda knobbed, spinulose, bearing 11-12 hairs. Subanal plate weakly indented. Legs pale yellowish, forecoxae slightly enlarged ; tibial hairs at most $3.0\times$ as long as the width at the middle of tibia ; first tarsal segments with 5 ventral and 2 dorsal hairs ; tarsi spinulose, empodial hairs flattened. Wing venation normal, veins never ending in dusky tips.

Colour.—Yellow with dark brown pigmentation on apices of antennal segments, tarsi and near apices of hind femora.



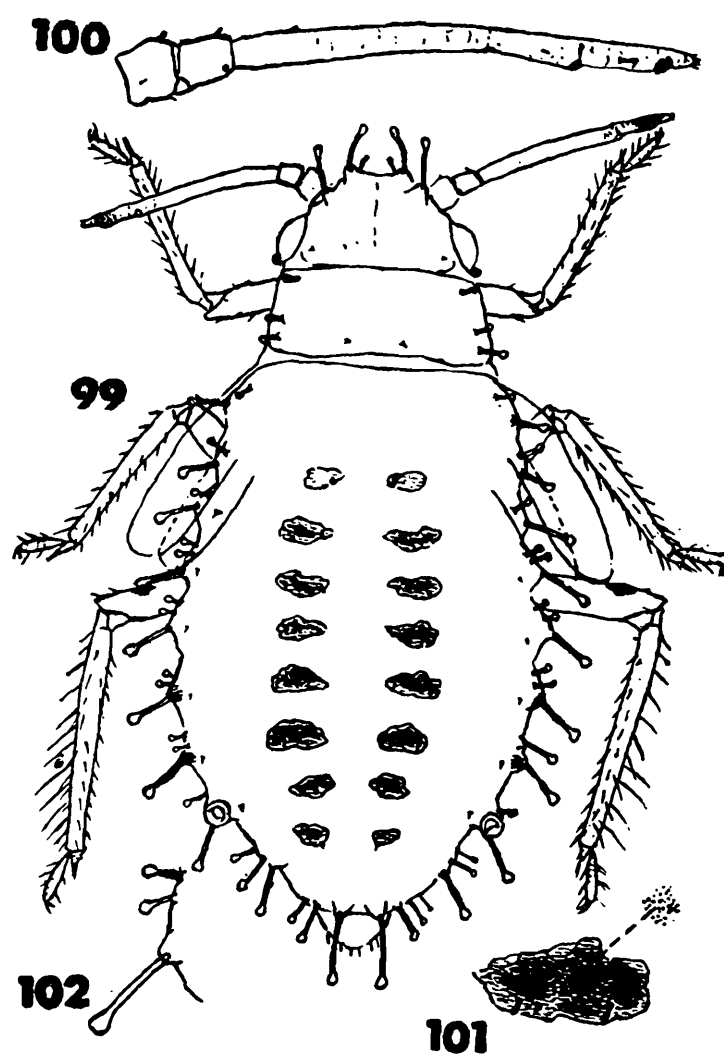
Chromaphis juglandicola (Kaltenbach). 89-98, alate vivipara : 89, body ; 90, head and pronotum ; 91, antennal segment III ; 92, antennal segment VI ; 93, apical rostral segment ; 94, hind tarsus ; 95, spinal sclerite of abdominal tergite V ; 96, lateral process of abdominal tergite IV ; 97, siphunculus ; 98, cauda and anal plate.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.11	0.82	1.03		
2.	1.80	0.72	0.87		
	Ant. Segments				
	III	IV	V	VI	
	0.42	0.22	0.16	(0.10+0.03)	0.073
	0.33	0.18	0.14	(0.08+0.02)	0.070

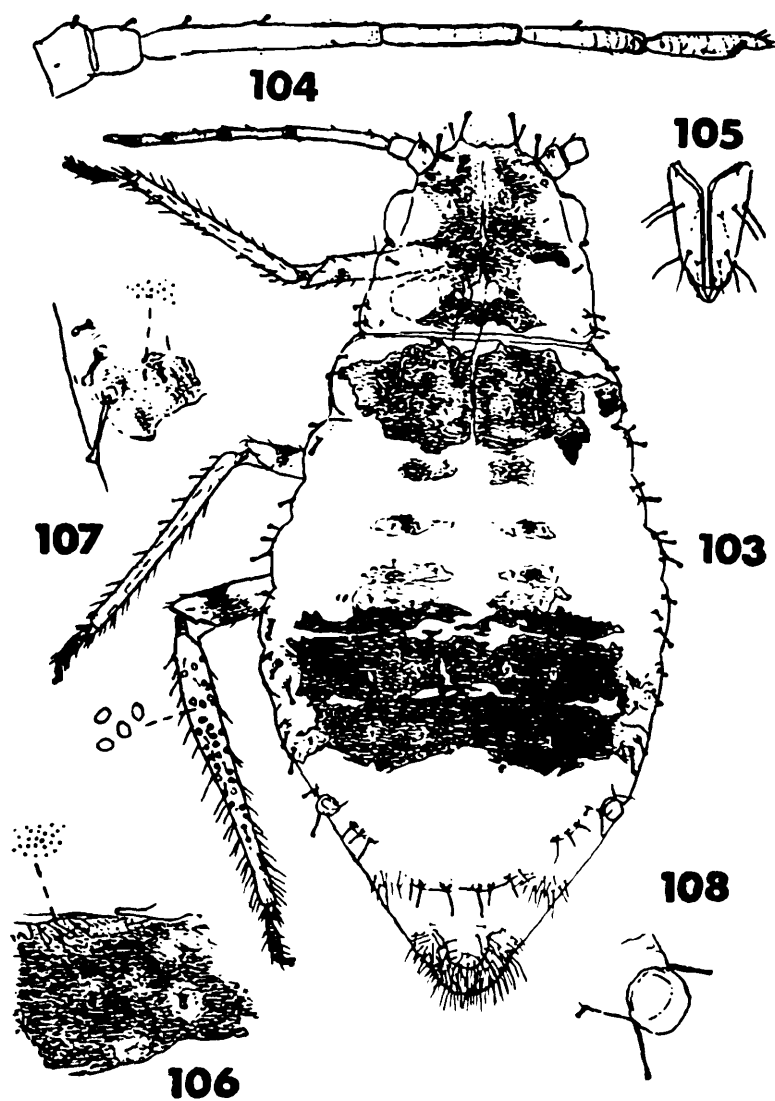
(1, 2 ex *Juglans regia*, Janakichoti, U.P., 1.vi.1981, K.U. Coll.).

Alatoid nymph.—Body pale 1.93 mm long. Frontal tubercles poorly developed. Frontal and anterior discal hairs capitate arising from papillate bases, 0.066-0.083 mm long, 2.0-2.5 $\times$ as long as the basal diameter of antennal segment III ; posterior discal hairs short, inconspicuous. Antennae pale, 4- or 5- segmented, 0.69 mm long ; hairs on inner margin of flagellum small, capitate, up to 0.007 mm long, always much shorter than basal diameter of segment III ; lengths of antennal segments I 0.065, II 0.058, III 0.38, IV 0.09 and V (0.08+0.04) mm. Rostrum reaches little beyond fore-coxae, ultimate rostral segment 0.106 mm long, little over 0.80 $\times$ as long as second segment of hind tarsus (0.130 mm) and bearing at least 6 accessory hairs. Abdominal dorsum pale bearing 3-4 capitate marginal hairs on each lobe on each of tergites 1-5, of which one is always longer (0.066-0.070 mm) than the others (0.033-



Chromaphis juglandicola (Kaltenbach). 99-102, alatoid nymph : 99, body ; 100, antenna ; 101, spinal sclerite of abdominal tergite IV ; 102, lateral lobe of abdominal tergite V.

0.050 mm); 6th tergite with 2-3 hairs on each side at the bases of siphunculi : 7th tergite with 2-3 pairs ; marginal hairs on each side 0.043 to 0.086 mm long ; 8th tergite with 7-8 capitate hairs all arising from strongly tuberculate bases, up to 0.100 mm long ; spinal hairs minute, blunt or capitate, up to 0.016 mm long, at least 4-6 per segment on tergites 1-6, 2 on 7th tergite. Siphunculi smooth with 2-3 hairs near base. Cauda and sub-anal plate rounded. Legs pale, hairy ; hairs on fore and midtibiae fine and capitate (0.053 mm), those on hind tibiae more numerous, mostly with acute apices and up to 0.106 mm long ; first tarsal segments with 5 ventral hairs.



Chromaphis juglandicola (Kaltenbach). 103-108, ovipara : 103, body ; 104, antenna ; 105, apical rostral segment ; 106, spinopleural sclerite of abdomen ; 107, lateral lobe of abdominal tergite V ; 108, siphunculus.

Colour.—Yellow in life.

Sexual forms.—(Not known from India, description based on Heie, 1982).

Alate male.—Abdominal dorsum with dark spinal sclerites on 4th and 5th tergites ; marginal sclerite on 5th tergite dusky. Antennae with secondary rhinaria arranged irregularly on III : 11-24, IV : 5-9, V : 4-7 and VI : 2-3. Otherwise very much like the alate viviparous female.

Apterous oviparous female.—Abdominal dorsum with dark sclerotic transverse bands on 3rd—5th tergites. Hind tibiae somewhat swollen and bearing 50-60 pseudosensoria.

Material examined.—Three alate viviparous females and one alatoid nymph from *Juglans regia*, Janakichoti, Uttar Pradesh, India, 1.vi.1981, coll. S. Saha (K.U. Coll. No. 1052).

Discussion.—This species is known to be widely distributed over the world and can be separated from the endemic *hirsutustibis* by the key. Apparently Palaearctic in origin, it is believed to have been introduced to North America and India. This species infests the undersurface of *Juglans regia* leaves during May-October in India and when infestation is heavy these insects can cause damage to foliage and young fruits.

Distribution.—India, Uttar Pradesh ; Himachal Pradesh ; Jammu & Kashmir. In Europe, the species is known from Denmark, Sweden to south in Portugal and Spain. It was also recorded from the Baltic region, Poland, Germany, Great Britain, Middle East, Central Asia, Atlas mountains in Africa ; introduced to North America (Heie, 1982).

Types.—Evidently lost (Richards, 1965).

Genus 4. *Chuansicallis* Tao, 1963

1963. *Chuansicallis* Tao, Charles Chia Chu, *Sc. Yb. Taiwan Mus.*, 6 : 54 ; Tao, Charles Chia Chu, 1964, *Quartly. J. Taiwan Mus.*, 17 : 217. Type species : *Chuansicallis chengtuensis* Tao.

1980. *Sinotherioaphis* Zhang, G. and Zhong, T., 1980. Type species : *Sinotherioaphis pterothorax* Zhang & Zhong.

Morphology.—Body small $\pm 1.7-1.8$ mm long. Head smooth, without a distinct epicranial suture. Frontal tubercles ill developed. Dorsal cephalic hairs short, sparse, pointed surrounded by cribriform wax glands (frontal-2, anterior discal-2, posterior discal-4). Antennae 6-segmented, slender, shorter than body ; secondary rhinaria elongate, narrow, restricted to antennal segment III of alatae ; primary rhinaria rounded, hairs on flagellum short, very sparse, processus terminalis shorter than base of segment VI. Eyes large with distinct ocular tubercles. Rostrum reaches near midcoxae, ultimate rostral segment subequal to second segment of hind tarsus and bears 2 accessory hairs. Abdominal dorsum smooth without any spinal tubercles but with sclerotic, scabrous, flat lateral processes bearing a single hair surrounded by cribriform wax glands on tergites 1-5. Dorsal hairs short, pointed, arranged spinally and marginally ; pleural hairs absent. Siphunculi dark, truncate, smooth, longer than wide, without any flange or hair appended to base. Cauda distinctly knobbed with 10-12 hairs. Subanal plate deeply bilobed, each lobe with 5-6 acute hairs. Subgenital plate sclerotic with 8-9 fine hairs arranged on posterior margin. Rudimentary gonapophyses 2. Gonochaetae 10-12. Legs with coxae elongate, tibial hairs acute, those near apices stiff, spine-like, first tarsal segments with 6 ventral and 2 dorsal hairs, second tarsal segments spinulose. Wing venation normal ; veins may be infuscated ; forewings with media twice branched, hind wings with both obliques.

Embryo not available. Oviparae apterous, little shorter than viviparae. Siphunculi small. Cauda not clearly constricted. Subanal plate entire. Hind tibiae swollen bearing small and large pseudosensoria over the entire length.

Males alate. Antennae with secondary rhinaria on III, IV, V segments, Abdominal sclerites evident. 7th and 8th tergites blackish, sclerotic. Subanal plate bilobed.

Discussion.—The monotypic genus was described from China. Tao (1963), while describing the genus, mentioned “absence of tubercles and papillae in adult” Careful examination revealed presence of marginal processes and also that first tarsal chaetotaxy should be 6+2 in each leg and not 3, 3, 3 as stated by Tao (op. cit). The single species being now recorded from Assam-Bhutan

border, appears to have wider distribution and remains a typical Far Eastern genus.

Biology.—Tao (op. cit) recorded alate viviparae as late as in November on *Dalbergia hupeana* in Taiwan but Indian records indicate occurrence of viviparae on *Phyllanthus* (may be vagrant) even in the month of January. Sexuales were recorded in China from *Rhus javanica* in late December and this may be indicative of a host alternating cycle, between Leguminosae and Anacardiaceae. In any case, the genus remains restricted to rosewoods. When alive, these insects remain covered with wax secretion and wings remain horizontally over the abdomen.

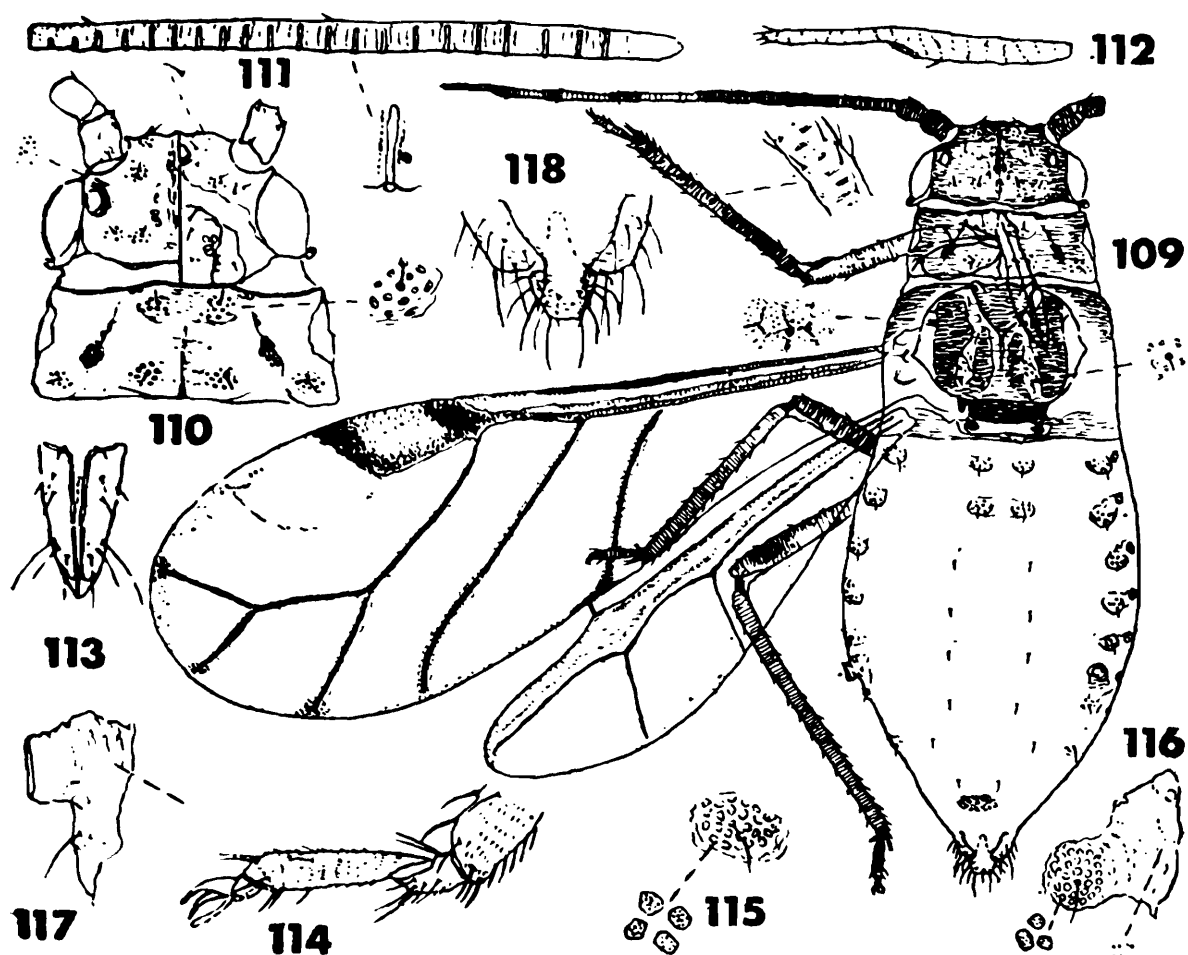
Distribution.—India ; Bhutan , Taiwan.

Type species.—*Chuansicallis chengtuensis* Tao, 1963. Deposited in the Taiwan Agricultural Research Institute, Taipei, Taiwan.

8. *Chuansicallis chengtuensis* Tao (Figs. 109-125)

1963. *Chuansicallis chengtuensis* Tao, Charles Chia Chu, *Sc. Yb. Taiwan Mus.*, 6 : 55.
1976. *Chuansicallis chengtuensis*, Ghosh, A.K., *Orient. Insects.*, 10 (1) : 40.
1980. *Sinotherioaphis pterothorax* Zhang & Zhong. *Zool. Res.*, 1 (4) : 434
New synonym.

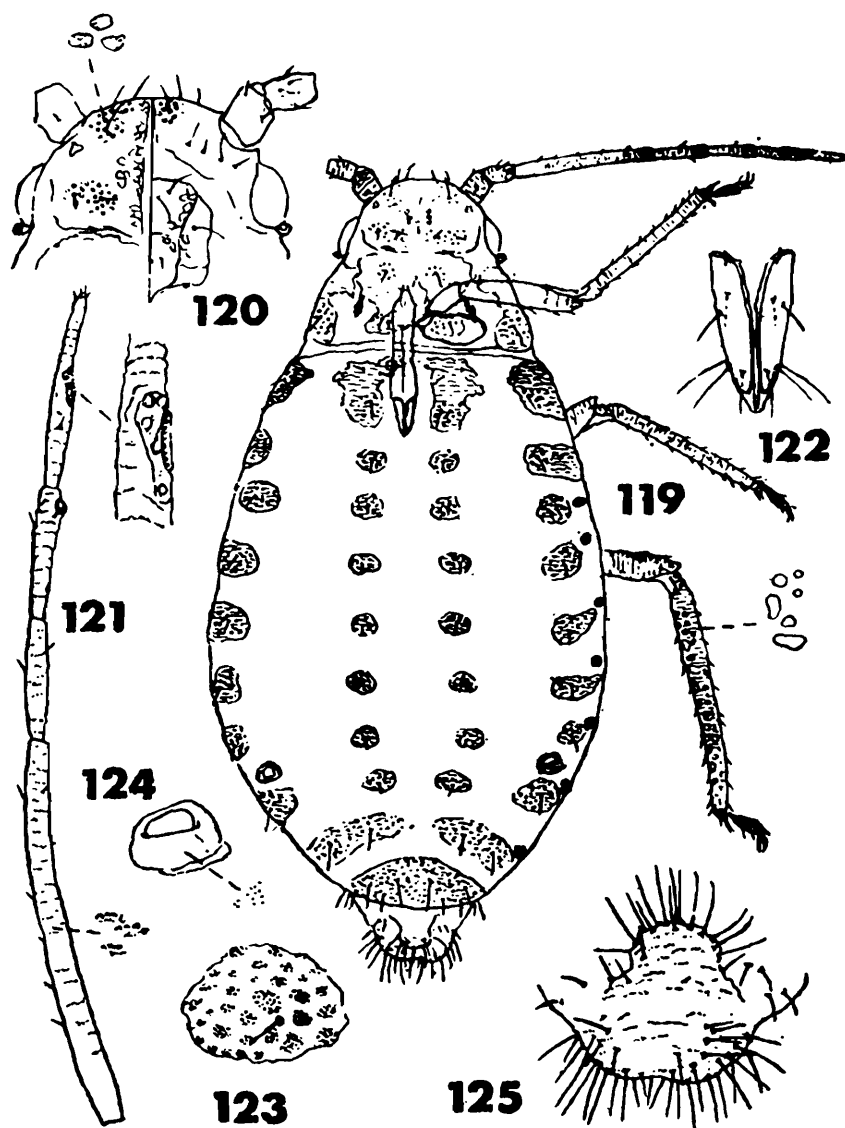
Alate viviparous female.—Body 1.7-1.9 mm long with 0.62-0.75 mm as maximum width. Head dusky brown with a distinct median furrow ; vertex with 4 pairs of hairs surrounded by cribriform wax gland pores ; epicranial suture absent ; all cephalic hairs short (0.010-0.016 mm long), pointed, at most $0.50\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, variably pigmented brown, $0.76-0.82\times$ as long as the body ; flagellum slender, imbricated, bearing 20-27 transverse ciliated secondary rhinaria on segment III ; hairs on flagellum sparse, hardly discernible, at most 0.010 mm long, $0.35\times$ as long as the basal diameter of antennal segment III ; processus terminalis $0.6-0.7\times$ as long as the base of antennal segment VI. Eyes large with distinct ocular tubercles. Rostrum reaches midcoxae, ultimate rostral segment $0.72-0.80\times$ as long as second segment of hind



Chuansicallis chengtuensis Tao. 109-118, alate vivipara : 109, body ; 110, head and pronotum ; 111, antennal segment III, 112, antennal segment VI ; 113, apical rostral segment ; 114, hind tarsus ; 115, spinal hair of abdominal tergite II with wax gland pores ; 116, lateral process of abdominal tergite III ; 117, siphunculus ; 118, cauda and anal plate.

tarsus. Abdominal dorsum pale bearing on tergites 1-5 a pair of flat, sclerotic marginal processes provided with wax gland pores and a single hair ; spinal hairs arranged in two rows, pleural hairs absent ; all dorsal hairs short, 0.013-0.020 mm long, 0.50-0.75 $\times$ as long as basal diameter of antennal segment III ; 8th tergite with 2 hairs ; lateral processes become much smaller and paler on post-siphuncular tergites. Siphunculi shorter than wide ; brown without any apical flange, 0.03-0.04 $\times$ as long as the body. Cauda distinctly constricted, apical knob with 9-13 hairs. subanal plate bilobed, each lobe with 9-11 long fine hairs ; subgenital plate with 10 hairs. Legs variably pale brown ; forecoxae weakly enlarged ; hairs on tibiae short and stiff, apical tibial hairs slightly

thicker ; apices of tibiae and whole of tarsi spinulose ; first tarsal segments with 6, 6, 6 hairs. Wing-veins bordered diffuse brown ; forewing with media twice branched ; hind wing with 2 obliques.



Chuansicallis chengtuensis Tao. 119-125, ovipara : 119, body ; 120, head ; 121, antenna ; 122, apical rostral segment ; 123, spinal abdominal sclerite ; 124, siphunculus ; 125, cauda and anal plate.

Colour.—Pale brown in life.

Measurements in mm.—

	Length	Width	Antenna
1.	1.93	0.75	1.45
2.	1.93	0.75	1.43
3.	1.72	0.62	1.42

III	Ant. segments			urs	ht ₂	Siph.
	IV	V	VI			
0.64	0.23	0.22	(0.14+ 0.09)	0.09	0.12	0.06
0.63	0.22	0.19	(0.15+ 0.08)	0.09	0.11	0.06
0.63	0.23	0.22	(0.14+ 0.08)	0.08	0.11	0.06

(1, 2, 3, ex *Phyllanthus* sp., Manas National Park, Bhutan side, 15.i.1974, N.Z.C.).

Material examined.—6 alate viviparous females from *Phyllanthus* sp., Manas National Park, Bhutan, 15.1.1974. coll. A.K. Ghosh (N.Z.C.).

Discussion.—The species was originally described from *Dalbergia hupeana* and *Rhus javanica* in Taiwan and was recorded only once from the Bhutan side of Manas National Park on *Phyllanthus* sp. It may be noted that both *Dalbergia* and *Rhus* species are available in Assam and Bhutan areas of Manas National Park. Findings of alate viviparae on *Phyllanthus* may indicate its acquisition of a new host in this region. Nymphs of *Pseudotinocallis nigropunctata* (Tao) were also collected on the same host plant in the same period.

Distribution.—Bhutan ; Taiwan.

Types.—In Taiwan Agricultural Research Institute, Taipei, Taiwan.

Genus 5. *Clethrobis* Mordvilko, 1928

1928. *Clethrobis* Mordvilko, A.K., In Philipjev, Keys for identification of Russian insects, 181 ; Higuchi, H., 1972, *Ins. matsum.*, 35 (2) : 57 ; Stroyan, H.L.G., 1977, *Handbk. Ident. Br. Insects*, II, 4 (a) ; 96 ; Raychaudhuri, D.N., Chakrabarti, S., Basu, R.C. and Ghosh, A.K., 1980, *In Aphids of North East India and Bhutan*, 286 ; Heie, Ole, E., 1982, *Fauna ent. Scand.*, 11 : 25. Type species : *Callipterus giganteus* Cholodkovsky.

Morphology.—Body 2.8—5.6 mm long, elongate, brown. Head with distinct frontal tubercles. Epicranial suture developed. Antennae 6-segmented, long, brown or dark and slender, segment III

subequal to IV+V, antennal segment III with transversely elongate ciliated secondary rhinaria distributed nearly over 0.60-0.75 portion of the segment; primary rhinaria oval on segment V, large and obliquely elongate on segment VI; hairs on flagellum long, fine, upto $3.0 \times$ as long as the basal diameter of segment III; processus terminalis shorter than base of segment VI, which bears only one hair. Eyes with distinct triommatidia. Rostrum at most reaching middle coxae, ultimate rostral segment rather obtuse, shorter than second segment of hind tarsus and with upto 22 accessory hairs. Abdominal dorsum always with brown marginal sclerites besides transverse sclerotic bands on 7th and 8th tergites and may be with variably developed hairbearing sclerites on anterior tergites; marginal sclerites on 1st-4th tergites often produced into blunt prominences or tubercles, bearing hairs; sclerites on 1st-6th tergites, at least the marginal ones, with distinct groups of wax-pores. Dorsal hairs long and fine, spinal and pleural hairs together being 10-12 (*comes*) or 16-20 (*dryobius*) per segment; 8th tergite with 15-25 long, fine hairs. Siphunculi truncate, bases may be nearly fused with marginal sclerites, with distinct flange, rugose and may be with few hairs encircling the base (*dryobius*). Cauda with indistinct to distinctly knob-like constriction bearing 9-23 hairs. Subanal plate entire, rudimentary gonapophyses 2. Subgenital plate may be with over 70 hairs. Legs long, tibiae usually dark; tibiae with fine spinules between the hairs, specially near the apices; hairs on the legs long, numerous; apical tibial hairs may be fine and flagellate on dorso-lateral side but short, thorn-like on ventral side and clearly differentiated as spines at extreme apices; first tarsal segments with 6-10 ventral and 2 dorsal hairs, the latter may sometimes be absent in one or more legs; empodial hair flattened. Wing venation normal, radial sector curved.

Apterous vivipare unknown. Embryos with 4-segmented antennae. Spinal and marginal hairs multiple (2-3 pairs), pleural hairs arranged singly from pronotum to at least 6th tergite on each side. Accessory hairs on ultimate rostral segment present but few. Apical tibial hairs spur-like.

Males are alate, slender, much smaller in size than viviparae. Antennal segment III always with secondary rhinaria in irregular

rows, IV and V with or without secondary rhinaria. Dorsum with pigmented transverse band variably developed on abdominal tergites, often with wax pores. Cauda distinctly knobbed.

Oviparae apterous. Head with ocelli. Antennae without secondary rhinaria. Dorsum with broken pigmented sclerites or sclerites but without any apparent wax gland group. Cauda rounded without any constriction. Hind tibiae swollen, may be with over 400 pseudosensoria ; first tarsal segments often without any dorsal hairs.

Discussion.—The genus resembles *Symdobius* Mordvilko, 1894 in its nature of chaetotaxy and shows close affinity by wax glands, shape of cauda etc. but differs in having only 1 seta on the base of antennal segment VI. Higuchi (1972) included this genus in his *Symbobius* group of genera and also recorded for the first time, the occurrence of *Clethrobis* outside Europe, in Japan. Heie (1982) mentioned that two species viz. *comes* (Walker) and *giganteus* (Cholodkovsky) recognised by Eastop and Hille Ris Lambers (1976) and many earlier authors, should be treated as one species, *comes*, because they cannot be separated morphologically. It may be added that earlier, Hille Ris Lambers (1974), while redescribing *comes*, mentioned that *giganteus* may prove to be the same species. In any case, a second species, *dryobius* described by Chakrabarti and Raychaudhuri (1976) from India can easily be separated from *comes* (please see key to the species). As such at least two species, viz., *comes* (from Europe, Japan and India) and *dryobius* (from India) are now known, besides a new species *vermai* described here.

Biology.—*C. comes* leads a holocyclic life cycle on Betulaceae. Heie (1982) mentioned that colonies of *C. comes* have been found on one to four year old branches of *Alnus* and *Betula* from May to October and that the aphids prefer apical branches. Sexuales are produced in October. These aphids often drop to the ground, if disturbed and sometimes may be attended by ants.

The biology of *C. dryobius*, which is known only by viviparae is unknown. In eastern Himalaya, the species has never been collected on *Alnus* or *Betula* (except once) but mostly from unidentified trees and in some cases, both alate viviparae and alatoid nymphs have been collected from improbable host plants like *Rhus* sp. Most of the collection records indicate its occurrence

during October to December, although a few specimens have also been collected during July-August.

Distribution.—India, Japan; Western Asia; Europe.

Type species.—*Callipterus giganteus* Cholodkovsky, 1899. Location of types not known. Location of types of *Aphis comes* Walker, 1848 is also not known.

Key to the species of *Clethrobius* Mordvilko

Alate viviparous females

Tibiae uniformly blackish brown with hairs on inner margin near apex of tibia spiny. Siphunculi brown sclerotic bearing a few hairs. Pronotum with about 80 hairs and marginal papillae. Spinopleural hairs on anterior abdominal tergites mostly on sclerites, in more than one row, totalling over 20 hairs. Tergite 8 with over 20 hairs. Host probably *Betula utilis*

dryobius Chakrabarti
Raychaudhuri.

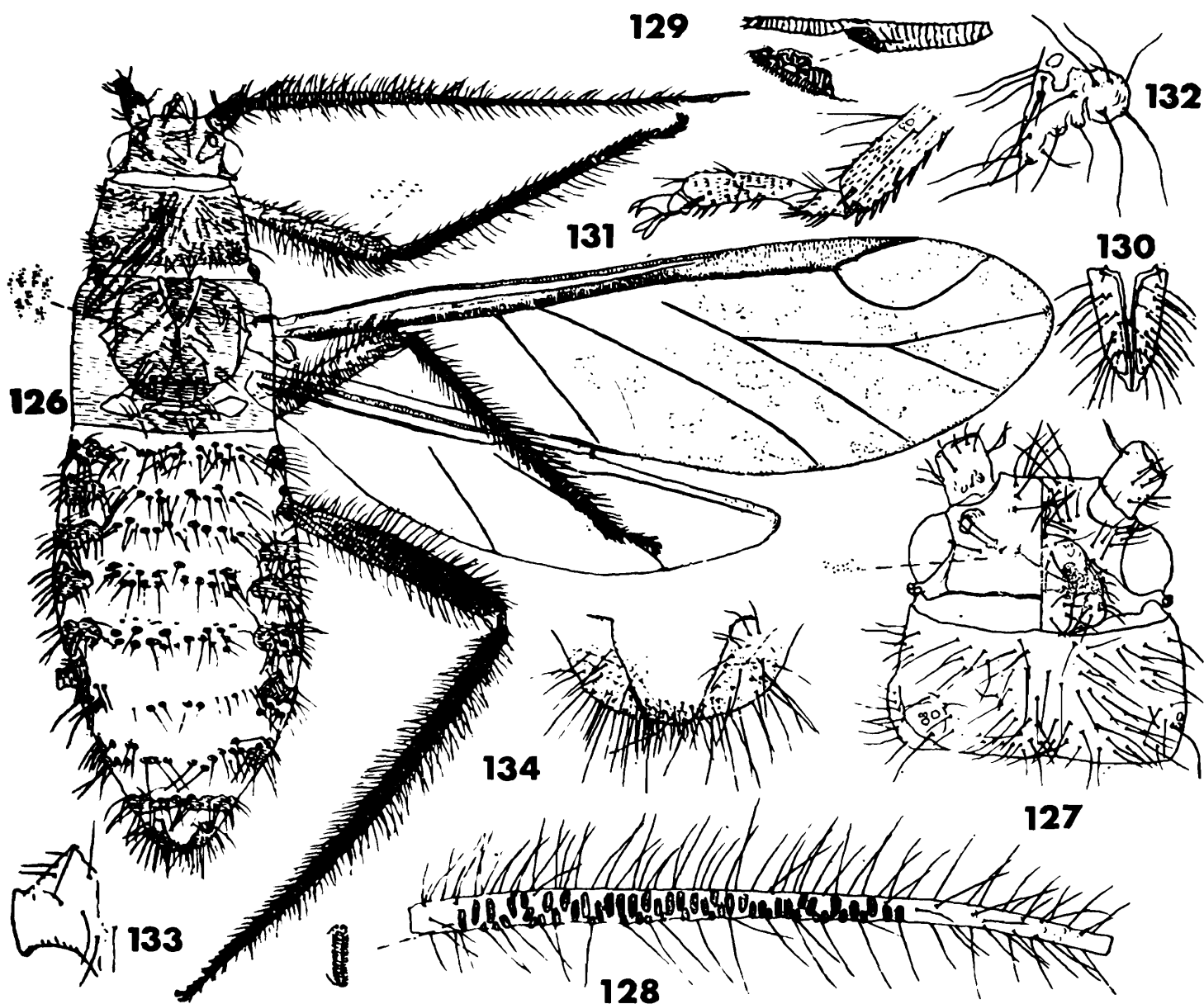
—Tibiae pale brown with black apices. Hairs on inner margin near apex of tibia normal, not spiny. Siphunculi pale without any hairs appended. Pronotum with about 30 hairs and without marginal papillae. Spinopleural hairs on anterior abdominal tergites mostly not on sclerites, in a single row, totalling at most 10 hairs. Tergite 8 with 13 hairs. . On *Betula* sp

vermai n.sp.

9. *Clethrobius dryobius* Chakrabarti and Raychaudhuri (Figs. 126-134)

- 1976. *Clethrobius comes*, Ghosh, A.K., Basu, R.C. and Raychaudhuri, D.N., *Orient. Insects.*, 4 : 68 (misid.).
- 1976. *Clethrobius dryobius* Chakrabarti, S. and Raychaudhuri, D.N., *Orient. Insects*, 10 : 443.
- 1980. *Clethrobius dryobius*, Raychaudhuri, D.N., Chakrabarti, S., Basu, R.C. and Ghosh, A.K., *In Aphids of North East India and Bhutan*, 287.
- 1984. *Clethrobius dryobius*, Agarwala, Basant K., and Ghosh, A.K., *Rec. zool. Surv. India, Misc. Publ., Occ. Paper*, 50 : 26.

Alate viviparous female.—Body large, elongate, hairy 2.9-5.6 mm long with 1.1-1.8 mm as maximum width. Head brown with minute wax gland pores in cluster and a ventral epicranial



Clethrobium dryobius Chakrabarti & Raychaudhuri. 126-134, alate vivipara : 126, body ; 127, head and pronotum ; 128, antennal segment III ; 129, antennal segment VI ; 130, apical rostral segment ; 131, hind tarsus ; 132, lateral abdominal process ; 133, siphunculus ; 134, cauda and anal plate.

suture ; dorsal cephalic hairs fine, 0.12-0.16 mm long, up to $2.0-2.5\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented variably pale brown, $0.60-0.80\times$ as long as the body ; segment I with 14 and II with 7-10 fine hairs, 0.05-0.06 mm long, at most equal to the basal diameter of antennal segment III ; segment III thick, stout bearing 46-62 transversely elongate, ciliated secondary rhinaria distributed over almost entire length except for apical 0.16-0.20 portion ; hairs

on flagellum numerous, fine, longest one on antennal segment III, 0.12-0.14 mm long (0.19 mm), 2.0-2.1 (2.6 $\times$) as long as basal diameter of antennal segment III; processus terminalis 0.65-0.75 $\times$ as long as base of antennal segment VI. Rostrum reaches midcoxae, ultimate rostral segment stout, 0.75-0.85 $\times$ as long as second segment of hind tarsus and bears at least 20-22 hairs. Thoracic tergum pale brown, hairy, longest hair on prothorax about 0.13-0.16 mm long. Abdominal dorsum pale with brownish marginal sclerites on each of tergites 1-7 and a transverse sclerotic band on 8th tergite; marginal sclerites with minute wax gland pores in clusters and a flat elevation with 24-26 long wavy hairs (0.13-0.15 mm); besides the marginal hairs, each of tergites 1-7 with 16-20 spinopleural hairs, 0.14-0.16 mm long, up to 2.0-2.5 $\times$ (3.0 $\times$) as long as the basal diameter of antennal segment III: 8th tergite with 20-24 hairs (19-21), 0.115-0.146 mm long. Siphunculi brown sclerotic arising between marginal sclerites of 5th and 6th tergite, with a distinct apical flange, wider than long and bear 4-6 fine hairs. Cauda brownish, broad, tongue-shaped or weakly knobbed with indistinct constriction at base and bears at least 20 fine hairs. Subanal plate entire, rudimentary gonapophyses not separated. Subgenital plate brown, scabrous, hairy. Legs brown to dark brown, hind tibiae and tarsi may be completely black; all legs bearing numerous hairs; apical part of tibiae and second segment of hind tarsi spinulose; hairs on inner margin near apices of tibiae short, thick and spiny, including the ones at very apices; first tarsal segments with 7-8 ventral hairs and 2 dorsal hairs. Wing venation normal.

Colour.—Brown to dark brown in life with paler abdominal region.

Measurements in mm.—

	Length	Width	Antenna
1.	4.70	1.99	?
2.	3.85	1.40	2.63
3.	2.95	1.15	2.40

Antennal segment				urs	ht ₂	Siph.
III	IV	V	VI			
—	—	—	—	0.16	0.20	0.09
1.24	0.62	0.53	(0.20	0.16	0.20	0.10
			+0.15)			
1.10	0.57	0.45	(0.18	0.16	0.19	0.09
			+0.12)			

(1, ex undet. host, Beadon Falls, Shillong, Meghalaya, 10.xi.1976, coll. K. Deb ; 2,3, ex Rosaceae, Old Barapani, Meghalaya, 2.ii.1974, N.Z.C.).

Alatoid nymph.—Body elongate with head antennae, rostrum, legs, 8th tergite and caudal region brown to dark brown, rest pale. Antennae 6-segmented ; flagellum with spinulose imbrications, flagellar hairs fine, numerous, 0.050-0.110 mm long ; processus terminalis $0.50\times$ as long as base of antennal segment VI. Dorsal hairs fine, flagellate, mostly arising from strong tuberculate bases, those on abdomen often with small scleroites around the base, 0.130-0.146 mm long ; 1st-7th abdominal tergites each with 18-22 hairs all arising from sclerotic bases ; 8th tergite with 16 hairs arising from a dark transverse sclerotic band, up to 0.163 mm long ; ventral hairs fine, numerous ; ultimate rostral segment $0.80-0.88\times$ as long as second segment of hind tarsus and bears 18-20 hairs. Siphunculi with a thick flange, arising from sclerotic bases without any hair. Legs dark brown, pubescent ; apical tibial hairs differentiated as thick spines ; other hairs long, flagellate excepting a few sharp, spine-like hairs on inner margin near apices of tibiae.

Measurements in mm.—

Length				Width	Antenna
3.46				1.60	1.65
Ant. segment				urs	ht ₂
III	IV	V	VI		
0.63	0.30	0.29	(0.14+	0.18	0.16
			0.07)		

(ex undet. host, Beadon Falls, Shillong, Meghalaya, 10.11.1976, N.Z.C.).

First instar nymph.—(From Chakrabarti and Raychaudhuri, 1976). Dorsal hairs fine, arranged in spinal, pleural and marginal rows, spinal hairs duplicated except on 1st or on 1st-2nd tergites ; pleural hairs single ; marginal hairs 2-3 on each side. Antennae 4-segmented, segment I and II with 3 hairs each, segment III with 3-4 hairs and segment IV with 1 hair. Ultimate rostral segment with at least 7 hairs.

Material examined.—One alate viviparous female and one alatoid nymph from *Rhus* spp., Shillong, Meghalaya, India. 29. VII. 1970, coll. H. Banerjee ; one alatoid nymph from indet. host plant, 10 km south of Basar, Siang district, Arunachal Pradesh, India, 14.II.1974, coll. A. K. Ghosh : Two alate viviparous females and 3 alatoid nymphs from plant of Rosaceae, old Barapani, Meghalaya, India, 2.I.1974. Coll. M. Vasant ; 2 alate viviparous females and 8 alatoid nymphs from undet. host plant, Beadon Falls area, Shillong, Meghalaya, 10.I.1976, coll. K. Deb (N.Z.C.).

Discussion.—This species, earlier misidentified as *Clethrobius comes* (Walker, 1848), a typically Palaerctic species, has now been recorded over wide areas of North East India, from Sikkim Himalaya to Arunachal Pradesh. It can easily be separated from *comes* (Walker) by the presence of hairs (in adults) on siphunculi, more accessory hairs on ultimate rostral segment, more hairs on antennal segment III, and by larval chaetotaxy. The species has been recorded in temperate hill region during July-August and again during October to February. It is noted that although plants of Betulaceae (normal host of *comes*) are common in Himalaya, this species has never been collected from the same.

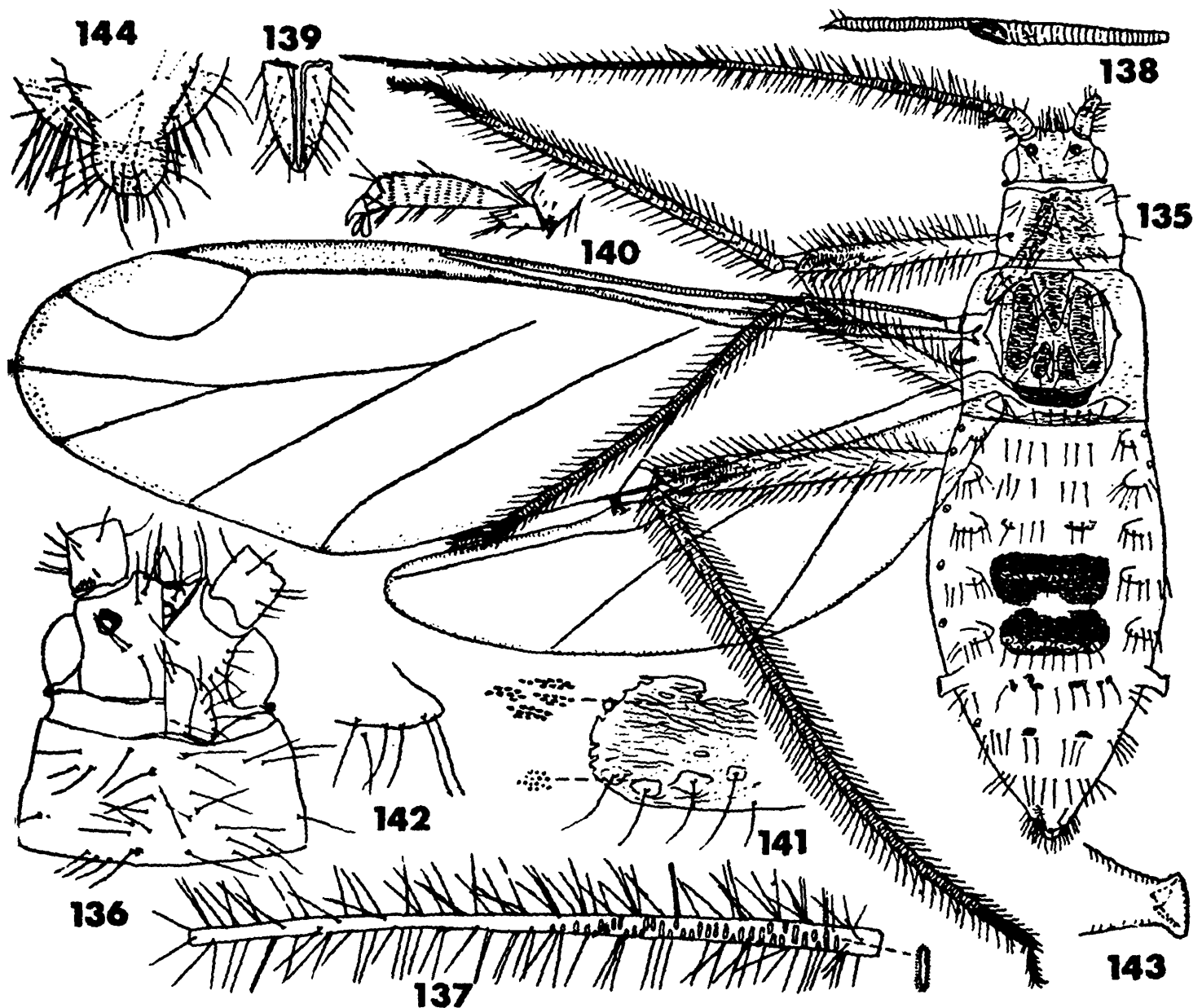
Distribution.—India : Sikkim, West Bengal, Meghalaya, Arunachal Pradesh.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

10. *Clethrobius vermai* n. sp.
(Figs 135-144)

Alate viviparous Female.—Body large, elongate, hairy, 3.3 mm long with 1.4 mm as maximum width. Head pale brown with dark

markings around dorsal ocelli, with an epicranial suture on ventral side. Vertex without discernible wax gland pore elements ; dorsal cephalic hairs arranged in 6 pairs, fine 0.09-0.12 mm long, up to $1.66\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, segments I-III rather pale, except for dark apex of III, rest of the flagellum brownish, almost as long as body



Clethrobium vermai n. sp. Holotype. 135-144, alate vivipara : 135, body ; 136, head and pronotum ; 137, antennal segment III ; 138, antennal segment VI ; 139, apical rostral segment ; 140, hind tarsus ; 141, spinopleural sclerite of abdomen ; 142, lateral process of abdominal tergite III ; 143, siphunculus ; 144, cauda and anal plate.

(0.97×) ; segment I with 9 and II with 10 fine hairs, 0.07-0.11 mm long ; segment III bearing 36-39 transversely elongate, ciliated secondary rhinaria distributed over basal half of the segment ; hairs on flagellum numerous, fine, the longest on antennal segment III 0.20 mm long, about 2.5 as long as basal diameter of antennal segment III, processus terminalis 0.70-0.76× as long as base of antennal segment VI, which bears 1 hair. Rostrum reaches between fore and midcoxae, ultimate rostral segment 0.75× as long as second segment of hind tarsus and bears 20 hairs. Thoracic terga mottled with brown, pronotum with 31 hairs, the longest of which is 0.15 mm long, without marginal papillae. Abdominal dorsum pale with two transverse rectangular dark brown, spinopleural sclerites on tergites 4 and 5, furnished with minute roundish or oblong wax pore elements in clusters ; a few small sclerotic spots also present on tergites 3, 6 and 7 ; the other abdominal hairs not on sclerites. Longer spinal abdominal hairs 0.17-0.19 mm long, up to 2.5× as long basal diameter of antennal segment III ; spinopleural hairs arranged in a single row of 6-10 hairs on each tergite ; marginal hairs developed as 2-7 on each marginal lobe ; those of tergites 1-5 in part on short cone-shaped elevations ; 8th tergite with 13 hairs, 0.171-0.201 mm long. Siphunculi pale, without hairs, constricted near apex, with a distinct flange. Cauda pale, weakly knobbed and bears 20 fine hairs, knob bearing a small dorsal hump with 1 hair. Subanal plate scarcely indented. Rudimentary gonapophyses 2. Legs with femora pale and mottled with brown near apex, tibiae pale brown with apices black ; tarsi black ; legs bearing numerous fine hairs, the longest on tibiae 0.266 mm long or up to 4.0× distal width of tibia ; apical part of tibiae and second segment of tarsi spinulose ; hairs on inner margin near apex of tibia not spiny, but rostral organ developed. First tarsal segments with 6-7 ventral and 2 dorsal hairs. Wing venation normal.

Colour —Not recorded.

Measurements in mm.—

Length	Width	Antenna
3.28	1.36	2.85

III	Ant. segments			urs	ht ₂	Siph.
	IV	V	VI			
1.92	1.04	0.76	(0.29+0.20)	0.18	0.24	0.19

(ex *Betula*, Kufri, Simla, India, 10.vii.1968, Coll. K. D. Verma, British Museum Coll., BM 1984-340).

Alatoid nymph and first instar nymph.—Not known.

Types.—Holotype : alate vivipara from *Betula* sp., Kufri, S. Simla, India, 10.VI.1968, K. D. Verma, No. BM 1984-340 in British Museum Collection. No other specimens known.

Discussion.—This species was originally identified as *Euceraphis pilosa* Nevsky by the late Dr. D. Hille Ris Lambers. However, if one reads carefully Nevsky's (1929) original description, the specimen from India does not fit it, because Nevsky states that his species has 'antennae not much longer than $\frac{1}{2}$ body length, antennae completely black, cauda and anal plate brownish, legs black with only bases of femora pale' Also *E. pilosa* was found on *Betula alba*, a host plant which does not occur in India. It appears that Nevsky's description refers to *Clethrobium comes* Walker. The new species which is named after its collector, Dr. K. D. Verma, differs from the other *Clethrobium* species known from India in having paler legs, pale siphunculi without hairs and also in having less dorsal body setae and these are mostly not placed on sclerites.

Distribution.—India : Himachal Pradesh.

Types.—In the collections of British Museum (Nat. Hist.), London (BM 1984-340).

Genus 6. *Cranaphis* Takahashi, 1939

1939. *Cranaphis* Takahashi, R., *Philipp. J. Sci.*, 69 : 28 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980, *In Aphids of North East India and Bhutan*, 288. Type species : *Myzocallis formosanus* Takahashi.

Morphology.—Body 2.0-2.3 mm long. Head without frontal tubercles but with a strong median prominence and epicranial suture. Dorsal cephalic hairs long, with acute apices. Antennae 6-segmented, usually shorter than the body ; secondary rhinaria

circular to elliptical, ciliated and restricted to the antennal segment III ; primary rhinaria ciliated ; hairs on flagellum short with acute apices ; processus terminalis subequal to base of segment VI. Rostrum short, hardly reaching beyond fore coxae, ultimate rostral segment shorter than second segment of hind tarsus and with a few accessory hairs. Abdominal dorsum pale, bearing large spinal and smaller marginal irregular sclerotic patches which may be fused in posterior tergites into transverse bands ; hairs on the dorsum short and fine, arranged in two spinal and two marginal rows, spinal ones on flat bosses, those on 7th tergite laterally displaced. 8th tergite with upto 8 hairs, sometimes with a median prominence bearing a stout, bent hair. Siphunculi small, truncate, shorter than wide, sometimes with spinulose imbrications. Cauda distinctly knobbed. Subanal plate bilobed ; rudimentary gonapophyses 2. Subgenital plate with 8-10 hairs on posterior margin. Fore coxae enlarged. Legs variably spinulose over length ; apical tibial hairs differentiated, thick and spiny ; first tarsal segments with 5 ventral and 2 dorsal hairs ; empodial hairs flattened. Minute wax gland pores present on dorsum of head, antennae and on part of femora and tibiae. Wing venation normal, veins of forewing little dusky at apices.

Only known by alate viviparae. Third instar nymph of *indica* resembles the adult in its chaetotaxy, rostrum, siphunculi and spinulosity of legs but hairs on the dorsum appear slightly spatulate.

Sexual forms are not known.

Discussion.—Takahashi (1939), while describing the genus, differentiated it from *Monellia* Oestlund and *Myzocallis* Passerini, by the very short siphunculi and median frontal prominence. Chakrabarti and Raychaudhuri (1975) and later Raychaudhuri, Chakrabarti, Basu and Ghosh (1980) referred to its similarity with *Tinocalloides* A. N. Basu and *Takecallis* Matsumura in having groups of wax pores on sclerotic parts but separable from both by its very short siphunculi, very short apical rostral segment, etc. Only two species are now recognised under the genus, viz., *formosanus* Takahashi (1924) from Taiwan and *indica* Chakrabarti and Raychaudhuri, 1976 from India ; of the three other described species, *arudinariae* Takahashi is being considered under

Shivaphis Das, *pilosa* David et al. under *Subtakecallis* Raychaudhuri and Pal and to accommodate *bambusicola* a new genus *Neocranaphis* is proposed because of very short apical rostral segment, setiform arolia and wax-gland pore element not biscuit-shaped and developed, frontal tubercles, all in contrast to *Shivaphis*.

Biology.—Both the species are known only by alate viviparae from *Arundinaria* sp., growing in temperate hills in Taiwan and India. Both the species have been collected during the month of December and none seems to form any sizeable colony. Ant attendance is not known.

Distribution.—India ; Taiwan.

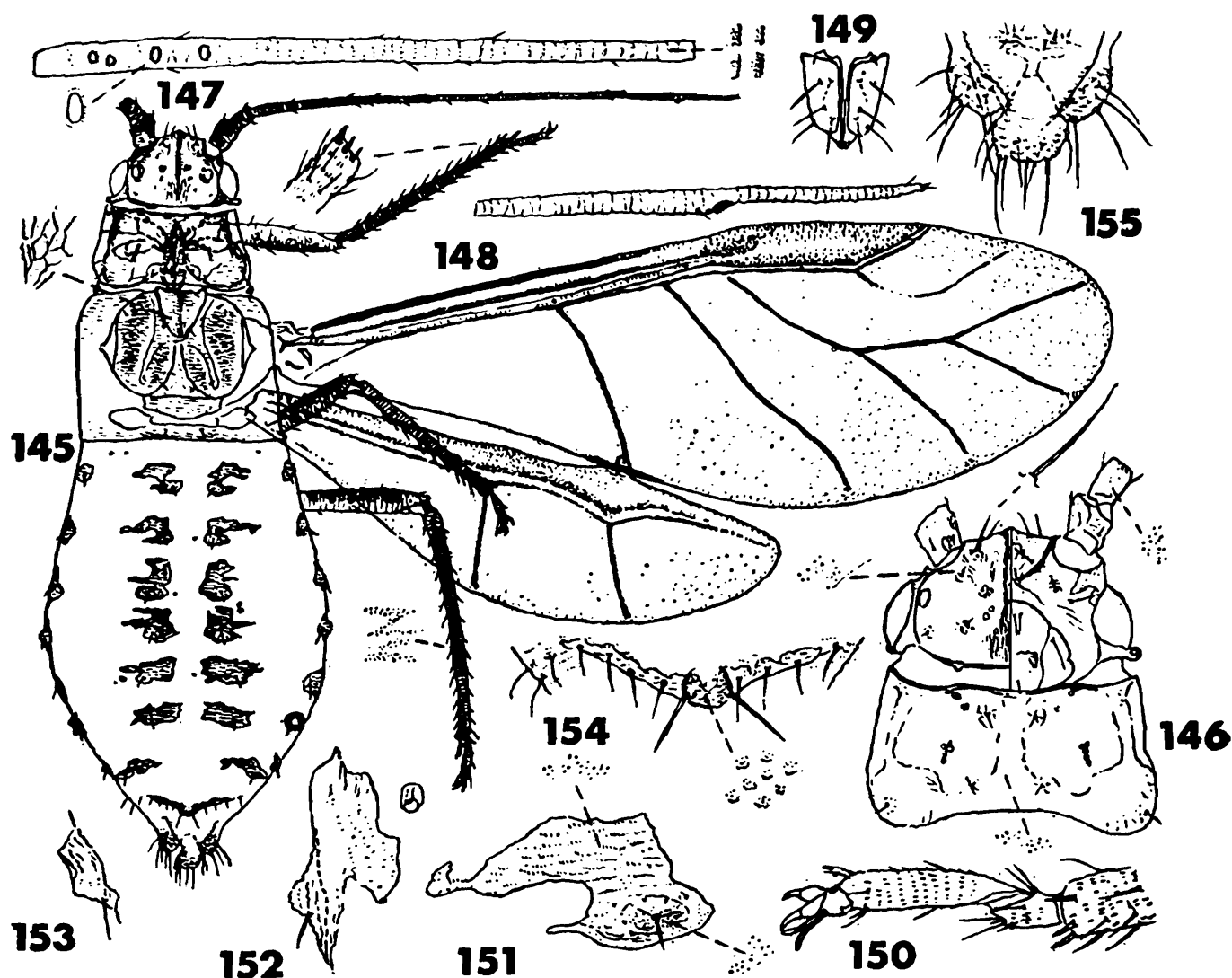
Type species.—*Myzocallis formosanus* Takahashi, 1924 ; deposited in the Taiwan Agricultural Research Institute, Taipei, Taiwan.

11. ***Cranaphis indica* Chakrabarti & Raychaudhuri**
(Figs. 145-161)

1976. *Cranaphis indica* Chakrabarti, S. and Raychaudhuri, D. N., *Orient Insects*, 10 (3) : 446.

1980. *Cranaphis indica*, Raychaudhuri, D. N., Chakrabarti ; S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 289.

Alate viviparous female.—Body elongate 2.25 mm long with 0.88 mm as maximum width. Head brown, without frontal tubercles ; vertex with a median groove, on ventral side of head epicranial suture well developed ; frons slightly protruded in the middle ; dorsal cephalic hairs 0.011-0.036 mm long, $0.40-1.2\times$ ($-3.0\times$) as long as the basal diameter of antennal segment III. Antennae 6-segmented brownish, distinctly shorter than the body ; antennal segment III with 3-4 oval, ciliated secondary rhinaria ; hairs on flagellum sparse, up to 0.013 mm long, at most $0.40\times$ as long as the basal diameter of antennal segment III. Rostrum reaches little beyond forecoxae, ultimate rostral segment short, blunt, $0.30\times$ as long as second segment of hind tarsus and bears 2 pairs of accessory hairs. Abdominal dorsum pale, bearing pairs of irregular brown, sclerotic spinal patches on tergites 1-7, those on 7th widely separated ; small marginal



Cranaphis indica Chakrabarti & Raychaudhuri. 145-155, alate vivipara : 145, body ; 146, head and pronotum ; 147, antennal segment III ; 148,, antennal segment VI ; 149, apical rostral segment ; 150, hind tarsus ; 151, spinal abdominal sclerite ; 152, lateral process of abdominal tergite IV ; 153, siphunculus ; 154, abdominal tergite VIII ; 155, cauda and anal plate.

sclerites visible at least on pre-siphuncular tergites ; hairs on dorsum of abdomen short, on each of tergites 1-6 a pair of spinal hairs arises from low mammiform bases on the sclerites ; similarly each marginal lobe bears a single hair ; spinal hairs on 7th tergite shifted laterad ; 8th tergite with 8-12 hairs and with a median spinal hump-like process which bears a pair of short, thick hairs. Siphunculi small, truncated, with a hair on 6th tergite appended to the base. Cauda knobbed, bearing about 10 hairs. Subanal plate of tibiae and second tarsal segments variably spinulose , apical tibial hairs differentiated as short spines, other hairs with

acuminate to acute apices, 0.14-0.33 mm long ; first tarsal segments with 5 ventral hairs and 2 dorsal hairs. Wing venation normal, radial sector faintly drawn. Integument of sclerotic parts of body as well as legs and antennae provided with minute wax gland pores.

Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna		
2.25		0.85		1.52		
		Ant. segments				
III	IV	V	VI	urs	ht ₂	Siph.
1.51	0.28	0.20	(0.15 + ?)	0.05	0.12	0.03

(ex *Arundinaria* sp., Sinchal, Darjeeling, 13.i.1970, C.U. Coll.).

Third instar nymph.—Head brown with a distinct median line and protruded at the frons, bearing 4 anterior blunt to spatulate hairs on tuberculate bases. Antennae brown, 5-segmented, $0.45\times$ as long as the body. Ultimate rostral segment short, blunt, without secondary hairs. Abdominal dorsum with one pair each of wrinkled spinal and marginal sclerites on 1st-7th tergites and a completely sclerotic band on 8th tergite ; paired spinal and marginal sclerites also present on each of the thoracic tergites ; hairs on dorsum of abdomen blunt to spatulate at apices, present in 4 rows (spinal 0.019-0.23 mm long and marginal 0.033 mm long) ; spinal hairs on 7th tergite (0.060 mm long) shifted laterad ; 8th tergite with 6 long marginal hairs. Siphunculi little raised on brownish sclerite. Caudal segment with 4 hairs. Legs brown, stout, hind tibiae spinulose at apices.

Colour.—Not recorded.

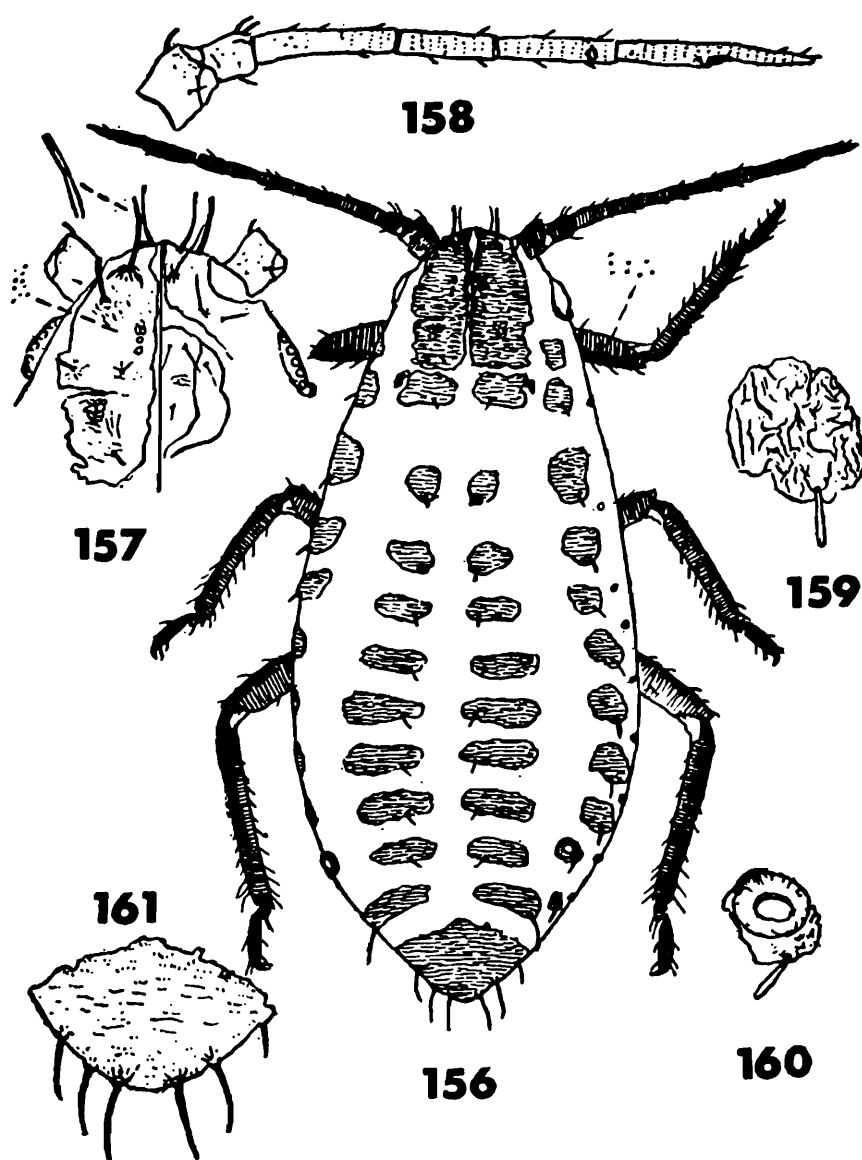
Measurements in mm.—

Length	Width	Antenna
1.65	0.73	0.74

Ant. segments			urs	ht ₂
III	IV	V		
0.27	0.12	(0.11+0.11)	0.06	0.09

(ex *Arundinaria* sp., Sinchal, Darjeeling, 13.i.1970, C.U. Coll.).

Material examined.—One alate viviparous female (Holotype) and two nymphs (Paratypes) from *Arundinaria* sp., Sinchal, Darjeeling, West Bengal, India, 13.I.1970. coll. S. Chakrabarti (C. U. colls.).



Cranaphis indica Chakrabarti & Raychaudhuri. 156-161, 3rd instar larva : 156, body ; 157, head ; 158, antenna ; 159, lateral sclerite of abdomen ; 160, siphunculus ; 161, abdominal tergite VIII.

Discussion.—The presence of long frontal hairs and of numerous hairs on the 8th tergite will help to differentiate this rare species from the related *Cranaphis formosana* (Takahashi). In spite of extensive surveys in Eastern Himalaya region, this species has not been recorded again since its collection in 1970.

Distribution.—India : West Bengal.

Types.—In the collections of Entomology Laboratory, University of Calcutta, Calcutta, India.

Genus 7. *Drepanosiphum* Koch 1855

1855. *Drepanosiphum* Koch, C., *Die Pflanzenläuse Aphiden*, Nürnberg, 201 ; Baker, A. C., 1920, *Bull. U. S. Dep. Agric.*, 826 : 32 ; Palmer, Miriam, 1952, *Aphids of the Rocky Mountain Region*, 88 ; Hille Ris Lambers, D., 1971, *Ent. Ber. Amst.*, 31 : 72 ; Eastop, V. F., 1966, *Aust. J. Zool.*, 14 : 507 ; Stroyan, H. L. G. 1977, *Handbk. Ident. Br. Insects*, II 4 (9) : 103 ; Heie, Ole, E., 1982, *Fauna ent. scand.*, 11 : 12. Type species : *Aphis platanoides* Schrank.

Morphology.—All viviparae alate. Body elongate, 2.5-4.0 mm. usually green or yellowish in life. Head with shallow frons, antennal tubercles diverging. Dorsal cephalic hairs acute, up to $2.0\times$ as long as basal diameter of antennal segment III. Antennae 6-segmented, always longer than the body; secondary rhinaria transverse or oval, restricted to antennal segment III ; secondary, accessory and primary rhinaria ciliated ; accessory rhinaria on segment VI, not entirely in a group but one placed at the base of VI and another located on the processus terminalis ; hairs on flagellum fine and acute, about $0.50\times$ as long as basal diameter of segment III ; processus terminalis always very long, upto $10.5\times$ as long as base of segment VI. Rostrum hardly reaches mid-coxae, ultimate rostral segment $0.8-0.9\times$ as long as second segment of hind tarsus and bears 6-25 accessory hairs. Abdominal dorsum without any processes or wax-pores but often with sclerotic transverse bands in the mid-dorsal region, either on 4th-5th or on 2nd-7th tergites besides pre-siphuncular sclerites ; other marginal sclerites variably developed. Spiracles on 1st and 2nd tergites placed apart. Hairs on dorsum of abdomen fine ; each of 1st-6th tergite, with a pair of spinal hairs, a pair of pleural hairs and one marginal hair on each side, making a total of 6 hairs per tergite ; 7th tergite with

4-6 hairs, 8th tergite with 4-5 hairs. Siphunculi upto $0.25\times$ as long as the body, elongate or vasiform, thick, usually slightly swollen, with a distinct subapical constriction before the well developed apical flange, without apical reticulation and smooth over the surface. Cauda distinctly knobbed with 5-6 hairs. Subanal plate entire, rounded. Rudimentary gonapophyses 3. Subgenital plate with an anterior group of 10-22 hairs including 2-4 long hairs and a posterior group of 16-22 hairs. Legs with front femora and base of front tibiae enlarged; apices of tibiae and second tarsal segments strongly spinulose, the former with 3-5 strong, sclerotic, black teeth-like rastral organ (short spines); first tarsal segments with 7 ventral hairs including a median sense peg and 2 dorsal hairs; empodial hairs flattened. Wing venation normal.

First instar larva pale, without scleroites. Antennae 4-5 segmented. Pleural hairs absent on 7th tergite. Dorsal hairs long, capitate, arranged in 6 longitudinal rows except on pronotum and 7th-8th tergites.

Males alate. Secondary rhinaria small, distributed on segments III (140-210), IV (23-60), V (3-15). Genitalia well developed. Otherwise as in alate viviparae (Eastop, 1966).

Ovipare apterous or variably alatiform. Antennae usually without, alatoid-intermediate oviparae of some species with secondary rhinaria. Dorsal hairs may be subacute, blunt or nearly capitate, 8th abdominal tergite with few long hairs besides a variable number of small hairs. Dorsal pigmentation variable. Cauda without constriction, bearing 14-20 hairs. Legs with hind tibiae feebly swollen, with 50-200 pseudosensoria (Stroyan, 1977).

Discussion.—The genus contains 9 species, viz., *acerinum* (Walker) from western and central Europe, *aceris* Koch from Europe, *braggii* Gillette from western part of U.S.A., *californicum* Mordvilko from western part of U.S.A., *caucasicum* Dzhibl., from Caucasus in U.S.S.R., *dixoni* Hille Ris Lambers from western and central Europe, *oregonensis* Granovsky from central and western Europe, western U.S.A., India, *platanoides* (Schrank) from Europe, North America and subspecies *iranicum* H.R.L. from Iran, and *quercifoliae* Walsh from North America; but the subspecies

californicum Mordvilko and *quercifoliae* Walsh appear to be questionable. As such most of the species are either Palaearctic or Holarctic in distribution. Hille Ris Lambers (1971) while describing *dixonii* and *iranicum* discussed in details the variation in pigmentation of the wing, brachyptery, and occurrence of ocelli and secondary rhinaria in oviparae and also provided a key to the seven species and one subspecies, excluding *californicum* and *quercifoliae*. The members of the genus are easily recognisable by long antenna, long processus terminalis and typical shape of siphunculi besides exclusive association with plants of Aceraceae. Dixon and his associates (1970, 1973, 1976) presented findings on spatial gregariousness of these aphids. During midsummer, the aphids remain evenly settled all over the leaves, preferring minor veins of large leaves but major veins of small leaves ; when disturbed these aphids can leave the leaves all in a quick succession by stretching out the forelegs, withdrawing the stylets and thus being released from leaf surface. During windy condition these aphids tend to congregate in the basal part of large leaves, but with normal condition, they assume former positions. Heie (1982) has dealt with 5 species of the genus in Scandinavia.

Biology.—All species of the genus are associated with *Acer* spp., and at least 5 species are holocyclic on these plants. The sexuales in Europe are normally produced in autumn and move out to the branches and trunk and lay eggs in crevices of bark. Parthenogenetic reproduction may take place during spring, summer and early autumn in Iran. In U.S.A., fundatrices of *bragii* appear during May-June, alate summer vivipare during June-October, oviparae during September-November and males during September-October. In India, only viviparae have been collected during May-June.

Distribution.—India ; Iran ; Europe ; North America ; Australia.

Type species.—*Aphis platanoides* Schrank 1801. Location of types not known.

Key to the species of *Drepanosiphum* Koch

Alate viviparous females —

Ocelli often ringed with dark brown. Outer margin of antennal sockets pale. Abdo-

men pale or with 3-6 dark sclerotic mutually free spinopleural bars. Embryo with long knobbed spinal hairs on abdominal tergites 1-6. Antennal segment III with 12-26 secondary rhinaria. Ultimate rostral segment 0.14-0.17 mm long. Fore femur moderately enlarged

.platanoides (Schrank)

—Ocelli not ringed with dark brown. Outer margin of antennal sockets dark. Abdomen without bars, often with black spots near bases of siphunculi. Embryo with inconspicuous hairs on abdominal tergites 1-6. Antennal segment III with 8-17 secondary rhinaria. Ultimate rostral segment rarely exceeds 0.13 mm in length. Fore femur rather strongly enlarged

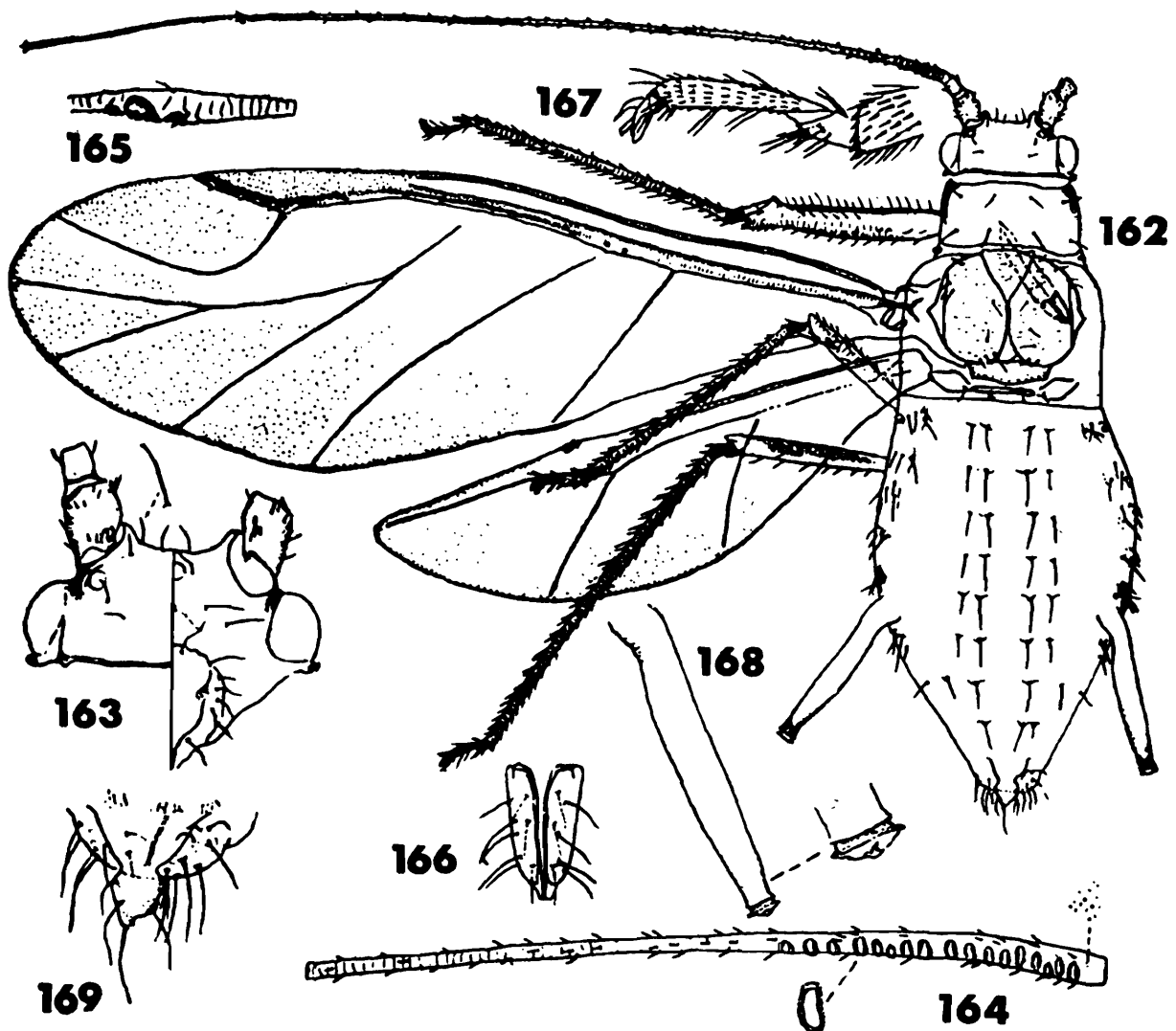
oregonensis Granovsky

12. *Drepanosiphum oregonensis* Granovsky (Figs. 162-172)

1939. *Drepanosiphum oregonensis* Granovsky, A. A., *Proc. ent. Soc. Wash.*, **41** : 143.
 1940. *Drepanosiphum zimmermanni* Börner, C., *Neue Blattläuse aus Mitteleuropa*. Selbstverlag des Verfassers. Nürnberg : 2.
 1961. *Drepanosiphum steven* Bozhko, M.P., *Hor. Soc. ent. Un. Sovieticae*, **48** : 10.
 1971. *Drepanosiphum oregonensis*, Hille Ris Lambers, D., *Ent. Ber., Amst.*, **81** : 75.
 1979. *Drepanosiphum oregonensis*, Maity, S.P., Ph.D. Thesis, Kalyani Univ., 365.
 1982. *Drepanosiphum oregonensis*, Heie Ole, E., *Fauna ent. Scand.*, **11** : 16.

Alate vivipara.—Body 2.3-3.3 mm long with 0.72-1.34 as maximum width. Frons distinctly emarginated with a slight median convexity ; ocelli are not ringed with dark brown circles but the outer margin of the antennal socket is black ; dorsal cephalic hairs fine, acute or nearly so, up to 0.04-0.06 mm long, at most equal to the basal diameter of antennal segment III. Antennae 6-segmented, brown to dark brown except segment III which is mostly pale brown with apex and base contrasting black and a narrow pale zone at the very base, distinctly longer than the body (1.3-1.7 ×) ; segment III with 8-18 (12-15) ciliated secondary rhinaria ; hairs on flagellum fine and acute, 0.015-0.020 mm long, 0.30 × as long as the basal diameter of antennal segment III ; processus terminalis about 7.0 times as long as the base of segment VI. Pro-

notum with two pairs of spinal hairs (0.08 mm long) and two pairs of marginal hairs of same length. Rostrum reaches between fore and middle coxae, ultimate rostral segment $0.76-0.86\times$ as long as second segment of hind tarsus and bears 7-10 accessory hairs. Thorax orange brown, sometimes with blackish mesosternum. Abdominal dorsum pale, sometimes with blackish spots near bases of siphunculi, but without transverse black bands; abdominal tergites 1-6 each with a pair of spinal hairs which may be up to 0.150 mm long and a pair of pleural hairs (0.083 mm): tergite 7 sometimes without pleural hairs; 8th tergite with 3-4 hairs up to 0.090 mm long; marginal hairs in clusters containing



Drepanosiphum oregonensis Granovsky. 162-169, alate vivipara: 162, body; 163, head; 164, antennal segment III; 165, base of antennal segment VI; 166, apical rostral segment; 167, hind tarsus; 168, siphunculus; 169, cauda and anal plate.

one long hair and several short ones on each lateral lobe of tergites 1-6 ; marginal sclerites sometimes developed on tergites 4 and 5. Siphunculi long, vasiform, nearly smooth and with a strongly marked circumcission before the apical flange, $0.22-0.36\times$ as long as the body. Cauda small knobbed, bearing 5 hairs. Subanal plate entire. Rudimentary gonapophyses 3. Legs with coxae normal, front femora enlarged, much thicker than siphunculi, with a blackish ventral stripe ; apices of tibiae with 5-6 dark teeth ; apical half of tibiae and second tarsal segment spinulose ; first tarsal segments with 7 ventral hairs including medioapical sense-peg and 2 dorsal hairs. Wing venation normal without any terminal pigmentation.

Colour.—Orange-yellow with a greenish tinge ; head often shaded to brick red (Granovsky, 1939).

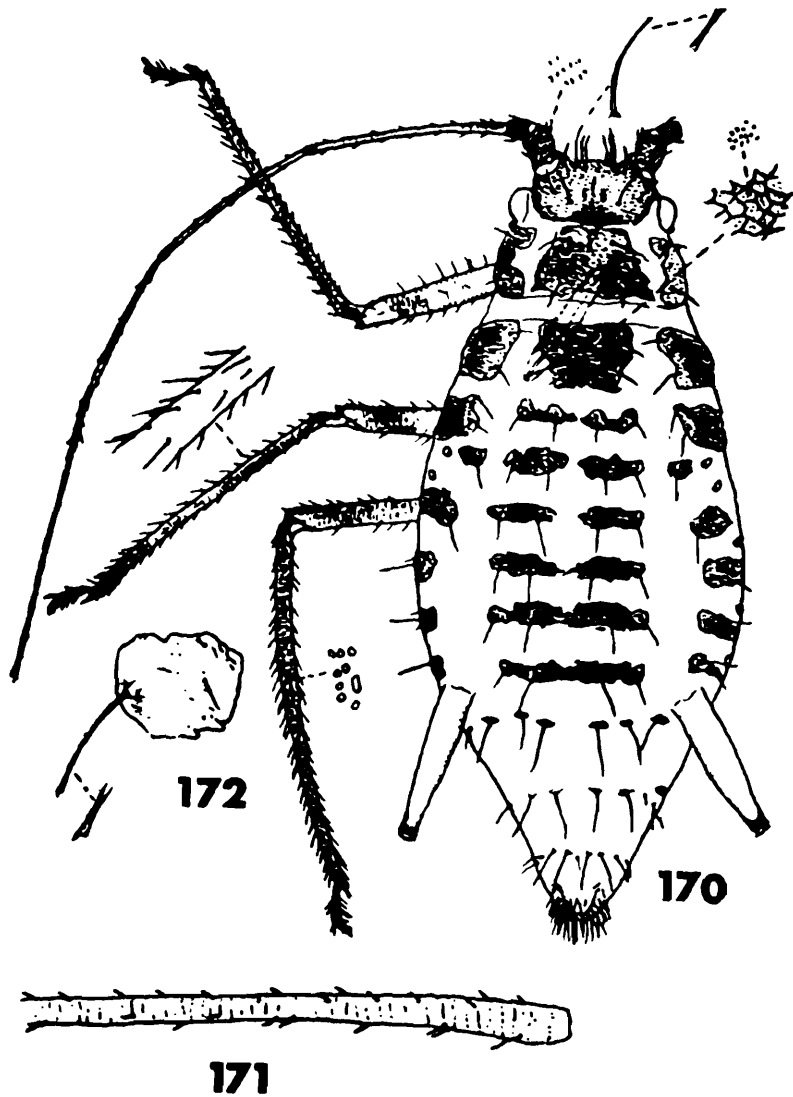
Measurements in mm.—

Length		Width		Antenna	
3.0		0.9		4.73	
Ant. segments		urs		ht ₂	
III	IV	V	VI		
1.22	1.04	1.83	0.14+1.05	0.12	0.16

(ex *Acer oblongum*, Mussoorie, U.P., 23.iv.1976, S. P. Maity coll.).

Embryo and first instar.—Dorsum with spinal and pleural hairs short and inconspicuous, the latter present from mesonotum to 6th abdominal tergite ; marginal hairs on abdomen and spinal hairs on tergites 7 and 8 elongate, with incrassate apices ; pigmentation absent ; antennae 4- to 5-segmented.

Alate male.—(after Heie 1982). Body slender. Antennae entirely dark, bearing numerous scattered secondary rhinaria on III (81), IV (26) and V (19) and none on base segment VI. Abdominal dorsum with dark transverse sclerotic spinopleural bars on tergites 1-7 and dark marginal sclerites on tergites 2-5 (6) Otherwise as in alate viviparae.



Drepanosiphum oregonensis Granovsky. 170-172, ovipara : 170, body ; 171, basal part of antennal segment III ; 172, lateral sclerite of abdominal segment II.

Ovipara.—(after Heie, 1982). Body olive green. Antennae without secondary rhinaria. Abdominal dorsum with segmentally developed crossbars on antesiphuncular tergites besides marginal sclerites, posterior portion of abdomen not drawn out. Hind tibiae swollen on basal part and with numerous pseudosensoria.

Material examined.—One alate vivipara, from *Acer oblongum*, Mussoorie, Uttar Pradesh, India, 23.vi.1976, (S. P. Maity coll.) ; several alate viviparae from *Acer monspessulanum* and *Acer opalus*, Berlin Botanic Garden, Germany, 26.ix.1974, (LFC Coll., Ste-Foy, Quebec, Canada).

Discussion.—This species feeds singly on *Acer monspessulanum*, *A. macrophyllum*, *A. trautvetteri* and *A. oblongum*. It is very similar to *D. platanoides* but can be at once distinguished by the absence of black circles around the ocelli and by the more strongly enlarged stouter fore femora.

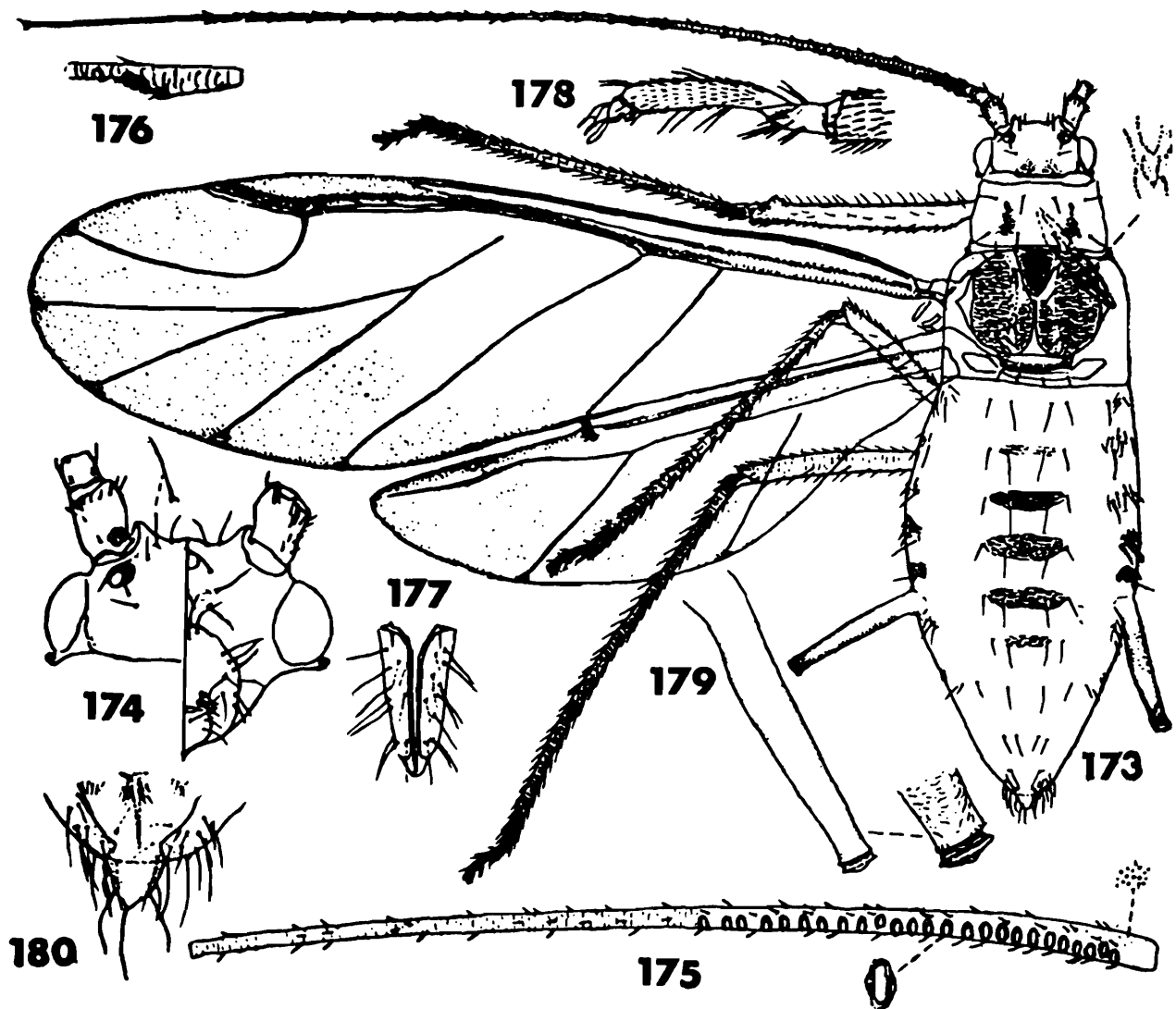
Distribution.—India : Uttar Pradesh ; Turkey ; Crimea ; Europe except northern region ; western North America.

Types.—In United States National Museum, Washington D.C., U.S.A.

13. *Drepanosiphum platanoides* (Schrank) (Figs. 173-183)

1801. *Aphis platanoides* Schrank F.V.P. *Fauna Boica* II, Ingolstadt, 2 : 112.
 1841. *Aphis aceris pseudoplatani* Mosley. O. Gdnr's. *chron.* 1 : 628, 741-48, 827-28.
 1841. *Aphis platanoides* Hartig, Th., *German's Z. ent.* 3 : 359-376.
 1855. *Aphis smaragdinum* Koch, C.L., *Die Pflanz. Aphiden.*
 1855. *Aphis tiliae* Koch, C.L., *Die Pflanz. Aphiden.*, 235-236.
 1876. *Drepanosiphum platanoides*, Buckton, G.B., *Mon. Br. Aphides*, 1 : 183.
 1952. *Drepanosiphum platanoides*, Palmer, Miriam, *Aphids of the Rocky Mountain Region*, 89.
 1976. *Drepanosiphum platanoides*, Stroyan, H.L.G., *Handbk. Ident. Br. Insects.*, II 4(a) : 105.
 1982. *Drepanosiphum plantanoides*, Bhagat, R. C., *Geobios News Rept.* 1 : 33.

Alate viviparous female.—Body 2.7-4.3 mm long with 0.90-1.15 as maximum width. Frons distinctly emarginate with slight median convexity ; dorsal ocelli ringed with black circles ; dorsal cephalic hairs fine, acute, up to 0.06-0.07 mm long, at most equal to the basal diameter of antennal segment III. Antennae 6-segmented, brown to dark brown, except paler basal half of segment III, distinctly longer than the body (1.3-1.5 $\times$) ; segment III with 19-21 (13-26) ciliated secondary rhinaria ; hairs on flagellum fine and acute, hardly 0.06-0.020 mm long, 0.25 $\times$ as long as the basal diameter of antennal segment III ; processus terminalis not more than 7.0— as long as base of segment VI. Pronotum with two pairs of spinal hairs (0.100 mm long), and two pairs of marginal hairs (0.115 mm long). Rostrum reaches between fore and middle coxae, ultimate rostral segment 0.9 $\times$ (0.8—1.0 $\times$) as long as second segment of hind



Drepanosiphum platanoides (Schränk.). 173-180, alate vivipara : 173, body ; 174, head ; 175, antennal segment III ; 176, base of antennal segment VI ; 177 ; apical rostral segment ; 178, hind tarsus ; 179, siphunculus ; 180, cauda and anal plate.

tarsus and bears 8 (8-16) accessory hairs. Abdominal dorsum pale or bearing brown, irregular spino-pleural sclerites on tergites 2-7, those on 4th and 5th tergite being widest ; abdominal tergites 1-6 each with a pair of spinal hairs which may be up to 0.100-0.120 mm long and a pair of pleural hairs 0.066-0.070 mm long, 7th tergite sometimes without pleural hairs ; 8th tergite with 4-5 hairs upto 0.083 mm long ; marginal hairs in clusters containing one long hair and several short ones on each lateral lobe of tergites 1-7 ; marginal sclerites sometimes developed on tergites 4 and 5. Siphunculi long, vasiform, scabrous to nearly smooth and with a strongly marked circumcission before the apical

flange, $0.16-0.18\times$ as long as the body. Cauda small, knobbed, bearing 5 hairs. Subanal plate entire. Rudimentary gonapophyses 3. Legs with coxae normal, front femora enlarged ; apices of tibiae with 3-4 dark teeth ; apical half of tibiae and second tarsal segment spinulose ; first tarsal segments with 7 ventral hairs including medioapical sense-peg and 2 dorsal hairs. Wing venation normal without any terminal pigmentation.

Colour.—Pale green to grey green ; sometimes may be reddish or lilac-tinged (Stroyan, 1977).

Measurements in mm.—

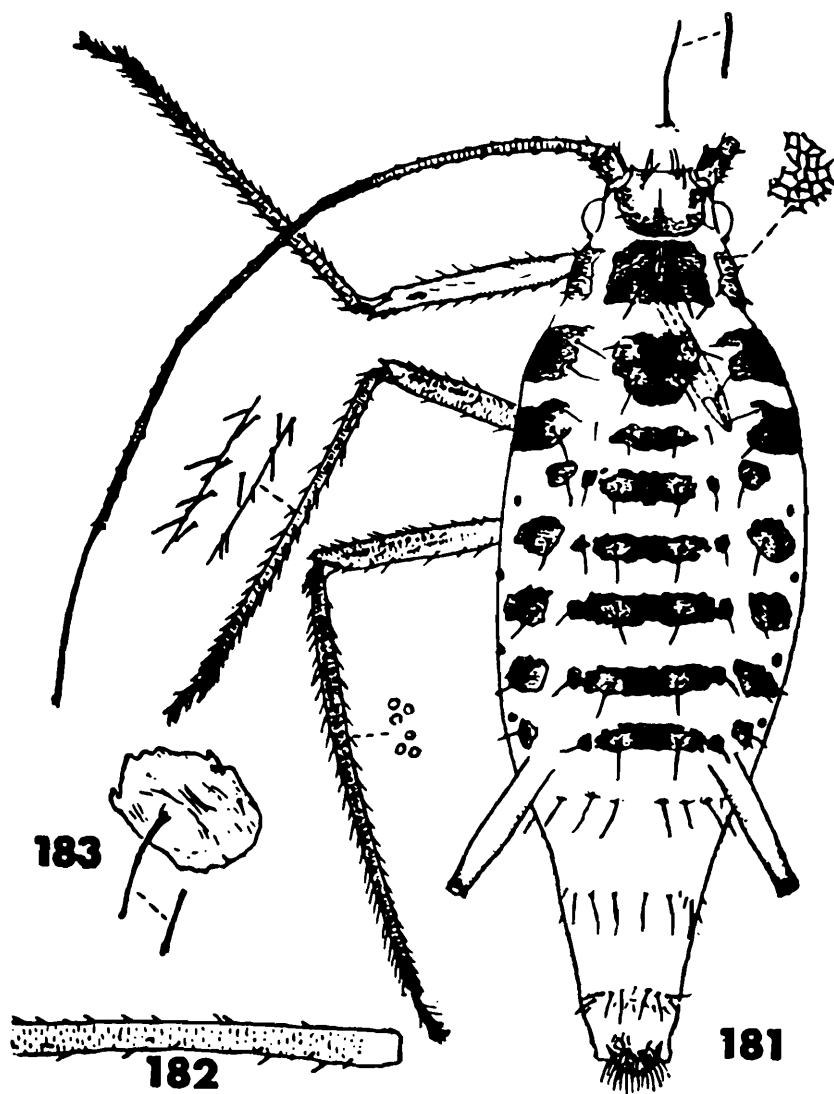
Length		Width		Antenna	
4.0		1.0		5.60	
Ant. segments		urs		ht ₂	
III	IV	V	VI		
1.65	1.38	1.10	(0.17+0.96)	0.17	0.18

(Vagrant, Jamunotri, U.P., 14.vi.1980, K.U. Coll.).

Embryo and first instar.—Dorsum with spinal and pleural hairs elongate, the latter present from mesonotum to 6th abdominal tergite ; pigmentation absent ; antennae in 1st instar 4-5 segmented.

Alate male.—(after Palmer, 1952 and Heie, 1982) Body slender. Antennae entirely dark, bearing numerous secondary rhinaria on III (125), IV (40-50) and V (5-36) and few (2-3) on base of segment VI. Abdominal dorsum with dark transverse sclerotic spinopleural hairs on tergites 1-7 and dark marginal sclerites on tergites 1-6, otherwise as in alate viviparae.

Alate oviparous female.—(after Palmer, 1952 and Heie, 1982) Body brown. Antennae without secondary rhinaria. Abdominal dorsum with segmentally developed cross bars on antesiphuncular tergites besides marginal sclerites ; posterior portion of abdomen drawn out to form an elongated ovipositor. Hind tibiae swollen on basal part and with numerous pseudosensoria.



Drepanosiphum platanoides (Schrank). 181-183, ovipara : 181, body ; 182, basal part of antennal segment III ; 183, lateral sclerite of abdominal segment II.

Material examined.—One alate viviparous female (Vagrant), Jamunotri, Uttar Pradesh, India, 14.vi.1980, (K.U. Coll.) ; one alate viviparous female from *Acer caesium* Khilanmarg, Kashmir, India, 21.iv.1976, (Kashmir, Univ. Colls.) ; two alate viviparous females from Sycamore leaf, Logan, Utah. U.S.A. 28.viii. 1971 (N.Z.C).

Discussion.—The variation of dorsal pigmentation is well known in *D. platanoides*. In the holarctic region, alates in autumn show distinct series of transverse bars across the abdomen and also black sclerotic spot near bases of each siphunculus ; however, specimens of the early generation which are without black bars (from the

same region) often lack a sclerotic spot near siphunculi ; Hille Ris Lambers (1971) considered a collection from *Acer cappadocicum* in Iran as a new subspecies *iranicum* because of presence of a dark spot near siphunculi combined with absence of other sclerotisation. However such variants are also found in Europe and it appears unlikely that they can be considered as a distinct subspecies. *D. platanoides* infests *Acer pseudoplatanus* and several other *Acer* species throughout its range of distribution. In the palaearctic region, viviparae occur from May till October and sexuales are produced in autumn and then they move to the branches and trunk and oviparae lay eggs in crevices of bark. The species infests the under surface of leaves of the host plants, often in large number. Dixon and his associates (1970, 1973, 1976) have studied in details the phenology and behaviour of *platanoides*. In India, the species was first collected from *Acer caesium* in Khilanmarg (c 3200 m), Kashmir, and a vagrant alate was collected later in Jamunotri, Uttar Pradesh, both during the month of June.

Distribution.—India : Uttar Pradesh, Kashmir ; Central Asia ; Turkey ; Europe ; Great Britain ; North America ; North Africa ; Tasmania ; New Zealand.

Types.—Location of types not known.

Genus 8. *Globulicaudaphis* Hille Ris Lambers

1966. *Globulicaudaphis* Hille Ris Lambers D., *Tijdschr. Ent.*, **109** : 207. Type species : *Globulicaudaphis pakistanica* Hille Ris Lambers.

Morphology.—Viviparae apterous or alate. Body 1.3-1.9 mm long. Head with poorly developed frontal tubercles, with a distinct median suture in apterae. Antennae 6—segmented, subequal to the length of the body, secondary rhinaria absent in apterae, in alatae roundish, ciliated, present only on segment III ; hairs on segment III in apterae capitate, shorter than basal diameter of the segment ; processus terminalis distinctly longer than base of segment VI. Rostrum reaches midcoxae, ultimate rostral segment subequal to second segment of hind tarsus bearing 4-6 accessory hairs. Abdominal dorsum with paired, free or partly fused spinal sclerites on 1st-4th tergite in both apterae and alatae, besides

variably developed marginal sclerites. Dorsal hairs in apterae appear capitate and long but in alatae shorter and thinner and with blunt or incrassate apices ; dorsal hairs mostly in spinal and marginal groups ; pleural hairs irregularly present ; 8th tergite with 8-9 hairs. Dorsal processes absent. Siphunculi short, truncate often fused at base with marginal sclerites of 6th abdominal tergite, which bears 2-3 hairs. Cauda without any constriction, apical part developed as a membranous colourless bladder with weakly sclerotic undersurface and of semicircular to globular shape with hairs on ventral surface. Subanal plates bilobed, lobes being widely separated ; rudimentary gonapophyses 2. Subgenital plate normal. Legs with tibiae spinulose apicad ; first tarsal segments with 5 ventral and 2 dorsal hairs ; empodial hairs flattened and enlarged at apices. Wing venation normal.

First instar larvae with spinal and marginal hairs mostly arising from dark sclerites and increasing in length caudad ; pleural hairs absent. Antennae 4-segmented. Cauda with 2 hairs placed ventrally.

Sexual forms not known.

Discussion.—The monotypic genus with *pakistanica* Hille Ris Lambers, as the type species appears to be very rare in the region, although several other species have more often been recorded on the same host group, *Quercus* spp. Hille Ris Lambers (1966) mentioned that in the nature of sclerotic pattern it resembles *Hoplochaetaphis* Aizenberg and perhaps appears most closely related to *Myzocallis* Passerini, but the peculiar structure of the cauda separates *Globulicaudaphis* from all other related genera.

Biology.—The only member of the genus is known from *Quercus dealbata*, a plant growing in temperate hills (c 2300 m) of North-western part of the subregion, in Pakistan. Since only viviparae have been recorded (both apterous and alate) no definite comments on its life cycle can be made.

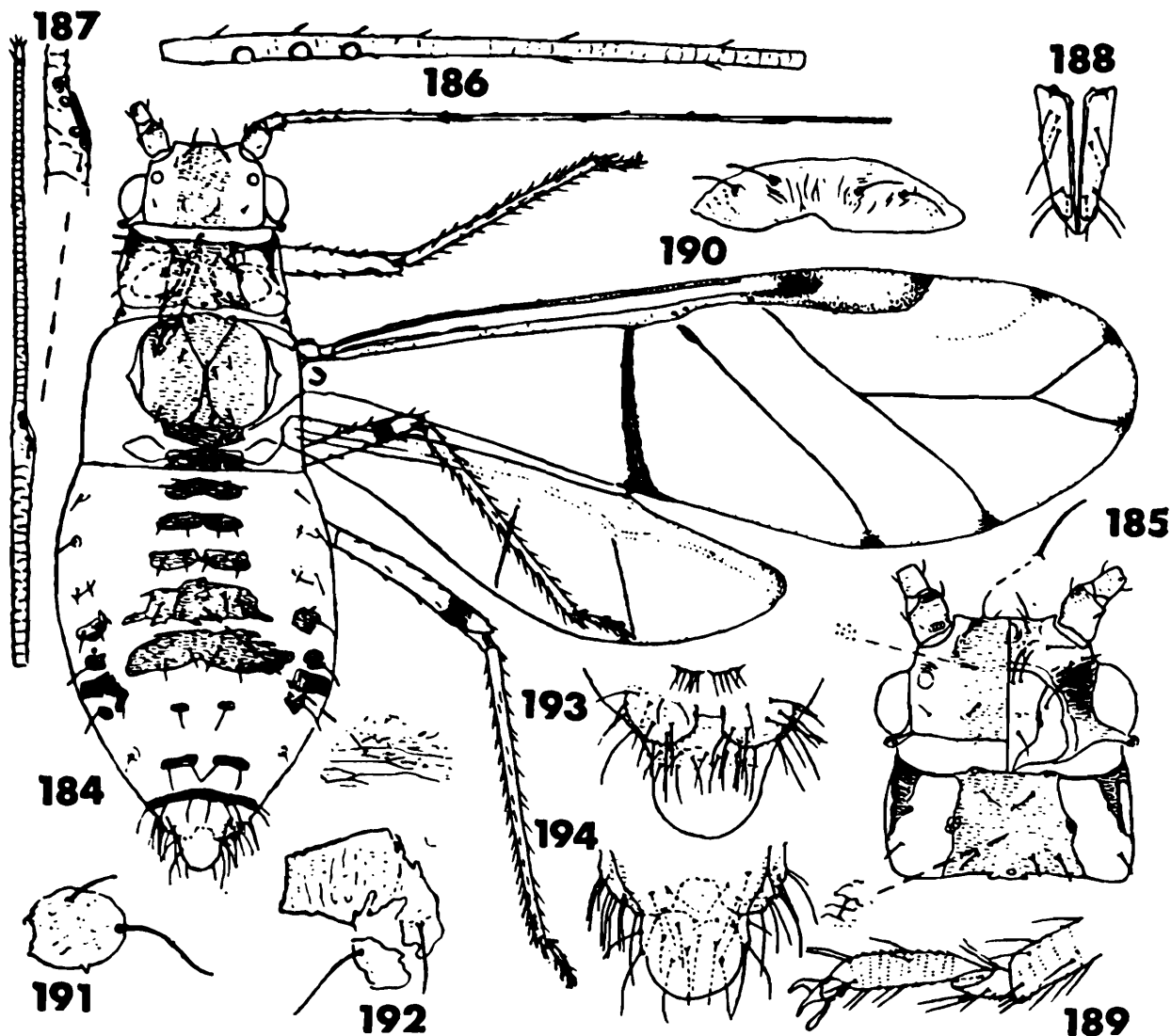
Distribution.—Pakistan.

Type species.—*Globulicaudaphis pakistanica* Hille Ris Lambers, 1966. Deposited in the collection of British Museum (Natural History), London, England.

14. *Globulicaudaphis pakistanica* Hille Ris Lambers
(Figs. 184–203)

1966. *Globulicaudaphis pakistanicus* Hille Ris Lambers, D., *Tijdschr. Ent.*, 109 : 207.

Apterous viviparous females.—Body elongate oval with paired sclerotic markings, 1.35–1.80 mm long with 0.80–0.96 mm as maximum width. Head pale anteriorly, vertex with a median groove and bearing four pairs of thick hairs, blunt or slightly expanded at apices, 0.08–0.10 mm long, up to $3.0\times$ as long as the basal diameter of antennal segment III ; posterior middle part of vertex with a dusky sclerite which is partly fused with a similar area on the pronotum. Dorsum of body with pairs of spinal rectangular dark sclerites on mesonotum, metanotum and abdominal tergites 1–7 of which the ones on tergite 4 have their posterior margin fused, and on tergite 5 become almost confluent with similar pleural and marginal sclerites, appearing as a broad, transverse, sclerotic band ; 8th tergite with a narrow transverse sclerotic band. Antennae 6-segmented, $0.91\text{--}1.02\times$ as long as the body, pale with dusky apices of the segments of the flagellum, without any secondary rhinaria ; hairs on segment I and II blunt to capitate, 0.03 mm long, on segment III, thinner and shorter (0.01 mm), hardly $0.33\times$ as long as the basal diameter of the segment ; processus terminalis $1.5\text{--}1.6\times$ as long as the base of antennal segment VI. Rostrum reaches mid-coxae, ultimate rostral segment subequal to second segment of hind tarsus and bears 4–6 accessory hairs. Dorsal body hairs thick, somewhat bent before the blunt or knobbed apices, 0.05–0.14 mm long, $2.0\text{--}4.0\times$ as long as the basal diameter of antennal segment III ; spinal sclerites of the mesonotum with 3 hairs each, those on metanotum and abdominal tergites 1–4 and 6–7 with 2 hairs (sometimes spinal sclerites on 6th and 7th tergites with one hair) but the transverse band across 5th tergite with 18–24 hairs ; 8th tergite with 8 hairs with acute apices up to 0.130 mm long and $4.0\times$ (— $6.5\times$) as long as the basal diameter of antennal segment III ; pleural hairs irregularly present on 1st–4th tergites ; marginal sclerites with 2–3 hairs on 1st–4th and on 6th and 7th tergites. Siphunculi conical, truncated, sclerotic, basally fused with marginal sclerites of 6th tergite, bearing 2–3 hairs. Knob of cauda bladder-like bearing 8–12 hairs on ventral side. Subanal plate bilobed, each lobe with 9–10 long hairs. Rudimentary gonapophyses



Globulicaudaphis pakistanica Hille Ris Lambers. 184-194, alate vivipara : 184, body ; 185, head and pronotum ; 186, antennal segment III ; 187, antennal segment VI ; 188, apical rostral segment ; 189, hind tarsus ; 190 spinal sclerite of abdominal tergite I ; 191, lateral sclerite of abdominal tergite V ; 192, siphunculus with lateral sclerite of abdominal tergite VI ; 193, cauda anal plate, ventral side ; 194, cauda and anal plate, dorsal side.

physes 2. Legs pale with dusky band around the apical portion of each femur ; tibiae spinulose near apices, apical tibial hairs not differentiated ; tarsi spinulose ; first tarsal segments with 5 ventral and 2 dorsal hairs.

Colour.—Pale greenish marked with dark olive green dorsal patterns and with apparent white, paired, waxy markings running laterally from the head to 0.66 portion of the body (Hille Ris Lambers, 1966).

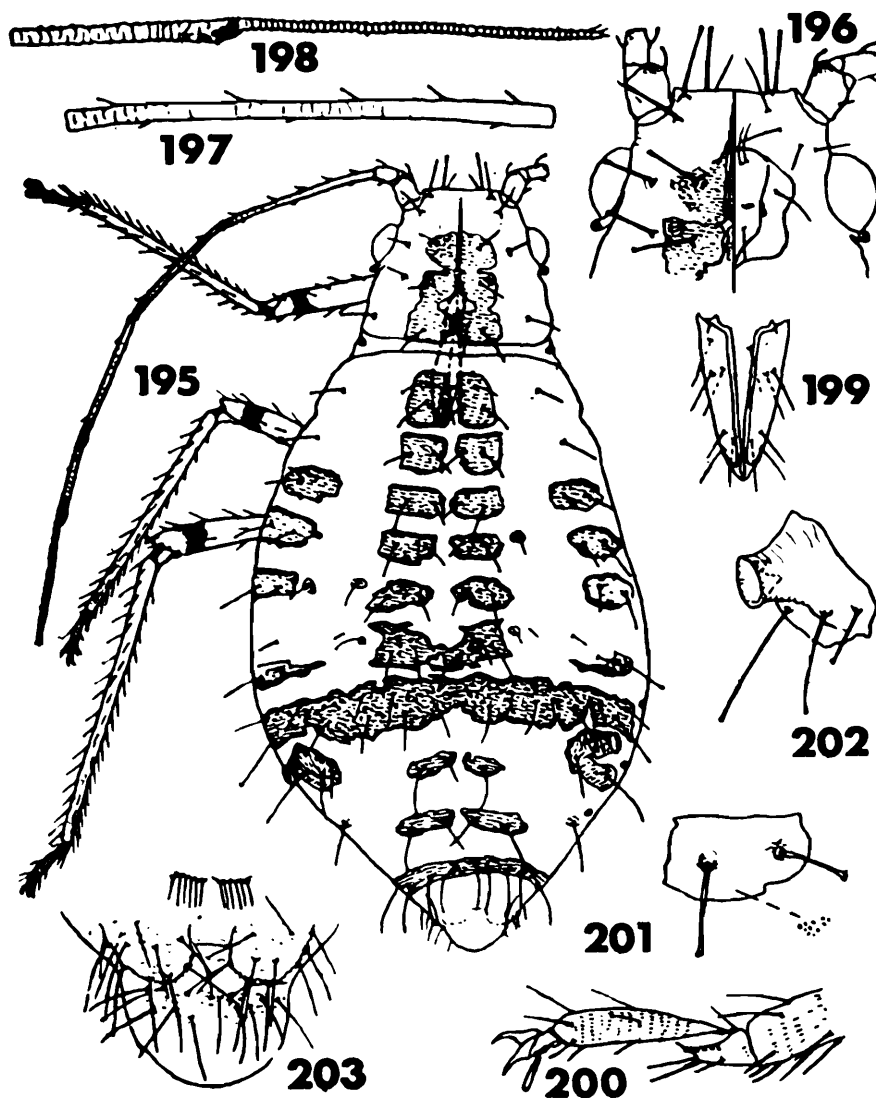
Measurements in mm.—

	Length	Width	Antenna
1.	1.80	0.99	—
2.	1.50	0.85	—
3.	1.79	—	1.63
4.	1.51	—	1.35
5.	1.35	—	1.39

	Ant. segments			urs	ht ₂	Siph.
III	IV	V	VI			
0.40	0.24	—	—	0.09	0.10	0.06
0.28	0.20	0.22	(0.15+?)	0.01	0.10	0.06
0.39	0.31	0.31	(0.19+0.29)	—	—	0.06
0.37	0.27	0.29	(0.18+0.25)	—	—	0.06
0.40	0.23	0.26	(0.15+0.25)	—	—	—

(1, 2, ex unidentified host, Simla, Himachal Pradesh, India, 14.xi. 1970, N.Z.C. ; 3, 5, *Quercus dealbata*? Murree, Pakistan, 30.vi.1964, data from D. Hille Ris Lambers, 1966).

Alate viviparous female.—(Not available, description based on Hille Ris Lambers, 1966). Body 1.85 mm long. Head with vertex laterally pale, dark smoky in the middle. Dorsum with middle portion of pronotum, middle part of meso- and metanotum, spinal sclerites on 1st-4th and 6th-7th abdominal tergites, a spino-pleural transverse sclerotic band on 5th tergite and a narrow transverse sclerotic band on 8th tergite, besides marginal sclerites on tergites 4 and 6 variably brown to dark, rest pale. Antennae 6-segmented, subequal to the length of body ; segment III with 2-3 rather large,



Globulicaudaphis pakistanica Hille Ris Lambers. 195-203, apterous vivipara : 195, body ; 196, head, 197, antennal segment III ; 198, antennal segment VI ; 199, apical rostral segment ; 200, hind tarsus ; 201, spinal sclerite of abdominal tergite II ; 202, siphunculus ; 203, cauda and anal plate, ventral side.

roundish, secondary rhinaria near base. Wing venation faint, except for vein Cu_2 which is bordered with dark brown and dusky tips of media and cubitus and a large brownish blotch near base of pterostigma ; hind wings with dusky tips.

Colour.—Not recorded.

Measurements in mm.—

Length	Antenna
1.85	1.77

III	Ant. segments			Siph.	Cauda
	IV	V	VI		
0.48	0.34	0.33	(0.19+0.29)	0.06	0.12

(Collection data same as for No. 3-5 of apterae viviparae).

Larva.—(Not available, description based on Hille Ris Lambers, 1966). Antennae 4-segmented, segment III with 2 hairs and segment IV with one hair. All spinal hairs and most of the marginal ones on dark sclerites ; all dorsal hairs placed at equal mutual distance and increasing in length from mesonotum towards cauda ; pleural hairs absent.

Material examined.—Two apterous viviparous females from unidentified host plant. Simla, Himachal Pradesh, India, 14.xi. 1970, coll. K. Narayanan (N.Z.C.).

Discussion.—Hille Ris Lambers (1966) pointed out that by the unique structure of cauda and more precisely the anal tergite, the genus can be separated from other members of related genera. This species was described from Murree Hills in Pakistan from collections made in June but subsequent collections in Simla Hills in India [from the same northwestern Himalaya region] indicates its occurrence also in November. It may be noted that the supposed host-plant *Quercus dealbata* also grows in northeastern hills of India but this species has never been collected from that host-plant in that region. The extensive surveys carried out in northeastern Himalaya during last 20 years, indicate that the species is rather rare in occurrence.

Distribution.—India : Himachal Pradesh ; Pakistan.

Types.—In the collections of British Museum (Nat. Hist.) London, England.

Genus 9. *Hoplocallis* Pintera, 1952

1952. *Hoplocallis* Pintera, A. Zool. ent. Listy, 3 : 151 ; Quednau. F. W. and Chakrabarti, S.. 1976, Can Ent., 108 : 408. Type species : *Hoplocallis rupertii* Pintera.

Morphology.—All viviparae alate. Body elongate, 2.0-2.5 mm long. Head distinctly protruded in the middle of frons. Dorsal cephalic hairs blunt or weakly to distinctly capitate. Antenna 6-segmented ; segment III with 2-5 oval or transversely oval secondary rhinaria ; hairs on flagellum pointed, blunt, or capitate, usually shorter than basal diameter of antennal segment VI ; processus terminalis 0.5-1.0× as long as base of segment VI. Rostrum reaches at most mid-coxae, ultimate rostral segment stiletto-shaped, up to twice as long as second segment of hind tarsus and bears 4-9 accessory hairs. Dorsal hairs on vertex and on pronotum in clusters, as also the spinal hairs (and also pleural hairs in *microsetosus*) on abdomen ; dorsal hairs may be acute to nearly capitate, hardly as long as basal diameter of antennal segment III ; marginal hairs multiple or sometimes single (on 7th and 8th tergites), usually on sclerites or on lateral processes (as on 3rd-4th tergites of *microsetosus*). Dorsum with a pale median line on vertex and thorax, separating the dark sclerotic areas, and on abdomen with paired spinal sclerites (at least on 1st-2nd tergite) which may be fused to form horse shoe shaped median blotches. Siphunculi small, smooth, truncate without apical flange. Cauda weakly to distinctly constricted and may bear upto 20 hairs. Subanal plate bilobed. Gonapophyses 2. Legs spinulose on parts of femora, apices of tibia and on tarsi ; first tarsal segments with 5 ventral and 2 dorsal hairs ; empodial hairs flattened or setiform with weakly expanded apices. Wing venation normal.

Embryos with dorsal body hairs long, spiny, capitate (*pictus*) blunt or pointed (*microsetosus*) with rough surface, arranged in four longitudinal rows ; pleural hairs absent. Antennae 4-segmented. Ultimate rostral segment stiletto-shaped, with accessory hairs.

Sexual forms not available. Oviparae are apterous.

Discussion.—The genus was described by Pintera (1952) with *ruperti* Pintera as the type species from Oaks in Europe. Richards (1968) while reviewing *Myzocallis* of the world mentioned that *Myzocallis pictus* (Ferrari) from Mediterranean region may be confused with *ruperti* but chaetotaxy of embryo and first instar nymph of *ruperti* is unlike those of *pictus*. Richards (op. cit.) also suggested that *Myzocallis boudyi* Mimeur and *M. bodenheimeri* Hille Ris Lambers, from the Middle East should be considered as synonyms of

pictus. Quednau and Chakrabarti (1976) while describing *microsetosus* from Oaks in North West India pointed out that this forms the third species of *Hoplocallis*, besides *ruperti* and *pictus*, and redefined *Hoplocallis* as a subgenus of *Myzocallis*. Eastop and Hille Ris Lambers (1976) considered *Hoplocallis* as a distinct genus containing two species, viz., *picta* (including its four synonyms) and *ruperti*, obviously not being aware of *microsetosus* from India. The genus is distinctive in having acutely-shaped rostrum, characteristic clusters of hairs on vertex and pronotum, variably shaped apices of hairs, extensive sclerotic patches on dorsum, etc.

Biology.—All the three species are known from Oaks (*Quercus* spp.). Bodenheimer and Swirski (1957) mentioned that in Israel, *H. picta* (*M. bodenneimeri*) leads autoecious holocyclic life cycle on *Quercus*. The sexuales, males and females appear during the month of December in this country. Eggs are laid on branches and usually in axiles of buds and hatch in February and become abundant during April-July but are scarce during hot, summer months. This species leads parthenogenetic cycle with adult fundatrices in March and alate viviparae from April to November.

Distribution.—India ; Eurasia ; North Africa ; South America.

Type species.—*Hoplocallis ruperti* Pintera, 1952. Deposited in the Institute of Entomology, Czechoslovak Academy of Sciences, Praha.

Key to the species of the genus *Hoplocallis* Pinters

Pleural abdominal hairs present in clusters.
Apical rostral segment stiletto-shaped,
about 1.75-2.10 times as long as second hind
tarsal segment, spinal abdominal sclerifica-
tions confined to the first two tergites.
Marginal abdominal processes III-V cone-
shaped. On *Quercus incana*

microsetosus Quednau
& Chakrabarti

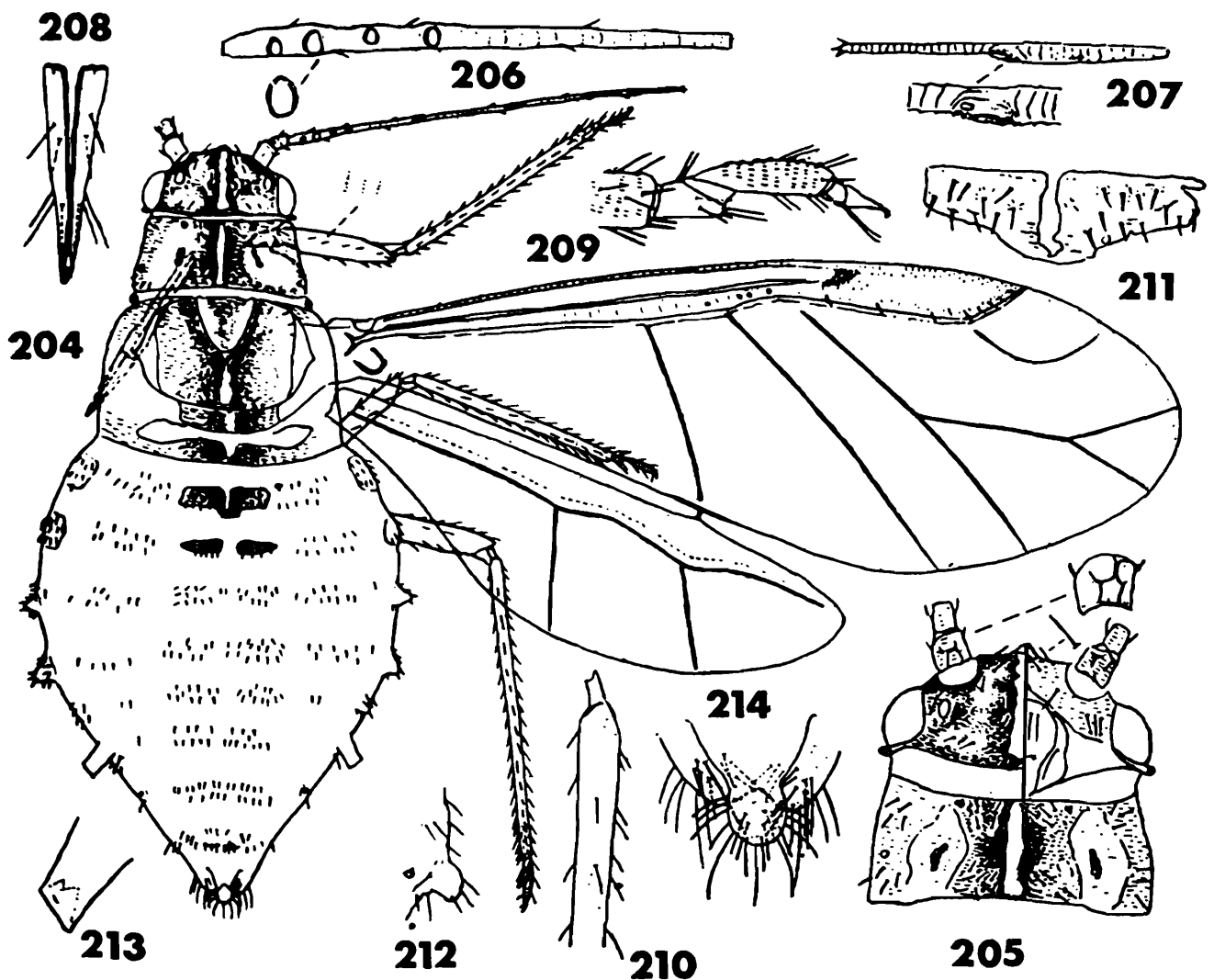
—Pleural abdominal hairs not developed.
Apical rostral segment acute and not excee-
ding 1.65 times the length of second hind
tarsal segment. Spinal abdominal sclerifica-
tions usually present on all tergites. Margi-
nal abdominal processes III-V very low or
undeveloped. On various species of ever-
green *Quercus*

pictus (Ferrari)

15. **Hoplocallis microsetosus** (Quednau & Chakrabarti : 1976)
(Figs. 204–214)

1976. *Myzocallis* (*Hoplocallis*) *microsetosus* Quednau, F. W., and Chakrabarti, S., *Can. Ent.*, 108 : 466.

Alate viviparous female.—Body 2.48 mm long with 1.20 mm as maximum width. Frons somewhat protruding, frontal and discal hairs pointed or very weakly capitate, up to 0.020 mm long, $0.75\times$ as long as basal diameter of antennal segment III ; posterior discal hairs present in groups, 0.016–0.20 mm long. Antennae pale yellow,



Hoplocallis microsetosus (Quednau & Chakrabarti). 204–214, alate vivipara : 204, body ; 205, head and pronotum ; 206, antennal segment III ; 207, antennal segment VI ; 208, apical rostral segment ; 209, hind tarsus ; 210, base of hind tibia ; 211, spinal sclerite of abdominal tergite I ; 212, lateral abdominal process ; 213, siphunculus ; 214, cauda and anal plate.

6-segmented, distinctly shorter than the body ; segment III with 3-5 roundish to oval secondary rhinaria distributed over basal 0.50 portion ; hairs on flagellum acute or weakly capitate, 0.013-0.016 mm long, up to $0.66\times$ as long as basal diameter of antennal segment III. Rostrum reaches mid-coxae, ultimate rostral segment stiletto-shaped, more than twice as long as second segment of hind tarsus and bears 4-5 accessory hairs besides preapicals. Pronotum with hairs in clusters, mostly with acute apices, sometimes with a marginal papilla. Abdominal dorsum pale, bearing paired spinal sclerites on 1st and 2nd tergites and short lateral abdominal process on tergites 2-5 ; hairs on the dorsum of abdomen small, acute or weakly capitate ; spinal hairs numerous, pleural hairs in clusters, marginal hairs in groups ; dorsal hairs measure up to same length as frontal hairs but marginal hairs on posterior tergites may be up to 0.033 mm long and $1.2\times$ as long as the basal diameter of antennal segment III. Siphunculi smooth, truncate. Cauda knobbed, bearing 18 hairs. Subanal plate indented with 12-15 hairs on each lobe. Gonochaetae in two clusters of 7-8 acute hairs each. Legs pale with short fine and sparse hairs on femora and stiff, acute and bluntish hairs on tibiae, the longest tibial hair on hind tibiae $0.75\times$ as long as the width at the middle of tibia ; first tarsal segment with 5 ventral hairs and 2 dorsal hairs ; apices of tibiae and whole of tarsi spinulose. Wing venation normal ; veins never ending in dusky tips.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna			
2.48	1.2	1.38			
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.50	0.30	0.26	(0.130+0.115)	0.230	0.100

(ex *Quercus incana*, Nainital, U.P., 7.v.1970, K.U. Coll.).

Embryo.—(after Quednau & Chakrabarti, 1976). Dorsal hairs elongate spine-like, blunt or acute, spinulose, arranged in 4 longitudinal rows ; spinal and marginal hairs, one pair per segment,

except on pronotum, where spinals are duplicated and on 8th tergite where marginals are absent; pleural hairs absent. Antennal chaetotaxy 1+1, 1, 2, 1. Ultimate rostral segment stiletto-shaped, with 4 accessory hairs.

Material examined.—One alate viviparous female from *Quercus incana*, Nainital, Uttar Pradesh, India, 7.iv.1970, coll. S. Chakrabarti (Paratype : K. U. Coll.)

Discussion.—This species can be separated from its close allies, *H. pictus* (Ferrari) and *H. rupertii* Pintera, by the very long ultimate rostral segment, smaller anal segment and presence of extensive fields of pleural hairs. The species is known only from *Quercus incana* in the Ranikhet-Nainital region of Uttar Pradesh and appears to be common during the months of April-May.

Distribution.—India : Uttar Pradesh.

Types.—In the collections of Department of Zoology, University of Kalyani, Kalyani, India.

16. *Hoplocallis pictus* (Ferrari) (Figs. 754-765)

1872 *Pterocallis pictus* Ferrari, P.M., *Ann. Mus. Ciudad. Stor. Nat.*, 2 : 77.

1934 *Myzocallis boudyi* Mimeur, J.M., *Mem. Soc. Nat. Phys. Maroc.*, 40 : 12.

1939 *Tuberculoides grodsinskyi* Blanchard, E.E., *Physis*, 12 : 883.

1948 *Myzocallis bodenheimeri* Hille Ris Lambers, D., *Trans. R. Ent. Soc.*, London, 99 : 281.

1957 *Myzocallis pictus*, Stroyan, H.L.G., *Trans. R. ent. Soc. London*, 109 : 344.

1968 *Myzocallis (Agrioaphis) picta*, Richards, W.R., *Mem. ent. Soc. Canada*, 57 : 57.

Alate vivipara.—Body 1.8-2.2 mm long with 0.9 mm as maximum width. Front with well developed median protrusion, ocellus visible when head is viewed from above. Frontal setae blunt or weakly capitate, slightly longer than the greatest basal diameter of antennal segment III. Discal setae of vertex blunt or pointed, the longest shorter than the mentioned diameter. Vertex with two brownish paramedian spots leaving a narrow pale median line, paler brown or colourless laterally. Antennae 0.6 times body length, segment I pale, segment II brownish, the remainder pale with brownish apices and spiculose imbrications. Setae on flagellum sparse, pointed, blunt or weakly capitate, the longest on

antennal segment III about half as long as the basal diameter of the segment ; processus terminalis shorter (0.7 times) than base of segment VI. Antennal segment III with 2-4 roundish secondary rhinaria. Rostrum extending between fore and middle coxae , apical rostral segment acute, 1.3-1.4 times as long as second segment of hind tarsus, with 6-9 secondary hairs. Pronotum with two paramedian spots as on vertex and a trace of brown on anterior angles, with clusters of anterior and posterior spinal and lateral hairs, of same shape and length as discal hairs of vertex. Pterothorax brown mesally, pale at sides. Wings almost colourless, with a small diffuse brown spot at base of stigma, radial sector complete. Legs almost colourless. Fore coxae not enlarged. Tibial hairs pointed and capitate, the longest equal to distal width of tibia. Apices of tibiae and tarsi spiculose. Rastral organ weakly developed on fore tibia. First tarsal segments with 5 ventral and 2 dorsal setae. Arolia narrow flabellate. Abdominal tergites with pairs of brown spinal sclerotic patches that are always fused mesally, forming crossbars that are anteriorly scalloped or indented and horse-shoe like in appearance, these sclerites may be fused in part with the patches of the preceding or following tergites, pigment sometimes absent on tergites 3-8. Lateral lobes of abdominal tergites usually without pigment except sometimes on tergites 6 and 7 dusky. Dorsal abdominal hairs developed as a pair of spinal and lateral clusters on each of the tergites 1-5, on tergites 6 and 7 each one pair of lateral hairs and 2 pairs of spinal hairs present. Pleural hairs mostly absent. Dorsal abdominal hairs pointed, blunt or weakly capitate, about as long as cephalic hairs, but lateral hairs of tergites 6 and 7 measuring $2-2\frac{1}{2}$ times the greatest basal diameter of antennal segment III. Tergite 8 with a sclerotic crossbar bearing about 6 hairs. Marginal abdominal elevations very low on tergite 3 and 4. Marginal papillae absent. Siphunculi well developed, 0.114 mm long, pale, smooth, truncate, without apical flange. Cauda knobbed, anal plate bilobate, both pale, spiculose.

Colour.—Not observed.

Measurements in mm.—

	Length	Width	Antenna
1.	2.15	0.9	1.3
2.	1.85	0.7	1.1

Antennal segments				urs	ht ₂
III	IV	V	Vi		
0.38	0.28	0.26	(0.16+0.13)	0.12	0.09
0.31	0.20	0.22	(0.15+0.10)	0.12	0.09

(1, 2, ex *Quercus ithaburensis*, Albnim, Israel, 23.V.1967. Swirski coll., in British Museum Collection).

Embryo.—Spinal and marginal setae weakly capitate, with rough surface, spinals on abdomen overlapping, not laterally displaced and only on tergite 1 slightly shortened. Antennal chaetotaxy : 1+1, 1, 2 (the outer one very small), 1. Apical rostral segment with 4 accessory setae.

Alatoid nymph.—Body 1.55-1.92 mm long with 0.96 mm as maximum width. Vertex with blotches of brown pigment around bases of some hairs. Frontal hairs pointed, 0.098 mm long. Discal hairs of vertex blunt or weakly capitate, the longest 0.095-0.114 mm long, weakly tinged with brown and rough surface. Antenna with brown annuli at apices of flagellar segments. Antennal segments I and II each with a long blunt or capitate hair, other segments with short hairs except for 2 or 3 on segment III that measure 0.057 mm. Pronotum mottled with brown, with anterior and posterior spinal and lateral hairs in clusters, of same shape and length as cephalic hairs. All clusters of hairs on mesonotum and abdominal tergites 1-7 on paired spinal and marginal smooth sclerites with pale or weakly pigmented centre and brown border, rarely uniformly brown. Spinal and marginal abdominal hairs blunt or capitate, on somewhat tubercular bases, the longest about as long as cephalic hairs, but longest marginal hairs more spear-shaped and measuring up to six times the greatest basal diameter of antennal segment III. Shorter pleural hairs in clusters on each of abdominal tergites 1-5, in part on sclerites, on tergite 5 on a pair of sclerites as big as lateral sclerites. Tibial hairs mostly pointed, some capitate, the longest measuring 2 times distal width of tibia. First tarsal segments without dorsal hairs. Apices of tibiae and tarsi spiculose.

Colour.—Not recorded.

Measurements in mm.—

	Length		Width	Antenna	
1.	1.92		0.96	0.96	
	Antennal segments				urs ht ₂
	III	IV	V	VI	
	0.23	0.17	0.19	(0.14+0.10)	0.13 0.10
(ex <i>Quercus ittaburensia</i> , Albnim, Israel, 23,V,1967. Swirski Coll., in British Museum Coll.)					

Distribution.—India ; Holarctic.

Genus 10. **Indiochaitophorus** Verma, 1970

1970. *Indiochaitophorus* Verma, K. D., *Bull. ent., (India)*, **10** ; 134. Type species : *Indiochaitophorus furcatus* Verma.

Morphology.—Body elongate, 1.3-1.9 mm long. Dorsal cephalic hairs thick, stiff and furcated in apterae but normal and acute in alatae. Antennae 6-segmented ; secondary rhinaria absent in apterae, transversely elliptical and present on segment III in alatae; flagellum spinulose ; hairs on flagellum shorter than or nearly equal to the basal diameter of antennal segment III ; processus terminalis very short, usually $0.20-0.33 \times$ base of segment VI. Rostrum reaches between mid- and hind coxae with a thickened basal sclerotic ridge ; ultimate rostral segment shorter than second segment of hind tarsus and bears 4-6 accessory hairs. Dorsum with each segment bearing spino-pleural sclerotic bands that are separated medially, besides marginal ones ; each spino-pleural sclerotic band in apterae bearing two primary spinal hairs and numerous shorter spino-pleural hairs ; dorsal hairs arising from strong sockets, smooth, thick and furcated at apices ; in alatae, sclerites are not as well developed as in apterae and dorsal hairs smaller and acute at apices. Spinal hairs on 5th and 7th tergite slightly displaced laterally. Siphunculi small, with some fine spinules, constricted at base and without any distinct apical flange. Cauda distinctly knobbed. Subanal plate bilobed. Rudimentary gonapophyses 2, free or partly fused. Legs normal in apterae, fore coxae enlarged in alatae ; first tarsal segment with 5 ventral and 2 dorsal hairs ; second segment of hind tarsus spinulose. Wing venation normal.

First instar larvae without pleural hairs.

Sexual forms not known.

Discussion.—This monotypic genus was considered as close to *Sinochaitophorus* Takahashi, by Verma (1969) but the acute apices of dorsal hairs, fusion of 2nd-6th tergites, small marginal papillae, shape of cauda, etc. in the latter helps to separate the present genus. The genus appears to be restricted to the Kashmir valley, as extensive surveys in other parts of Northwest region of India did not yield any collection during last 15 years.

Biology.—The only species *furcatus* has been reported to infest heavily the undersurface of leaves and twigs of *Ulmus wallichiana*. It may be added that on the same host-plant, galls or other aphids were reported by Verma (1969) which perhaps refers to *Eriosoma* (*Schizoneura*) *phaenax* Mordvilko. Only viviparae (both apterous and alate) have been recorded and no other biological information is available.

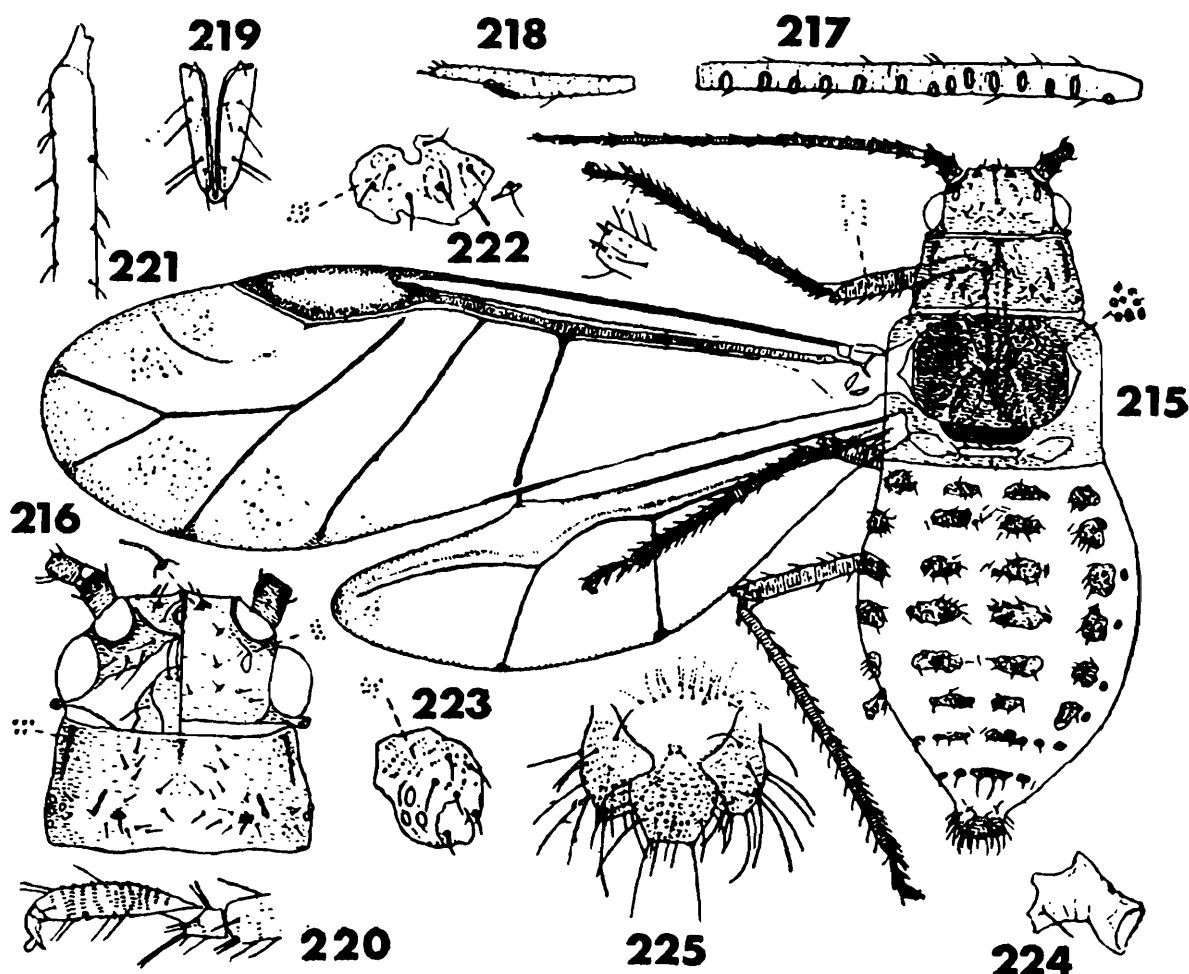
Distribution.—India (Kashmir).

Type species.—*Indiochaitophorus furcatus* Verma, 1970. Deposited in the collection of K. D. Verma, Central Potato Research Institute, Modipuram, U.P.; some paratypes in the collection of British Museum (Natural History), London, England.

17. *Indiochaitophorus furcatus* Verma (Figs. 215–235)

1970. *Indiochaitophorus furcatus* Verma, K.D., *Bull. Ent.* 10 : 134.

Apterous viviparous female.—Body elongate, 1.30–1.95 mm long with 0.65–0.75 mm as maximum width. Head and prothorax brown to dark brown. Dorsal hairs thick, stiff, smooth, arising from tuberculate bases, bluntly furcated at apices, on head ± 0.080 – 0.083 mm long, $3.0\times$ as long as the basal diameter of antennal segment III. Antenna 6-segmented, $0.50\times$ as long as the body, slender, pale, but dusky at the tips of segments III–V and base of processus terminalis on VI; secondary rhinaria absent; hairs on flagellum much thinner



Indiochaitophorus furcatus Verma. 215-225, alate vivipara : 215, body ; 216, head and pronotum ; 217, antennal segment III ; 218, antennal segment VI ; 219, apical rostral segment ; 220, hind tarsus ; 221, base of hind tibia ; 222, spinal abdominal sclerite ; 223, lateral abdominal sclerite of tergite IV ; 224, siphunculus ; 225, cauda and anal plate.

than dorsal hairs, capitate and pointed, 0.016-0.023 mm long, shorter than or at most equal to the basal diameter of antennal segment III ; flagellum imbricated ; processus terminalis about 0.30-0.33 $\times$ as long as base of segment VI. Rostrum reaches hind-coxae ; ultimate rostral segment nearly equal to the second segment of hind tarsus and bears 6 (8) accessory hairs besides preapical. Thoracic nota almost entirely sclerotized except for a pale membranous median zone. Abdominal tergites 1-6 with well developed dark brown, paired, spinopleural and marginal sclerites ; spinopleural and marginal hairs in groups, thick, arising from tuberculate bases similar to those on head, 0.025-0.090 mm long ; tergites 7 and 8 each with a single transverse sclerotic band, bearing 9-12 hairs. Siphunculi dusky to dark brown, with a distinct constrict-

tion near base. Cauda pale, knobbed, bearing 10-13 fine hairs. Subanal plate bilobed. Legs pale ; hairs on femora and tibiae fine ; first tarsal segments with 5 ventral and 2 dorsal hairs.

Colour.—Light brown with black longitudinal stripes on dorsum.

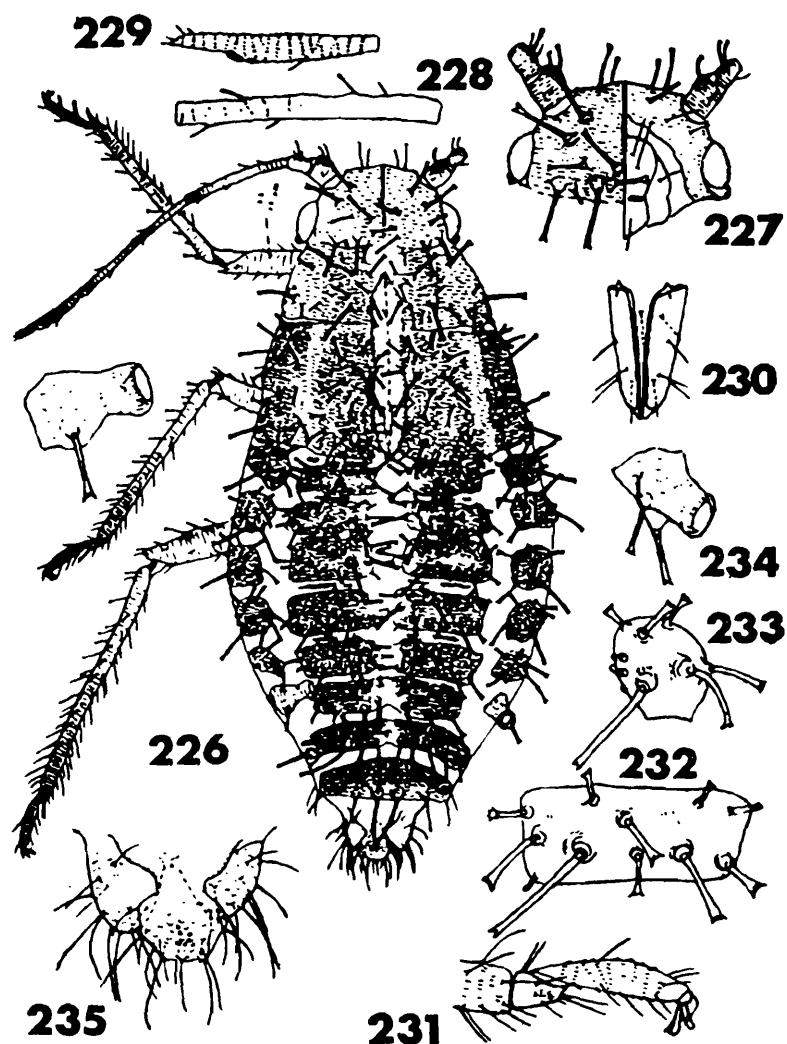
Measurements in mm.—

	Length	Width	Antenna			
1.	1.24	0.62	0.72			
2.	1.38	0.72	0.76			
3.	1.40	0.721	0.78			
	Ant. segments			urs	ht ₂	Siph.
III	IV	V	VI			
0.18	1.10	0.14	(0.11+0.05)	0.10	0.09	0.05
0.19	0.12	0.15	(0.11+0.05)	0.12	0.10	0.06
0.21	0.12	0.15	(0.11+0.05)	0.12	0.10	0.06

(1, 2, 3, ex *Ulmus wallichiana*, Srinagar, May 1982, coll. R. C. Bhagat).

Alate viviparous female.—(Material not available for study ; description based on original description, Verma 1970). Body 1.65-1.85 mm long. Head with epicranial suture. Head and thorax dark, dorsal cephalic hairs 0.024 mm long. Antennae dark brown, darker at tips of segments III-VI ; hairs on flagellum 0.015 mm long ; antennal segment III with 10-13 transverse secondary rhinaria, arranged in a row ; processus terminalis 0.20-0.33 × as long as base of segment VI. Abdominal dorsum light brown bearing paired, segmentally separated, spinopleural and marginal sclerites, the latter with 2-4 marginal papillae on tergites 1-5 ; hairs on the dorsum of abdomen smaller and thinner than in apterae and with mostly acute apices. Cauda knobbed, bearing 15-20 hairs. Subanal plate bilobed. Legs with forecoxae enlarged ; hairs on femora sparse, on tibiae numerous. Siphunculi black, truncate. Wing veins not bordered, with dusky tips, media in forewing twice branched ; hind wings with both obliques.

Colour.—As in apterae but dorsal streaks darker.



Indiochaitophorus furcatus Verma. 226-235, apterous vivipara : 226, body ; 227, head ; 228, antennal segment III ; 229, antennal segment VI ; 230, apical rostral segment ; 231, hind tarsus ; 232, spinal abdominal sclerite, 233, lateral abdominal sclerite ; 234, siphunculus ; 235, cauda and anal plate.

Measurements in mm.—

	Length	Width	Antenna
1.	1.66	—	—
2.	1.80	—	—
3.	1.91	—	—

Ant. segments				urs	ht ₂
III	IV	V	VI		
0.33	0.28	0.28	(0.13—0.05)	0.13	0.13
0.36	0.26	0.26	(0.13+0.05)	0.13	0.13
0.38	0.25	0.25	(0.15+0.05)	0.13	0.13

(1, 2, 3, ex *Ulmus wallichiana*, Srinagar, 4. v. 1964, coll. K. D. Verma).

Nymph.—(early instar). Body 0.82 mm long, broad. Head and body brown, darker on bases of dorsal hairs. Dorsal hairs thick, blunt or slightly furcated at apices, all arising from strongly tuberculate bases, those on head 0.050-0.060 mm long, on thorax and abdomen 0.033-0.083 mm long. Antennae 6-segmented ; flagellum distinctly spinulose. Rostrum reaches beyond hind coxae, ultimate rostral segment 0.09 mm long, little longer than second segment of hind tarsus. Thoracic and abdominal dorsum with segmentally separated paired, spinoploear and marginal, hair-bearing sclerites ; dorsal hairs in pairs. Siphunculi short, ring-like. Legs pale with some scattered spinules on tibiae ; tibial hairs fine.

Material examined.—10 apterous viviparous females and 2 nymphs from *Ulmus wallichiana*, Srinagar, J & K State, India. May 1982, coll. R. C. Bhagat (N.Z.C.).

Discussion.—The species appears to be very restricted in its distribution even in Kashmir Valley. It usually causes heavy infestation on *Ulmus* growing by the riverside in the Srinagar area and is seen in competition on the same host-plant with pemphigid aphids. The period of heavy infestation appear to be during May-June. No natural enemy is known.

Distribution.—India : Jammu & Kashmir (Srinagar).

Types.—In the collection of Dr. K. D. Verma, C.P.R.R., Modipuram, Uttar Pradesh, India ; some paratypes deposited in the collection of British Museum (Nat. Hist.), London (Hille Ris Lambers Collection).

Genus 11. *Machilaphis* Takahashi, 1960

1960. *Machilaphis* Takahashi, R., *Kontyu*, 28 : 11 ; Higuchi, H., 1972, *Ins. matsum.*, 35 (2) : 72 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980, *In Aphids of North East India and Bhutan*, 289. Type species : *Phyllaphis machili* Takahashi.

Morphology.—Body elongate, 1.6-2.8 mm long. Head smooth with wax pore plates, bearing fine hairs. Antennae 6-segmented, shorter than body, bearing wax pores on basal segments and spinules and minute wax pores over the flagellum (except on VI) ; secondary rhinaria absent in apterae, subcircular to slightly elliptic in alatae, ciliated, primary rhinaria round with minute cilia around the rim ;

hairs on flagellum sparse, short and fine ; processus terminalis distinctly shorter than base of segment VI. Eyes with indistinct ocular tubercles, compound eyes divided in apterae. Rostrum hardly reaching midcoxae, ultimate rostral segment distinctly shorter than second segment of hind tarsus and bears 2-4 accessory hairs. Abdominal dorsum with paired spinal, pleural and marginal sclerites on 1st-6th tergites, which bear one hair each but often 2 marginal hairs are developed on posterior tergites and also groups of minute ring-like wax pores exist at the base of the hairs in addition to circles composed of cribriform pores ; on 7th and 8th tergite these plates appear consolidated : 8th tergite with 6-8 hairs. Siphunculi appear as mere rings or very small cones. Cauda short and rounded in aptera, weakly constricted in alata. Subanal plate entire. Rudimentary gonapophyses 2. Legs long, bearing short hairs , femora with minute wax pores ; tibiae sparsely spinulose apicad , tarsi finely spinulose ; first tarsal segments, without any dorsal hairs, with 5 ventral hairs, of which one short, thick and spiny ; dorso-apical hairs on second tarsal segments fine ; empodial hairs setiform. Wing venation normal.

Embryos with very short and pointed dorsal hairs on abdomen ; pleural hairs present , marginal hairs single (Higuchi, 1972).

Sexual forms.—Not known.

Discussion.—Takahashi (1960) erected this monotypic genus with *Phyllaphis machili* Takahashi (1928) ; the combination of presence of setiform empodial hairs, distinctly separated trochanter, indistinct ocular tubercle and 5 ventral hairs in first tarsal segment help to separate *Machilaphis* from other related genera e.g. *Phyllaphis* Koch, *Diphyllaphis* Takahashi etc. Higuchi (1972) considered these three genera under “*Diphyllaphis* group”, as all the three genera share the character of II antennal segment being longer than the 1st, besides other characters ; he also mentioned that the embryos in the “*Diphyllaphis* group” are similar to “*Neophyllaphis* group” and considered this group as the most primitive among his “*Callipterinae*”

Biology.—Only viviparae of the single species *machili* are known from *Machilus* spp., in India, China, Taiwan and Japan. The genus as such appears autoecious on Lauraceae. In Japan the species has been noted during the months of May—July but in India it has

been recorded up to the month of November, mostly restricted to tropical and subtropical regions. No other information on its biology is available.

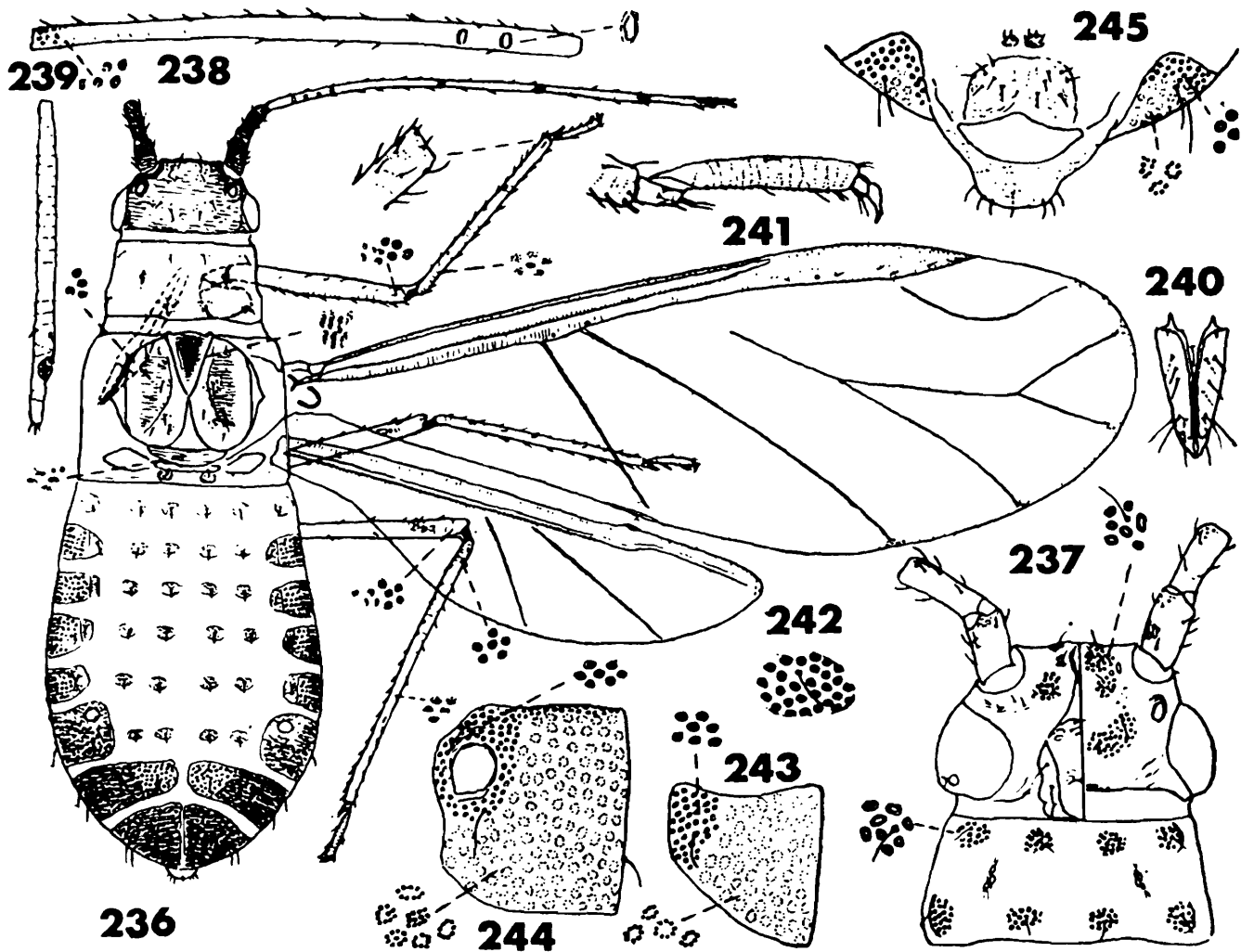
Distribution.—India ; China ; Taiwan ; Japan.

Type species.—*Phyllaphis machili* Takahashi, 1928. Deposited in Taiwan Agricultural Research Institute, Taipei, Taiwan.

18. *Machilaphis machili* (Takahashi)
(Figs. 236-253)

1928. *Phyllaphis machili* Takahashi, R. *Trans nat. Hist. Soc. Formosa*, 16 : 146.
 1933. *Phyllaphis machili*, Shinji, G. O., *Kontyu*, 7 : 156.
 1960. *Machilaphis machili*, Takahashi, R. *Kontyu*, 28 : 11.
 1971. *Machilaphis machili*, Ghosh, A. K., Banerjee, H., and Raychaudhuri, D. N., *Orient. Insects*, 5 : 106.
 1972. *Machilaphis machili* Higuchi, H., *Ins. matsum.*, 35 (2) : 73.
 1978 (1975) *Machilaphis machili*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. Zool. Soc., Calcutta*, 28 : 82.
 1980. *Machilaphis machili*, Raychaudhuri, D. N., Chakrabarti S., Basu, R. C., and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 294.
 1985. *Shivaphis cinnamomophila*, Zhang, *Acta Entomol. Sin.*, 28 (2) : 219. (New Synonymy).

Apterous viviparous female.—Body 1.8-1.9 mm long with 0.90-0.95 mm as maximum width. Head without frontal tubercles ; dorsal cephalic hairs fine, arranged in 4-5 pairs, equal in length to the basal diameter of antennal segment III, and surrounded by extensive fields of wax gland pores. Antennae 6-segmented, shorter than the body ; segment II longer than I and segment III longer than VI, bearing 8-10 hairs that are a little shorter than or equal to the basal diameter of the segment ; flagellum with wax pores on distal part of each segment except on VI, variably spinulose from apical part of segment III ; processus terminalis much shorter than base of segment VI, at most twice as long as wide. Ultimate rostral segment $0.60\times$ as long as second segment of hind tarsus and bears 8 accessory hairs. Dorsum of body pale, but on abdomen weakly pigmented ; marginal sclerites developed on tergites 2-6 and tergite 7 with two large plates ; tergite 8 entirely brown sclerotic. Thoracic terga each with 2 pairs of fine spinal and marginal hairs and on the abdominal tergites one pair each of similar spinal, pleural



Machilaphis machili (Takahashi). 236-245, alate vivipara : 236, body ; 237, head and pronotum ; 238, antennal segment III ; 239, antennal segment VI ; 240, apical rostral segment ; 241, hind tarsus ; 242, spinal abdominal hair with wax gland pores ; 243, lateral sclerite of abdominal tergite V ; 244, lateral sclerite of abdominal tergite VI with siphunculus ; 245, cauda and anal plate, ventral side.

and marginal hairs developed, but tergite 7 with 2 pairs of marginal hairs. Dorsal body hairs surrounded by numerous ring-shaped wax gland pore elements. In addition, wax gland pores in clusters on marginal sclerites 2-6 and on entire surface of tergites 7 and 8. Tergite 8 bearing 6-7 hairs, about $1.3 \times$ as long as the basal diameter of antennal segment III. Siphunculi poriform. Cauda rounded with 4-6 hairs. Subanal plate indented bearing 12 hairs. Subgenital plate with 13 hairs. Femora with minute wax pores and similar pores may be present on inner margin of tibiae, tibiae with faint spinulose imbrications, apical tibial hairs not differentiated ; first tarsal segments with 5 ventral hairs including one short, spiny hair, second tarsal segment spinulose ; empodial hair setiform.

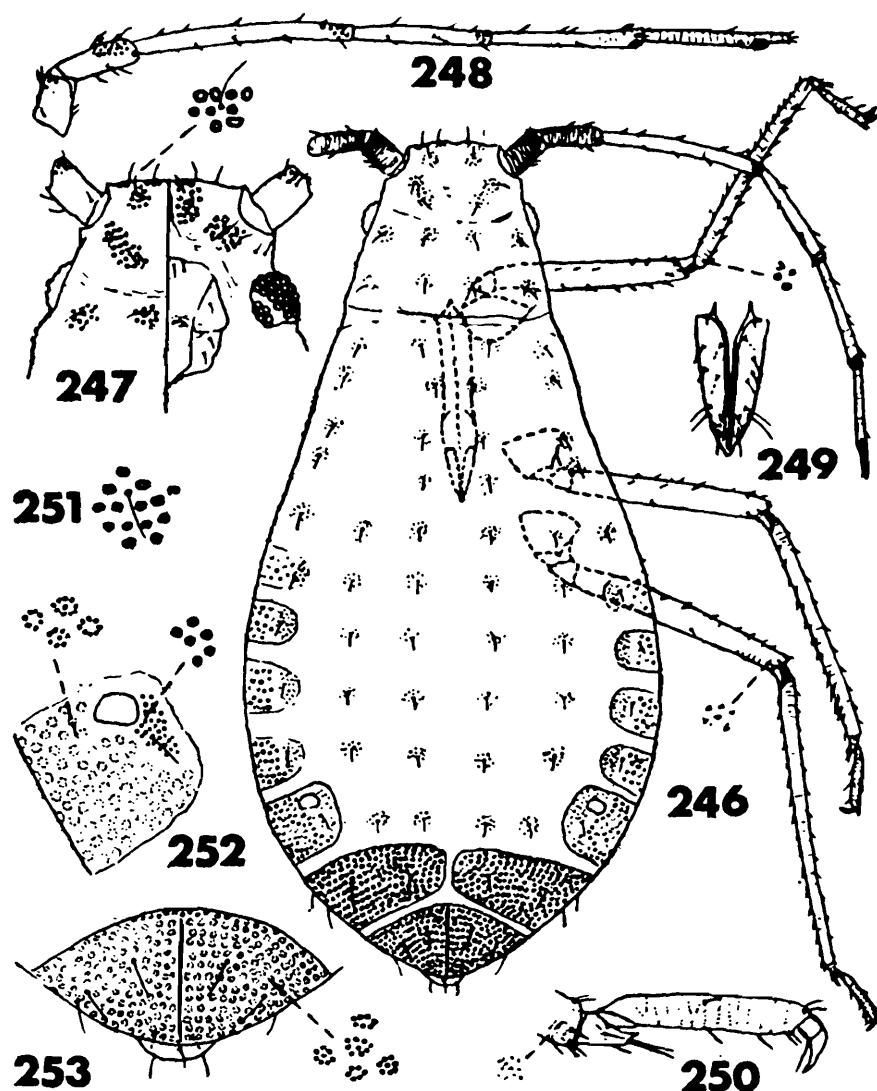
Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna			
1.	1.89	0.93	1.39			
2.	1.91	0.93	1.41			
		Ant. segments		urs	ht ₂	
	III	IV	V	VI		
	0.38	0.26	0.29	(0.22+0.05)	0.11	0.15
	0.30	0.26	0.29	(0.22+0.04)	0.11	0.15

(1, 2, ex *Machilus odoratissima* Titabar, Assam, 2. xi. 1969).

Alate viviparous female.—Body 2.20-2.65 mm long with 0.88-0.94 mm as maximum width. Dorsal cephalic hairs fine 0.016-0.020 mm long, at most $0.66 \times$ as long as the basal diameter of antennal segment III. Antennae pale, 6-segmented, much shorter than the body ($0.65\text{--}0.70 \times$) ; segment II distinctly longer than I, segment III nearly twice as long as VI, pale, bearing 2-3 small, oval ciliated secondary rhinaria on basal part of segment ; flagellum toward apex gradually more distinctly provided with spinulose imbrications ; hairs on flagellum sparse, fine, 0.010-0.016 mm long, at most $0.50 \times$ as long as the basal diameter of a segment III ; processus terminalis $0.21\text{--}0.22 \times$ as long as base of segment VI. Rostrum reaches between fore and mid-coxae, ultimate rostral segment with a sclerotic rim at base on dorsal side, $0.65\text{--}0.70 \times$ as long as second segment of hind tarsus and bears 8 accessory hairs. Abdominal dorsum pale except for marginal sclerites and tergites 7 and 8 which are brownish sclerotic and bear wax gland pores in ring-shaped arrangements ; each of 1st-6th tergites with marginal, pleural and spinal hairs on weakly sclerotic areas which bear clusters of minute wax gland pores, similar to those on vertex ; hairs on dorsum fine ; 7th tergite with 3 pairs of marginal hairs besides the spinal and pleural ones, these being up to 0.040 mm long, $1.3 \times$ as long as the basal diameter of antennal segment III ; 8th tergite with 6 hairs on a broad sclerotic plate. Siphunculi poriform, placed on anterior corner of marginal sclerite 6. Cauda with indistinct knob, wider



Machilaphis machili (Takahashi). 246-253, apterous vivipara : 246, body ; 247, head ; 248, antenna ; 249, apical rostral segment ; 250, hind tarsus ; 251, spinal abdominal hair with wax gland pores ; 252, siphunculus ; 253, abdominal tergite VIII and cauda.

than long, bearing 5-7 hairs. Subanal plate weakly indented ; gonochaetae in two clusters. Wax gland pores minute, ring-like, present in cluster around hairs of head, pronotum, mesonotum, abdomen and basal parts of tibiae. In addition, cribriform discs arranged in circles are found on the marginal sclerites and on the 7th and 8th abdominal tergite. Legs slender, hairs on legs short ; second tarsal segment with spinulose imbrications ; empodial hairs fine. Wing veins pale, normal.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.41	0.91	1.85		
2.	2.20	0.89	1.82		
		Ant. segments		urs	ht ₂
	III	IV	V	VI	
	0.53	0.33	0.33	(0.23+0.03)	0.11
	0.55	0.32	0.33	(0.23+0.05)	0.11

(1, 2, ex *Machilus odoratissima*, Titabar, Assam, 9. xi. 1969).

Embryo.—Dorsal hairs very short, pointed, arranged in rows ; pleural hairs present ; marginal hairs on abdomen single.

Material examined.—Two apterous viviparous females and 4 alate viviparous females from *Machilus odoratissima*, Titabar, Assam, India, 9. xi. 1969, Coll. H.B., N.Z.C.

Discussion.—The member of this monotypic genus can be recognised by the setiform empodial hair, arrangement and shape of wax pores elements, sclerotic basal thickening of ultimate rostral segment and specific host association with Lauraceae. Higuchi (1972) has pointed out its affinities with related genera under his “Diphyllaphis group” of genera, viz., *Diphyllaphis* Takahashi and *Phyllaphis* Koch. The description of the embryo of *machili* in Raychaudhuri et al. (1980) appears erroneous when compared with actual specimens.

Distribution.—India : Assam, Meghalaya ; China ; Taiwan ; Japan.

Types.—In the collections of Entomological Laboratories, Hokkaido University, Sapporo, Japan.

Genus 12. *Mesocallis* Matsumura, 1919

1919. *Mesocallis* Matsumura S., *Trans. Sapporo nat. Hist. Soc.*, 7 : 103 ; Higu-chi, H., 1972, *Ins. matsum.*, 35 (2) : 22 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980, *In Aphids of North East India and Bhutan*, 291. Type species : *Myzocallis sawashibae* Matsumura.
1919. *Neocallis* Matsumura, S., *Trans. Sapporo nat. Hist. Soc.*, 7 : 104. Type species : *Neocallis carpinocola* Matsumura = *Myzocallis sawashibae* Matsumura.
1961. *Nippochaitophorus* Takahashi, R., *Kontyu*, 29 : 247. Type species : *Nippochaitophorus moriokaensis* Takahashi = *Myzocallis sawashibae* Matsumura.

Morphology.—Body 1.0-1.7 mm long, pale yellow. Head without distinct frontal tubercles ; dorsum smooth. Antennae 6-segmented, shorter than body, secondary rhinaria absent in apterae, circular to subcircular and weakly ciliated in alatae, usually confined to segment III ; primary rhinaria ciliated ; hairs on flagellum short and fine ; processus terminalis $0.6-1.1\times$ as long as base of antennal segment VI. Rostrum short, hardly reaches midcoxae, ultimate rostral segment $0.5-1.4\times$ as long as second segment of hind tarsus and bears 2-12 accessory hairs. Abdomen pale, usually without spinal processes but sometimes dorsal hairs on small cone-shaped bases in the apterae ; marginal processes normally present, mammiform, each bearing a single hair ; dorsal hairs in apterae long, conspicuous and with capitate apices, in alatae short and with acute to acuminate apices ; spinal hairs in longitudinal rows, 2-3 per segment, or single pleural hairs sometimes present on some tergites, hairs on 6th tergite not appended to the base of siphunculi ; 7th tergite with 4 hairs and 8th tergite with 2 hairs. Siphunculi short truncate, without flange, $0.5-0.6\times$ as long as second segment of hind tarsus. Cauda distinctly knobbed. Subanal plate bilobed, each lobe bearing a few long hairs with acute apices. Rudimentary gonapophyses appear fused in two almost confluent clusters. Subgenital plate with 4-5 hairs on anterior margin and 6-7 hairs on posterior margin. Legs with trochanters sometimes fused with femora in apterae and spinulose on apices of tibiae and whole of tarsi ; first tarsal segment with 5 ventral hairs and 2 dorsal hairs ; empodial hairs flattened. Wing veins normal ; forewings with media twice branched, radial sector seemingly absent or only apical part visible as a stippled line, hind wings with both obliques.

Embryos with long capitate marginal and spinal hairs, arranged in parallel rows ; pleural hairs absent ; spinal hairs contrasting in length and laterally displaced on tergites 3, 5 and 7. Siphunculi discernible.

Ovipara apterous, with wax gland pore plates subventrally on posterior abdomen. Antennae 5-6 segmented with minute hairs. Dorsal hairs capitate, 4 per tergite, including the marginal one. Hind tibiae with about 20 pseudosenosaria. Males not recorded.

Discussion.—The genus was described with *Mesocallis sawashibae* Matsumura, 1917 as type. Of 5 species that have been recognised under this genus, (Eastop and Hile Ris Lambers, 1976 treated it as a subgenus of *Pterocallis* Passerini, 1860), three, viz., *fagicola* Matsumura, 1919, *pteleae* Matsumura, 1919 and *sawashibae* Matsumura, 1917 are known from Japan and Taiwan, while *alnicola* A.K. Ghosh, 1974 and *obtusirostris* A. K. Ghosh, 1974 are known from India, but all the species are restricted to plants of Betulaceae. The genus was ignored till 1972 when Higuchi provided detailed redescription of two of Matsumura's three species from Japan, discussed their affinity with *Tinocallis* and pointed out that *Nippochaitophorus* Takahashi 1967, should be treated as a synonym of *Mesocallis*, Matsumura. Higuchi (op. cit.) also considered *Mesocallis* as a member of the *Myzocallis* group of genera.

Biology.—No detailed biological information for any of the 5 species is available. The members of this genus apparently lead autoecious life cycles on Betulaceae and in Japan, the alate viviparae have been recorded during June—August, apterae viviparae in August and oviparae in October, while in India, alatae viviparae have been recorded during February to May and apterae vivipara in October.

Distribution.—India ; Japan ; Taiwan.

Type species.—*Mesocallis sawashibae* Matsumura, 1917. Location of types not known.

Key to the species of *Mesocallis* Matsumura*Alate viviparous female* :

Abdomen with 2 spinal hairs per tergite. Processus terminalis equal to the base of segment VI. Antennal segment III with 4-7 secondary rhinaria, longest hair on segment III $0.40\times$ as long as the basal diameter of the segment. Ultimate rostral segment 0.040 mm long, $0.50-0.55\times$ as long as second segment of hind tarsus. Antennal segment III variegated. Hind femur pale. On *Betula alnoides*

obtusirostris
A. K. Ghosh

—Abdomen with 2-5 spinal hairs per tergite. Processus terminalis $0.6-0.7\times$ as long as base of antennal segment VI. Antennal segment III with 9-11 and IV with 0-1 secondary rhinaria. Longest hair on segment III $0.25-0.30\times$ as long as the basal diameter of the segment. Ultimate rostral segment 0.08 mm long, $0.8-0.9\times$ as long as the second of hind tarsus. Antennal segment III dark except for very base. Hind femur with dark apical spot. On *Alnus nepalensis*

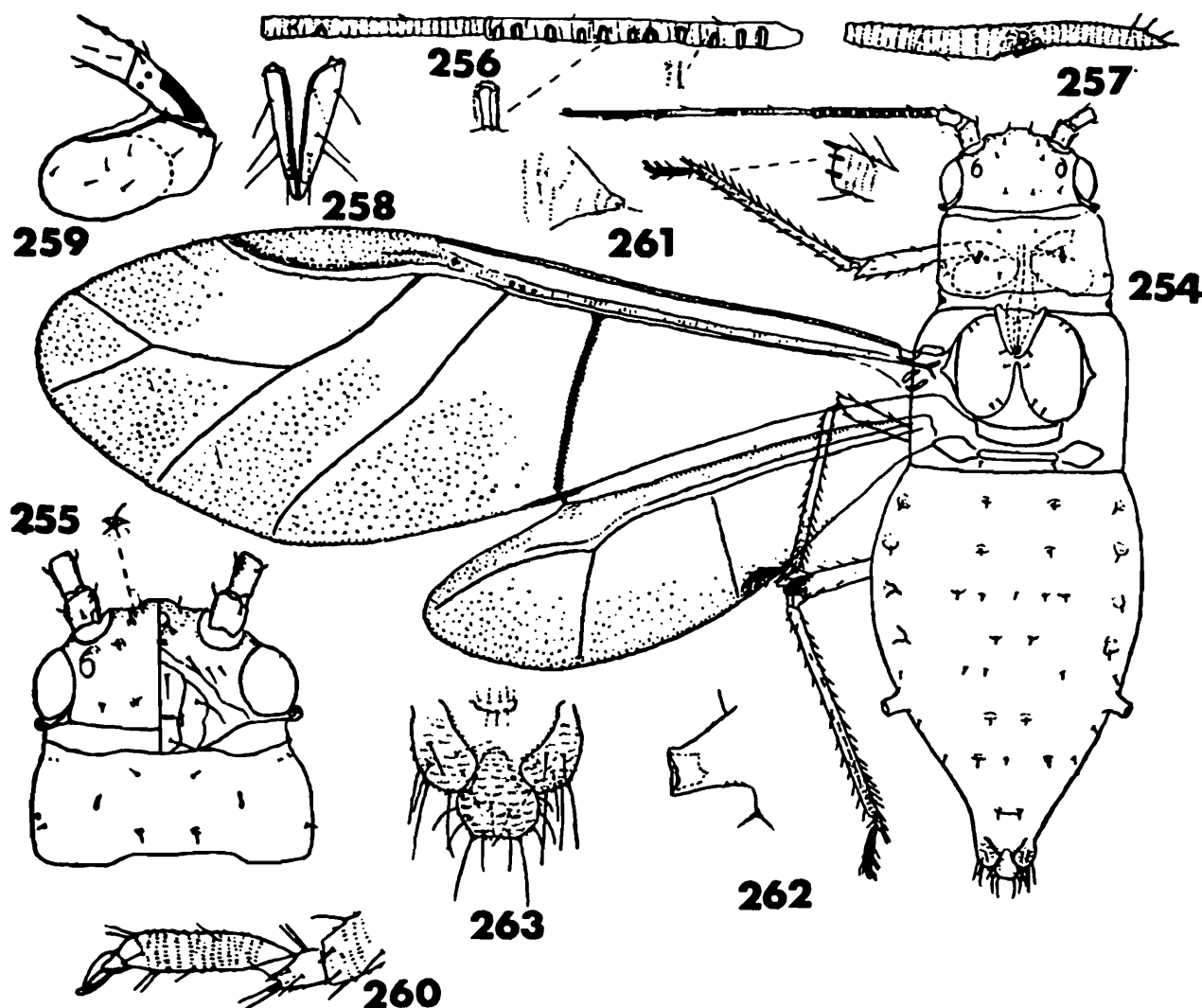
alnicola A. K. Ghosh

19. *Mesocallis alnicola* A. K. Ghosh
(Figs. 254-271)

1974. *Mesocallis alnicola* Ghosh. A. K., *Orient Insects*, 8 (4) : 425.

1980. *Mesocallis alnicola*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C., Ghosh, A. K. *In* Aphids of North East India, 292.

Alate viviparous female.—Body pale 1.3-1.4 mm long. Head pale with a broad roundish frontal prominence ; dorsal cephalic hairs minute, those on frons at most equal to the basal diameter of antennal segment III. Antennae 6-segmented, fuscous on segment III, (except at very base which is pale), apical half of segment IV and V and most part of segment VI, rest pale, $0.59-0.61\times$ as long as the body ; segment III with 9-11 elliptical secondary rhinaria distributed over entire length except at very base, segment IV with 0-1 similar rhinaria placed near the middle ; hairs on the flagellum sparse, longest one on segment III, 0.012-0.016 mm long, hardly



Mesocallis alnicola A. K. Ghosh. 254-263, alate vivipara : 254, body ; 255, head and pronotum ; 256, antennal segments III and IV ; 257, antennal segment VI ; 258, apical rostral segment ; 259, fore coxae ; 260, hind tarsus ; 261, lateral abdominal process ; 262, siphunculus ; 263, cauda and anal plate.

0.25-0.35 $\times$ as long as the basal diameter of antennal segment III ; processus terminalis 0.60-0.66 as long as base of segment VI. Rostrum reaches little beyond forecoxae, ultimate rostral segment acute, 0.8-0.9 $\times$ as long as second segment of hind tarsus and bears 3 fine accessory hairs. Abdominal dorsum pale, 2nd-4th tergites with very small marginal processes. Hairs on the dorsum of abdomen sparse, spinal hairs normally 2 per segment, but on tergites 3, 5 and 7 there may be a few more ; marginal hairs single, arising from a small process 0.006 mm long. Siphunculi pale, truncate, without apical flange or hair appended to the base, 0.50 $\times$ as long as base of

antennal segment VI. Cauda knobbed, bearing 10-11 hairs. Subanal plate bilobed, each lobe with 6-8 hairs. Legs pale except apices of hind femora which are dark brown and tarsi of all legs which are fuscous. Legs with 3-4 circular pseudosensoria like structures on trochanters and 2-3 similar ones near bases of femora ; apices of tibiae and whole of tarsi spinulose ; apical tibial hairs stiff and acute ; first tarsal segments with 5 ventral and 2 dorsal hairs. Wings pale but vein Cu_2 of forewings bordered brown, media twice branched, radial sector not developed.

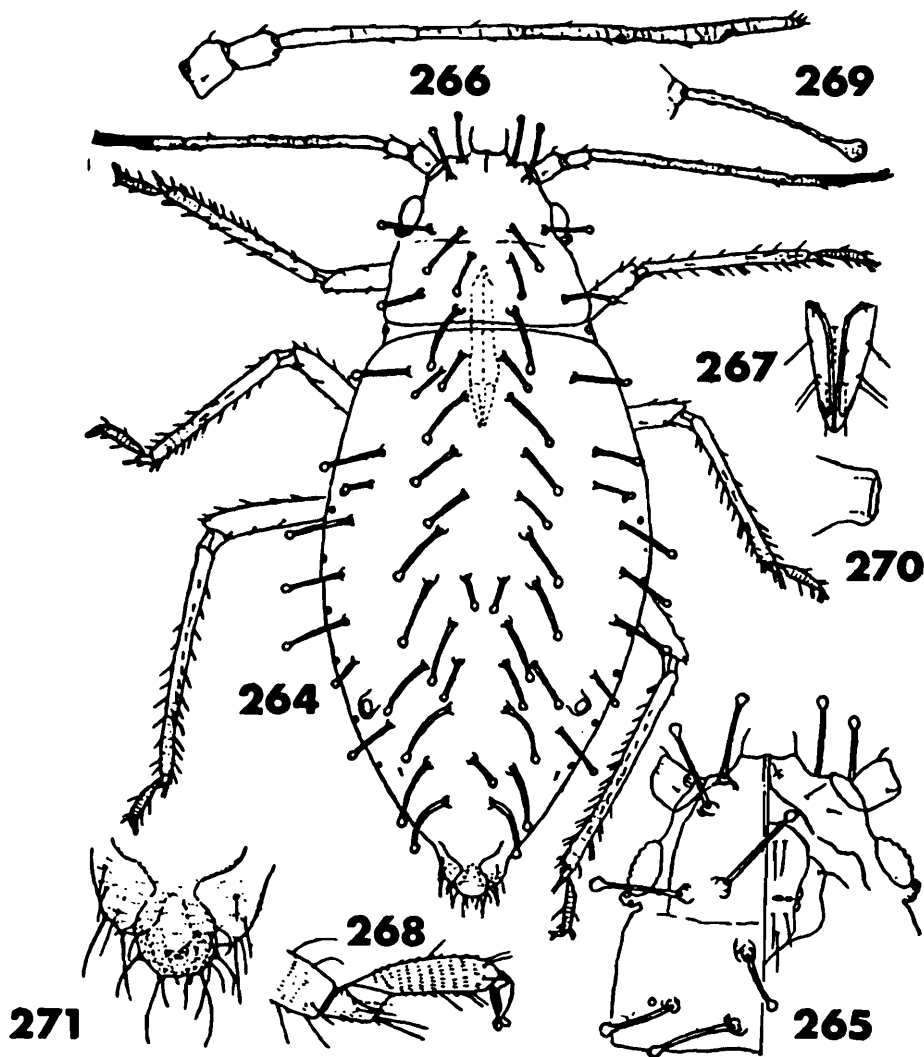
Colour.—Pale in life.

Measurements in mm.—

	Length	Width	Antenna			
1.	1.35	0.55	0.82			
2.	1.40	0.56	0.84			
	Ant. segments				urs	ht ₂
	III	IV	V	VI		Siph.
	0.24	0.17	0.15	(0.10+0.08)	0.08	0.10
	0.25	0.17	0.16	(0.10+0.06)	0.08	0.10

(1, 2, ex *Alnus nepalensis*, Shillong, Meghalaya, 11.vi.1973, Z.S.I.).

Apterous viviparous female.—Body pale, 1.0-1.16 mm long with 0.42-0.44 mm as maximum width. Head smooth with capitate hairs on vertex, those on frons 0.33-0.40 mm long, 2.0-2.1× as long as the basal diameter of antennal segment III, on vertex 0.07-0.09 mm long, upto 5.0× as long as the mentioned diameter. Antennae 0.50× as long as the body, slender, pale, except apical half of segment VI which appears fuscous ; segment III feebly imbricated, hairs hardly discernible ; processus terminalis 0.6-0.7× as long as base of antennal segment VI. Rostrum reaches between fore and midcoxae, ultimate rostral segment slender, 0.75-0.88× as second segment of hind tarsus and bears a pair of accessory hairs. Abdominal dorsum pale ; hairs on the dorsum of abdomen thick with spinulose surface, arising from tuberculate bases and with capitate apices, usually one pair of spinal hairs and a pair of marginal hairs



Mesocallis alnicola A. K. Ghosh. 264-271, apterous vivipara : 264, body ; 265, head and pronotum, 266, antenna ; 267, apical rostral segment ; 268, hind tarsus ; 269, lateral hair of abdomen ; 270 siphunculus ; 271, cauda and anal plate.

present on 1st-6th tergites, sometimes 3rd and 5th tergites with 3-4 spinal hairs, those on anterior tergites 0.080-0.085 mm long, up to $5.0\times$ as long as the basal diameter of antennal segment III ; 7th and 8th tergite each with 4 hairs, upto 0.100-0.106 mm long, nearly $5.0-5.5\times$ as long as the basal diameter of antennal segment III. Siphunculi pale, truncate, without apical flange hardly $0.50\times$ as long as base of antennal segment VI and $0.60\times$ as long as second segment of hind tarsus. Cauda knobbed with 11-12 hairs. Legs pale, spinulose near apices of tibiae and on whole of tarsi and bear 5 ventral and no dorsal hairs.

Colour.—Pale in life.

Measurements in mm.—

	Length	Width	Antenna			
1.	1.16	0.44	0.57			
2.	1.10	0.40	0.55			
	Ant. segments			urs	ht ₂	Siph.
	III	IV	V VI			
	0.13	0.09	0.11 (0.09+0.06)	0.07	0.08	0.05
	0.12	0.08	0.11 (0.09+0.06)	0.07	0.08	0.05

(Ex *Alnus nepalensis* Shillong, Meghalaya, 11.v.1973, Z.S.I.).

First instar nymph.—Not available.

Material examined.—Three alate viviparous females (Holotype and paratypes) from *Alnus nepalensis*, Shillong, Meghalaya, India, 11.v.1973 and 6 apterous viviparous females (paratypes) from *Alnus nepalensis*, C.P.R.I. farm, Shillong, Meghalaya, India, 10.v.1972, coll. A. K. Ghosh (N.Z.C.).

Discussion.—These small pale soft-bodied insects form small colonies on leaves of *Alnus* during the winter months but appear to be very restricted in distribution. Re-examination of the specimens during present study necessitated some changes in description of the apterous viviparous female specially in the length of dorsal hairs. The species can be separated from all other species of the genus following the key given by Ghosh, A. K. (1974).

Distribution.—India : Meghalaya.

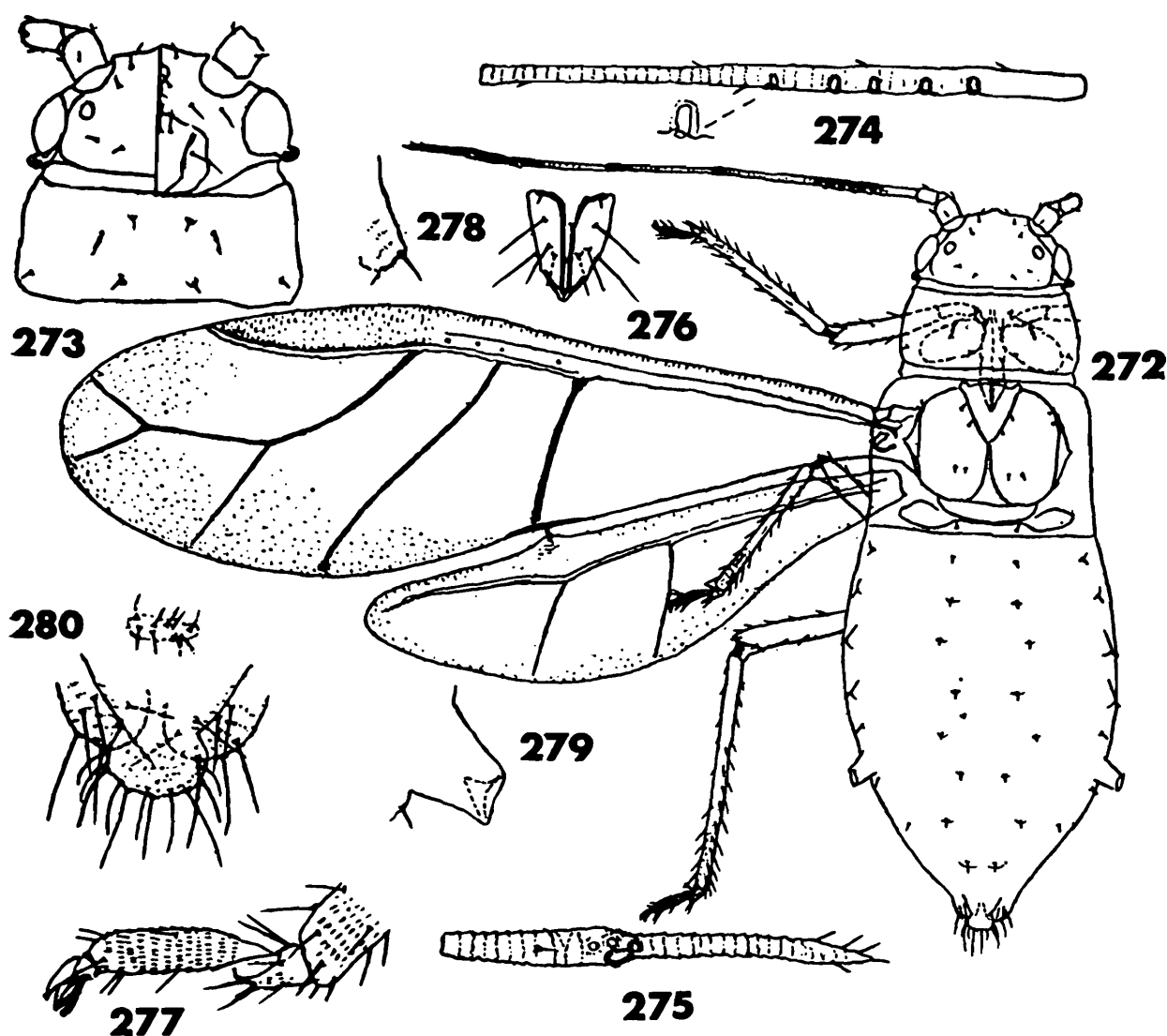
Types.—In the National Zoological Collections, Zoological Survey of India, Calcutta, India.

20. *Mesocallis obtusirostris* A. K. Ghosh
(Figs. 272-282)

1974. *Mesocallis obtusirostris* Ghosh, A. K., *Orient. Insects* 8 (4) : 428.

1980. *Mesocallis obtusirostris*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 428.

Alate viviparous female.—Body 1.2-1.5 mm long with 0.55-0.65 mm as maximum width. Head and vertex pale ; frons elevated in the middle ; dorsal cephalic hairs short, sparse, 0.003-0.005 mm long, $0.4-0.7 \times$ as long as basal diameter of antennal segment III. Antennae 6-segmented $0.61-0.75 \times$ as long as the body, thin, slender, pale except at middle of segment III, apices of segment III-V and whole of segment VI which are fuscous ; flagellum imbricated ; segment III with 4-7 somewhat elliptical secondary rhinaria mostly restricted to basal half of the segment ; hairs on flagellum minute, inconspicuous, longest one on segment III at most 0.003 mm long, $0.4 \times$ as long as the basal diameter of the segment ; processus



Mesocallis obtusirostris A. K. Ghosh. 272-280, alate vivipara : 272, body ; 273, head and pronotum ; 274, antennal segment III ; 275, antennal segment III ; 276, apical rostral segment ; 277, hind tarsus ; 278, lateral abdominal process ; 279, siphunculus ; 280, cauda and anal plate.

terminalis equal to the base of segment VI. Rostrum reaches fore-coxae or little beyond, ultimate rostral segment short and broad, $0.50-0.65 \times$ as long as second segment of hind tarsus and bears a pair of accessory hairs. Dorsum without spinal processes but with small, blunt marginal processes each bearing a single hair, present on 2nd-4th tergites, these processes becoming larger caudad; hairs on dorsum of abdomen short, pointed, arranged in one spinal pair besides a single marginal pair of hairs on each tergite, these being $0.003-0.004$ mm long, $0.4-0.5 \times$ as long as basal diameter of antennal segment III. Siphunculi pale, truncate, without apical flange, wider than long, $0.62-0.65 \times$ as long as second segment of hind tarsus and $0.56-0.62 \times$ as long as base of antennal segment VI. Cauda pale, knobbed, bearing 9-12 hairs. Subanal plate bilobed, each lobe with 5-6 hairs. Subgenital plate with 9-10 hairs on posterior margin. Legs pale with apices of tibiae and whole of tarsi spinulose, densely so on second segment of hind tarsus; first tarsal segments with 5 ventral hairs and 2 dorsal hairs. Wing venation normal, pale; radial sector absent.

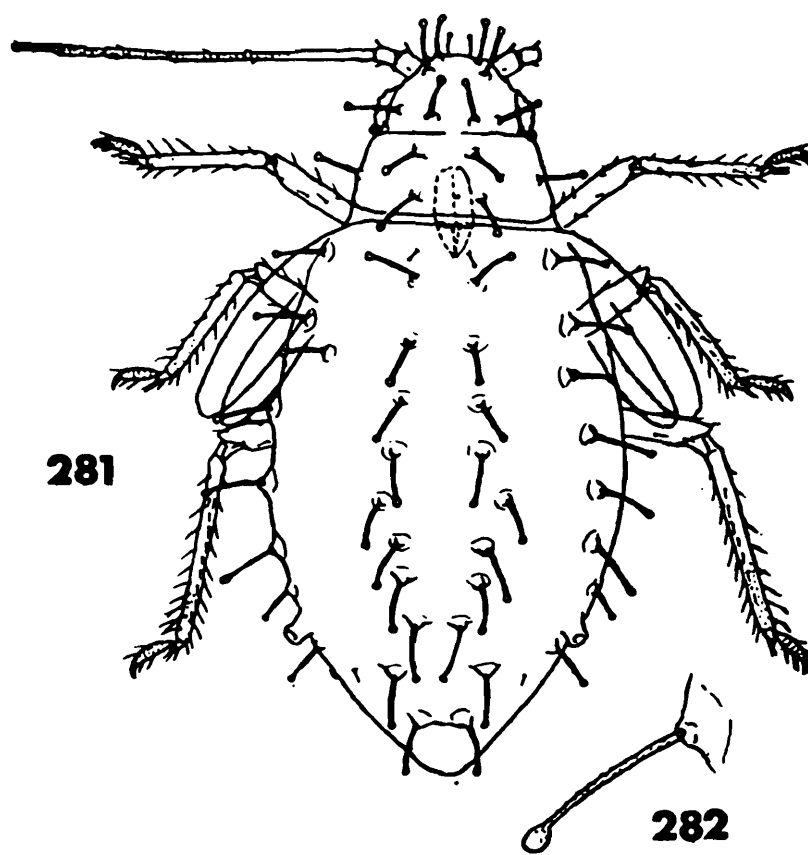
Colour.—Pale yellow in life.

Measurements in mm.—

	Length	Width	Antenna			
1.	1.51	0.57	0.97			
2.	1.48	0.61	0.96			
3.	1.48	0.65	0.97			
III	Ant. segments			urs	ht ₂	Siph.
	IV	V	VI			
0.35	0.19	0.16	(0.09+0.09)	0.05	0.08	0.05
0.35	0.19	0.16	(0.09+0.08)	0.04	0.08	0.05
0.35	0.19	0.17	(0.09+0.08)	0.05	0.08	0.05

(1, 2, ex *Alnus nepalensis*, Mongbul, Kalimpong, 11.ii.1971; 3, ex *Betula alnoides*, Mongpu, Darjeeling dist., 9.ii.1971; N.Z.C.).

Alatoid nymph.—Body 1.10 mm long, pale, elliptical. Head with frons convex; dorsal cephalic hairs thick arising from tuberculate bases and distinctly capitate at apices, two pairs on frons and 3



Mesocallis obtusirostris A. K. Ghosh. 281-282, alatoid nymph : 281, body ; 282, lateral abdominal process.

pairs on vertex, the ones at the middle of frons shortest, 0.036 mm long, others 0.073-0.093 mm long, these being 1.3 $\times$ and 2.7-3.5 $\times$ as long as the basal diameter of antennal segment III, respectively. Antennae slender, pale, 6-segmented, 0.61 $\times$ as long as the body ; segment I wider than long, bearing one capitate hair, II with a similar hair 0.013 mm long ; hairs on flagellum hardly discernible ; segment VI with spinulose imbrications ; processus terminals equal to base of segment VI ; ultimate rostral segment triangular, 0.58 $\times$ as long as second segment of hind tarsus and bears a pair of accessory hairs. Dorsal body hairs thick, capitate, arranged in pairs, each of the thoracic tergites 2 and 3 and 1st-8th abdominal tergites with a pair of spinal hairs arising from strongly tuberculate bases, 0.073-0.083 mm long, 2.8-3.1 $\times$ as long as the basal diameter of antennal segment III ; one pair of marginal hairs present on each thoracic and abdominal segments 1-6, 0.066-0.073 mm long, 2.5-2.8 $\times$ as long as the mentioned diameter. Siphunculi small, pale, truncate.

Legs pale, apices of tibiae sparsely and whole of tarsi densely spinulose.

Colour.—Pale in life.

Measurements in mm.—

Length		Width		Antenna	
1.10		0.50		0.69	
Ant. segment		urs		ht ₂	
III	IV	V	VI		
0.22	0.11	0.11	(0.076+0.083)	0.043	0.73

(ex *Betula alnoides*, Kalimpong, 9.ii.1971, N.Z.C.).

Material examined.—4 alate viviparous females (holotype and paratypes) from *Alnus nepalensis*, Mongbul, Kalimpong, West Bengal, India, 11.ii.1971, coll. M.R. Ghosh ; 2 alate viviparous females and one alatoid nymph from *Betula alnoides*, Mongpu, Darjeeling district, West Bengal, 9.ii.1971, coll. M.R. Ghosh (N.Z.C.).

Discussion.—Ghosh, A. K. (1974) mentioned that this species appears close to *Mesocallis sawashibae* (Matsumura) known from *Carpinus cordata* in Japan but differs in having a short and broad ultimate rostral segment and a different arrangement of secondary rhinaria besides other host-plant association. Like *M. alnicola* A. K. Ghosh, the present species also appears to be rare in occurrence with a limited area of distribution.

Distribution.—India : West Bengal (Darjeeling district).

Types.—In the National Zoological Collections, Zoological Survey of India, Calcutta, India.

Genus 13. *Myzocallis* Passerini, 1960

1860. *Myzocallis* Passerini, G., *Gli Afidi*, Parma, 28 ; Richards, W. R., 1968, *Mem. ent. Soc. Can.*, 57 : 3 ; Higuchi, H., 1972, *Ins. matsum*, 35 (2) : 26 ; Stroyan, H.L.G., 1977, *Handbk. Ident. Br. Insects*, II, 4(a) : 53 ; Heie, Ole. E. 1982, *Fauna ent. scand.*, 11 : 48. Type species : *Aphis coryli* Goeze.

1870. *Agrioaphis* Walker, F., *Zoologist* (2), 5 : 2000. Type species : *Aphis myricae* Kaltenbach (used as subgenus).
1917. *Nippocallis* Matsumura, S., *J. Coll. Agr. Tohoku Imp. Univ. Sapporo*, 7 (6) : 365.
1948. *Dryomyzus* Hille Ris Lambers, D., *Trans. R. ent. Soc. Lond.*, 99 : 285. Type species : *Myzocallis (Dryomyzus) glandulosus* Hille Ris Lambers.
1959. *Pasekia* Aizenberg, E. E., *Zool. Zh.*, 38 : 1647. Type species : *Myzocallis komareki* Pasek.
1965. *Lineomyzocallis* Richards, W.R., *Mem. ent. Soc. Can.*, 44 : 29. Type species : *Aphis bella* Walsh (used as subgenus).
1965. *Neomyzocallis* Richards, W. R., *Mem. ent. Soc. Can.*, 44 : 29. Type species: *Callipterus punctatus* Monell.

Morphology.—Body 1.5-3.0 mm long, yellowish, green to black in life. Frontal tubercles poorly developed ; median frontal prominence evident. Dorsal cephalic hairs small, anterior discal hairs sometimes on elevated tubercles. Antennae 6-segmented $0.60-0.90\times$ as long as the body ; flagellum usually with spinulose imbrications ; secondary rhinaria round to oval, restricted to antennal segment III of alatae ; feebly ciliated ; primary rhinaria distinctly ciliated ; processus terminalis $0.80-2.75\times$ as long as base of antennal segment VI. Rostrum reaches little beyond fore-coxae, ultimate rostral segment $0.40-1.60\times$ as long as second segment of hind tarsus and may bear 5-12 accessory hairs. Dorsum with variably developed sclerotisation or dark bands on head. Dorsal hairs multiple ; spinal hairs in clusters of 2-6, on paired spinal sclerites which may be pale or dark ; dorsal hairs may be fine or subacute or weakly to distinctly capitate ; 8th tergite usually with a single row of hairs. Abdomen sometimes with variably developed dorsal and lateral processes (flat elevations, bosses), but lateral processes without any apical hair. Siphunculi truncate, smooth or variably imbricated or spinulose, without any apical flange or hair appended to the base. Cauda distinctly knobbed bearing 4 long hairs on posterodorsal region, besides a few ventral hairs. Subanal plate distinctly bilobed. Rudimentary gonapophyses 2. Subgenital plate with variable number of hairs on anterior and posterior margin. Legs spinulose ; apical tibial hairs distinctly differentiated as short and thick spines ; first tarsal segments usually with 5 ventral hairs and 2 dorsal hairs ; empodial hairs flattened. With venation normal ; forewings hyaline, or heavily pigmented, sometimes costal margin heavily pigmented with black (as in members of *Lineomyzocallis*).

Embryos with paired spinal and marginal hairs on each segment, at least the spinal hairs distinctly knobbed ; pleural hairs absent. Siphunculi visible.

Male alate, with transverse dark bands on dorsum of abdomen and secondary rhinaria on antennal segment III-V and on base of VI.

Oviparae apterous with long dorsal hairs with capitate apices. Secondary rhinaria absent.

Discussion.—Richards (1968) recognised *Myzocallis* as a genus of 30 species, associated with holarctic Fagaceae and Betulaceae (*Corylus*, *Carpinus*, *Myrica*) of which a large number (25) occur in North America. He (op. cit) mentioned that 4 distinct subgenera viz. *Myzocallis* Passerini, *Agrioaphis* Walker, *Neomyzocallis* Richards and *Lineomyzocallis* Richards can be distinguished, both structurally and geographically. Eastop and Hille Ris Lambers (1976) recognised 28 species from the World under *Myzocallis* Passerini s. str. (12 species) and subgenus *Lineomyzocallis* Richards 1965 (15 species) and subgenus *Nippocallis* Matsumura 1917 (1 species) and considered *Agrioaphis* Walker and *Neomyzocallis* Richards as synonyms of *Myzocallis* s. str. All the 15 species of *Lineomyzocallis* Richards (Nearctic, and mainly feeding on *Quercus* spp.) recognised by Richards (1963) have been considered valid by Eastop and Hille Ris Lambers (1976), but while Richards (1965) considered *Nippocallis* Matsumura, 1917 as belonging to *Agrioaphis* Walker, Eastop and Hille Ris Lambers (1976) retained *Nippocallis* as a valid subgenus only synonymising *Agrioaphis* with *Myzocallis*.

Richards (1968) mentioned that only one species, *kuricola* (Mats.) on *Castanea* in Japan is known from Asia. David (1969) described *Myzocallis* (*Dryomyzus*) *polychaetus* from *Quercus* in India and as such two species appear to be known from Asia and the last named endemic species being the only one from India.

The genus is characterised by clusters of spinal hairs on the abdomen and absence of hairs on lateral processes when latter are present. Richards (1968) has provided a synopsis of the world fauna of *Myzocallis*. Quednau (1954) has given a key to the first

instar larvae of European species of the genus ; other regional reviews include Boudreaux and Tissot (1962) and Richards (1965) for North American species, Eastop (1966) for Australian species, Stroyan (1977) for British species and Heie (1982) for Scandinavian species.

Biology.—Most of the species are known to be monoecious and holocyclic on plants of Fagaceae besides a few on Corylaceae, Myricaceae, etc. Viviparae are usually alate except in 3-4 species where apterae viviparae are also known. The sexuales usually appear in November-December and eggs are laid on branches, in axils of buds and they hatch in spring and may continue parthenogenetic reproduction throughout, being scarce in summer months. The cycle may vary in different species and in different geographical regions and sexuales may appear in late autumn. These aphids are not attended by ants.

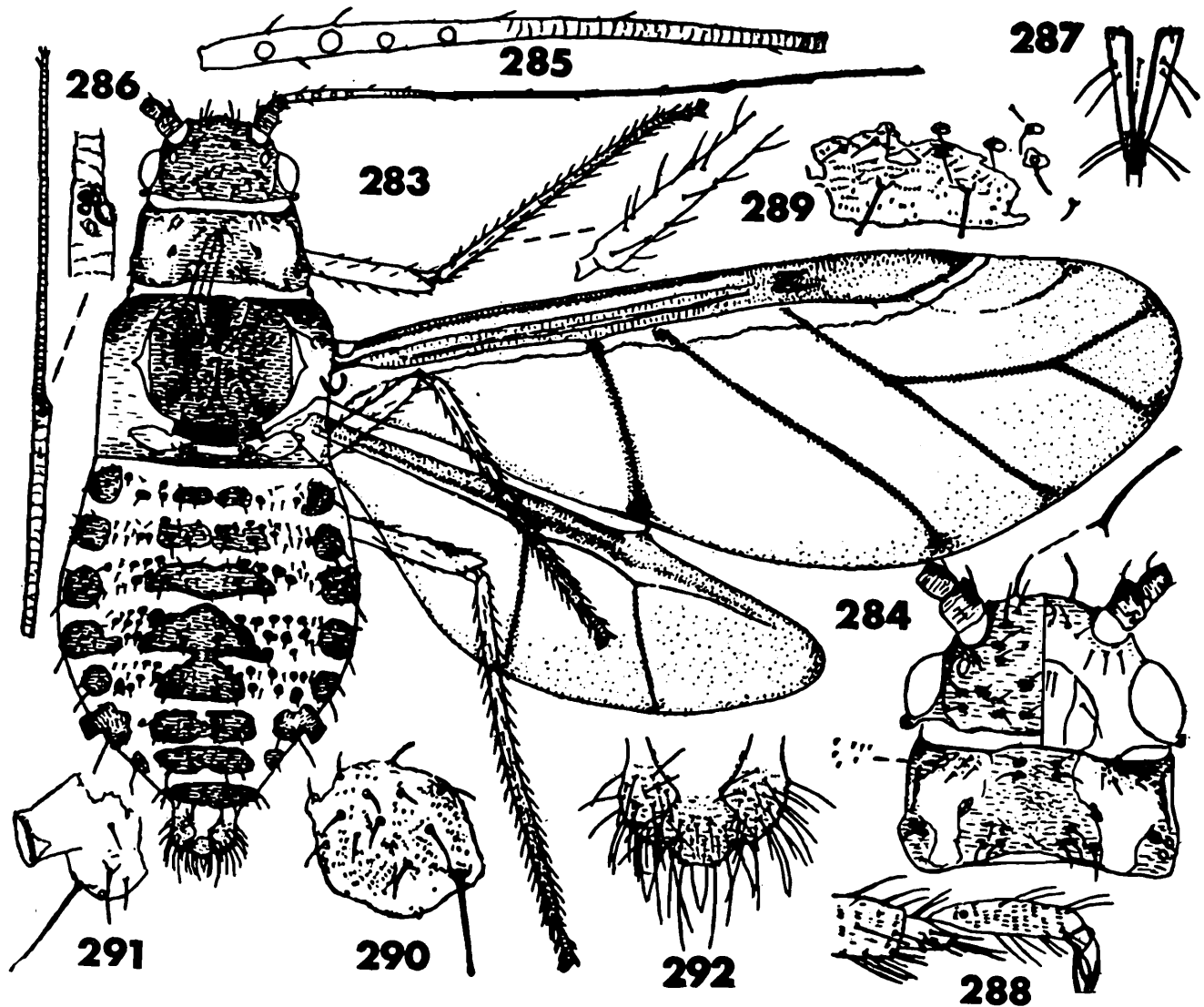
Distribution.—Originally holoarctic extending upto northern limit of Oriental region but a number of species are now widespread having been introduced to new areas, as into Australia.

Type species.—*Aphis coryli* Goeze, 1778. Location of type not known.

21 *Myzocallis polychaetus* David (Figs. 283-301)

1969. *Myzocallis (Dryomyzus) polychaetus* David, S. Kanakaraj, *Orient. Insects*, 3 (1) : 79.
1971. *Myzocallis (Agrioaphis) aptera* Richards, W.R., and Kumar, R., *Can. Ent.*, 103 : 116.
1974. *Myzocallis polychaeta*, Chakrabarti, S. and Raychaudhuri, D. N., *Indian J. Ent.*, 36 : 129,

Alate vivipara.—Body 2.3 mm long with 0.95 mm (of one specimen) as maximum width. Front convex, median protrusion undeveloped. Vertex brownish, dorsal cephalic hairs placed on small dark brown spots. Frontal hairs and anterior pair of discal hairs weakly capitate, about as long as antennal segment I. Remainder of cephalic setae in clusters, pointed, about half as long as discal setae. Antennae 0.9 times body length, segments I and II brown, the remainder



Myzocallis (Dryomyzus) polychaetus David. 283-292, alate vivipara : 283, body ; 284, head and pronotum ; 285, antennal segment III ; 286, antennal segment VI ; 287, apical rostral segment ; 288, hind tarsus ; 289, spinal sclerite of abdominal tergite II ; 290, lateral abdominal sclerite ; 291, siphunculus ; 292, cauda and anal plate.

yellowish with brown apices of segments and smooth imbrications; setae on flagellum sparse, pointed, the longest on segment III about equal to basal diameter of segment, processus terminalis 1.3 times as long as the base of segment VI. Antennal segment III with 4-5 secondary rhinaria. Rostrum reaching between fore and middle coxae, apical segment acute, 1.1 times as long as second segment of hind tarsus, bearing 5 accessory setae. Pronotum mottled with brown bearing anterior pleural setae in clusters and also 2 anterior and 4 posterior spinal setae and one pair of posterior lateral setae besides 0-2 marginal papillae. Pterothorax brown, wings hyaline,

costal veins and stigma fuscous, the latter with a small brown diffuse spot at base, veins brown with narrow diffuse bordering and small spots at apices, radial sector distinct but obliterated at base. Fore coxae normal. Legs yellowish with a small diffuse brown spot at subapical depression of hind femur, tarsi fuscous. Tibial setae pointed, the longest about 1.5 times as long as apical diameter of tibia. Rastral organ on fore tibia poorly developed. First tarsal segments with 5 dorsal and 2 ventral hairs. Empodials narrow flabellate. Abdomen with a pair of roundish brown lateral sclerites and a brown spinal crossbar on each of the tergites 1-7, the spinal bars of tergites 1 and 2 divided in the middle. Dorsal abdominal hairs mostly blunt or weakly capitate, arranged in clusters, longest spinal hairs 0.064-0.076 mm long and longest lateral hairs on tergites 6 and 7 0.083-0.098 mm long. Pleural hairs developed in clusters, about as long as basal diameter of antennal segment III, sometimes on sclerites. Tergite 8 with a brownish crossbar bearing 15 setae of which the longest measure 0.057 mm. Otherwise as in apterous vivipara.

Colour.—As in apterous vivipara.

Measurements in mm.—

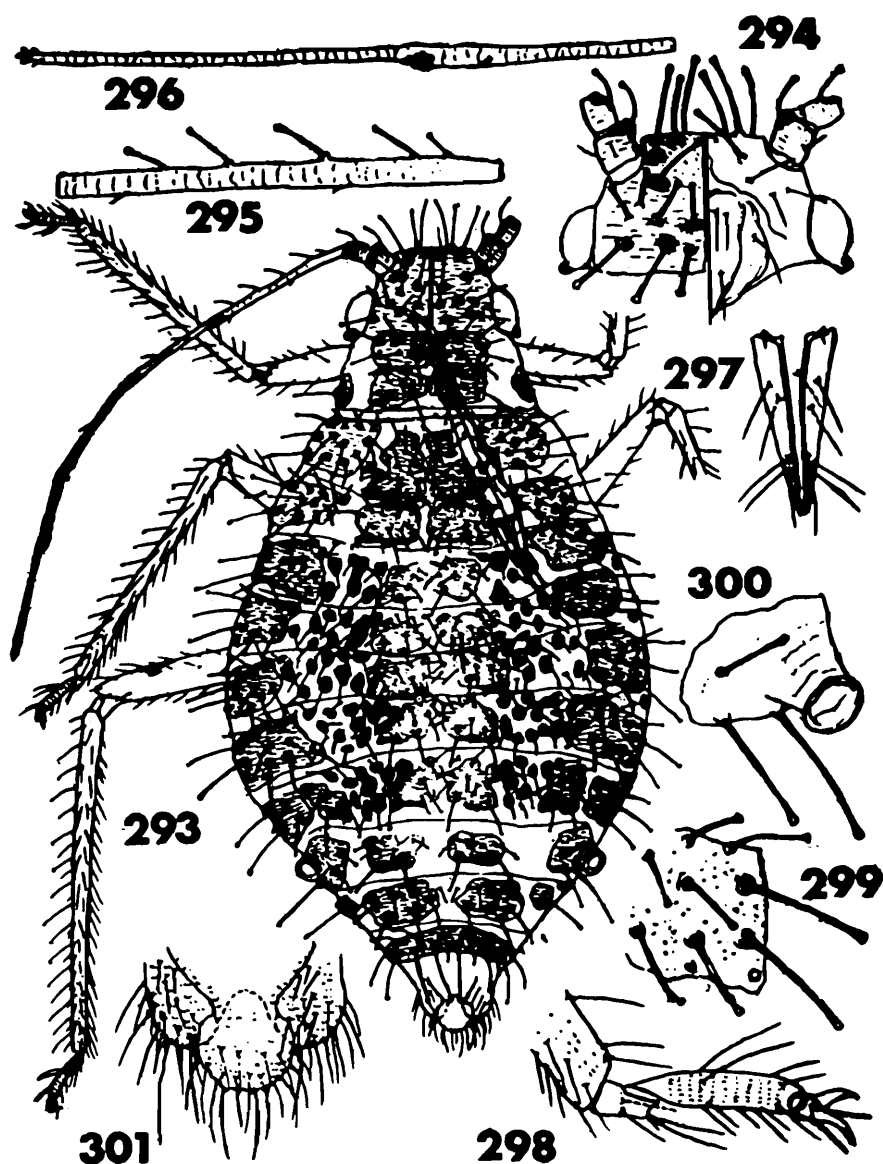
Length		Width		Antenna	
1.	2.27		0.95		2.05
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.51	0.42	0.41	(0.23+0.30)	0.11	0.11

(ex *Berberis vulgaris*, Kufri, India, 20. ii. 1966, Rabinder Kumar, in Canadian National Coll.).

Embryo.—Spinal and marginal setae capitate ; spinals on abdomen overlapping, not shortened nor laterally displaced. Antennal chataotaxy : 1+1, 1, 2 (inner seta longer than outer one), 1. Apical rostral segment with four accessory setae.

Apterous viviparous female.—Body 1.28 (—1.55 mm) long with 0.62 mm (of one specimen) as maximum width. Head with frons

convex, smooth. Dorsal cephalic hairs capitate, about 20, of these on frons (6) longer than others, up to 0.083-0.086 mm long, $3.2\times$ ($-5.0\times$) as long as the basal diameter of antennal segment III. Antennae $0.66\times$ ($0.70-0.75\times$) as long as the body, pale, slender, 6-segmented ; segment I and II with 1 big capitate hair each, 0.02 mm long (besides 1-2 shorter, acute hairs) , flagellum imbricated over antennal segments V and VI, rest smooth ; hairs on flagellum sparse, mostly capitate, except on V which has a single pointed hairs these being 0.010-0.016 mm long ; processus terminalis $1.4\times$ ($1.28-1.60\times$) as long as base of segment VI. Rostrum reaches



Myzocallis (Dryomyzus) polychaetus David. 293-301, apterous vivipara : 293, body ; 294, head ; 295, antennal segment III ; 296, antennal segment VI ; 297, apical rostral segment ; 298, hind tarsus ; 299, lateral abdominal sclerite ; 300, siphunculus ; 301, cauda and anal plate.

hind coxae, ultimate rostral segment $1.4 \times (1.25 \times)$ as long as second segment of hind tarsus bearing 5 accessory hairs. Tergum pale, often with sclerotic areas around bases of dorsal hairs, besides distinct light brown, paired, spinal and marginal sclerites on thoracic segments and abdomen ; spinal sclerotic areas often coalesced on 1st to 6th tergites ; dorsal hairs thick, long, of variable length, numerous ; at least one of the marginal hairs on 1st-6th tergites longer than others and up to 0.063 mm long, (shortest one on the same segment being 0.030 mm) ; some of the spinal hairs on 7th and 8th tergites may be as long as the longest marginal hair ; 8th tergite with 8-13 hairs, up to 0.103 mm long. Siphunculi short, truncate, brown, with dark rim. Cauda pale, knobbed, bearing 12-15 long, pointed hairs. Subanal plate bilobed, each lobe with 15-18 hairs (10). Legs pale with femora broad, and tibiae bearing numerous fine, stiff hairs, capitate in part ; first tarsal segments with 5 ventral hairs of which middle one is shorter than others (Figures within parenthesis from original description).

Colour.—Pale yellowish brown, may be with sclerotic markings.

Measurements in mm.—

	Length	Width	Antenna
1.	1.28	0.62	0.88
*2.	1.35	—	0.92
*3.	1.55	—	1.17

III	Ant. segments		VI	urs	ht ₂
	IV	V			
0.20	0.11	0.13	(0.11+0.14)	0.10	0.08
0.21	0.13	0.11	(0.13+0.21)	0.11	—
0.22	0.19	0.22	(0.16+0.20)	0.11	—

(ex *Quercus semicarpifolia* Rahla, Himachal Pradesh, 22.viii. 1969 ; *from David, S. K. 1969).

Material examined.—One apterous viviparous female from *Quercus semicarpifolia* Rahla, Himachal Pradesh, India, 22.viii. 1960, coll. S. S. Sekhon, det. S. K. David, N.Z.C.

Discussion.—The species was differentiated from its nearest ally, *M. glandulosus* H.R.L., by greater number of dorsal hairs, different sclerotic pattern and presence of long capitate hairs on antennal segment III. The species appears to be restricted to *Quercus* in North West Himalaya.

Distribution.—India : Himachal Pradesh.

Types.—In the collections of Dr. S. Kanakaraj David, 22 Kamaraj Avenue, Madras, India ; Paratypes in above collections and also in the collections of British Museum (Nat. Hist.), London, England.

Genus 14. *Neobetulaphis* A. N. Basu, 1964

1964. *Neobetulaphis* Basu, A. N., *J. Linn. Soc. (Zool.)*, **45** : 226 ; Higuchi, H., 1972, *Ins. matsum.*, **35** (2) : 84 ; Chakrabarti, S., and Raychaudhuri, A. N., 1978 (1975), *Proc. zool. Soc. Calcutta*, **25** : 84 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980, *In Aphids of North East India and Bhutan*, 292. Type species : *Neobetulaphis pusilla* A. N. Basu.

Morphology.—Body 1.3 to 2.5 mm long, elongate. Head (vertex) scabrous or integument corrugated, sometimes with a distinct median rectangular prominence. Antennae 6-segmented, distinctly shorter than the body ; apterae without secondary rhinaria ; alatae with transversely oval, ciliated, secondary rhinaria, restricted to segment III ; primary rhinaria ciliated ; hairs on flagellum very short, sparse ; processus terminalis $0.60 \times$ to nearly equal to the base of segment VI. Rostrum sometimes reaches hind-coxae, ultimate rostral segment subequal or equal to second segment of hind tarsus and bearing 2-5 accessory hairs. Dorsum in apterae distinctly segmented, sclerotic, locally scabrous or variolose, may also be unpigmented (*immaculata*), in alatae with or without dorsal dark, quadrangular, median patch ; dorsal hairs in apterae variable in length, usually on distinct tubercular bases, shorter ones with incrassate apices and longer ones capitate ; in alatae dorsal hairs long and acute, often with marginal sclerites on 2nd-5th tergite on low processes ; usually dorsal hairs are arranged in 6 longitudinal rows on 1st-6th tergite, 7th tergite with 4 hairs, 8th tergite with 6-10 hairs. Siphunculi truncated and conical with a wide flange, sometimes hairs appended to the base. Cauda in apterae

elongate with distinct constriction near basal 0.33 portion, with a nearly acute tip ; in alatae, cauda may be very broadly conical without any constriction (e.g. *pusilla*) or may be distinctly knobbed with a basal constriction (*chaetosiphon*). Subanal plate bilobed, lobes may be widely separated each bearing up to 16 hairs. Rudimentary gonapophyses 4 or indistinctly separated. Legs with apices of tibiae and whole of second tarsal segments spinulose ; apical tibial hairs differentiated in alatae ; first tarsal segments with 5 ventral hairs and without any dorsal hairs ; empodial hairs flattened. Wing venation normal.

Embryos with minute spinal and pleural hairs but with distinct capitate marginal hairs, usually 6 per segment on 1st-6th tergite ; 7th and 8th tergite each with 2 spinal and 2 marginal hairs, all of which are capitate. Apical rostral segment without accessory hair. Siphunculi pore-like.

Sexual forms not known.

Discussion.—Basu (1964) described the type species *pusilla* from Darjeeling in West Bengal, India (not Assam ; cf. Higuchi, 1972) and separated the genus from closely related *Betulaphis* by the constriction of elongated cauda and rectangular median frontal prominence. Raychaudhuri et al. (1980) mentioned that wax pores are absent but Quednau and Chakrabarti (1980) while describing *N. chaetosiphon* from Darjeeling-Sikkim region, mentioned about presence of minute wax gland pores in clusters on the dorsum of apterae and also on appendages of alatae. The genus now contains 4 species, viz., *N. pusilla* Basu, 1964 from Darjeeling, India, *N. alba* Higuchi, 1972 from Japan, *N. immaculata* A. K. Ghosh, 1976 from Shillong, India and *N. chaetosiphon* Quednau and Chakrabarti, 1980 from Darjeeling-Sikkim region of India, all being recorded only on Betulaceae. Higuchi (1972) included *Neobetulaphis* under *Symydobius* group (=Phyllaphidini Börner), which resembles *Myzocallis* group but can be separated by the presence of pleural hairs in embryos. Quednau and Chakrabarti (1980) pointed out that embryos resemble those of *Betulaphis*, but unlike the latter, have the marginal and spinal hairs on 7th tergite elongate and capitate.

Biology.—All the four species, as stated, are known to be associated only with Betulaceae (*Alnus* and *Betula* spp.). Most of the collection records in India indicate predominance during December to February, although apterae and nymphs have also been collected in July and August, both in India and Japan. These species appear to lead anholocyclic life cycles on Betulaceae.

Distribution.—India ; Japan.

Type species.—*Neobetulaphis pusilla* A. N. Basu, 1964. Deposited in the Section of Entomology, State Agricultural Research Institute, Govt. of West Bengal, Calcutta, India.

Key to the species of *Neobetulaphis* Basu

Apterous viviparous females :

1. Spinal and pleural hairs arising from elevated bases, upto $1.8-2.5 \times$ as long as the basal diameter of antennal segment III. Tergum weakly sclerotic, scabrous on head and thorax, variably wrinkled on abdomen *.pusilla* A. N. Basu

—Spinal and pleural hairs minute, never placed on elevations 2

2. Tergum mostly smooth, unpigmented, without wax gland pores. Rostrum reaches almost to hind coxae. Marginal hairs 0.050 mm long, $2.1 \times$ as long as the basal diameter of antennal segment III. Siphunculi 0.06 mm long without hairs appended. Longest hair on 8th tergite $3.1-3.5 \times$ as long as basal diameter of antennal segment III. Body upto 1.52 mm long *immaculata* A. K. Ghosh

—Tergum pigmented, sclerotic, scabrous or variolose with minute wax gland pores. Rostrum reaches to midcoxae. Marginal hairs $1.50-2.0 \times$ as long as basal diameter of antennal segment III. Siphunculi 0.095 mm long with 1 or 2 hairs appended near base. Longest hair on 8th tergite $2.0-3.0 \times$ as long as basal diameter of antennal segment III. Body up to 2.17 mm long *chaetosiphon* Quednau & Chakrabarti

Alate viviparous females :

Siphunculi 0.121 mm long with hair attached near middle. Dorsum of abdomen pale. Cauda with an elongate knob and bearing a dorsal projection

chaetosiphon Quednau &
Chakrabarti

—Siphunculi up to 0.110 mm long without hair being appended near middle. Dorsum of abdomen with irregular quadrate sclerotic patch. Cauda broadly conical without any constriction

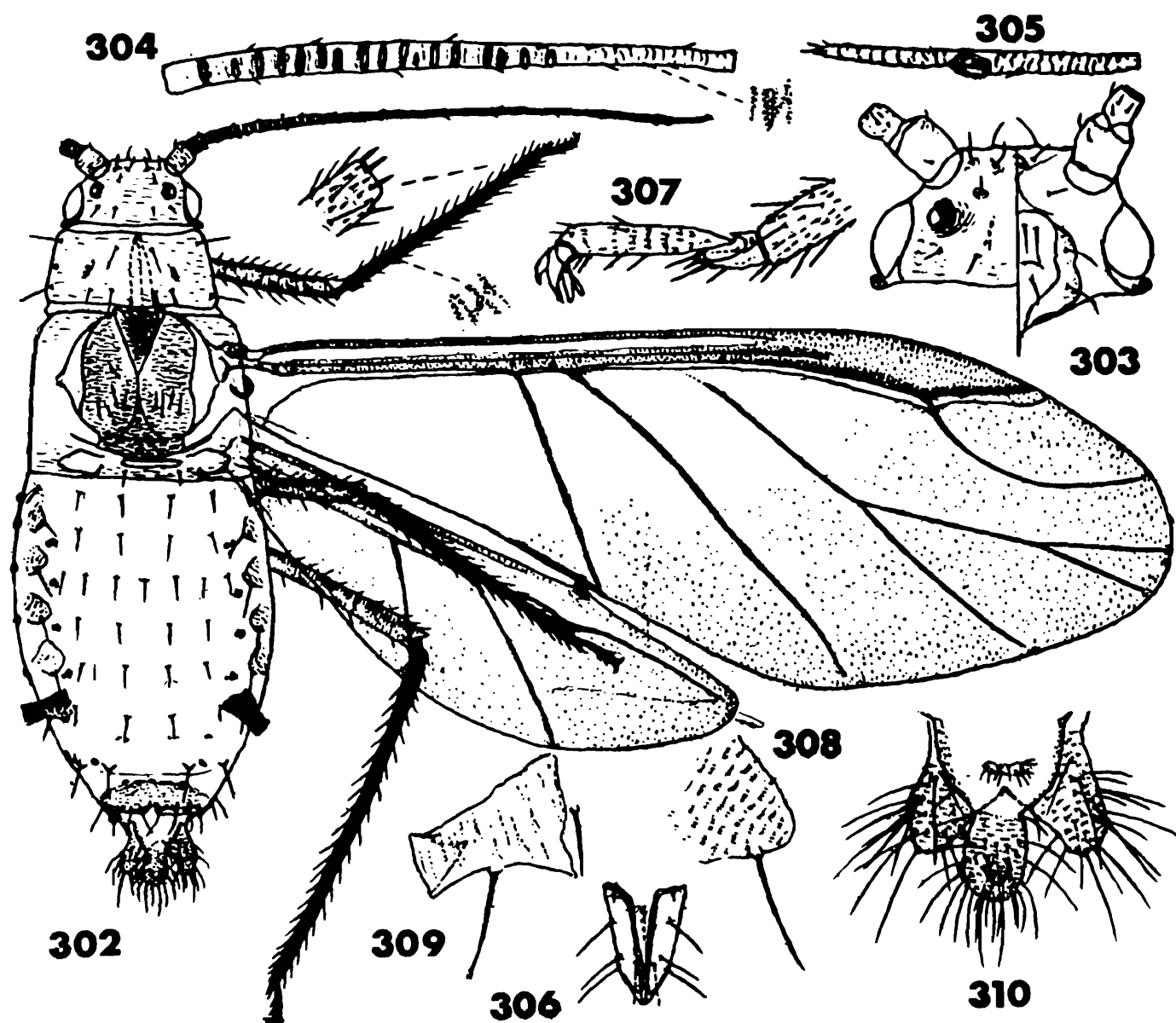
.pusilla A. N. Basu

22. *Neobetulaphis chaetosiphon* Quednau & Chakrabarti
(Figs. 302-319)

1980. *Neobetulaphis chaetosiphon* Quednau, F. W. and Chakrabarti, S., *Can. Ent.*, **112** : 5.

1980. *Neobetulaphis chaetosiphon*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India, Bhutan*, 294.

Alate viviparous female.—Body somewhat elongate, 2.55 mm long. Head and pronotum pale brown ; cephalic hairs on vertex 1.0-1.5× as long as basal diameter of antennal segment III. Antennae 6-segmented ; segment I and II pale brown, flagellum blackish except for pale base of antennal segment III ; segment III with 16-22 narrow elliptical ciliated secondary rhinaria ; hairs on flagellum short, hardly exceeding 0.30-0.35 of the basal diameter of segment III ; processus terminalis a little shorter (0.78-0.81×) than the base of segment VI. Rostrum reaches between fore and midcoxae, ultimate rostral segment 0.81× as long as second segment of hind tarsus and bears 2-3 accessory hairs. Mesonotum dark, with hairs 1.5-2.5× as long as basal diameter of antennal segment III, with acute or fimbriate apices. Abdominal dorsum pale except lateral processes on tergites 2-4 and the 8th tergite which are infuscated ; hairs on abdominal tergites basically arranged in 6 longitudinal rows on 1st-6th tergites but with a few additional spinopleural hairs interspersed, the spinal ones 1.5-1.75× and the marginal ones 1.5-2.5× as long on the basal diameter of antennal segment III ; 7th tergite with 4 hairs, 2.75-3.0× as long as the mentioned diameter ; 8th tergite with 8-10 hairs, 2.0-3.0× as long as the mentioned diameter. Siphunculi 0.092-0.095 mm long.



Neobetulaphis chaetosiphon Quednau & Chakrabarti. 302-310, alate vivipara : 302, body ; 303, head ; 304, antennal segment III ; 305, antennal segment VI ; 306, apical rostral segment ; 307, hind tarsus ; 308, lateral abdominal process ; 309, siphunculus ; 310, cauda and anal plate.

truncate, sclerotic, spinulose, with two hairs of tergite 6 appended, one near base and one at midlength. Cauda constricted, with an elongate knob bearing a dorsal projection and about 30 hairs of which 2 at base of cauda. Subanal plate deeply bilobed, each lobe with 16 hairs. Legs with tibial hairs acute, up to $2.0\times$ as long as the distal width of tibia ; apices of tibiae and tarsi spinulose ; first tarsal segments with 5 ventral hairs and without any dorsal hairs ; empodials flabellate. Minute wax pores present in clusters on appendages , vertex, pronotum and mesonotum scabrous.

Colour.—Not recorded.

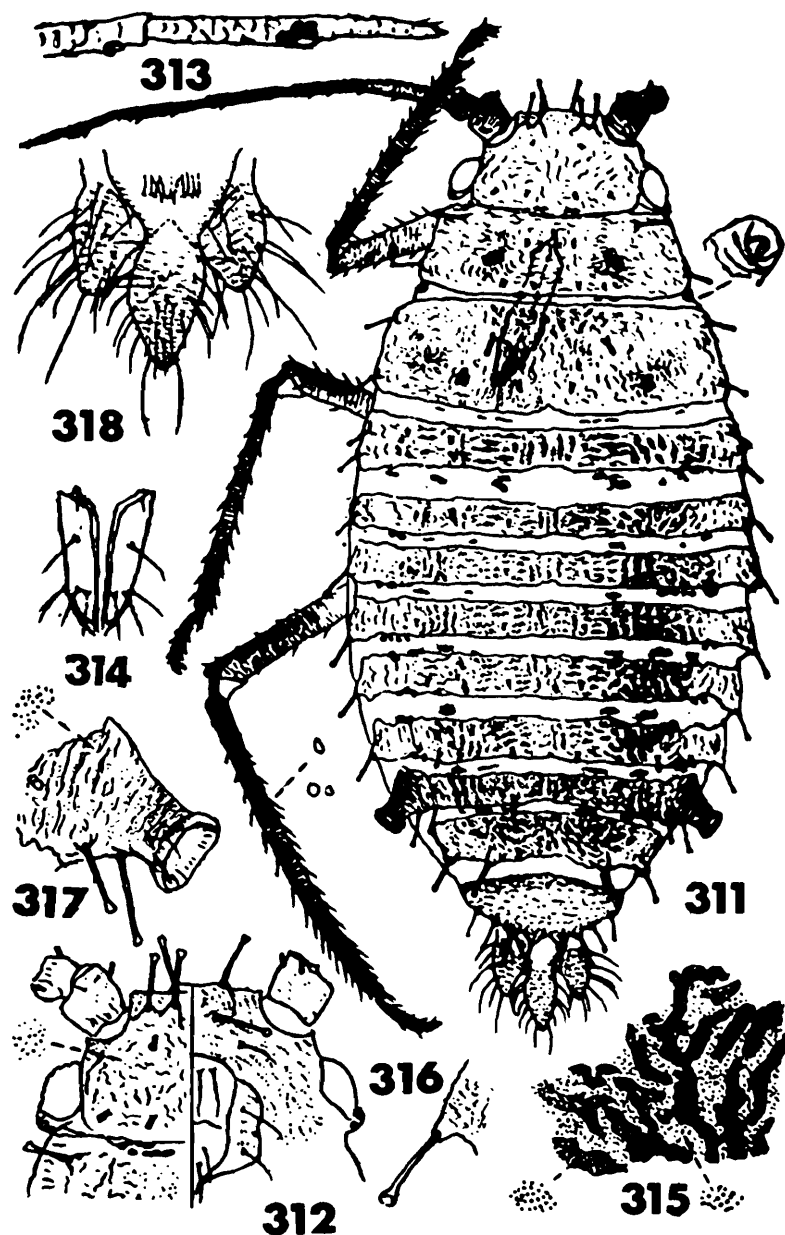
Measurement in mm.—

	Length	Width	Antenna
1.	2.55	0.92	1.86
2.	2.09	0.75	1.52
3.	2.21	0.79	1.61

	Ant. segments				urs	ht ₂	siph
III	IV	V	VI				
0.680	0.425	0.334	0.163+0.114	0.098	0.121	0.121	
0.619	0.364	0.304	0.152+0.133	0.089	0.120	0.100	
0.665	0.399	0.330	0.163+0.121	0.089	0.117	0.104	

(1, ex *Alnus nepalensis*, Pandam, Basti, Darjeeling, 4.xi.1970 ; 2, 3, ex *Betula* sp., Kalimpong, W. Bengal, 17.xi.1972, U. Calcutta Coll.).

Apterous viviparous female.—Body 2.1-2.3 mm long with 0.96-1.1 as max. width. Frons little protruded in the middle. Dorsal hairs on vertex 1.5-1.66 $\times$ as long as basal diameter of antennal segment III ; two pairs of anterior capitate hairs 0.073 mm long arising from small cone-shaped process and 4 capitate hairs 0.050 mm long arising from the median ventral processus of frons, two small anterior and 4 small posterior discal hairs hardly 0.33 $\times$ as long as the mentioned diameter and with blunt or incrassate apices. Antennae 6-segmented about 0.58-0.60 $\times$ as long as the body ; segments I and II brown ; flagellum blackish brown ; hairs on flagellum sparse, 0.006-0.010 mm long, blunt or with incrassate apices ; processus terminalis a little shorter than the base of segment VI. Rostrum reaches near middle coxae, ultimate rostral segment 0.85-0.87 $\times$ as long as second segment of hind tarsus and bears 2-3 accessory hairs. Dorsum pigmented with dark brown segmentally separated sclerotic bands which are variolose and bear minute wax gland pores in clusters ; dorsal hairs on tergites 1-6 arranged in basically 6 longitudinal rows with sometimes a few additional spinopleural hairs ; spinal and pleural hairs minute 0.006-0.010 mm long, 0.16 $\times$ (0.33-0.50 $\times$) but marginal hairs capitate 0.05-0.07 mm long, 1.5-2.0 $\times$ as long as the basal diameter of anten-



Neobetulaphis chaetosiphon Quednau & Chakrabarti. 311-318, apterous vivipara : 311, body ; 312, head ; 313, antennal segment VI ; 314, apical rostral segment ; 315, integument of abdominal tergites with wax gland pores ; 316, lateral abdominal hairs ; 317, siphunculus ; 318, cauda and anal plate.

nal segment III, respectively, hairs on tergites 7 and 8 capitate ; 0.080-0.115 mm long or 2.0-3.0 $\times$ as long as the mentioned diameter ; marginal hairs arising from small lateral processes. Siphunculi truncate with marginal and pleural hairs of 6th tergite appended to the base. Cauda with a pointed elongated knob and bears 28-32 hairs of which 2 at the base of cauda. Subanal plate bilobed, each lobe with 12-16 hairs. Gonochaetae 11. Legs with longest tibial hairs about 0.70 $\times$ as long as the middle width of tibia ;

hind tibiae sometimes with a few pseudosensoria ; apices of tibiae and second tarsal segments spinulose ; first tarsal segments with 5 ventral hairs.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.11	0.96	1.24		
2.	2.35	1.08	1.38		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.39	0.216	0.216	(0.14+0.10)	0.102	0.117
0.45	0.289	0.242	(0.15+0.11)	0.104	0.117

(1, 2. ex *Quercus* sp., Kalimpong, W.B., 17.ii. 1972, K. U. Coll.).

Embryo.—Antennae 4-segmented bearing 1+1, 3,2, 1 hairs on segments I-IV Vertex with 6 anterior hairs elongate and capitate, lateral hairs in pairs on pro-meso- and metanotum, single on tergites 1-6 ; spinal and pleural hairs arranged in longitudinal rows of 1 spinal and 1 pleural pair each per tergite, minute ; 7th tergite with all 4 hairs elongate and capitate ; 8th tergite with 2 capitate hairs. Siphunculi ring-like.

Material examined.—Two apterous viviparous females from *Quercus* sp., Kalimpong, West Bengal, India, 17.ii .1972, (K.U. Coll.) ; Three alate viviparous females from *Alnus nepalensis*, Kalimpong, West Bengal, 17.XI.1972, (C.U. Coll.).

Discussion.—The species differs from the closely related, *N. immaculata* A. K. Ghosh in the variolose nature of tergum and in having shorter antennae, rostrum and marginal hairs but in particular the sclerotic condition of the tergum with wax pores makes the species distinctive. This species occurs during months of November to March on *Alnus nepalensis* and *Betula utilis* in Sikkim-Darjeeling Himalaya, besides occassionally on *Quercus*.

Distribution.—India : West Bengal, Sikkim.

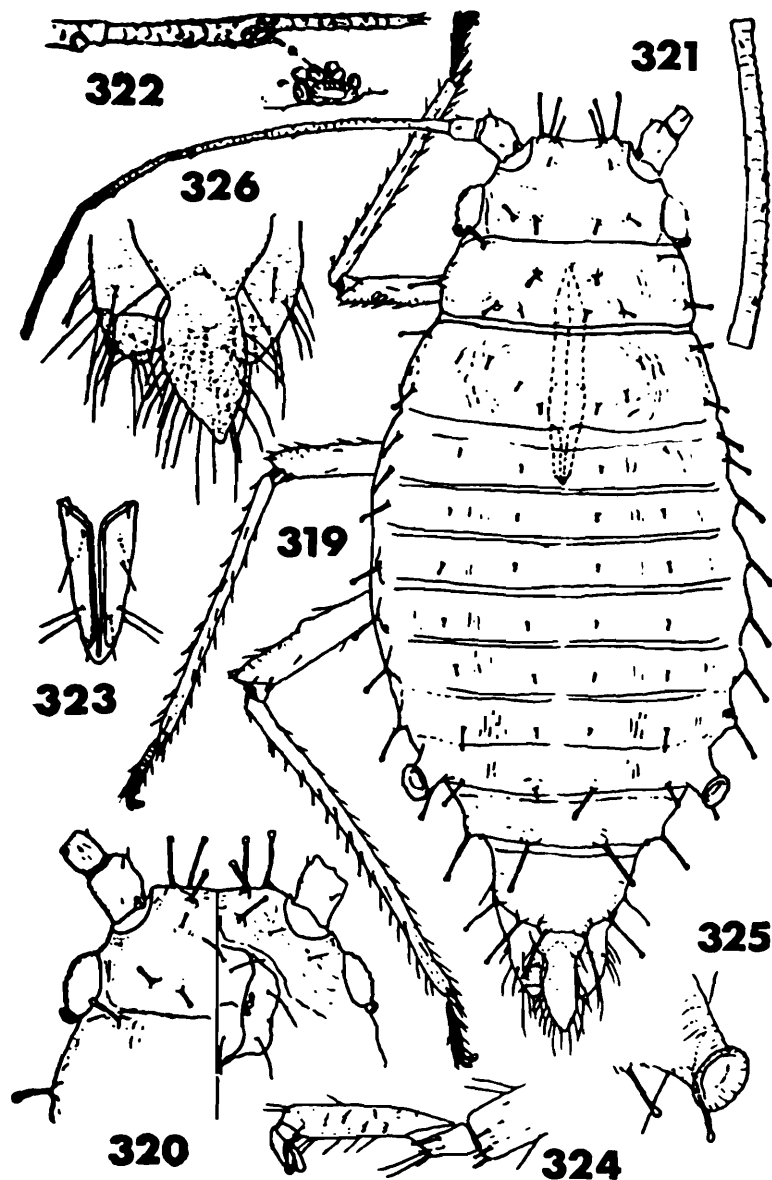
Types.—Holotype and paratypes in the collections of Entomology Laboratory, University of Calcutta, Calcutta, India ; paratypes also in the collection of Canadian National Collection, Canada, British Museum (Nat. Hist.), London, England and in Department of Zoology, University of Kalyani, Kalyani, India.

23. *Neobetulaphis immaculata* A. K. Ghosh
(Figs. 319-326)

1976. *Neobetulaphis immaculata* Ghosh, A. K. *Orient. Insects*, 10 : 46.

1980. *Neobetulaphis immaculata*, Quednau, F. W. and Chakrabarti, S., *Can. Ent.*, 112 : 7.

Apterous viviparous female.—Body pale elliptical 1.20-1.52 mm with 0.60-0.75 mm as maximum width. Head pale, on ventral long side spinulose, with an indistinct median prominence, vertex bearing 5 pairs of stout hairs with knobbed apices, the longest one 0.050-0.063 mm long, the shortest one 0.020-0.036 mm long, these being 2.7-3.0 $\times$ and 1.5-2.0 $\times$ as long as the basal diameter of antennal segment III, respectively. Antennae 6-segmented, 0.62-0.68 $\times$ as long as the body, thin and pale except apices of segment V and whole of segment VI which are darker ; flagellum imbricated ; hairs on flagellum sparse, minute, 0.006-0.007 mm long, hardly 0.3 $\times$ as long as the basal diameter of the segment III ; processus terminalis 0.35-0.38 $\times$ as long as base of segment VI. Rostrum reaches nearly hind coxae, ultimate rostral segment as long as second segment of hind tarsus and bears 4 accessory hairs. Tergum pale, nearly smooth, except some longitudinal wrinkles in the pleural region. Marginal hairs stout, elongate and capitate, but the spinal and pleural ones short with incrassate apices ; hairs on the dorsum of abdomen arranged in 6 longitudinal rows with 2 spinal, 2 pleural and 2 marginal hairs per segment ; longest hair on anterior tergites (marginal) 0.050 mm long, shortest one (spinal) 0.010 mm long, these being 2.1 $\times$ and 0.4 $\times$ as long as basal diameter of antennal segment III, respectively ; 7th tergite with 4 long, stout hairs, longest one being 0.073-0.083 mm long, 3.1-3.5 $\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 6-7 long hairs, longest one being 0.083-0.100 mm long, 3.5-4.3 $\times$ as long as the mentioned diameter. Siphunculi pale, truncate, 0.60 $\times$ as long as their basal width, 0.06-0.08 $\times$ as long as the body, nearly smooth and with wide apical flange.



Neobetulaphis immaculata A. K. Ghosh. 319-326, apterous vivipara : 319, body ; 320, head ; 321, antennal segment III ; 322, antennal segment VI ; 323, apical rostral segment ; 324, hind tarsus ; 325, siphunculus ; 326, cauda and anal plate.

Cauda pale, elongate, pointed, constricted near basal 0.30 portion and bearing about 25 long fine hairs. Subanal plate pale, spinulose, deeply bilobed, bearing 10-14 long hairs on each lobe. Legs pale with tarsi a little darker, tibiae with some spinulose imbrications near apices ; apical tibial hairs not much differentiated.

Colour.—Pale yellow in life.

Measurements in mm.—

	Length	Width	Antenna
1.	1.52	0.75	0.96
2.	1.20	0.60	0.87
3.	1.24	0.68	0.85

	Ant. segments				urs	ht ₂	Siph.
III	IV	V	VI				
0.29	0.18	0.16	(0.10+0.10)	0.10	0.10	0.10	0.06
0.25	0.15	0.15	(0.10+0.09)	0.10	0.10	0.10	0.05
0.24	0.16	0.15	(0.10+0.09)	0.10	0.10	0.10	0.05

(1, 2, 3, ex undet. Rosaceae (?), Shillong, Meghalaya, India, 8.vii.1974, N.Z.C.).

Apterous nymph.—Body pale 0.59 mm long with 0.44 mm as maximum width. Dorsal cephalic hairs knobbed 0.033-0.036 mm long. Antennae 5-segmented 0.69×as long as body ; hairs on flagellum sparse, blunt or acuminate, hardly 0.006 mm long. Rostrum reaches hind coxae, ultimate rostral segment 0.093 mm long, nearly equal to second segment of hind tarsus and bears 2 accessory hairs. Dorsal hairs arranged in 6 longitudinal rows from pronotum to 6th abdominal tergites, spinal and pleural hairs 0.013-0.016 mm long, marginals 0.033-0.060 mm long ; 7th and 8th tergite each with 4 long thick hairs, 0.066-0.073 mm long, up to 2.0×as long as basal diameter of antennal segment III. Siphunculi small with thick apical flange. Legs pale, short, stout ; hind titibae densely spinulose over apical portion ; hairs on legs fine, acute.

Colour.—pale in life.

Measurements in mm.—

Length	Width	Antenna
0.89	0.44	0.62

	Ant. segments			urs	ht ₂
III	IV	VI			
0.31	0.11	(0.09+0.10]	0.093	0.10	

(ex unidentified plant, Shillong, Meghalaya, 8.vii.1974, N.Z.C.).

Material examined.—Seven apterous viviparous females (holotype and paratypes) and 2 apterous nymphs (paratypes) from unidentified plant of (?) Rosaceae, Shillong, Meghalaya, India, 8.vii.1974, coll. A. C. Sukla (N.Z.C.).

Discussion.—The presence of long rostrum and long marginal hairs, pale smooth tergum and pale antennae and legs help to separate this species from related ones. This species appears to be rare in occurrence in its area of distribution.

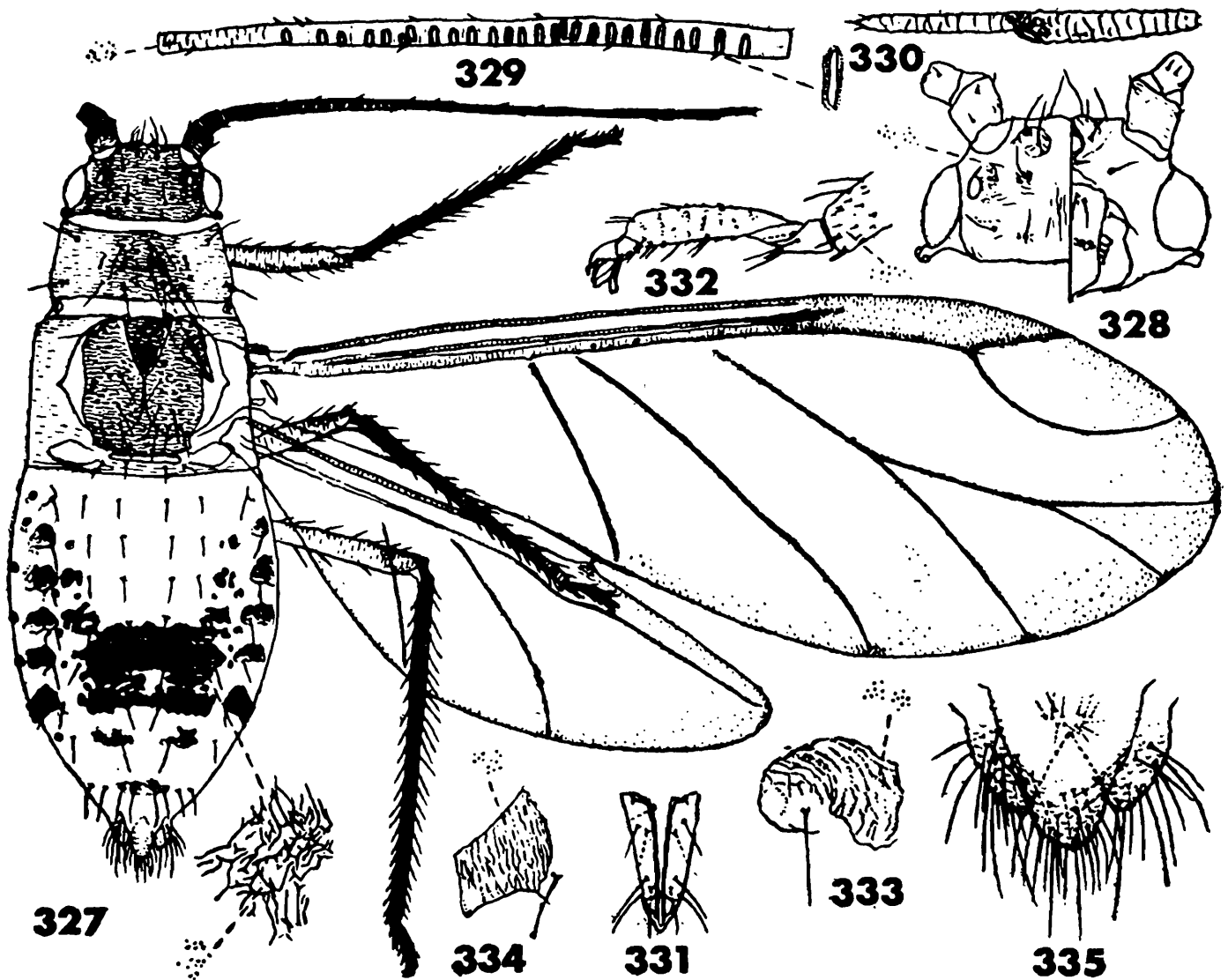
Distribution.—India : Meghalaya.

Types.—In the National Zoological Collections, Zoological Survey of India, Calcutta, India.

24. *Neobetulaphis pusilla* A. N. Basu (Figs. 327–344)

1964. *Neobetulaphis pusilla* Basu A.N. *J. Linn. Soc. (Zool.)* ; 45 : 223.
 1978. (1975) *Neobetulaphis pusilla*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. Zool. Soc. Calcutta*, 28 : 84.
 1984. *Neobetulaphis pusilla*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 294.

Apterous viviparous female.—Body elongate, spindle-shaped, 1.69-2.33 mm long with 0.89-1.20 mm as maximum width. Head spinulose on ventral side, with a quadrangular scabrous median prominence ; vertex bearing 5 pairs of cephalic hairs, 0.052-0.067 mm long, 1.5-2.5× as long as basal diameter of antennal segment III. Antenne 6-segmented, 0.47-0.59× as long as the body ; flagellum distinctly imbricated except on outer margin of antennal segment III ; hairs on antennae minute, 0.006-0.010 mm long, 0.16-0.20× (—0.25×) as long as basal diameter of antennal segment III ; process terminalis 0.56-0.84× as long as base of antennal segment VI. Rostrum hardly reaches beyond mid-coxae, ultimate rostral segment subequal to second segment of hind tarsus and bears 2-4 accessory hairs. Tergum weakly sclerotic, distinctly segmented ; abdomen often with distinct segmentally separated scabrous brownish bands ; dorsal hairs conspicuous mostly long and capitate arising from distinct tuberculate bases ; but some spinal and pleural



Neobetulaphis pusilla A. N. Basu. 327-335, alate vivipara : 327, body ; 328, head ; 329, antennal segment III ; 330, antennal segment VI ; 331, apical rostral segment ; 332, hind tarsus ; 333, lateral abdominal process ; 334, siphunculus ; 335, cauda and anal plate.

hairs on mesonotum and abdominal tergites 1-3 short with incrassate apices ; abdomen on 1st-6th tergites with 6 longitudinal rows of hairs (2 spinal, 2 pleural, 2 marginal per segment) of which the marginal hairs are longest, $1.5-2.0\times(-2.8\times)$ as long as the basal diameter of antennal segment III and arising from short processes ; 7th tergite with 4 hairs arising from tuberculate bases and 8th tergite with 8-9 hairs arising from tuberculate bases, these hairs being $0.056-0.086$ mm long, up to $2.0\times(-3.12\times)$ as long as the basal diameter of antennal segment III. Siphunculi pale at base, brownish or brownish black on the remainder, truncated, $0.50\times$ as long

as basal width, $0.03-0.04 \times$ as long as the body. Cauda pale, elongate, pointed, distinctly constricted near basal 0.33 portion, bearing 19-17 hairs. Subanal plate deeply bilobed, each lobe with 10-15 hairs. Rudimentary gonapophyses 3 or fused. Legs brown with second tarsal segments darker ; apices of hind tibiae spinulose ; apical tibial hairs acute, stiff but not much differentiated from other hairs near apices ; first tarsal segments with 5, 5, 5, ventral and without dorsal hairs.

(Figures within parenthesis from original description.)

Colour.—Yellowish green with deep green transverse bands on thorax and abdomen ; antennae brown, eyes red ; siphunculi and cauda greenish (Basu, 1964).

Measurements in mm.—

	Length	Width	Antenna
1.	2.20	1.07	1.31
2.	1.95	0.82	?
3.	2.10	1.00	1.10

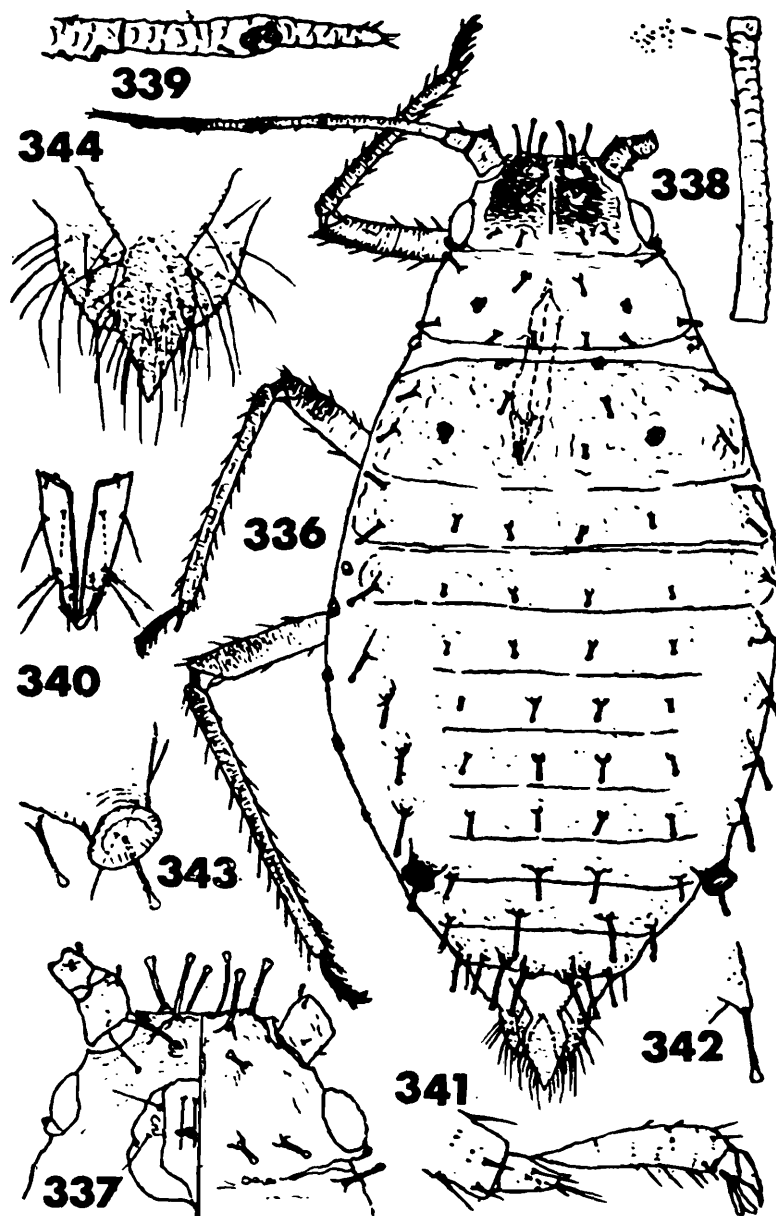
III	Ant. Segments			urs	ht ₂	Siph.
	IV	V	VI			
0.41	0.21	0.21	(0.13+0.09)	0.10	0.11	0.09
0.20	—	—	—	0.10	0.11	0.09
0.35	0.21	0.21	(0.12+0.09)	0.11	0.11	0.09

(1, 2, 3, ex *Alnus nepalensis*, Darjeeling, W.B., 4.ii.1970 (1) and 24.i.1972 (2, 3).)

Nymph.—Appears similar to apterae ; dorsal chaetotaxy as in adults ; legs with apical 0.66 portion spinulose.

Alate viviparous female.—(Not available for present study ; description based on A. N. Basu, 1964).

Body 2.03 mm long. Head and thorax blackish brown ; head without frontal tubercles. Antennae $0.78 \times$ as long as the body ;



Neobetulaphis pusilla A. N. Basu. 336-344, apterous vivipara : 336, body ; 337 head ; 338, antennal segment III ; 339, antennal segment VI ; 340, apical rostral segment ; 341, hind tarsus ; 342, lateral abdominal process ; 343 siphunculus ; 344, cauda and anal plate.

flagellum brown to dark brown except pale base of segment III which is hardly imbricated, and bears 23—24 transversely oval secondary rhinaria arranged in a row, segment IV-VI imbricated ; processus terminalis $0.73\times$ as long as the body. Ultimate rostral segment bears 6 accessory hairs. Abdomen with a blackish brown quadrangular patch, formed by fusion of segmental bars on 4th-6th tergites, bearing perforations ; pleural sclerites discernible on 2nd, 3rd and 7th tergites, marginal sclerites on 2nd-5th tergite appear processus-like, spinulose and bearing a hair each, dorsal hairs

acute, of similar length as those on vertex, $2.0 \times$ as long as the basal diameter of antennal segment III ; 8th tergite with 8 hairs, $2.4 \times$ as long as the mentioned diameter. Siphunculi blackish brown and bearing fine spinulose striae. Cauda pale, broadly tongue-shaped without any constriction and bears 17 hairs. Legs with apices of tibiae spinulose. Wing venation normal.

Colour.—Not recorded.

Measurement in mm.—

Length		Antennae			
2.03		1.60			
III	Ant. segments		VI	Siph.	Cauda
	IV	V			
0.63	0.33	0.26	(0.13+0.09)	0.11	0.08

(ex *Betula utilis*, Darjeeling, W.B., 13.iii.1958).

Material examined.—Two apterous viviparous females and 2 nymphs from *Alnus nepalensis*, Darjeeling, West Bengal, India, 24.1.1970, coll. S. D. Chakrabarti ; two apterous viviparous females and one nymph, 4.2.1970, other data same (N.Z.C.).

Discussion.—The species originally recorded from *Betula utilis* also infests *Alnus nepalensis* in the same region. Small colonies are formed on the undersurface of leaves of host plants, during January to March. This species is rather restricted to Darjeeling hill region and has not been recorded elsewhere.

Distribution.—India : West Bengal (Darjeeling).

Types.—Holotype and some paratypes in the collections State Agriculture Research Institute, W.B. Government, Calcutta, India, and paratypes in the collection of British Museum (Nat. Hist.), London, England.

15. *Neocranaphis* new genus

Type species : *Shivaphis arundinariae* Takahashi, 1940.

Morphology.—Alate vivipara. Body pale or with infuscations on vertex and thoracic nota, antennal segments I and II dusky, the remainder pale or with infuscations at apices of segments III to VI, legs pale with knees, apices of tibiae and tarsi brownish. Frontal tubercles weakly developed. Frons not produced in the middle. Epicranial suture rudimentary or absent. Antennae of 6 segments, subequal to or shorter than body length. Antennal segment I longer than wide. Primary rhinaria ciliate. Accessory rhinaria not separated from primary rhinarium. Secondary rhinaria small, suboval. Processus terminalis much shorter than base of ant. segm. VI. Hairs of ant. segm. III about as long as the basal width of the latter, pointed. Apical rostral segment shorter than hind tarsus II, as long as wide at base. Wings normal, hyaline or with veins weakly bordered, radial sector rudimentary with only basal part near pterostigma developed; pterostigma infuscated at base and apex. Fore coxae moderately enlarged. Rastral organ of tibiae not much differentiated from other setae. Femora and tibiae with elongate pointed setae and provided with fields of wax gland pore elements. Empodial hairs short, setiform. Abdomen without processes and distinct sclerites, marginal lobes developed as low convex elevations. Dorsal body hairs rather elongate, thin, pointed, on abdomen developed as one spinal and one marginal pair on each tergite, those of tergite 7 sometimes marginally displaced, and a few pleural setae may also be present. Dorsal body hairs surrounded by fields of wax gland pore elements of various shapes, but these may be absent on some of the posterior abdominal tergites. Siphunculi poriform on low elevations provided with wax gland pore elements. Marginal abdominal hair, on 6 not appended to siphunculi. 8th abdominal tergite with variable number of hairs. Cauda with knob more or less separated by a constriction. Anal plate deeply indented.

Alatoid nymph with general body features much as in the alate vivipara.

Embryo not known.

Discussion.—This genus is closely related to *Shivaphis* Das, 1918. Two species are known, the genotype from Formosa and *N. bambusicola* (David, Rajasingh & Narayanan) from Darjeeling, which was originally placed in *Cranaphis* and later on considered under *Shivaphis*. The differences from *Shivaphis* mainly concern the shape of the empodial hairs that are setiform (flabellate in *Shivaphis*), the very short apical rostral segment and the peculiar shape of the radial sector which is developed only at its base, the more elongate first antennal segment and the weak indication of an epicranial suture (totally absent in *Shivaphis*). The genus *Cranaphis* Takahashi, 1939, is also related, but differs by a produced frons, presence of well developed epicranial suture, absence of specialized wax gland pore fields on the dorsum and by complete radial sector, flabellate empodial hairs and shorter, stiffer dorsal body hairs. The genus *Phyllaphoides* Takahashi, 1921 is also related but differs by the total absence of the empodial hairs, by enlarged femora and by siphunculi with an appended hair.

Biology.—Both the members of the genus infest Bamboo in temperate hill-tracks. Takahashi (1940) mentioned that *arundinariae* occurs in small numbers during the month of September on *Arundinaria* which is abundant in higher elevation in Formosa. While nothing is known about life cycle of *arundinariae*, the Indian species *bambusicola* appears to lead an autoecious holocyclic life cycle on *Bambusa* sp., as is evident from occurrence of viviparae and sexuales during the months of November-December on the same plant in Darjeeling hills.

Distribution.—India : Eastern Asia.

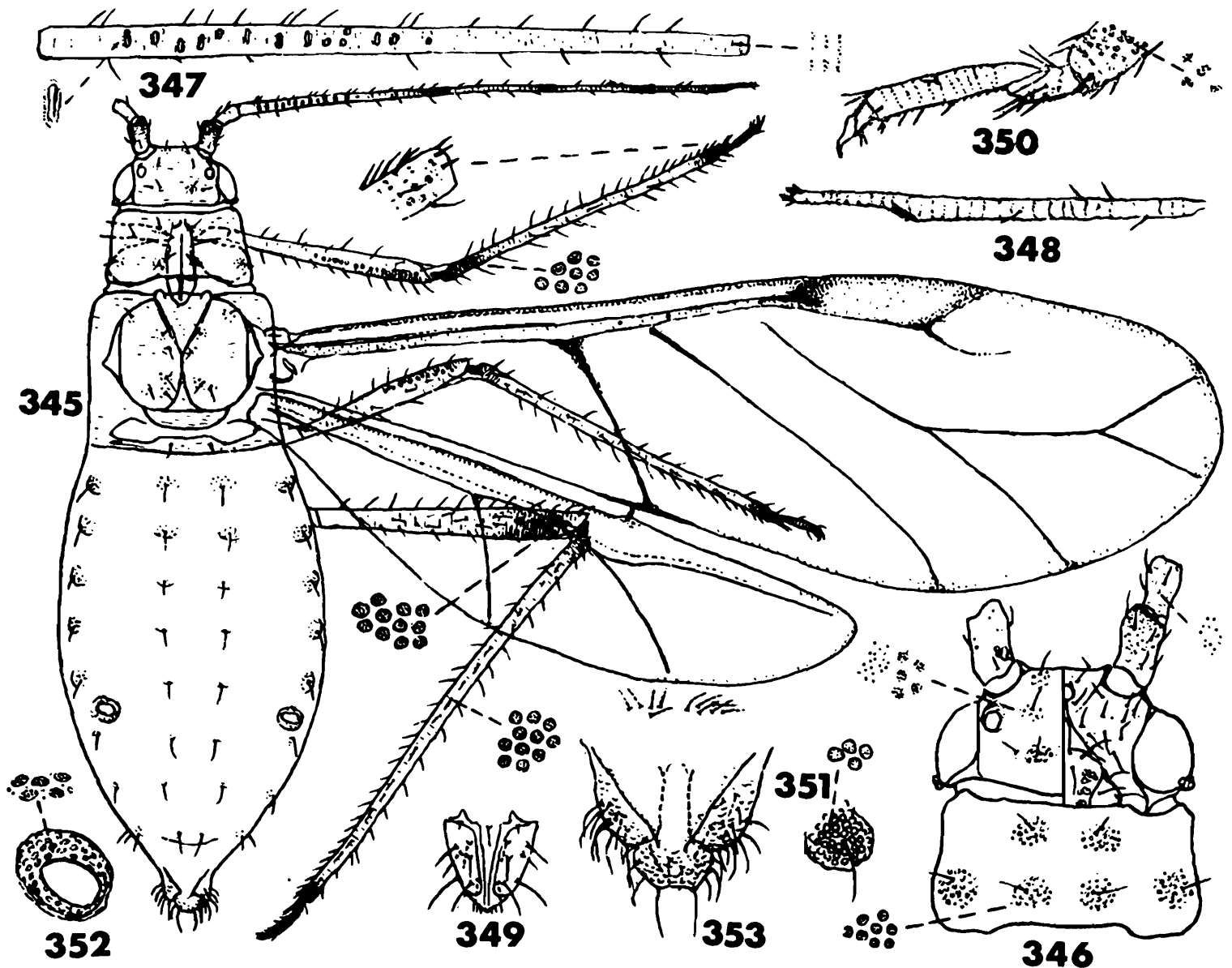
Type species.—*Shivaphis arundinariae* Takahashi 1940. Deposited in the Agricultural Research Institute, Taipei, Taiwan.

25. *Neocranaphis bambusicola* (David, Rajasingh & Narayanan)
(Figs. 345-353)

1970. *Cranaphis bambusicola* David, S. K., Rajasingh, S. G. and Narayanan, K., *Orient. Insects*, 4(4) : 407.

1976. *Shivaphis bambusicola*, Eastop V. F. and Hille Ris Lambers, D. *Survey of the World's Aphids* : 395.

Alate viviparous female.—Body 2.8 mm long with 1.2 mm as maximum width. Head slightly depressed in the frontal region,



Neocranaphis bambusicola (David, Rajasingh & Narayanan), 345-353, alate vivipara : 345, body ; 346, head and pronotum ; 347, antennal segment III ; 348, antennal segment VI ; 349, apical rostral segment ; 350, hind tarsus ; 351, lateral abdominal process with wax gland pores ; 352, siphunculus ; 353, cauda and anal plate.

bearing four pairs of wax gland fields with cribriform discs in clusters, each with a fine hair 0.03-0.04 mm long. Antennae of six segments ; segment I, apices of segments III, IV, V and middle of VI dark, rest pale ; segment III with 9-12 circular and elliptical rather small secondary rhinaria, scattered over basal $\frac{4}{7}$ of the

segment on ventral side ; flagellum with faint wax-gland-lined imbrications that become more distinct apicad ; hairs on flagellum about 0.03 mm long ; processus terminalis $0.30 \times$ as long as the base of segment VI. Rostrum reaching just past the first coxae. Ultimate rostral segment 0.08-0.09 mm long, about $0.5 \times$ as long as the second segment of hind tarsus and bears 9 accessory hairs in addition to the preapicals. Pronotum with 3 pairs of well defined fields of wax gland pores similar to those on vertex. Mesonotum also provided with similar fields of wax gland pores. Abdominal tergites 1-7 with one pair each of spinal and lateral wax gland pore fields, the spinal ones of tergite 7 shifted laterad ; 8th tergite with a single dorso-median wax-gland field and two lateral ones ; each of the wax gland pore fields, except on tergite 8, bears a single fine hair 0.06-0.07 mm long, equal to $1.5-1.75 \times$ as long as the basal diameter of antennal segment III ; tergite 8 with 2 spinal and 2-3 pairs of marginal hairs about 0.05 mm long. Siphunculi pale, 0.07 to 0.11 mm in width, hardly elevated, with the aperture 0.05 mm wide and provided with numerous wax gland pore elements. Cauda pale, globular knob 0.07 mm wide, bearing 11 hairs. Subanal plate deeply bilobed and each lobe bearing 9-12 setae each. Legs pale with brownish apex of hind femora and brown base and apex of tibiae and brown tarsi ; fore coxae moderately enlarged ; coxae, trochanters, femora and tibiae with wax gland pore elements ; longest hairs on tibia 0.060 mm long ; first tarsal segment with 5 ventral and 2 dorsal hairs ; empodials short setiform ; second tarsal segment spinulose. Wings with pterostigma brown in the basal one-fifth and a light diffused pigmentation at the apex ; radial sector only half-way drawn and its apical half missing ; second cubitus with marked brown diffusion at the basal one-fifth, otherwise veins colourless ; hind wing with both oblique veins.

Colour.—White, with powdery wax covering the body, legs and antennae ; legs brownish ; eyes red.

Measurements in mm.—

	Length	Width	Antenna
1.	2.82	1.24	—
2.	3.01	1.04	2.20

III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.72	0.38	0.29	(0.24+ ?)	0.08	0.15
0.82	0.47	0.38	(0.28+0.09)	0.09	0.16

(1, Holotype, ex *Bambusa* sp., Darjeeling, W.B., 14.xi.1968, coll. S. G. Rajasingh. 2. Paratype, same data as for holotype, in British Museum Collection).

Oviparous female.—Body 3.08 mm long. Vertex with hairs 0.04 mm in length. Antennal segment III 0.06 mm long, without rhinaria ; hairs on III 0.02 mm long and with wax glands arranged in transverse groups ; other segment broken. Hind tibia smaller with numerous pseudosensoria and wax glands. Cauda 0.06 mm long ; anal plate 0.04×0.08 mm. Other characters as in the alate vivipara.

Colour.—Pale throughout with the tarsi brown.

Apterous oviparoid viviparous female.—Body 2.82 mm long. Antennal segment III 0.53 mm long, other segments broken. Hind tibia swollen with pseudosensoria. Abdomen with two nymphs. Other characters, in particular cauda and anal plate, as in the ovipara.

Colour.—As in the alate form.

Alatoid nymph.—Very much like the alate vivipara. Wax gland pore elements on antennae smaller (about 0.003 mm), present on all antennal segment except VI.

Measurements in mm.—

Length	Width	Antenna
2.32	—	1.20

III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.44	1.28	0.26	(0.23+0.08)	—	—

(Collection data as for holotype).

Material examined.—Two alate viviparous females, one alatoid nymph, one oviparous female and one oviparoid female from *Bambusa* sp. Darjeeling, West Bengal, India, 14.xi.1968, coll. S. G. Rajasingh (C.U. Coll.).

Discussion.—This species was originally described under *Cranaphis*, and Eastop and Hille Ris Lambers (1976) placed it in *Shivaphis*. However, more recent studies of this and another closely related species from Taiwan (*Cranaphis arundinariae* Takahashi) have shown that its position in *Shivaphis* is not satisfactory because of the hair-like empodials and an apical rostral segment that is specialised for feeding on Bamboo, and that a new genus *Neocranaphis* n.g. is justified to accommodate these species. *N. bambusicola* has not been recorded again from the Oriental region since its description.

Genus 16. *Panaphis* Kirkaldy 1904

1904. *Panaphis* Kirkaldy, G. W., *Entomologist*, 37 : 279 ; Palmer, Miriam, 1952. Aphids of the Rocky Mountain Region, 79. Type species : *Aphis juglandis* Goeze.
1885. *Callipterus* Koch, C.L., *Die Pflauzenläuse Aphiden*, Nürnberg, 208. Type species : *Aphis juglandis* Goeze (Preoccupied).
1870. *Callaphis* Walker, F., *Zoologist*, 2 (5) : 2000. Type species : *Aphis juglandis* Frish = *Aphis juglandis*, Goeze. (Preoccupied).
1881. *Ptychodes* Buckton, G.B., *Monog. Brit. Aphides*, London, 3 : 39. Type species : *Aphis juglandis* Frisch = *Aphis juglandis* Goeze. (Preoccupied).
1928. *Callipterinola* Strand, E., *Arch. Naturgesch* ; 92 (A 8) : 47. Type species : *Aphis juglandis* Frish = *Aphis juglandis* Goeze.

Morphology.—All viviparae alate. Body large, 3.5-4.5 mm long. Frontal tubercles not discernible. Dorsal hairs on head, specially posterior discals, numerous. Antennae 6-segmented, much shorter than the body ; segment III with transversely oval secondary rhinaria ; hairs on flagellum very long and fine, sometimes up to 4.0×

as long as basal diameter of antennal segment III ; processus terminalis shorter than base of segment VI. Rostrum hardly reaches midcoxae, ultimate rostral segment subequal to or longer than second segment of hind tarsus and with 8-10 accessory hairs. Dorsal hairs numerous, usually in cluster varying between 8-18 on anterior tergites, 8th tergite with 18-22 hairs. Dorsum of abdomen with broad transverse sclerotic spinopleural bands on 1st-7th tergites or on 3rd-7th tergites, often broken sclerites on 1st and 2nd tergites besides large marginal sclerites ; 8th tergite with a median sclerotic patch. Siphunculi truncate, conical, arising from marginal sclerites of 6th tergite, with hairs appended to base and with distinct apical flange. Cauda distinctly constricted, apical knobbed part globular or finger-shaped with many hairs. Subanal plate bilobed. Rudimentary gonapophyses 2. Legs with a blackish patch near apices of femora, tibiae finely spinulose apicad, apical tibial hairs not differentiated , tarsi densely spinulose, first tarsal segments with 5 ventral hairs including a median sensepeg and 1-2 dorsal hairs ; empodial hairs flattened. Wing venation normal but veins may be variably infuscated. Embryos with pleural hairs absent, spinal hairs on first abdominal segment laterally displaced.

Oviparous female apterous. Abdominal dorsum with segmental marginal and dorsal sclerites up to 7th tergite, 8th with only one transverse band. Hind tibiae swollen bearing pseudosensoria.

Males alate, slender than alate vivipare. Antennal segment II, IV and V bearing secondary rhinaria.

Discussion.—This is a small genus of two species, *juglandis* (Goeze), a typically Palaearctic species later introduced elsewhere and *nepalensis* Quednau, both infesting *Juglans*. The genus has been considered earlier by most of the authors as a synonym of *Callaphis* Walker 1870. In accordance with opinion 147 of International Commission of Zoological Nomenclature the name *Callaphis* Walker 1870 is considered to be preoccupied by *Calaphis* Walsh 1862 and the name *Panaphis* Kirkaldy which was proposed as a new name for *Ptychodes* Buckton with *Panaphis juglandis* (Goeze) n. comb, (Palmer, 1952), is accepted and followed here.

Biology.—*P. juglandis* is known to infest veins, in files, on the upper surface of leaves of *Juglans regia* and is often visited by ants. Stroyan (1977) mentioned that due to interspecific competi-

tion between *Chromaphis juglandicola* and *P. juglandis*, the two aphids are rarely found together on the same host. The members of the genus lead autoecious holocyclic life cycle on *Juglans regia*.

Distribution.—Nepal ; Middle East ; Central Asia ; Europe ; Western North America.

Type species.—*Aphis juglandis* (Goeze, 1778). Location of types not known.

Key to the species of the *Panaphis* Kirkaldy

Alate viviparous female :

Caudal knob globular, about as long as its greatest width. Pronotum with a pale, membranous zone on spinal region. 1st and 2nd abdominal tergites broken into numerous small, hair-bearing spinopleural sclerites. Ultimate rostral segment shorter than second segment of hind tarsus. Forewings with all veins bordered brown

juglandis (Goeze)

—Caudal knob finger-shaped about $2.0 \times$ as long as its greatest width. Pronotum mesally completely sclerotized. 1st and 2nd abdominal tergites with dark brown spinopleural bands. Ultimate rostral segment equal to or longer than second segment of hind tarsus. Forewings with only vein Cu_2 bordered brown

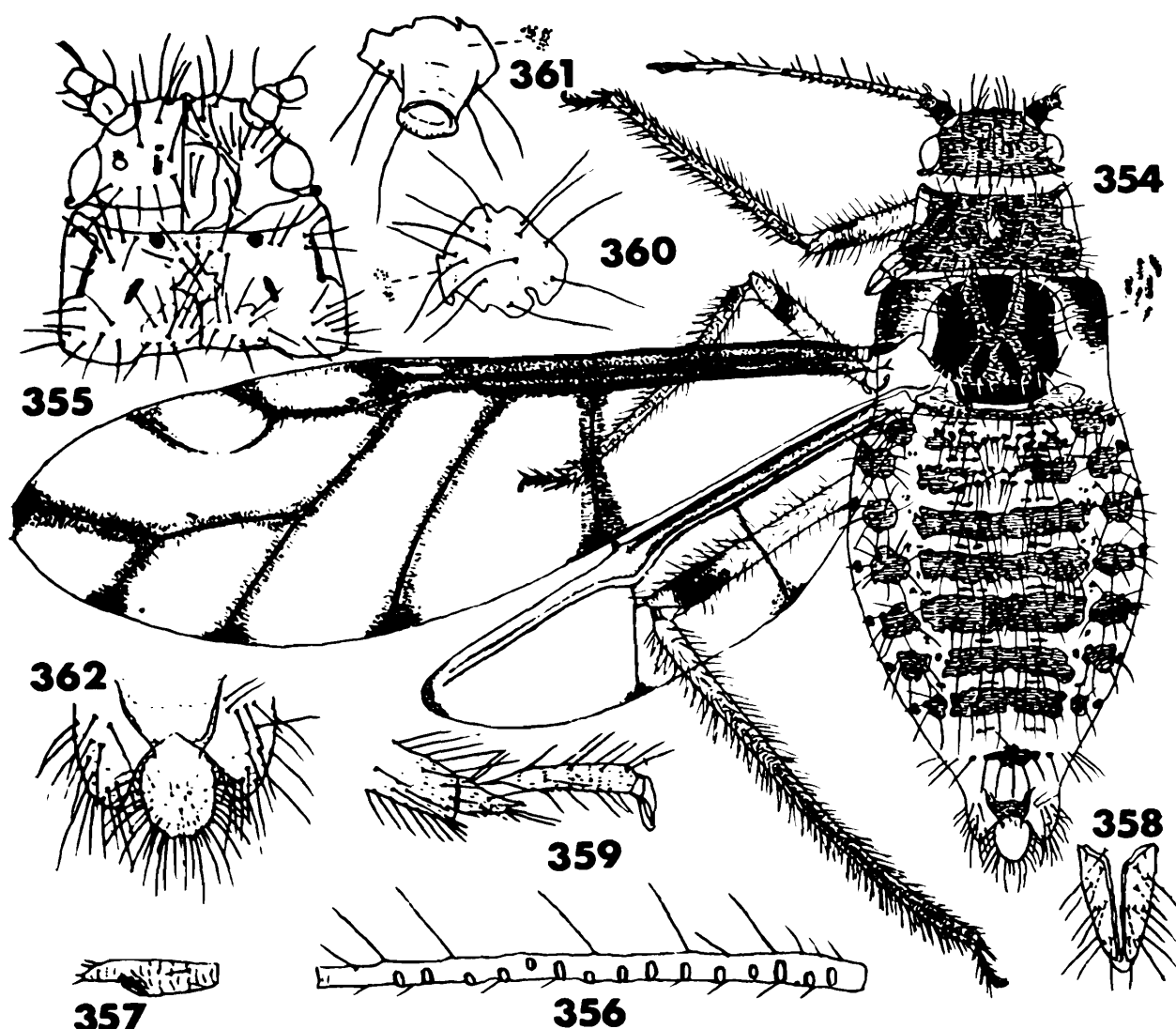
.nepalensis (Quednau)

26. *Panaphis juglandis* (Goeze) (Figs. 354-367)

1734. *Aphis juglandis* Frisch, S.L., *Beschreib. v. allerlei Insekten* : 11 : 12.
 1778. *Aphis juglandis* Goeze, J. A., *Ent. Beit. Natur.*, 2 : 311.
 1880. *Callaphis juglandis*, Walker, F., *Zoologist* (2) : 5-2000.
 1843. *Lachnus juglandis*, Kaltenbach, J. A., *Mon. Fam. Pflanz.*, 130.
 1855. *Callipterus juglandis*, Koch, C. L., *Die Pflanz. Nürnberg*, 222.
 1818. *Ptychodes juglandis*, Buckton, G. B., *Mon. Br. Aphides*, 3 : 40.
 1931. *Callipterinola juglandis*, Gillette, C. P., and Palmer, Miriam, *Ann. ent. Soc. Am.*, 24 : 887.

1952. *Panaphis juglandis*, Palmer, Miriam, Aphids of the Rocky Mountain Region, 79.
1977. *Callaphis juglandis*, Stroyan, H. L. G., *Handbk. Ident. Br. Insects*, 11 4(9) : 51.
1982. *Callaphis juglandis*, Heie, Ole E., *Fauna ent. scand.*, 11 : 46.

Alate viviparous female.—Body large, stout, 4.3 mm long with 1.51 as maximum width. Head brown to dark brown, frontal tubercles undeveloped, dorsal cephalic hairs fine, wavy, up to 0.163 mm long, nearly $4.0\times$ as long as the basal diameter of antennal segment III, posterior discal hairs in double transverse row. Antennae pale brown $0.3-0.4\times$ as long as the body, flagellum smooth on III and basal half of IV, the rest imbricated; antennal segment III longer than IV+V+VI taken together, with 18-21 (14-22) large oval to irregular secondary rhinaria distributed over the entire length of segment; hairs on flagellum sparse, fine, those on inner margin up to 0.033 mm long, on outer margin up to 0.120 mm long, these being $0.76\times$ and $3.0\times$ as long as the basal diameter of antennal segment III, respectively; segment VI hardly $0.20\times$ as long as segment III; processus terminalis $0.41\times$ as long as base of segment VI. Pronotum incompletely sclerotic with a small pale median membranous zone bearing numerous fine hairs arranged in two pairs of spinopleural and two pairs of marginal clusters. Rostrum reaches between fore-and middle coxae, ultimate rostral segment equal to second segment of hind tarsus and bears 8-13 accessory hairs. Abdomen with dark marginal sclerites on tergites 1-7, broken spino-pleural sclerites on tergites 1-2, broad transverse sclerotic bands on tergites 3-7 and a small trapezoidal sclerite on 8th tergite; each marginal sclerite usually with 6 (5-16) hairs, up to 0.130 mm long and the sclerotic area furnished with about 10-18 hairs, 0.066-0.155 mm long, these being $3.0\times$ and $0.65-4.0\times$ as long as the basal diameter of antennal segment III respectively; 8th tergite with 18-22 hairs, all dorsal hairs wavy with acute apices. Siphunculi short, truncate, conical, dark sclerotic, placed on marginal sclerites of the 6th tergite with sometimes a hair appended on the base of the cone. Cauda much paler than siphunculi, distinctly knobbed and bearing 35-45 hairs. Subanal plate bilobed, each lobe with 16-18 hairs. Legs pale brown with a dark girdle encircling the apex of hind femora; hairs on femora and tibiae numerous fine, on hind tibiae up to 0.216 mm



Panaphis juglandis (Goeze). 354-362, alate vivipara : 354, body ; 355, head and pronotum ; 356, antennal segment III ; 357, antennal segment VI ; 358, apical rostral segment ; 359, hind tarsus ; 360, lateral abdominal sclerite ; 361, siphunculus ; 362, cauda and anal plate.

long or $2.3\times$ as long as the middle width of the tibia ; apical tibial hairs not differentiated ; apices of tibiae finely and tarsi densely spinulose ; first tarsal segments with 5-6 ventral hairs and 1-2 (1-3) dorsal hairs. Wings veins bordered dark, middle part of radial sector in forewing weakly indicated. (Figures within parenthesis from Stroyan, 1977).

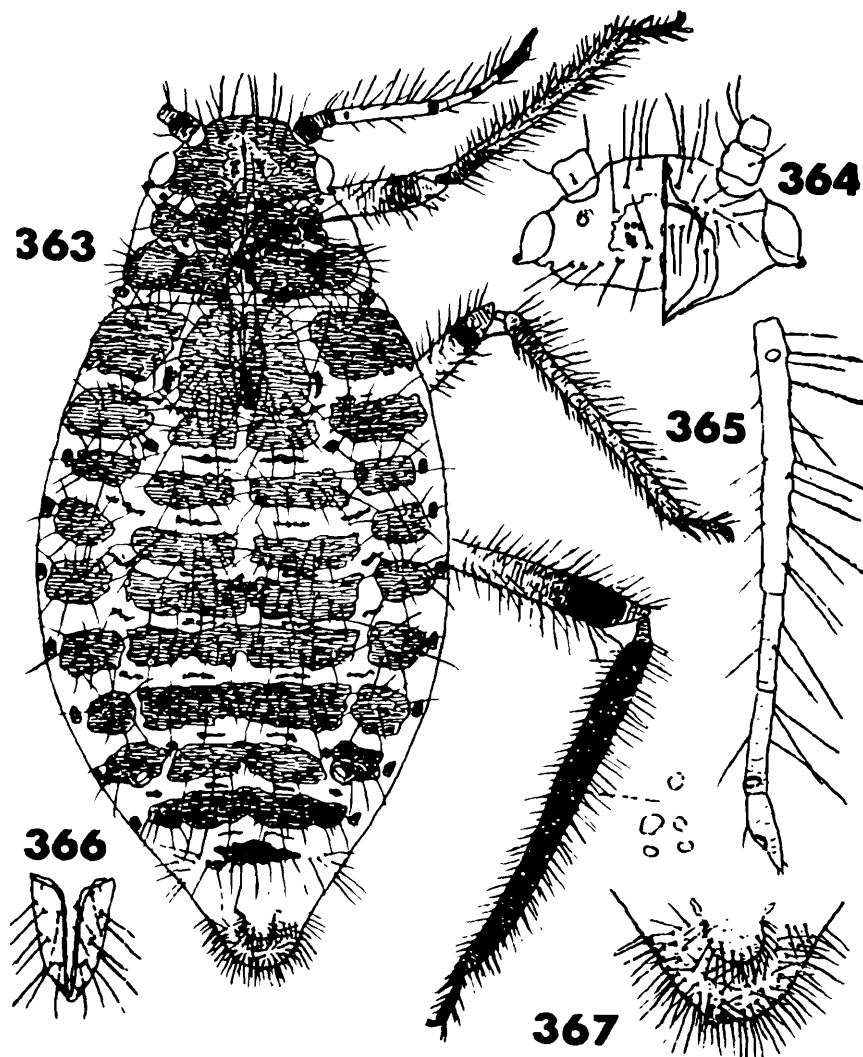
Colour.—Yellowish in life with dark brown to blackish sclerotic patches.

Measurements in mm.—

Length		Width		Antenna	
4.30		1.51		1.44	
Ant. segments		urs		ht ₂	
III	IV	V	VI		
0.70	0.27	0.19	(0.10+0.04)	0.16	0.16

(ex *Juglans* sp., Chaubattia, U.P., 4.iv.1970, K.U. Coll.).

Embryo.—Antennae 3 segmented ; pleural hairs absent ; spinal hairs on 1st tergite slightly displaced laterad (after Stroyan, 1977).



Panaphis juglandis (Goeze). 363-367, ovipara : 363, body ; 364, head ; 365, antennal segments III-VI ; 366, apical rostral segment ; 367, cauda and anal plate.

Alate male.—Similar to alate vivipara but slender and bearing more secondary rhinaria on III : 36-40, besides similar rhinaria on IV : 6-8 and V : 6.

Apterous oviparous female.—Abdominal dorsum with dark, paired marginal and rectangular spinopleural sclerites on tergites 1-7 ; 8th tergite with a single transverse sclerotic band. Hind tibiae somewhat swollen bearing numerous pseudosensoria (after Stroyan, 1977).

Material examined.—Alate viviparous females from *Juglans* sp., Chaubattia, Uttar Pradesh, India, 4.iv.1970, coll. B.P. Gupta, det. S. Chakrabarti ; (K.U. Coll.)

Discussion.—This species is widespread in areas with *Juglans regia* and feeds on the upper surface of leaves on the midrib. The life cycle is known to be autoecious and holocyclic. Attendance by ants is common. Stroyan (1977) about the work on interspecific relationships between *Chromaphis juglandicola* and *Panaphis juglandis* which may adversely affect the former if both species are feeding together. However it is reported that both species are rarely found together on the same tree.

Distribution.—India : Uttar Pradesh ; Europe ; Middle East ; Central Asia ; Western North America.

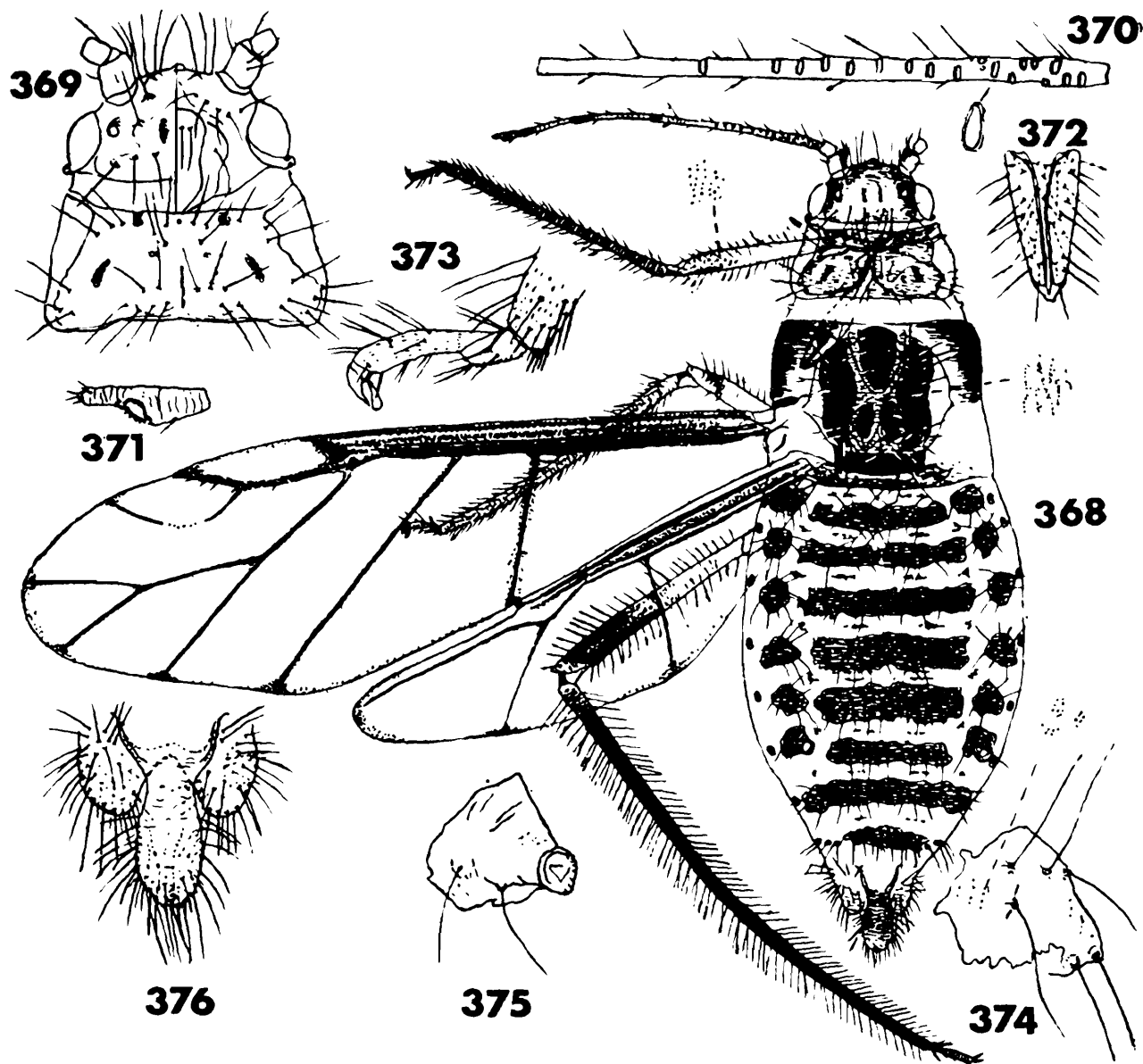
Types.—Apparently lost.

27. *Panaphis nepalensis* (Quednau)
(Figs. 368-376)

1973. *Callaphis nepalensis*, Quednau, F.W., *Can. Ent.*, **105** : 221.

1981. *Callaphis nepalensis*, Zhang Guang-Xue & Zhong Tie-sen. *Insects of Xizang*, **1** : 247.

Alate viviparous female.—Body large, stout, 4.4 mm long with 1.5 as maximum width. Head dark brown to mottled brown, frontal tubercles undeveloped ; dorsal cephalic hairs fine, wavy, up to 0.163 mm long, nearly 4.0× as long as the basal diameter of antennal segment III ; posterior discal hairs in a transverse



Panaphis nepalensis (Quednau), 368-376, alate vivipara : 368, body ; 369, head and pronotum ; 370, antennal segment III ; 371, antennal segment VI ; 372, apical rostral segment ; 373, hind tarsus ; 374, lateral abdominal sclerite ; 375, siphunculus ; 376, cauda and anal plate.

row. Antennae pale brown with dark apices of segments III-V , flagellum smooth on III and basal half of IV, the rest imbricated ; antennal segment III a little longer than IV + V + VI taken together with 16-26 oval secondary rhinaria arranged in an irregular row over most of the segment , hairs on flagellum thin and pointed, the longest about $2.0\times$ as long as the basal diameter of antennal segment III , segment VI less than $0.20\times$ as long as segment III ; processus terminalis $0.45\times$ as long as base of segment VI. Pronotum fully sclerotized bearing numerous fine hairs arranged as

two pairs of spinopleural and two pairs of marginal clusters. Rostrum reaches between fore- and middle coxae, ultimate rostral segment as long as or longer than second segment of hind tarsus and with about 20 accessory hairs. Abdomen with spinopleural sclerotic bar entire on all tergites, and with dark marginal sclerites on tergites 1-6, those of tergite 7 being fused with the spinopleural ones; each marginal sclerite with 2-6 (maximum 8) hairs up to 0.160 mm long and the other sclerotic bars are furnished with about 10-15 hairs of approximately same length, all wavy, with acute apices. Siphunculi short, truncate, conical, dark, sclerotic, placed on marginal sclerites of the 6th tergite with sometimes a hair appended on the base of the cone. Cauda dark elongate, knob dark, weakly sclerotic, somewhat fingerlike and bearing about 40 hairs. Subanal plate bilobed, each lobe with 25-28 hairs. Legs with femora pale and with irregular black markings subapically, most extensive on hind femur; fore- and middle tibiae light brown, hind tibiae dark brown except for lighter base and apex; tarsi brown; forecoxae moderately enlarged; hairs on femora and tibiae numerous and fine, the longest on femora 4× as long as the basal diameter of antennal segment III; longest tibial hairs 3-4× as long as distal width of tibiae; apical tibial hairs not differentiated; apices of tibiae and tarsi spinulose; first tarsal segments with 5 ventral and 2 dorsal hairs. Wing veins brown, in forewing only Cu_2 with narrow brown border, costal cell largely blackish, pterostigma black at base and along inner margin, middle part of radial sector interrupted.

Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
4.35		1.51		1.95	
Ant. segments		urs		ht ₂	
III	IV	V	VI		
0.97	0.30	0.08	0.04	0.18	0.18

(ex *Juglans regia*, Godavari, Nepal, July 1967, British Museum Collection).

Embryo.—Antennae 3-segmented ; pleural hairs absent ; spinal hairs on 1st tergite slightly displaced laterad.

Material examined.—Alate viviparae from *Juglans regia* Godavari, Nepal, July 1967, (K. C. Sharma) in British Museum Collection.

Discussion.—This species is closely related to *Panaphis juglandis* (Goeze), but differs mainly by a different sclerotisation pattern of pronotum and abdomen and by different pigmentation of the forewing, besides by a more elongate cauda.

Distribution.—Nepal ; China.

Types.—In the collection of British Museum (Nat. Hist.), London, England.

Genus 17. *Paoliella* Theobald 1928

1928. *Paoliella* Theobald, F.V. *Bull. Ent. Res.*, **19** : 177. Eastop, V.F., 1958. A study of Aphididae (Homoptera) of East Africa, London, 87. Eastop, V.F. 1961. A study of Aphididae of West Africa, London, 60 ; Quednau, F.W., 1974. *Can. Ent.*, **196** : 60 ; Eastop, V.F. and Hille Ris Lambers, D., 1976. Survey of the World's Aphids, 332. Type species : *Paoliella hystrix* Theobald.

1932. *Unipterus* Hall, W.J., *Stylops*, **1** : 50. Type species : *Unipterus terminaliae* Hall.

Morphology.—Body small, 1.1-2.0 mm long. Head with well developed or rudimentary epicranial suture. Dorsal cephalic hairs acute. Antennae 5-6 segmented ; secondary rhinaria sub-circular, oval, usually arranged in a row on segment III or on III-IV, finely ciliated ; hairs on flagellum sparse, shorter than basal diameter of antennal segment III ; processus terminalis $0.40-4.5\times$ as long as base of last antennal segments. Eyes of apterae of only three facets. Rostrum reaches mid-coxae or sometimes hind coxae ; second rostral segment without basal stiffening ; ultimate rostral segment shorter than or more than $2.0\times$ as long as second segment of hind tarsus and bears 0-8 accessory hairs. Body often with fingerlike dorsal processes, in apterae at least with 3 pairs of abdominal processes per tergite, arranged in spinal, pleural and marginal rows ; processes on vertex may be short wart-like or

long finger-like ; alatae without pleural processes and other processes normally smaller in size. Dorsum of abdomen in alatae may be with dark dorsal and or lateral sclerites and then siphunculi also appear blackish sclerotic or may be without heavy sclerotisation and then pale. Siphunculi on 5th abdominal tergite, poriform or little elevated. Cribriform wax pores may be present on dorsal integument and appendages. Cauda distinctly knobbed. Subanal plate bilobed. Rudimentary gonapophyses indistinct. Legs with fore femora enlarged or normal ; tibial hairs pointed ; tarsal segments, at least in alatae, with 0-2 dorsal hairs besides 5-7 ventral hairs. Forewings with media once branched and pterostigma often extending to apex of wing. Radial sector terminating below apex of wing, which may be with or without a large black blotch at the apex, or veins may terminate in pigmented apices ; hind wings with both obliques.

Embryos usually with 6 wart-like processes on 1st-6th abdominal tergite and on meso and metanotum besides on pronotum (variable)-head, and posterior tergites but spinal and pleural processes may be short or absent ; or all the processes may be absent and only dorsal cribriform wax glands each bearing a short hair may be discernible at various stages of development ; pleural hairs may sometimes be suppressed. Antennae usually 4-segmented. Rostrum well developed.

Sexual forms not available.

Discussion.—The genus contains about 19 species from the world all being confined largely to Africa. The dorsal processes of body along with small body size and other characters and their host association helps to separate the genus from related ones. Quednau (1974) described two new species viz. *melanocallis* and *reticulosiphon* from South America, both of which have been transferred to *Lizerius* by Eastop and Hille Ris Lambers (1976). Quednau (op. cit) showed the relationship between primitive South American members of *Paoliella*, considered under the tribe Paoliellini. The tribe Paoliellini was proposed by Eastop (1958) with three genera *Pterasthenia* Stroyan, *Paoliella* Theobald and (its synonym) *Unipterus* Hall.

The production of both apterae and alate viviparae appears to be a variable phenomenon in this genus. Eastop (1961) mentioned that *Paoliella* s. str. produces apterae viviparae and all viviparous forms of *Unipterus* Hall [which was considered as a subgenus by Eastop (op. cit) but latter listed as a synonym (Eastop and Hille Ris Lambers, 1976)] are alate, as far as is known. But *Unipterus ayari* Eastop, 1955, *U. delotti* Hille Ris Lambers, 1954, *U. papillata* Hall, 1932, *U. ufuasi* Eastop, 1955 are now known to produce both apterous and alate vivipare and as such, subgeneric classification on the basis of morph differentiation is not tenable. Quednau (1974) has provided a key to the alate viviparae of 17 valid species and apterae viviparae of 9 species of the genus, many of which were also covered earlier by Eastop (1958). Only one endemic species *P. nirmalae* David, is known from India.

Biology.—All the species feed on Bursaraceae (*Commiphora* spp.) and Combretaceae (*Combretum*, *Terminalia* spp.). Sexual forms of a few species like *P. commiphorae* (Doncaster) and *P. papillata* (Hall) are known from the same host plant and suggest a possible holocycle. The african records indicate occurrence of the members of the genus between August to March. Most of the species feed on undersurface of leaves and some may remain covered by wax in life. Nymphs of some species (e.g. *nachensis* Eastop) may readily jump off when disturbed.

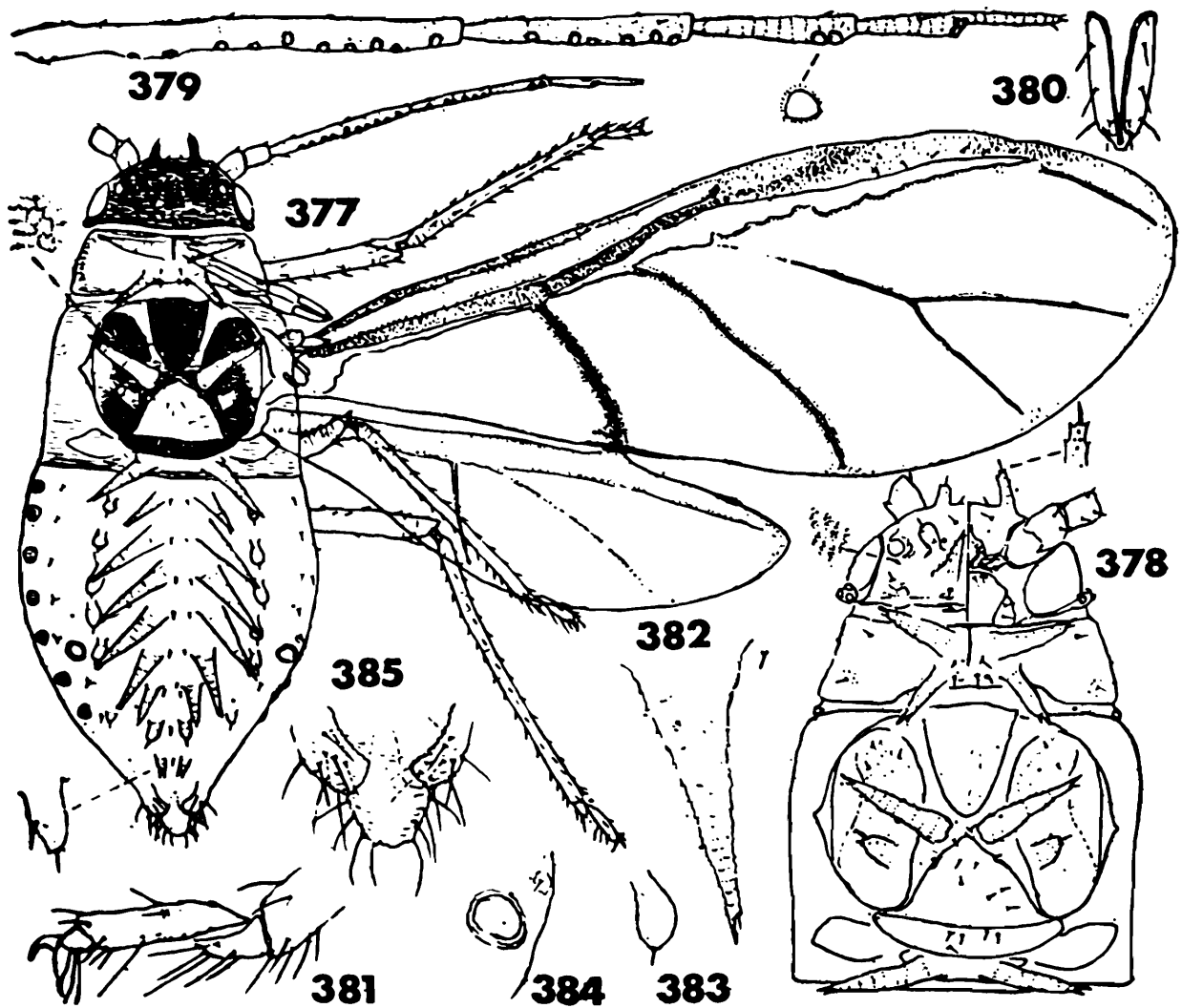
Distribution.—India ; Africa.

Type species.—*Paoliella hystrix* Theobald, 1928. Deposited in the collection of British Museum (Nat. Hist.), London, England.

28. *Paoliella nirmalae* (David) (Figs. 377-393)

1969. *Unipterus* (*Paoliella*) *nirmalae* David, S. Kanakaraj, *Orient. Insects*, 3 (1) : 80.

Alate viviparous female.—Body 1.22-1.44 mm long with 0.55-0.69 mm as maximum width. Head and thorax dark brown, smooth. Head with a pair of small frontal processes, 0.020 mm long, besides two other pairs on vertex, one dorsal pair 0.035 mm long and one pair near hind margin, 0.010 mm long. Antennae pale, 6-segmented,



Paoliella nirmalae (David). 377-385, alate vivipara : 377, body , 378, head and thoracic nota ; 379, antennal segments III-VI ; 380, apical rostral segment ; 381, hind tarsus ; 382, spinal abdominal process ; 383, pleural abdominal process ; 384, siphunculus ; 385, cauda and anal plate.

0.55-0.80× as long as the body ; segment III longer than segment IV+V taken together, bearing 7-13 small, oval, ciliated secondary rhinaria ; segment IV with 2-5 and segment V with 1-4 similar rhinaria ; flagellum imbricated ; hairs on flagellum hardly discernible ; processus terminalis slightly shorter than base of segment VI. Rostrum reaches midcoxae, ultimate rostral segment with 2 accessory hairs. Pro-and mesothorax with 2 pairs of spinal processes, the longest 0.065 mm and 0.045 mm long, respectively. Abdominal tergites with paired spinal and pleural processes on 1st-7th segments ; marginal processes absent ; spinal pair on anterior tergites up to 0.147 mm long, on 6th tergite 0.045 mm

and on 7th tergite 0.035 mm long ; 8th tergite with only a pair of spinal processes, 0.018 mm long. Abdominal dorsum pale, membranous. Siphunculi ring-like with dark apical rim. Cauda distinctly knobbed, spinulose and bears 8 long fine hairs. Subanal plate bilobed, each lobe with 6-8 hairs. Legs pale, hairs on femora short, sparse, on tibiae 0.002-0.016 mm long. Forewings with media once branched, radial sector short, nearly straight, cubital veins bordered brown ; hind wings with both obliques.

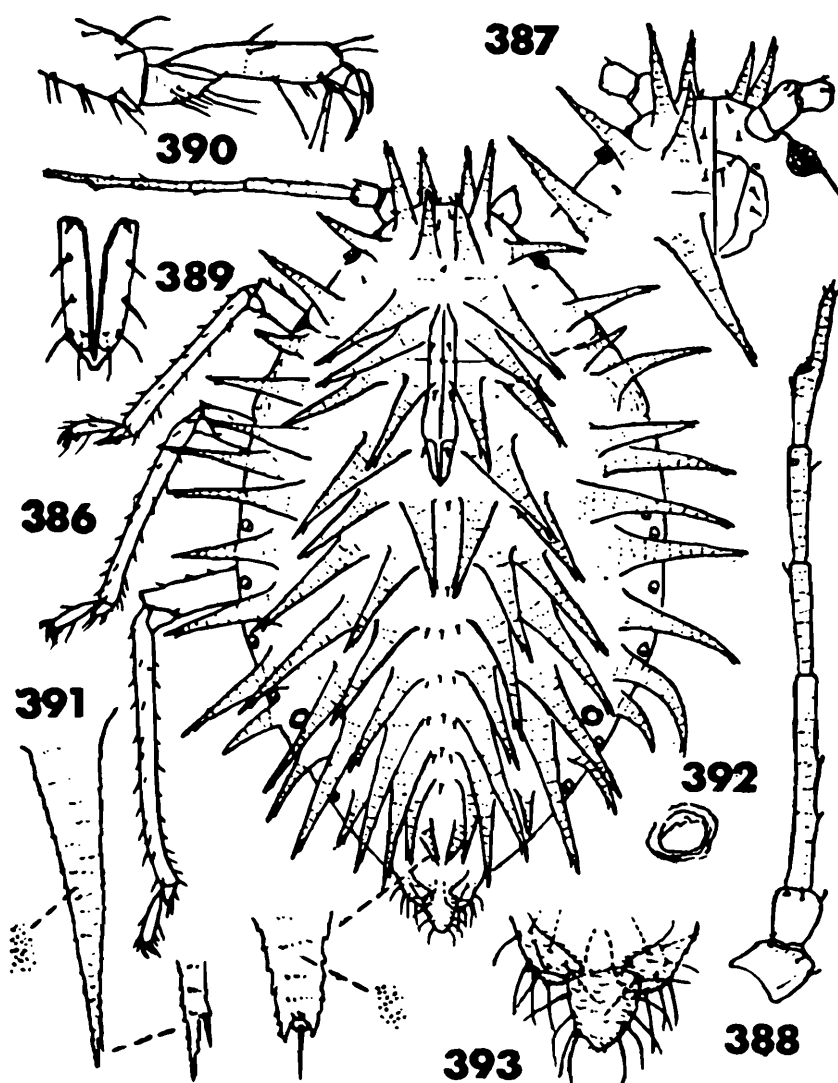
Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	1.36	0.69	0.94		
2.	1.21	—	0.63		
3.	1.44	—	0.94		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.33	0.18	0.13	(0.10+0.08)	0.08	0.10
0.31	0.18	0.12	(0.08+0.05)	—	—
0.34	0.18	0.13	(0.10+0.08)	—	—

(1-2, ex *Terminalia arjuna*, Bangalore, Karnataka, 21.iv.1967, 3, ex *Terminalia arjuna*, Bangalore, Karnataka, — vii.1962, biometric data for 2-3, from David, 1967).

Apterous viviparous female.—Body 1.15-1.35 mm long, elongate oval. Head pale, frons convex, vertex bearing a pair of processes on frons, 0.06 mm long, besides three other pairs of processes, one anterior pair near base of antennae (0.13 mm) and one spinal (0.053 mm) and one lateral pair on posterior vertex (0.123 mm). Antennae pale brownish, 6-segmented, a little less than half the length of the body ; flagellum without secondary rhinaria, with some spinulose imbrications, hairs on flagellum sparse, minute, pointed ; primary rhinaria ciliated ; processus terminalis a little shorter than base of segment VI. Rostrum reaches midcoxae ; ultimate rostral segment $0.75\times$ as long as second segment of hind tarsus. Thoracic and abdominal segments 1-7 with processes



Paoliella nirmalae (David). 386-393, apterous vivipara : 386, body ; 387, head ; 388, antenna ; 389, apical rostral segment ; 390, hind tarsus ; 391, spinal abdominal process ; 392, siphunculus ; 393, cauda and anal plate.

arranged in longitudinal rows of spinal, pleural and marginal ones, one pair of each per tergite, except 6th and 7th abdominal tergites, where pleural processes appear suppressed ; 8th tergite with only a pair of spinal processi, 0.080 mm long. The processes on abdomen are the longest of all, 0.120-0.240 mm long ; the processes on head, thorax and abdomen, are broad at base, narrowing at apex and each with a short hair apically or subapically. Siphunculi ring-like. Cauda knobbed. Subanal plate bilobed. Legs pale with short hairs, tibiae and tarsi smooth ; first tarsal segments with 5, 5, 5 hairs.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna
1.	1.15	0.60	0.58
*2.	1.26	—	0.61
*3.	1.35	—	0.57

Ant. segments				urs.	ht ₂
III	IV	V	VI		
0.17	0.09	0.09	(0.07+0.05)	0.07	0.10
0.17	0.10	0.08	(0.09+0.07)	—	—
0.17	0.09	0.09	(0.07+0.06)	—	—

(1-3 ex *Terminalia arjuna*, Bangalore, India, 21.iv.1967 ;
 *biometric data for 2-3, from David, 1969).

Material examined.—One apterous viviparous female and one alate viviparous female from *Terminalia arjuna*, Bangalore, Karnataka, India, 21.iv.1967, coll. K. Narayanan, det. S. K. David (Paratypes, N.Z.C.).

Discussion.—The Indian species, the only species of the genus outside the Ethiopian region, as pointed out by Eastop (in David, 1969) differs from all other related species of the genus *Paoliella* in having dorsal processes on all tergites, relatively small rhinaria on antennae, not enlarged fore—femora (in alatae) and an ultimate rostral segment that is shorter than the second segment of hind tarsus (in apterae). The species is unique in possessing small accessory spinal hairs on the mid-dorsum of all tergites. David (op. cit.) considered *Paoliella* as subgenus of *Unipterus* but the latter has now been considered as a synonym of *Paoliella*.

Distribution.—India : Karnataka (Bangalore).

Types.—In the collections of Dr. S. Kanakraj David, 22-Kamaraja Avenue, Madras (holotype and some paratypes), National Zoological Collections, Zoological Survey of India, Calcutta, India (paratypes) and British Museum (Nat. Hist.), London, England (paratypes).

18. *Pseudotinocallis* new genus*

Type species : *Sarucallis nigropunctatus* Tao, 1963.

Morphology.—Alate vivipara. Body pale without sclerotic markings, antennae with basal half of segment III and apices of segments III-VI black, legs pale. Frons slightly produced above frontal ocellus. Anterior discal setae of head on short mammiform processes, but posterior discals not on processes. Epicranial suture well developed. Antennae 6-segmented, slightly shorter than body. Primary rhinaria ciliate. Accessory rhinaria somewhat isolated from primary rhinarium ; secondary rhinaria very narrow, almost annular ; processus terminalis subequal to base of ant. segment VI. Apical rostral segment shorter than hind tarsus II. Mesonotum smooth. Wings normal, hyaline, radial sector only at apical half developed. Pterostigma with a small black spot at its base. Fore coxae distinctly enlarged and saltatorial. Apices of tibia with rastral organ well developed. Empodials flabellate. Abdomen with short mammiform processes marginally on tergites 1-4 and spinally on tergites 1-8, of the latter only those of tergite 7 are laterally displaced. Dorsal body hairs short setiform. Stigma of abdominal segment I built into base of marginal process. Siphunculi normal, truncate. Cauda with well constricted apical knob. Anal plate deeply indented. Wax pore elements not developed.

Alatoid nymph with general body features much as in the alate vivipara, but dorsal body setae capitate. Setae of vertex and pronotum on low elevations and lateral setae of body and spinal setae of abd. tergites 7 and 8 more elongate, longer than respective processes. Spinal processes 7 and 8 the longest, almost finger-like. First tarsal segment without dorsal setae. Marginal abdominal seta 6 not appended to cornicle. Anal segment rounded.

Embryo with normal protopattern of Callaphidini (Richards, 1965). Dorsal body setae in 4 longitudinal rows, capitate or with incrassate apices but marginal setae of tergites 5-7 short, pointed. Of the spinal setae only those of tergite 7 laterally displaced.

*Chakrabarti, S. (1988) has described a new subgenus *Quednaucallis* under *Tinocallis* which is the same as *Pseudotinocallis*

Discussion.—This genus is closely related to *Tinocallis* Matsumura, 1919 as shown by the annular secondary rhinaria and by the presence of the first abdominal stigma at the base of the marginal processus. However, in contrast to *Tinocallis*, the spinal abdominal setae 3 and 5 are not displaced laterally (but only those of tergite 7). The peculiar mammiform, not coneshaped, condition of the dorsal processes in the alatoid nymph is also distinctive. There is some superficial resemblance to *Takecallis* but the latter genus has a nose-like processus on the clypeus, more roundish secondary rhinaria and a complete radial sector.

Biology.—Nothing is known about the biology of the sole member of the genus. In its type locality, *nigropunctata* infests *Dalbergia*, but in India, alate nymphs have been recorded during the month of January on *Phyllanthus* (?).

Distribution.—India : Eastern Asia.

Type species.—*Sarucallis nigropunctata* Tao 1963. Deposited in the Taiwan Agricultural Research Institute, Taipei, Taiwan.

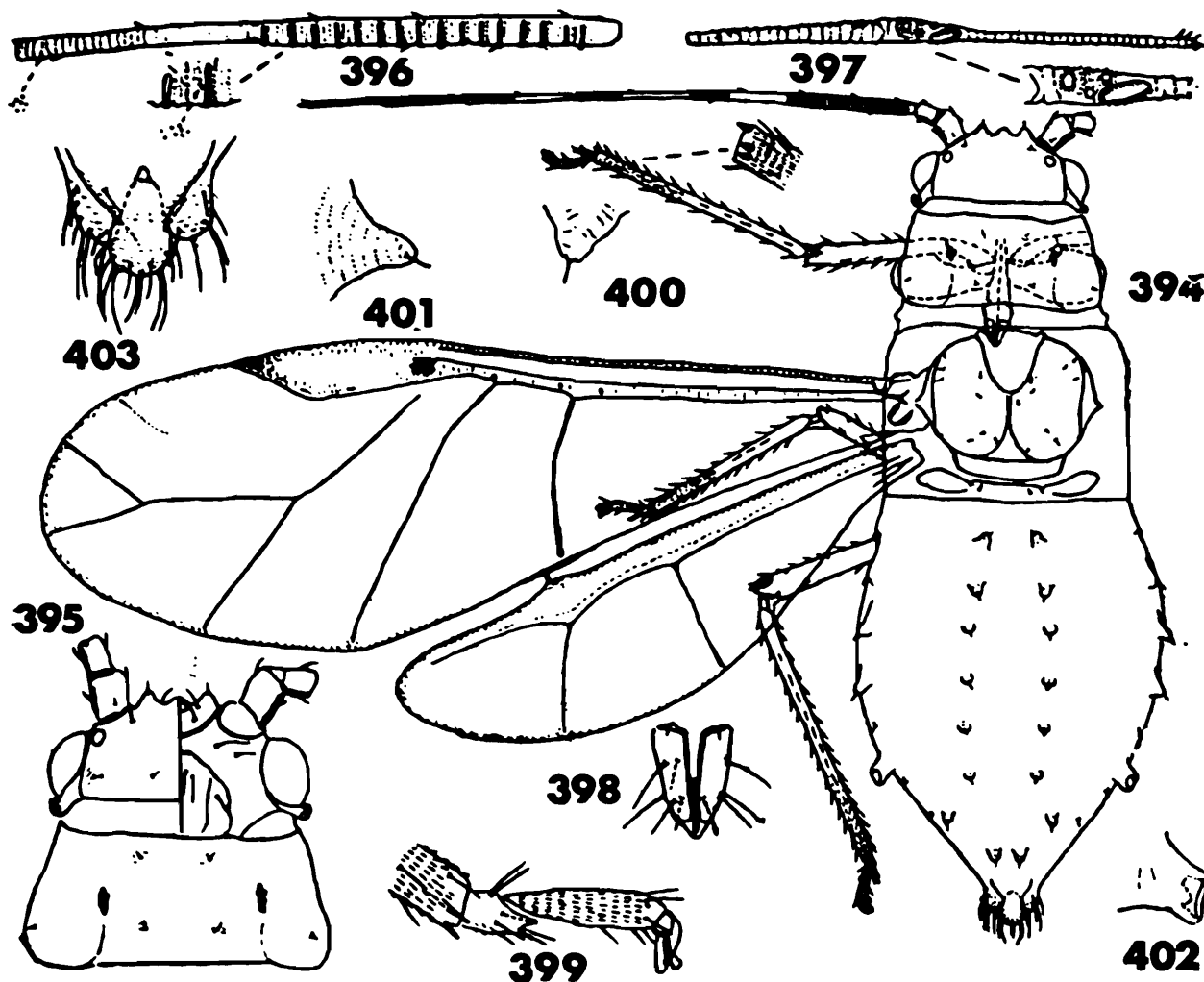
29. *Pseudotinocallis nigropunctatus* (Tao) (Figs. 394-405)

1963. *Sarucallis nigropunctatus* Tao, Charles China-chu. *Sc. yb. Taiwan Mus.*, 6 : 69.

1976. *Sarucallis nigropunctatus*, Ghosh, A.K. *Orient. Insects*, 10 : 47.

1980. *Tinocallis dalbergiae* Zhang Guang-xue and Zhong Tie-sen, *Zoological Res.*, 1(4) : 433.

Alate viviparous female.—Body elongate, 1.58-2.04 mm long with 0.77 mm as maximum width. Head with an epicranial suture on ventral side ; frons with small median protrusion above frontal ocellus. One pair of anterior discal hairs on short mammiform processes, the other 3 pairs of discal hairs not on processes, these hairs pointed, up to 0.011 mm long. Antennae 6-segmented, slender, shorter ($0.8\times$) than the length of body, pale except for outer margins of segments I and II, basal half to 0.60 portion of segment III and apices of segments III, IV, V and middle of VI which are black ; segment III with 14-20 narrow slit-like, secondary rhinaria on basal half to 0.60 portion ; flagellum gradually more distinctly



Pseudotinocallis nigropunctatus (Tao). 394-403, alate vivipara : 394, body : 395, head and pronotum ; 396, antennal segment III ; 397, antennal segment VI ; 398, apical rostral segment ; 399, hind tarsus ; 400, spinal abdominal process ; 401, lateral abdominal process ; 402, siphunculus ; 403, cauda and anal plate.

furnished with spinulose imbrications ; hairs on flagellum scarce, pointed, 0.007-0.011 mm long. Rostrum reaches midway between fore- and midcoxae, ultimate rostral segment shorter ($0.7\times$) than second segment of hind tarsus and bears 4 accessory hairs besides the preapicals. Thorax pale without processes or elevations, pronotum with one pair of marginal and 2 pairs of spinal hairs, as long as dorsal cephalic hairs. Abdominal dorsum completely pale, with short mammiform marginal processes on tergites 1-4 and spinal processes of same shape (the longest 0.038-0.045 mm long), of the latter, those of tergite 7 are shifted laterally. Dorsal abdominal hairs 0.011 mm long, or $0.33\times$ as long as the basal diameter

of antennal segment III. Siphunculi pale, truncate, 0.06 mm long, smooth. Cauda pale, knobbed, bearing 13 hairs. Subanal plate bilobed. Legs pale except for small black spot on apex of hind femur ; fore coxae greatly enlarged ; apical hairs of fore tibiae well differentiated as rastral organ ; apical 0.30 portion of tibiae and whole of tarsi spinulose ; first tarsal segments with 6-7 ventral and 2 dorsal hairs. Wing venation normal, pterostigma with small black spot at its base and radial sector developed only on apical half as a stripped line.

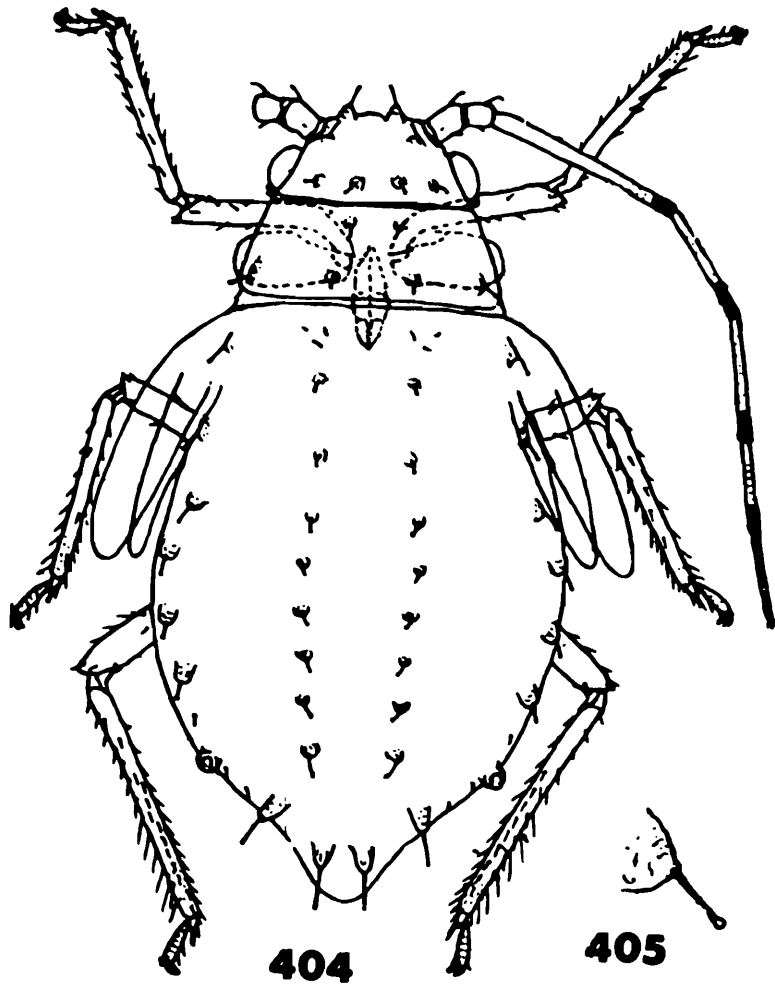
Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
1.85		0.72		1.57	
III	Ant. segments		VI	urs	ht ₂
	IV	V			
0.55	0.30	0.31	0.20+0.18	0.07	0.09

(ex unknown host, Kuan-Hsien (nr. Chengtu), Szechuan, China, 13.vii.1936, C. C. Tao, Taiwan Agr. Res. Inst. Coll.).

Alatoid nymph.—Frontal tubercles poorly developed. On vertex, discal hairs capitate or with incrassate apices, up to 0.045 mm long, 1.0-1.25× as long as the basal diameter of antennal segment III ; first pair of cephalic hairs on short processes 0.038 mm long. Antennal segment I and II each with a single capitate hair 0.041 mm long, other hairs on antenna short with acute apices ; processus terminalis 1.1-1.2× as long as base of segment VI. Rostrum reaches between fore- and midcoxae, ultimate rostral segment with 4 accessory hairs. Hairs of pronotum 3 pairs on very low elevations. Mesonotum with a pair each of marginal and posterior spinal hairs on very low elevations and 3 pairs of anterior spinal hairs not on elevations. Metanotum and abdominal tergites 1-7 each with a pair of spinal hairs and a pair of marginal hairs on short elevations or processes with capitate or incrassate apices but marginal hairs of tergite 5 and 7 short, pointed and not on processes ; tergite 8 with 2 processes. Of the spinal processes only



Pseudotinocallis nigropunctatus (Tao). 404-405, alate nymph : 404, body ; 405, lateral abdominal process.

those of tergite 7 laterally displaced ; abdominal processes 0.038-0.057 mm long, on tergites 7 and 8 the longest, finger-like ; marginal hairs up to 0.046 mm long, longest spinal hairs (on tergites 7 and 8) 0.057 mm long. Siphunculi short, smooth, without distinct flange, a little shorter than antennal segment II. Forecoxae enlarged, first tarsal segments only with ventral hairs (6) ; empodials flabellate.

Measurements in mm.—

Length	Width	Antenna
1.64	0.83	1.44

III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.39	0.20	0.24	0.16+0.20	0.06	0.09

(ex unknown host, Kuan-Hsien (nr. Chengtu), Szechuan, China, 13.vii.1936, C.C. Tao, Taiwan Agr. Res. Inst. Coll.).

Material examined.—3 alate viviparae and 3 alatoid nymphs (paratypes) from unknown host, Kuan-Hsien (nr. Chengtu), Szechuan, China, 13.vii.1936. coll. C.C. Tao (Taiwan Agr. Res. Inst. Coll.) ; 4 alatoid nymphs from *Phyllanthus* sp., Manas Sanctuary, Bhutan, India, 15.i.1974, coll. A. K. Ghosh (L.F.C. Coll. Ste-Foy, Quebec, Canada).

Discussion.—Tao (1963) described *nigropunctatus* under *Sarucallis* but as *Sarucallis* is now considered as a synonym of *Tinocallis*, a new genus *Pseudotinocallis* n.g. is proposed to accommodate the present species. No adult of *P. nigropunctatus* has so far been collected in India. Subsequent collections from Taiwan reveals that the species feeds on *Dalbergia* although nymphs have been collected on *Phyllanthus* in India.

Distribution.—India : Assam-Bhutan Border (Manas) ; Taiwan.

Types.—Deposited in the collections of Taiwan Agricultural Research Institute, Taipei, Taiwan.

Genus 19. *Pterocallis* Passerini, 1960

1860. *Pterocallis* Passerini, G., Gli. Aphidi con un prospetto dei generi ed alcune specie nuove Italiane. Parma 28 ; Richards, W.R., 1965. *Mem ent. Soc. Can.*, 44 : 71 ; Stroyan, H.L.G., 1977, *Handbk. Indent. Br. Insects*, II, 4(a) : 72 ; Heie, O.E. 1982, *Fauna ent. scand.* 11 : 57. Type species : *Aphis alni* Fabricius (= *Aphis alni* de Geer).

1908. *Subcallipterus* Mordvilko, A.K. *Ann. Mus. Zool. Acad. Sc. St. Petersburg*, 13 : 377. Type species : *Aphis alni* Fabricius.

Morphology.—Body 1.3-2.0 mm long, pale. Head without distinct frontal tubercles, vertex normally smooth, Frons often with a small median prominence. Antennae 6-segmented, as long as

or shorter than the body, rarely longer ; secondary rhinaria usually absent in apterae, circular to subcircular in alate, always confined to segment III ; primary rhinaria ciliated ; hairs on flagellum short and pointed ; processus terminalis $0.3-0.9\times$ as long as base of antennal segment VI. Rostrum reaches rarely beyond mid-coxae, ultimate rostral segment $0.5-0.9\times$ as long as second segment of hind tarsus and bears 2-6 accessory hairs. Abdomen pale, usually without spinal processes but in the alate form of some species spinal hairs of tergites 1-4 on very flat or inconspicuous, paired or unpaired median prominences ; low marginal abdominal processes normally present in the alate form from tergite 1-4 or 2-4, which bear 2-3 hairs each ; dorsal hairs in apterae mostly elongate, conspicuous and with raggedly broadened or capitate apices, with the shafts roughened by minute apically directed spicules ; in alates these hairs usually short with acute apices, rarely with some long spinal hairs ; spinal hairs in 2-3 longitudinal rows, pleural hairs on tergite 6 not appended to the base of siphunculi. 8th tergite with 3-7 hairs. Siphunculi short, truncate, without flange, $0.1-0.7\times$ as long as second segment of hind tarsus. Cauda distinctly knobbed. Subanal plate bilobed, each lobe bearing a few pointed hairs. Rudimentary gonapophyses more or less fused. Alate with fore coxae slightly enlarged. Femora spiculose on apices of tibiae and whole of tarsi ; first tarsal segments with 5-7 ventral and 1-2 dorsal hairs ; empodial hairs flabellate. In fore wing, radial sector more or less obsolete or missing ; media and cubital veins often a little pigmented at their bases, Cu_2 usually more strongly pigmented and originating from a more or less triangular dark spot. Hind wings with both obliques. In some species, the apterae viviparae are suppressed.

Embryos mostly with long capitate marginal and spinal hairs ; pleural hairs absent ; spinal hairs variable in length and not arranged in parallel rows. Siphunculi discernible.

Discussion.—The genus was originally known to occur only in the Palaearctic, but one species has recently been discovered in the Oriental Region.

Biology.—No detailed biological information for the Indian species is available, but all known species are recorded from *Corylus* and *Alnus*.

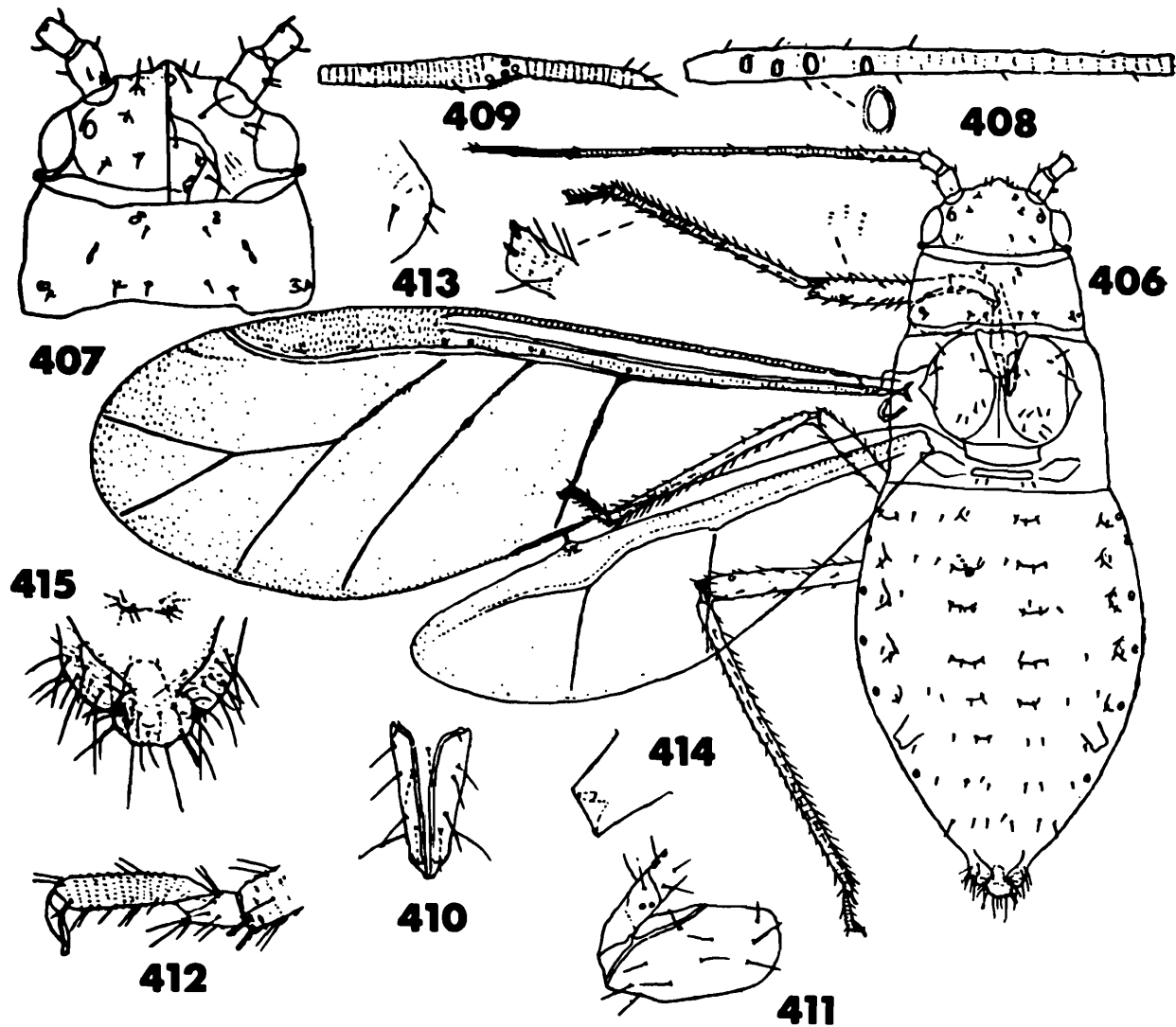
Distribution.—India ; Europe ; North America ; Japan ; Mediterranean and Manchurian Region.

Type species.—*Aphis alni* Fabricius, 1781 (= *Aphis alni* de Deer, 1773). Types are lost.

30. ***Pterocallis affinis* Chakraborti, 1988**
(Figs. 406-415)

1988. *Pterocallis affinis* Chakraborti, S., *Orient. Insects*, **22** : 38

Alate viviparous female.—Body 1.8-1.9 mm long with 0.72 mm as maximum width. Head and vertex pale ; frons somewhat produced in the middle ; dorsal cephalic hairs in 5 pairs, 0.011-0.015 mm long, $0.4-0.6\times$ as long as basal diameter of antennal segment III. Antennae 6-segmented, $0.68\times$ as long as the body, slender, pale except for apices of segments IV-VI and middle of segment VI which are dusky ; flagellum with spinulose imbrications ; segment III with 3-4 somewhat elliptical secondary rhinaria restricted to basal half of the segment, longest hair on flagellum 0.011 mm long, about $0.5\times$ as long as the greatest basal diameter of the segment ; processus terminalis shorter ($0.7\times$) than the base of segment VI. Rostrum reaches between fore and middle coxae, ultimate rostral segment elongate, $0.96\times$ as long as second segment of hind tarsus and bearing 6 accessory hairs. Thoracic nota pale. Pronotum with 6 pair of hairs as long as dorsal cephalic ones, with 1-2 marginal papillae on each posterior lobe. Lobes of mesonotum without sculpturing. Abdomen pale, with pairs of low spinal elevations from tergites 1-5 (6) each bearing 2-4 spinal hairs ; pleural hairs 1-3 pairs on each of the tergites 1-6, not on elevations, pairs of blunt marginal process measuring 0.011-0.015 mm present on tergites 1-4 on each side, on tergites 5-7 only one pair, those of tergite 5 on low elevations. Hairs of abdominal tergites 1-7 as long as dorsal cephalic hairs, tergite 8 with 7 hairs, the longest of which measures 0.038 mm. Siphunculi pale, truncate without apical flange, longer than wide, measuring 0.068 mm. Cauda pale, knobbed, bearing about 20 hairs. Subanal plate bilobed, each lobe with 10-13 hairs. Legs pale, except for black apex of hind femur and dusky tarsi, tibial hairs pointed, the longest $1.5\times$ as long as distal width of tibia. Rastral organ developed. First tarsal segments with 6-7 ventral and 2 dorsal hairs. Wing venation normal



Pterocallis affiris 406-415, alate vivipara : 406, body; 407, head and pronotum; 408, antennal segment III ; 409, antennal segment VI ; 410, apical rostral segment; 411, fore coxa ; 412, hind tarsus ; 413, lateral abdominal process ; 414, siphunculus ; 415, cauda and anal plate.

except for very short radial rector. Pterostigma and costal veins unpigmented, Cu₂ in fore wing with very narrow black bordering.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna
1.	1.82	0.72	1.25
2.	1.88	0.74	1.28

III	Ant. segments			urs	ht ₂	Siph.
	IV	V	VI			
0.38	0.28	0.23	(0.13+0.08)	0.10	0.10	0.07
0.45	0.29	0.24	(0.12+0.09)	0.10	0.11	0.06

(1, 2, ex *Corylus colurna*, Ghangaria, U.P., 30.V.1980, A. Mondal, No. 937. K.U. Coll.).

Embryo.—Normal “protopattern” of Callaphidini (Richards, 1965). Dorsal body setae in 4 longitudinal rows, capitate and with weakly roughened shaft, mostly elongate, but marginal hairs of pronotum and abdominal tergites 1 and 5-7 shortened, and also anterior spinal hairs of pronotum and hairs of mesonotum and abdominal tergites 1 and 5 rather short. Spinal abdominal hairs of tergites 2-4 very little shifted laterally, but those of tergite 7 distinctly laterally displaced. Apical rostral segment with 1 pair of secondary hairs.

Material examined.—Two alate viviparous females and embryo from *Corylus colurna*, Ghangaria, Uttar Pradesh India, 30.V.1980, coll. A Mondal (Kalyani University Collections).

Distribution.—India : Uttar Pradesh.

Discussion.—This species, of which only the alate viviparae are known, appear close to *P. rhombifoliae* Granovsky in the pale body combined with the somewhat elongate processus terminalis and the short radial sector in the forewing. However *P. rhombifoliae* has fewer hairs on the mesonotum and the abdominal tergites.

Genus 20. *Saltusaphis* Theobald 1915

1915. *Saltusaphis* Theobald, F.V., *Bull. ent. Res.*, 6 : 138 ; Richards, W.R., 1971 *Mem. ent. Soc. Can.*, 80 : 51 ; Heie, Ole. E., 1981. *Fauna ent. scand.*, 11 : 97. Type species : *Saltusaphis scripus* Theobald.
1949. *Hiberaphis* Börner, C., *Beitr. tax.*, 1 : 52. Type species : *Hiberaphis iberica* Börner = *Saltusaphis scripus* Theobald.

Morphology.—Body elongate 1.7-2.5 mm long. Frons convex, frontal tubercles ill-defined. Dorsal hairs between eyes and antennal socket expanded, fan-shaped at apices, with setae on the lateral margins of the head between the eye and antennal socket. Antennae 6-segmented, usually distinctly shorter to nearly equal to the body ; secondary rhinaria absent in apterae, present on segment III and in alatae ; accessory rhinaria separated from primary rhinaria on segment VI ; hairs on the flagellum pointed, shorter than basal diameter of segment III ; processus terminalis $1.5-2.3\times$ as long as base of antennal segment VI. Eyes large, triommatidium not prominent. Rostrum hardly reaches beyond forecoxae, ultimate rostral segment short, $0.50\times$ as long as second segment of hind tarsus and bears 2-3 accessory hairs. Abdominal tergites in apterae with marginal and spinal sclerotic patches arranged segmentally, spinopleural sclerotic patches may also extend to thorax ; in alatae, these may form transverse bands on the abdomen and may become fused partly on 3rd-8th tergites ; dorsal hairs, in apterae short, fan-shaped, arising from small brownish scleroites or may be long, blunt and capitate in posterior tergites ; in alatae, the hairs may be similar to those in the apterae, or may be thick, blunt, rod-shaped ; 8th abdominal tergite with two processes each bearing two long rod-shaped hairs. Siphunculi short, truncate, spinulose, arising from sclerotic pigmented bases. Cauda distinctly knobbed, sclerotic, bearing a pair of long apical hairs besides shorter hairs. Subanal plate bilobed. Legs with fore and mid-femora enlarged, bearing sclerotic knee-cap, which are used for leaping ; hairs on tibia normal or rod-shaped ; first tarsal segments with only 5 ventral hairs. Wing venation normal. Body in life covered with waxy powder.

Embryos have legs with fore and mid-tibiae widened at base. Dorsal hairs in 4 longitudinal rows. Marginal hairs 1+1 on each segment. Siphunculi poriform.

Males apterous. Antennae bearing secondary rhinaria on segment III-V. Small in size, 1.6-1.7 mm.

Oviparae apterous, similar to apterous viviparae but hind tibiae swollen and bearing pseudosensoria, and with 2 large subventral wax-pore plates.

Discussion.—Eastop and Hille Ris Lambers (1976) recognised four species of *Saltusaphis* viz. *elongata* 1917, *kienshuensis* Shinji, 1942, *lasiocarpae* (Ossianilsson, 1953) and *scripus* Theobald 1915, from the World. Earlier, Richards (1971) while reviewing the world fauna of Saltusaphidinae, recognised two species viz. *iberica* Brnöer (now considered a synonym of *scripus*) with *lasiocarpae* as a synonym of *iberica* and *scripus* Theobald. The exact status of *kienshuensis* Shinji can not be determined without authentic material.

The genus, like other genera of Saltusaphidini, is associated with Cyperaceae and can be separated from related genera by the enlarged fore and mid-femora, absence of conspicuous wax glands and presence of lateral hairs between antennal sockets and anterior margin of eyes.

Only one species, *scripus* Theobald, is known from India. Richards (1971) has dealt with the Saltusaphidini of the World, Higuchi (1972) dealt with Japanese species of the *Saltusaphis* group and Heie (1982) has given a brief account of species recorded in Scandanavia.

Biology.—The members of this genus lead autoecious holocyclic life cycle on plants of Cyperaceae (*Carex*, *Cyperus*, *Scripus*). In Egypt, *scripus* Theobald has been noted to occur in December and again during March to June (Theobald, 1915, Hall, 1926) and alatae are uncommon. In Scandinavia, sexuales have been recorded from August to October (Heie, 1982).

Distribution.—India ; Middle East ; Central Asia ; Africa ; Europe , North America.

Type species.—*Saltusaphis scripus* Theobald 1915. Deposited in the collections of British Museum (Nat. Hist.), London, England.

31. *Saltusaphis scripus* Theobald (Figs. 416–431)

1915. *Saltusaphis scripus* Theobald, F.V., *Bull. ent. Res.*, **6** : 138.

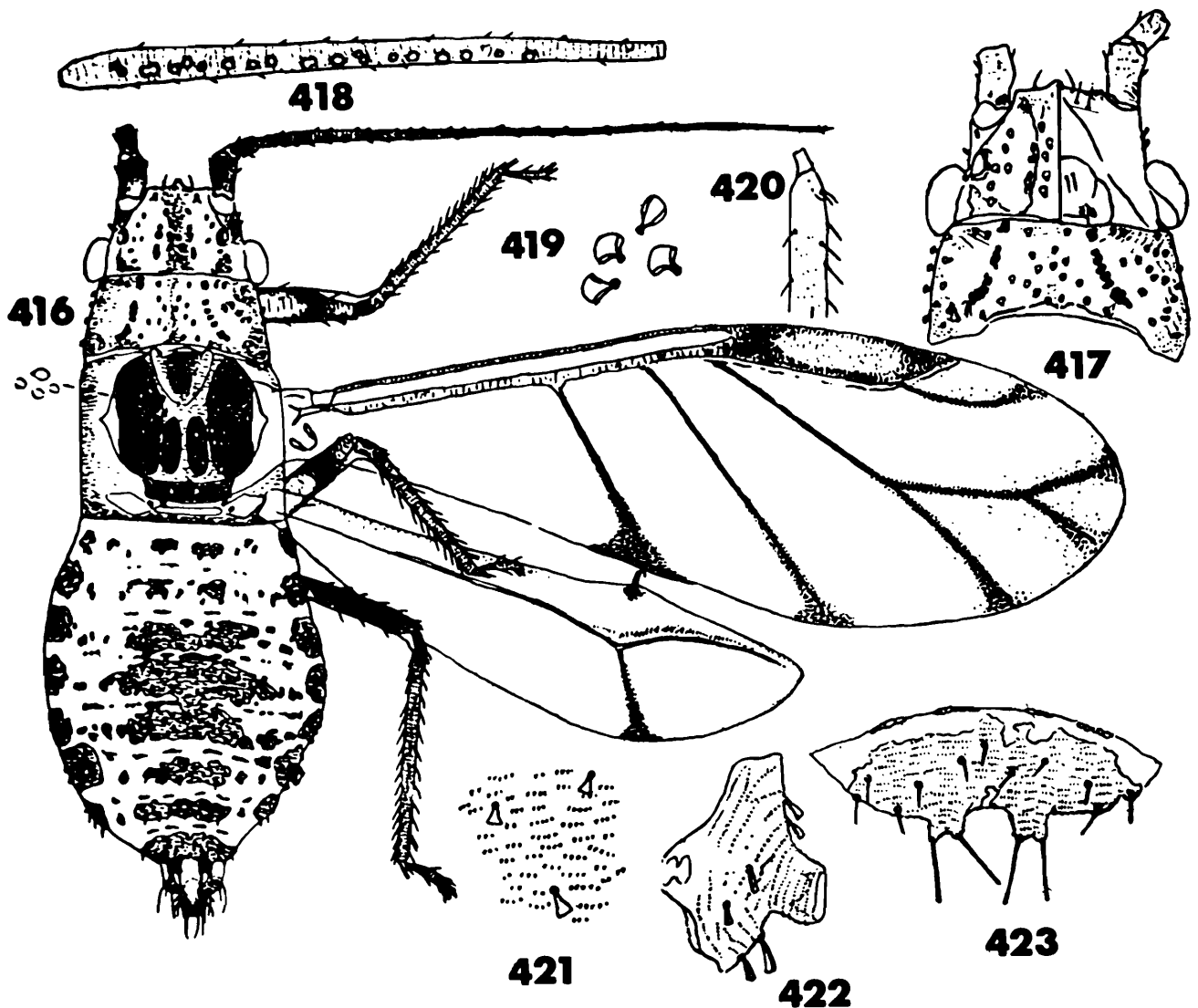
1949. *Hiberaphis iberica* Börner, C., *Beitr. Taxon. Zool.*, **1** : 52.

1953. *Saltusaphis africana* Eastop, V.F., *Entomologists Mon. Mag.*, **89** : 202.

1958. *Saltusaphis africana*, Ramdas Menon, J.G. and Pawar, J.G. *Proc. 15th Indian Sci. Cong. Assocn. III*, 348 (misid.).

1970. *Bacillaphis afghanica* Narzikulov. M.N. and Umarov, S.A. *Dokl. Acad. Sci. Tadzik. SSR*, 13 (2) : 58.
1971. *Saltusaphis scripus*, Richards, W.R., *Mem. ent. Soc. Can.*, 80 : 63.
1974. *Saltusaphis scripus*, David, S. Kanakaraj, Ghorpade, G.P. *Orient. Insects*, 8 : 197.
1982. *Saltusaphis scripus*, Heie, Ole, E. *Fauna ent. Scand.*, 11 : 98.

Alate viviparous female.—Body 1.85 mm long with 0.64 mm as maximum width. Head mottled, darker along lateral margin, discal hairs flabellate. Antennae brown, 6-segmented, about as long as the body; segment III with 12-14 (20) irregular oval secondary rhinaria, mostly restricted to basal 0.50 -0.75 portion; hairs



Saltusaphis scripus Theobald. 416-423, alate vivipara : 416, body ; 417, head and pronotum ; 418, antennal segment III ; 419, hairs of pronotum ; 420, base of hind tibia ; 421, spinal abdominal hairs ; 422, siphunculus ; 423, abdominal tergite VIII.

on flagellum fine, acute, 0.010-0.013 mm long, at most $0.50\times$ as long as basal diameter of antennal segment III; processus terminalis not quite twice as long as base of segment VI. Abdominal dorsum with paired, spinulose, brown marginal sclerites besides similar irregular, paired spinopleural sclerites which may be variably confluent; hairs on the dorsum of abdomen flabellate but may be blunt or rod-shaped or pointed on the 8th tergite; 8th tergite bilobed, each lobe with 2 long blunt hairs. Siphunculi, cauda and anal plate as in apterous viviparous female. Legs darker on femora, otherwise yellowish; tibiae and tarsi finely spinulose. Wing venation normal, forewings with media twice branched, all veins with dusky tips.

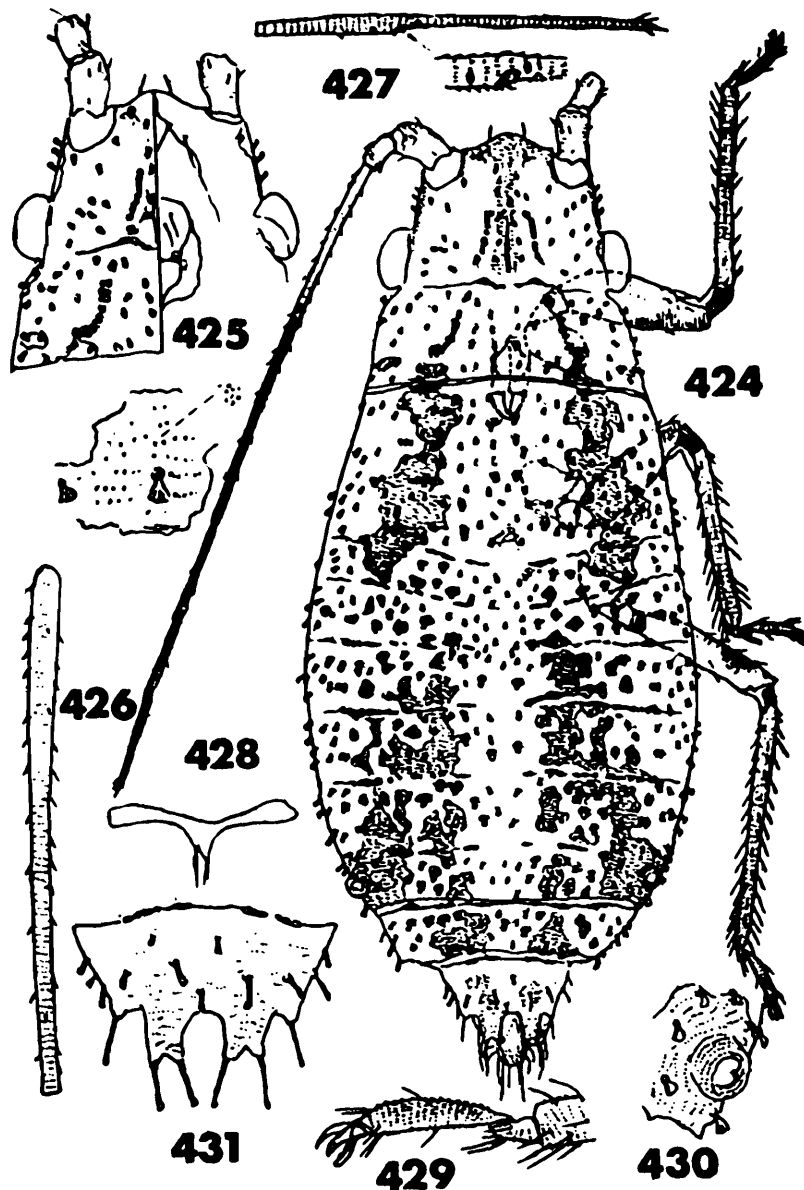
Colour.—Not recorded.

Measurements in mm.—

Length				Width	Antenna	
1.85				0.64	2.19	
Ant. segments				urs.	ht ₂	Siph.
III	IV	V	VI			
0.69	0.39	0.31	(0.16+ 0.27)	0.075	0.15	0.04

(ex *Cyperus* sp., Delhi, 16.xi.1964, N.Z.C.).

Apterous viviparous female.—Body elongate, 1.9-2.5 mm long with 0.90-1.10 mm as maximum width at the middle of abdomen. Head with poorly developed lateral frontal tubercles but with a short, rounded projection in the middle; vertex with discal hairs short, flabellate. Antennae light brown, 6-segmented, $0.70-0.74\times$ as long as the body; segment I narrowed near very base, longer than broad, segment III equal to segment IV and V taken together; flagellum densely covered with rows of spinules; hairs on flagellum acute, stiff, 0.013 mm long, at most $0.50\times$ as long as the basal diameter of antennal segment III; processus terminalis up to $1.5\times$ as long as base of antennal segment VI. Rostrum barely reaches beyond forecoxae, ultimate rostral segment $0.50\times$ as long as second of hind tarsus and bears a pair of secondary hairs.



Saltusaphis scirpus Theobald. 424-431 : apterous vivipara : 424, body ; 425, head and pronotum ; 426, antennal segment III ; 427, antennal segment VI ; 428, mesothoracic furca ; 429, hind tarsus ; 430, siphunculus ; 431, abdominal tergite VIII.

Dorsum of body distinctly segmented, tergites with irregular patches formed of brownish sclerites or scleroites that are darker around base of hairs, which are mostly flabellate except for rod-shaped hairs with weakly expanded apices on 8th abdominal tergite; flabellate hairs 0.010-0.013 mm long ; 8th tergite bilobed, each lobe with 2 rod-shaped hairs with expanded apices, up to 0.052 mm long, besides 6-8 flabellate hairs on basal portion. Siphunculi elevated short, cylindrical spinulose. Cauda distinctly

knobbed, spinulose and bears 6-7 fine hairs on knobbed part. Subanal plate bilobed. Legs with tibiae and tarsi finely spinulose; hairs on basal portion of tibiae flabellate, rod-shaped or capitate, most of the other hairs acute; first tarsal segments with only 5 ventral hairs.

Colour.—Not recorded, body in life covered with fine waxy powder.

Measurements in mm.—

	Length	Width	Antenna
1.	2.41	1.10	1.79
2.	2.15	0.94	—
3.	2.41	1.10	1.72

	Antennal segments				urs	ht ₂	Siph.
	III	IV	V	VI			
	0.59	0.31	0.30	(0.16+ 0.24	0.075	0.15	0.04
	0.55	—	—	—	0.075	0.15	0.04
	0.58	0.28	0.30	(0.15+ 0.22)	0.075	0.15	0.04

(1, 2, 3, ex *Cyperus* sp., Delhi, 9.ii.1967, N.Z.C.).

Material examined.—Apterous viviparous females and one alate viviparous female from *Cyperus* sp., Indian Agricultural Research Institute, Delhi 16.xi.1964 coll. R. Menon; four apterous viviparous females, 9.ii.1968, coll. N. J. Deshmuni, other data same; (N.Z.C.).

Discussion.—Richards (1971) considered *S. iberica* (Borner) and *S. scripus* Theobald as distinct species, separating the former by the presence of rod shaped hairs on 7th and 8th tergite in apterae, while these are confined only to 8th tergite in *scripus*; this view cannot be maintained after examination of Borner's types which clearly show that his species is the same as *scripus*. Eastop and Hille Ris Lambers (1976) considered both as one and the same species and Indian specimens also show the above mentioned

variations of hairs in the apterae viviparae. Ramdas Menon & Pawar (1968) recorded this species as *africana*, another synonym of *scripus*. The species has subsequently been collected in Delhi and Bangalore and may also occur in Tamil Nadu.

Distribution.—India : Delhi and Karnataka (Bangalore). Africa; Europe.

Type.—Deposited in the collections of British Museum (Nat. History) London, England.

Genus 21. *Serratocallis* Quednau & Chakrabarti

1976. *Serratocallis* Quednau, F.W. and Chakrabarti, *S. Can. Ent.*, **108** : 461 ;
Type species : *Serratocallis takahashii* Quednau and Chakrabarti.

Morphology.—Body small, 2.2 mm long. head and prothorax separated incompletely in apterae. Median frontal prominence present. Hairs on frons long and fine. Discal hairs and hairs on pronotum in clusters and spine-like with spinulose surface in apterae, thinner in alates. Antennae 6-segmented, shorter than body ; secondary rhinaria absent in apterae, oval and restricted to segment III and IV in alatae ; primary rhinaria weakly ciliated, accessory rhinaria close to primary rhinaria ; hairs on flagellum sparse, short, fine ; processus terminalis subequal to base of segment VI. Rostrum reaches up to hind coxae in apterae, shorter in alatae, ultimate rostral segment acute, distinctly longer than second segment of hind tarsus and bears 8-10 accessory hairs. Dorsum of abdomen with transverse dark brown sclerotic bars, often broken into spinal, pleural and marginal areas. Dorsal hairs in alatae of two types, viz. fine mixed with stout spinulose spine-like hairs arising from tuberculate bases, in apterae mostly of latter type. In alatae spinal and marginal papillae present in clusters and appear blister-shaped. Siphunculi short, truncate, fused with lateral sclerites, imbricated. Cauda broad, tongue-shaped without any constriction. Subanal plate feebly indented. Legs normal, tarsi spinulose, first tarsal segments with 5 ventral hairs and 0-1 dorsal hairs ; empodial hairs setiform. Wing venation normal.

Embryos with paired spinal and marginal hairs (4) on abdominal segments 1-7 ; pleural hairs absent. Antennae 4-segmented. Ultimate rostral segment with 6 accessory hairs. Siphunculi appear ring-like.

Sexual forms not known.

Discussion.—The combination of characters like presence of spinulose dorsal hairs, the depth and extent of dorsal sclerotisation, the complete radial sector in the forewings of alatae, normal coxae and the arrangement of dorsal hairs in embryos help to separate this monotypic genus from closely related genera, viz. *Hoplochaetaphis* Aizenberg 1959, *Sinochaitophorus* Takahashi, 1936 and *Neochromaphis* Takahashi, 1921.

Biology.—Apterae, alatae and alatoid nymphs were collected on *Quercus* in hills of North-west India during the month of October. The member of the endemic genus appears to lead anautocyclic life cycle on Fagaceae.

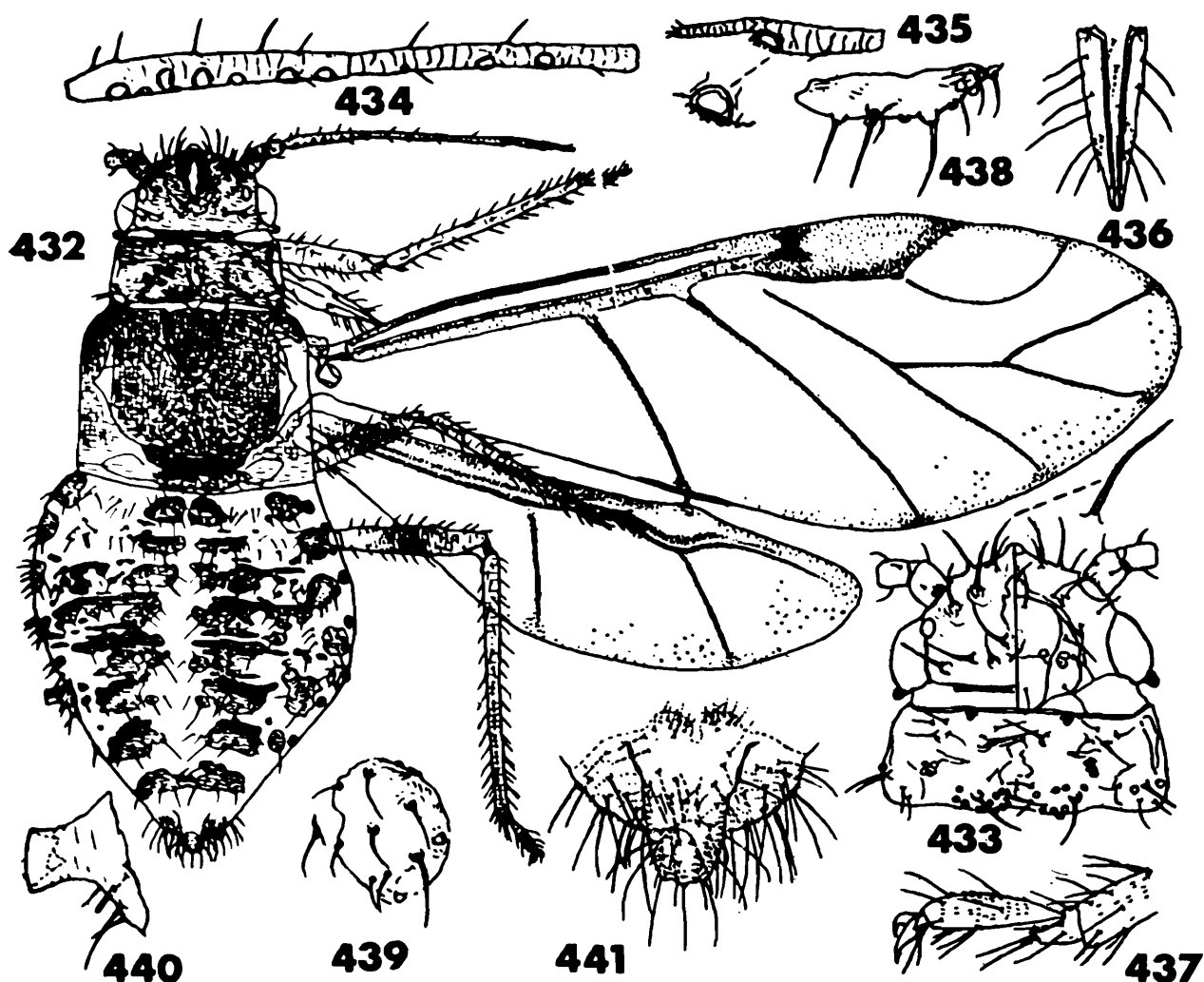
Distribution.—India.

Type species.—*Serratocallis takahashii* Quednau and Chakrabarti, 1976. Deposited in the Department of Zoology, University of Kalyani, Kalyani, India ; some paratypes deposited in the Canadian National Collection, Canada.

32. *Serratocallis takahashii* Quednau & Chakrabarti (Figs. 432-451)

1976. *Serratocallis takahashii* Quednau, F.W. and Chakrabarti, S. *Can. Ent.*, 108 : 464.

Alate viviparous female.—Body 2.01 mm long with 0.91 mm as maximum width. Frons protruding and frontal ocellus visible when head is viewed from above. Discal hairs blunt or pointed, tinged with brown, with rough or spinulose surface on strongly tuberculate bases, up to 0.091 mm long, 2.5-3.0× as long as the greatest basal diameter of antennal segment III ; posterior discal hairs present in groups. Antennae pale brown, 6-segmented,



Serratocallis takahashii Quednau & Chakrabarti. 432-441, alate vivipara :
 432, body ; 433, head and pronotum ; 434, antennal segments III and IV ;
 435, antennal segment VI ; 436, apical rostral segment ; 437, hind tarsus ;
 438, spinal sclerite of abdominal tergite II ; 439, lateral abdominal sclerite ;
 440, siphunculus ; 441, cauda and anal plate.

distinctly shorter than the body ; segment III with 4-8, segment IV with 1-3 roundish to oval secondary rhinaria on III, distributed in an irregular row on whole length of segment ; hairs on flagellum pointed, the longest on segment III 0.030 mm long, about as long as greatest basal diameter of the segment. Rostrum reaches mid-coxae, ultimate rostral segment tapering, acute, $1.4\times$ as long as second segment of hind tarsus and bears 8-10 accessory hairs besides preapicals. Pronotum with hairs in clusters, similar to those on vertex. Marginal papillae 1-2 on each side of pronotum, spinal papillae in clusters of 10-20 on each of the thoracic nota. Dorsal abdominal sclerites mutually free and mesially separated,

especially on posterior abdominal segments widely apart ; pleural sclerites absent or poorly developed on tergites 1 and 2, on tergites 3-4 broken into small sclerites or developed as spinopleural bars of irregular outline ; marginal abdominal sclerites roundish, one pair per tergite ; spinal sclerites of tergites 1-3 bulging ; hairs on spinal and marginal sclerites in groups of 7-10, except marginal sclerites of tergite 7 where there are 1-2 pleural hairs in clusters ; dorsal abdominal hairs measure up to the same length as those on vertex ; tergite 8 with a sclerotic bar carrying 12-15 hairs 0.060 mm long ; marginal sclerites of tergites I-IV each with 1-4 marginal papillae, spinal papillae on tergites 1-6 numbering 1-10. Siphunculi cylindrical, truncate, fused with lateral sclerite of abdominal segment 6. Apical part of cauda not separated by a constriction, with 25-27 hairs. Subanal plate indented with 23-25 setae on each lobe. Gonochaetae in two clusters of 9 each. Legs pale brown with some dark mottling on middle and hind femur ; hairs on tibiae pointed, the longest $1.3\times$ as long as distal width of tibia ; first tarsal segments with 5 ventral and 0-1 dorsal hairs ; empodials arolii setiform ; apices of tibiae with a few spinules ; tarsi spinulose. Wing venation normal, pterostigma with black spot at base and brown bordering of inner margin, veins ending in small weakly furcous spots.

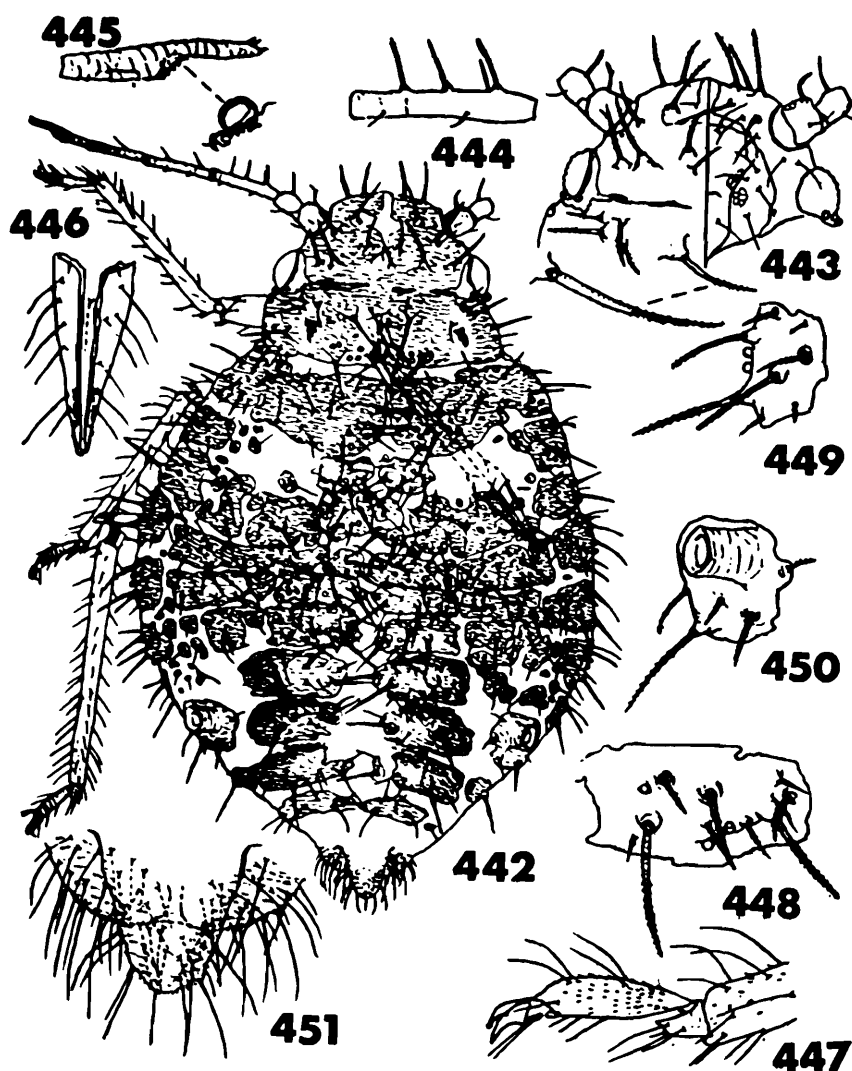
Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
1.84		0.82		0.85	
Ant. segments		urs		ht ₂	
III	IV	V	VI		
0.23	0.20	0.18	0.08+0.06	0.148	0.110

(ex *Quercus* sp., Loharkhet, Almora, U.P. 11. $\times$. 1970, Univ. of Kalyani Coll.)

Apterous viviparous female.—Body 1.38-1.76 mm long with 1.14 mm (of one specimen) as maximum width. Head with frons convex and vertex incompletely fused with pronotum. Vertex



Serratocallis takahashii Quednau & Chakrabarti. 442-451, apterous vivipara 442, body ; 443, head ; 444, antennal segment III ; 445, antennal segment VI ; 446, apical rostral segment ; 447, hind tarsus ; 448, spinal abdominal sclerite ; 449, lateral abdominal sclerite ; 450, siphunculus ; 451, cauda and anal plate.

incompletely sclerotic leaving free a pale median zone. Dorsal cephalic hairs spine-like, tinged with brown, spinulose and on tuberculate bases, numbering about 15-17, up to 0.09 mm long, $3.5\times$ as long as the greatest basal diameter of antennal segment III. Antennae $0.44\times$ as long as the body, pale with apices of segments III-IV infuscated ; segment I and II with 1 big spine-like hair each, 0.04 mm long (besides 1-2 shorter, thin hairs) ; flagellum from apex of segment III with weakly spinulose imbrications ; longest antennal hairs blunt or pointed, the longer ones on segment III spinulose and 0.04 mm long ; processus terminalis $0.66\times$ ($0.56-0.75\times$) as long as base of segment VI. Rostrum reaches between

hind coxae, otherwise as in alate morph. Pronotum with spinal and marginal hairs in clusters of same length and shape as dorsal cephalic hairs, with 0-2 marginal papillae on each side and about 10 spinal papillae. On the remainder of the terga transverse sclerotic crossbars, segmentally separated with the widest median gap on posterior abdominal tergites ; on tergites 1-5 these bars irregularly broken into spinal, pleural, and marginal portions ; pleural sclerites often absent on metanotum and tergite 5 ; spinal sclerites often paler medially. Dorsal hairs on body mostly arranged in spino-pleural and marginal clusters of same length and shape as dorsal cephalic hairs. Marginal sclerites with 0-3 papillae each and 0-10 spinal papillae present on each tergite from mesonotum until abdominal tergite 5. Siphunculi and cauda as in the alate vivipara. Legs pale with femora and tibiae bearing numerous stiff hairs, blunt and spinulose in part ; first tarsal segments with 5 ventral hairs of which the middle one is shorter than others.

Colour.—Not recorded.

Measurements in mm.—

Length		Width	Antennae		
1.72		1.14	0.68		
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.17	0.13	0.13	(0.09+0.05)	0.16	0.11

(ex *Quercus* sp., Loharkhet, Almora, U.P. 11.x.1970, Univ. of Kalyani Coll.).

Embryo.—(after Quednau & Chakrabarti, 1976). Dorsal hairs elongate spine-like, blunt or acute, spinulose, arranged in 4 longitudinal rows ; spinal and marginal hairs one pair per segment, except on pronotum, where spinals are duplicated and on 8th tergite where marginals are absent ; pleural hairs absent. Antennal chaetotaxy 1+1, 1, 2, 1. Ultimate rostral segment tapering with 6 accessory hairs.

Material examined.—Several alate and apterous viviparae from *Quercus* sp., Loharkhet, Almora, Uttar Pradesh, India, 11.x.1970, coll. S. Chakrabarti (paratypes, Univ. of Kalyani Coll.)

Discussion.—The present species, the only member of the monotypic genus is distinctive in its combination of characters of dorsal hairs, sclerotisations, nature of coxae and embryonic chaetotaxy.

Distribution.—India : Uttar Pradesh ; Afghanistan.

Types.—In the collection of Department of Zoology, University of Kalyani, Kalyani, India.

Genus 22. *Shivaphis* Das

1918. *Shivaphis*, Das, B., *Mem. Indian Mus.*, 6 : 245 ; Baker, A.C., 1920. *Bull. U.S. Dep. Agric.*, 836 : 24 ; Shinji, O., 1941. Monograph of Japanese Aphididae, 120 ; Higuchi, H., 1972. *Ins. Matsum.*, 35 (2) : 34 ; Chakrabarti, S., and Raychaudhuri, D. N., 1978 (1975). *Proc. zool. Soc. Calcutta*, 28 : 88 ; Raychudhuri, D. N. Chakrabarti, S. Basu, R. C. and Ghosh, A. K., 1980. In *Aphids of North East India and Bhutan*, 298 ; Quednau, F.W. and Remaudière, G., 1985. *Can. Ent.*, 117 : 227. Type species : *Shivaphis celti* Das.

Morphology.—Body 1.4-2.8 mm long, elongate. Head without frontal tubercles, frons nearly convex, with a distinct mid dorsal suture in apterae. Wax pore-plates well developed on head, at least in apterae. Antennae 6-segmented, shorter than body ; secondary rhinaria absent in apterae, in alatae transversely elongated and ciliated, restricted to segment III ; flagellum with spinulose imbrications ; hairs on flagellum short, sparse, acute at apices ; primary rhinaria rounded, ciliated ; processus terminalis distinctly shorter than base of segment VI, 3.0-6.0× as long as wide. Rostrum at most reaches mid-coxae, ultimate rostral segment shorter than or almost equal to second segment of hind tarsus and bears upto 10 accessory hairs. Abdominal dorsum pale, bearing segmentally separated, weakly sclerotic marginal and spinal areas containing wax-plates ; hairs on the dorsum of medium length, acute, arranged as two spinal and two marginal hairs on each tergite ; pleural hairs absent ; the 8th tergite may bear 5-12 hairs ; in alate, 8th abdominal tergite sometimes bearing a short, triangular spinal

process (subgenus *Sinishivaphis* Zhang & Zhong). Wax pore elements compound, biscuit-shaped. Siphunculi short, cylindrical, near slightly raised marginal sclerite of tergite VI containing wax pores or may be small pore-like (as in *szelegiewiczi*). Cauda constricted with rounded knob or digitiform with irregular outline. Subanal plate bilobed. Rudimentary gonapophyses 2. Subgenital plate with a row of few hairs on posterior margin and 2 long fine hairs placed wide apart besides 2 other long fine hairs near anterior margin. Legs with fore coxae elongate to strongly enlarged ; wax gland pores well developed on legs ; apices of tibiae and 2nd tarsal segment spinulose ; apical tibial hairs differentiated, spine-like ; first tarsal segment with 5 ventral hairs and 2 dorsal hairs ; empodial hairs flattened at apices. Wing veins may be dark bordered ; in forewing pigmented zones of media and cubitus may be confluent (in *Sinishivaphis*) or not (in *Shivaphis*) ; hind wings pale with both obliques.

Embryos with 4-5-segmented antennae and 4 longitudinal rows of single hairs (spinal and marginals) upto 7th abdominal tergite ; hairs on 7th may be displaced laterally (in *Shivaphis*) or not (*Sinishivaphis*) ; wax glands may be visible or not.

Oviparae apterous. Wax glands present on weakly sclerotic plates arranged in four rows on body. Subanal plate entire. Hind tibiae swollen bearing many small pseudosensoria, 8th tergite with up to 17 hairs. Similar to apterae viviparae in other respects.

Males alate, appear similar to alate vivipara but smaller in size with secondary rhinaria on all segments or at least on III-IV. Claspers of genitalia well developed. Subanal plate is not bilobed but with feeble indentation.

Discussion.—The genus is considered typically an oriental genus with five species so far known from the world viz., *celti* Das, from Indo-Pakistan and east Asia, *catalpinari* Quednau and Remaudiere from Turkey, *hangzhouensis* Zhang and Zhong from China, *celticola* (Nevsky) from Central Asia and *szelegiewiczi* Quednau from Korea and China. Almost all the species are known to be associated with *Celtis* sp., except *hangzhouensis* from *Osmanthus* in China. Zhang and Zhong (1982) proposed a new genus *Sinishiv-*

aphis Zhang with *hangzhouensis* as type. Quednau and Remaudière (1985) while providing a key to all the 5 species known from the world considered *Sinishivaphis* as a subgenus of *Shivaphis* Das, and included *celticola* (Nevsky) and *szelegiewiczi* Quednau under the latter besides *hangzhouensis*; as such only two species, *celti* Das and *catalpinari* Quednau and Remaudière remain under subgenus *Shivaphis*. The two subgenera can be separated by the key given below (following Quednau & Remaudière, 1985).

Key to the Subgenera

Forewings with dark border on the apical part of median and cubital veins but pigmented zones of M and Cu₁ not confluent; antennal segment VI with processus terminalis about 3.0 × as long as wide and basally provided with a hair close to the primary rhinarium; in the alate viviparae, 8th abdominal tergite without spinal elevation; 1st instar larva with 5 segmented antennae and with short abdominal hairs (15 μm), those of 7th abdominal tergite being displaced laterally

Shivaphis Das

—Forewings with pigmented zones on the media and cubital 1, confluent. Antennal segment VI with processus terminalis at least 6.0 × as long as wide and basally with 1-2 hairs placed at a distance from the primary rhinarium; in the alate, coxae I always strongly enlarged; viviparae exclusively alate; alate with 8th abdominal tergite bearing a short, triangular, spinal process; 1st instar larva with 4 segmented antennae, hairs on 7th abdominal tergite not displaced laterally

Sinishivaphis Zhang & Zhong.

Cranaphis bambusicola David, Rajasing and Narayanan was transferred to *Shivaphis* by Chakrabarti and Raychaudhuri (1975) but it has now been observed that *bambusicola* differs considerably from other *Shivaphis* and was made type species of a new genus *Neocranaphis* Quednau, differing from *Shivaphis* as follows: First antennal segment elongate; small frontal tubercles developed; mpodial hairs thin, pointed; apical rostral segment short, as long as its basal width; wax pore elements on dorsum and

appendages developed as rings or cribriform discs, host association with Bamboo (cf. p. 148).

Shivaphis Das has been considered as a member of the tribe Panaphidini occupying an intermediate position between *Tinocallis* Matsumura and *Cranaphis* Takahashi.

Biology.—The members of this genus lead autoecious holocyclic life cycles on *Celtis* spp. (except one on *Osmanthus*). Das (1918) described in detail the biology of the type species, *S. celti* in the Punjab-Himachal Pradesh region; oviparae are observed in December and they lay eggs on young twigs of *Celtis*, sometimes in between hairs of twigs or on small lenticels in January and with the advent of new foliage in late February or March these eggs hatch; the fundatrix starts the colony which reproduces parthenogenetically for 2-3 generation (mostly apterae viviparae) and alates are produced at a later period. Both apterous and alate viviparae can be seen almost throughout the period of March-November, with the lowest population in middle of May to June; males appear in November and can be seen up to December. Quednau and Remaudière (1985) recorded apterous and alate viviparae and also males and oviparae of *S. catalpinari* on *Celtis australis* in Turkey (c 1500 m) during October. Das (op. cit) recorded *Chilomelis* sp. (both adult and larvae) as major predator of *S. celti* and notes that because of active habit (jumping off with slightest touch) it appears to be free from attack of Syrphid larvae, but a species of *Chrysopa* has been noted to feed exclusively on it. A few unnamed parasitoids have also been mentioned by him and at least one parasitoid *Trioxys* (*T.*) *shivaphis* Takada, is now known. The woolly covering of live aphids infesting the undersurface of leaves of host perhaps offers additional protection.

Distribution.—India; Pakistan; Central Asia; China, Korea and Turkey.

Type species.—*Shivaphis celti* Das 1918. Location of types not known.

Key to the species of *Shivaphis* Das*Alate viviparous females :*

Forewing with diffuse brown bordering on apical parts of median and cubital veins, but pigment between third branch of media and first cubitus not anastomosing. Processus terminalis about 3 times as long as wide and base of antennal segment VI with one hair that is rather close to the primary rhinarium. Lateral abdominal wax gland pore field of tergite 6 much larger than siphunculi. Knob of cauda fingerlike. Viviparae alate and apterous. On *Celtis* spp

celti Das

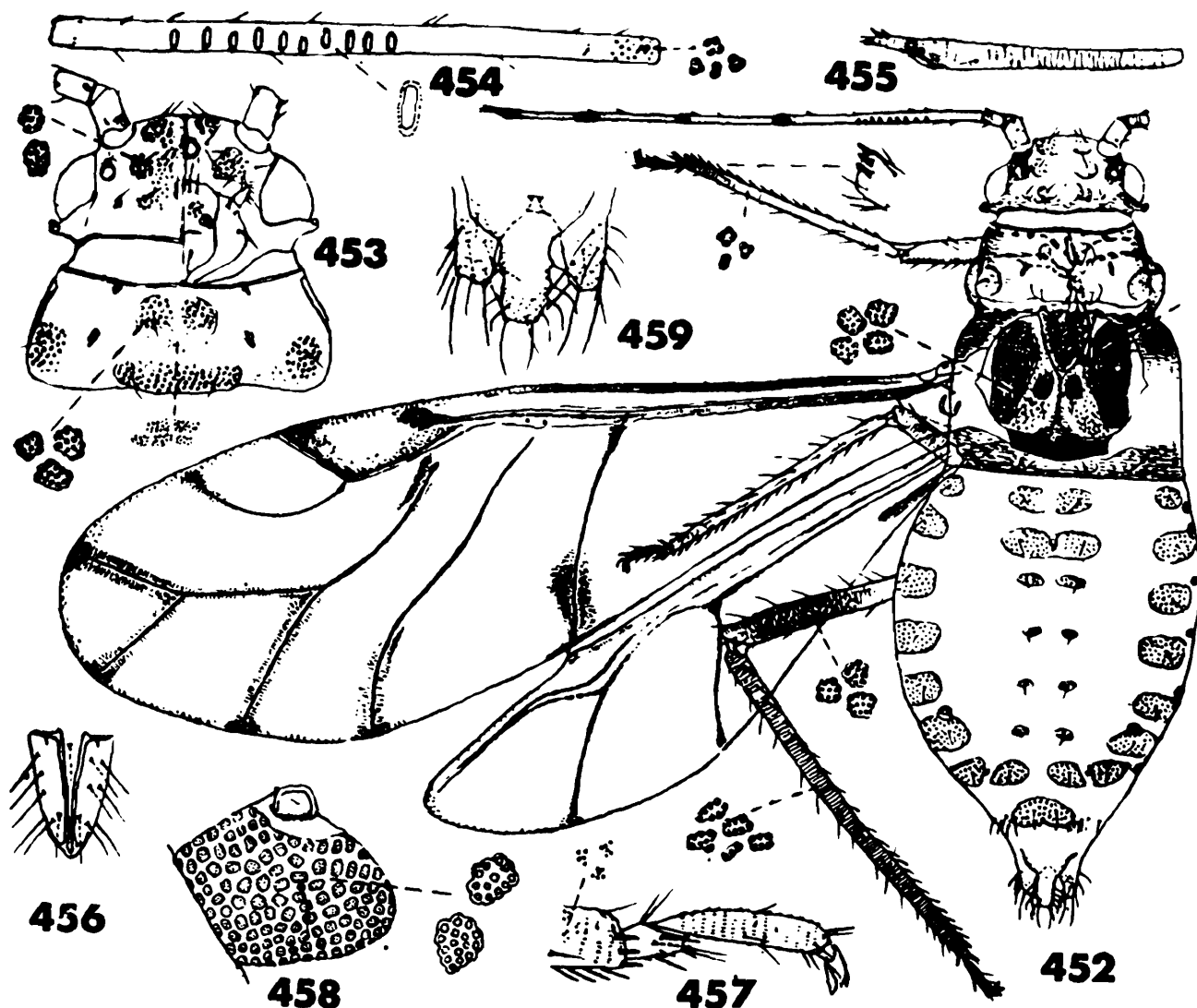
- Forewing as above but pigment between third branch of media and first cubitus anastomosing. Processus terminalis at least 6 times as long as wide and base of antennal segment VI with 2 hairs that are rather far apart from the primary rhinarium. Lateral abdominal wax gland pore field of tergite 6 not much larger than siphunculi. Knob of cauda globular. Only alate viviparae. On *Celtis* spp

celticola (Nevsky).

33. *Shivaphis celti* Das, 1918
(Figs. 452–465)

1918. *Shivaphis celti*, Das. B., *Mem. Indian Mus*, 6 : 245.
1918. *Chromaphis celticolens* Essig, E.O., and Kuwana, S.I. *Proc. Calif Acad. Sci.*, 4th Ser., 8 : 95.
1980. *Shivaphis celti*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C., and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 299.
1981. *Shivaphis celti*, Raychaudhuri, D. N., Raychaudhuri, D., Singh, T. K., *Sci. Cult.*, 47 : 171.
1984. *Shivaphis celti*, Agarwala, Basant, K., and Ghosh, A. K., *Rec. zool. Surv. India. Misc. Publ. Occ. Paper*, 50 : 26.

Alate viviparous female.—Body 2.2-2.3 mm long with 0.85-0.89 mm as maximum width. Head dark brown, bearing four pairs of wax gland fields with biscuit shaped elements, each with a fine hair, up to 0.043 mm long. Antennae 6-segmented, distinctly shorter than the body ; segment I, apices of segments III, IV, V and processus terminalis dark, rest pale ; segment III with 7-13 elongate



Shivaphis celti Das. 452-459. alate vivipara : 452, body ; 453, head and pronotum ; 454, antennal segment III ; 455, antennal segment VI ; 456, apical rostral segment ; 457, hind tarsus ; 458, siphunculus with compound wax gland pore elements ; 459, cauda and anal plate.

oval secondary rhinaria, arranged in a row and restricted to the middle portion of segment III ; flagellum gradually more distinctly imbricated apicad ; hairs on flagellum sparse, minute ; processus terminalis $0.20-0.22\times$ as long as base of segment VI. Pronotum with 3 pairs of fields of wax gland pore elements similar to those on vertex. Abdominal tergites with one pair each of spinal wax gland pore fields which appear confluent on tergites 1-3 ; those on tergites 4-6 rather small and separated and on tergite 7 large and separated ; tergites 1-7 each with a pair of lateral wax gland pore fields ; 8th tergite with a single dorso-median wax-gland field ; each of the wax gland pore fields except on tergite 8, bears a single

fine hair, 0.033-0.050 mm long, equal to or upto $1.3\times$ as long as the basal diameter of antennal segment III. Tergite 8 with 10-12 hairs. Siphunculi dark, ring like. Cauda and subanal plate as in apterae viviparae. Legs pale brown, forecoxae greatly enlarged, hind femora dark on apical part. Forewings with pterostigma and other veins bordered with dusky pigment ; hind wings with similar spots at the apex of wing and tips of veins.

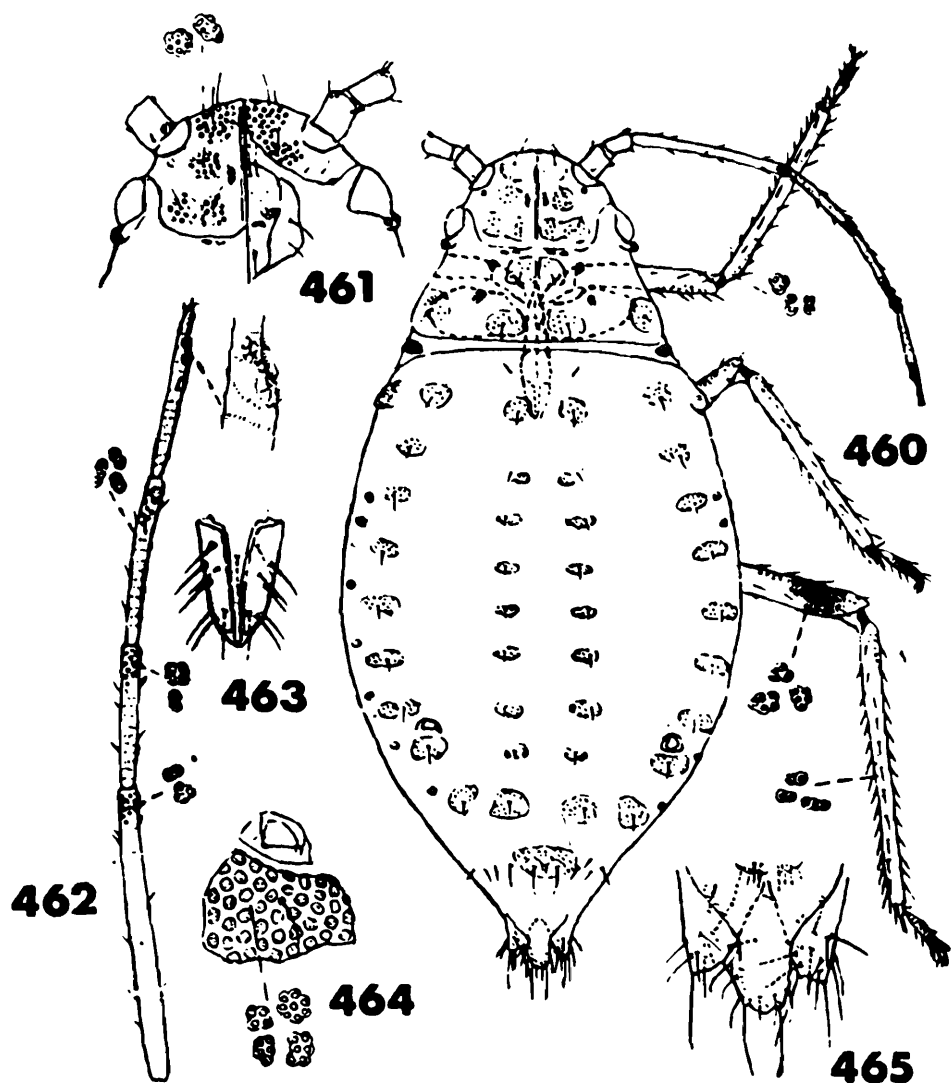
Colour.—Greenish yellow or pink with predominance of dark colour, covered with white flocculence.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.30	0.89	1.70		
2.	2.20	0.85	1.85		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.62	0.34	0.32	(0.28+0.05)	0.09	0.12
0.73	0.37	0.34	(0.25+0.05)	0.08	0.11

(1, ex *Celtis trandia*, Suakeithul, Manipur, 16. xii. 1971, C.U. Coll.,
2., ex *Celtis* sp., Kalimpong, W. B. 7. xii 1970, C.U. Coll.).

Apterous viviparous female.—Body elongate oval, 1.9-2.20 mm long with 0.95-1.16 mm as maximum width. Head brown without frontal tubercles, on vertex 4 pairs of fields with biscuit shaped wax gland pore elements, each with a fine hair up to 0.050 mm long. Antennae 6-segmented, distinctly shorter than the body, pale, but dusky-brown at spices of segments III-V and on processus terminalis ; flagellum gradually more distinctly imbricated apicad, without secondary rhinaria ; hairs on flagellum sparse, short (0.013 mm); processus terminalis $0.27-0.29\times$ as long as the base of antennal segment VI. Rostrum reaches middle of midcoxae, ultimate rostral segment $0.75\times$ as long as second segment of hind tarsus and bears 6-9 accessory hairs, besides the pre-apicals. Pronotum with 3 pairs of well defined field of wax gland pore elements similar to those on vertex. Meso-and metanotum and abdominal tergites 1-7 each



Shivaphis celti Das. 460-465, apterous vivipara : 460, body ; 461, head ; 462, antennal segments III-VI ; 463, apical rostral segment ; 464, siphunculus with compound wax gland pore elements ; 465, cauda and anal plate.

with a pair of spinal and a pair of lateral wax gland fields, each bearing a fine hair up to 0.033-0.040 mm long ; 8th tergite with a single broad median wax gland field bearing two fine hairs up to 0.050-0.056 mm long besides about 8 shorter hairs. Siphunculi pale, very low, appearing as a double rimmed flat ring. Cauda dusky brown, scabrous bearing 6-8 hairs on the elongate knob. Subanal plate deeply bilobed, each lobe with 9-11 hairs including a very long and stout hair measuring up to 0.033 mm. Subgenital plate dusky ; gonapophyses 2, each with 4 hairs. Legs pale brown, darker on apical half of femora ; fore coxae enlarged ; hairs on femora fine, acute, on tibiae stiff, up to 0.033 mm long ; first tarsal segments with 5 ventral and 1-2 dorsal hairs ; second tarsal segments spinulose.

Colour.—Pale to dusky greenish, sometimes pink, covered with white woolly flocculence.

Measurements in mm.—

Length	Width	Antenna			
2.20	1.16	1.24			
III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.41	0.23	0.24	(0.18+0.05)	0.09	0.12

(ex *Celtis trandia*, Khangampat, Manipur. 10. xii. 71, C.U. Coll.).

Apterous oviparous female.—Body 1.90 mm long with 0.94 mm as maximum width. Wax gland pore fields on head, thorax and abdomen arranged in the similar pattern as in apterae viviparae. Dorsal hairs on wax gland pore fields fine, acute, 0.03-0.04 mm long. Ultimate rostral segment dark brown, 0.75× as long as second segment of hind tarsus. Siphunculi dusky, ring-like. Subanal plate entire, very hairy (hirsute) without any indication of indentation. Subgenital plate large, conspicuous, bearing many fine hairs. Hind tibiae swollen and bearing numerous (more than 80) pseudosensoria distributed almost over entire surface.

Colour.—Scarlet body with black legs (Das, 1918).

Measurements in mm.—

Length	Width	Antenna	Antennal segment	urs	ht ₂
1.90	0.94	(broken)	—	0.09	0.12

(ex *Celtis trandia*, Khangampat, Manipur, 10. xii. 1971, C.U. Coll.).

Alate male (material not examined ; description based on original description by Das, 1918). Body slender 1.25 mm long with 0.48 mm as maximum width. Head dark. Antennae 6-segmented ; 1.45 mm long, segment III longest (0.35mm) and bears 20 secondary rhinaria, IV (0.26 mm) with 8-10, V (0.25 mm) with 6-8 similar rhinaria ; all rhinaria fringed. Pronotum with 3 pairs of wax gland

pore fields. Abdominal dorsum with glands fields arranged in 4 rows (lateral and spinal) as in viviparae. Siphunculi ring-like. Cauda dusky. Subanal plate not strongly bilobed. Genitalia consist of two lateral claspers, triangular in shape and bearing on the ventral side numerous hairs the bases of which appear whitish ; sheath of penis small with numerous small whitish sensoria.

Material examined.—One apterous viviparous female and two nymphs from *Celtis australis*, Simla, Himachal Pradesh, India 21. vi. 1969, coll. A.N.C. ; one alate viviparous female and three alatoid nymphs from *Celtis* sp., Tista, Kalimpong, West Bengal, India, 7 xii. 1970 ; one alate viviparous female from *Celtis* sp., Imphal, Manipur, India, 25. iv. 1976, Coll. D.R.C. ; one alate viviparous female, one apterous viviparous female and one apterous oviparous female from *Celtis trandia*. Khangampat, Manipur, India 10. xii. 1971, Coll. T. K. Singh (All C.U. Coll.)

Discussion.—The species was originally described from *Celtis australis* in Lahore, Punjab (Pakistan) by Das (1918). Das (op. cit) has provided a detailed account of all morphs including the eggs with observations on biology. The oviparous females appear in late December (in Lahore area, now in Pakistan) as a long row on the underside of yellowish leaves of *Celtis* and lay 4-7 eggs, which are oval, twice as long as broad and are glued to the young twigs etc , most of the eggs are deposited in January and mostly within small cracks in the bark or on lower surfaces of scales. In early March, the eggs hatch and the young start to colonize newly emerged tender leaves. The colonies appear small and remain covered with flocculence. After 2-3 generations of apterae viviparae, winged forms appear and disperse to other plants (being monoecious holocyclic) of *Celtis*. These insects are reported to be very sensitive to slightest touch and jump off or fall to the ground. They also produce copious honeydew. *S. celti* disappears from the plains of Punjab during the hot summer months of June, July and August but can be found in Simla Hills during the same period. From September, the insects begin to appear in the plains and a large number become what Das (op. cit.) called “Pink forms” The entire cycle from egg to adult is reported to be completed in 12-20 days under laboratory conditions. *Chilomeles* has been identified to be the worst natural enemy besides a species of *Chrysopa*. The aphid is now known to infest (besides *C. australis*) *C. trandia* and *C. tetrandra*.

Distribution.—India : Jammu & Kashmir, Himachal Pradesh, Sikkim, West Bengal, Meghalaya, Manipur, Pakistan ; Sri Lanka ; Korea ; Japan ; China.

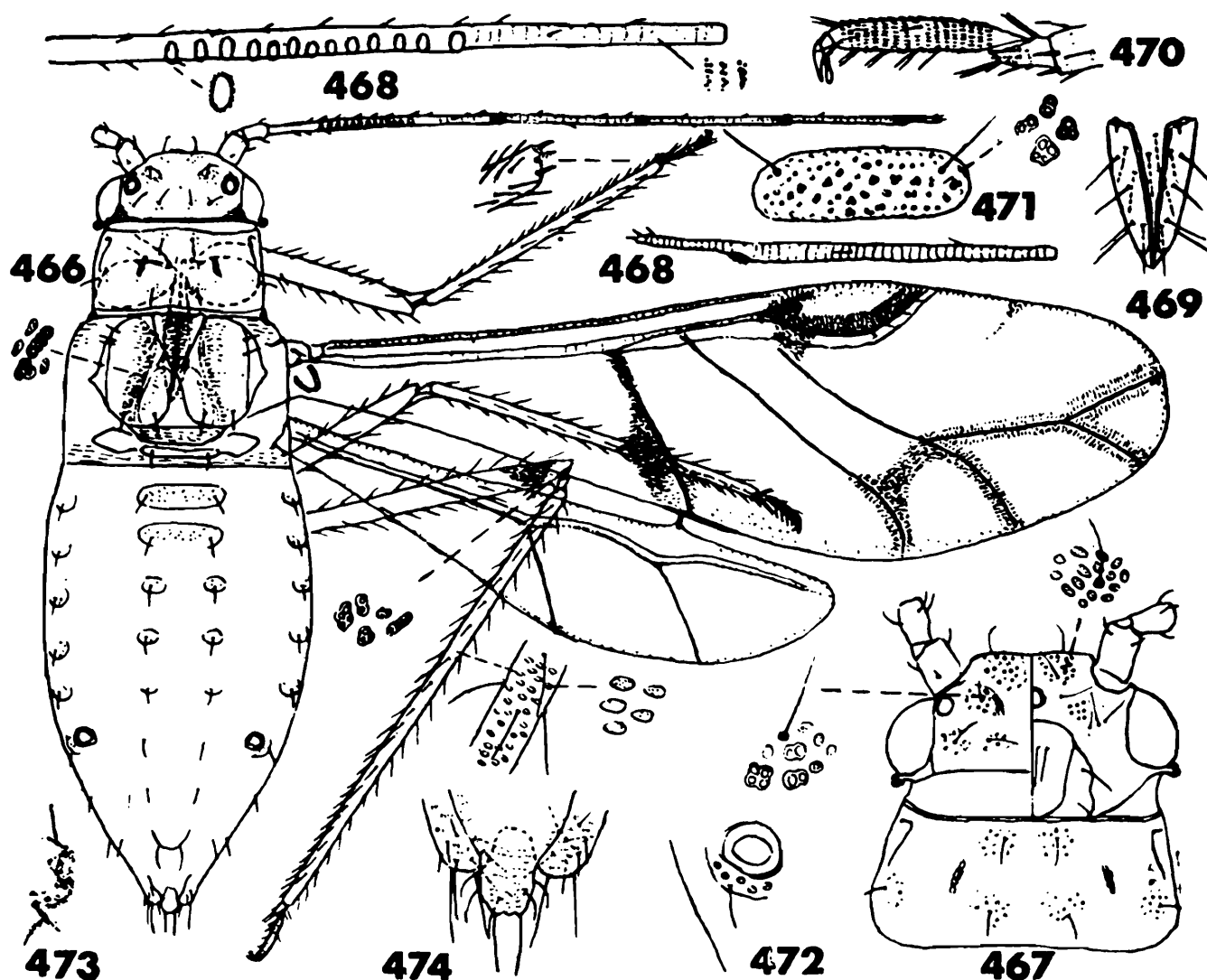
Types.—Location of types not known.

34. *Shivaphis celticola* (Nevsky, 1929)
(Figs. 466–476)

1929. *Therioaphis celticola*, Nevsky, A., Uzbekistan Plant Protect. Exp. Sta., Bull., 16 : 318.

1976. *Shivaphis celticola* Eastop, V.F. and Hille Ris Lambers, D., Survey of the World's Aphids, 395.

Alate viviparous female.—Body 1.5-2.2 mm long with 0.78 mm as maximum width. Head pale, brown around ocelli and at sides of posterior margin of vertex, bearing four pairs of wax gland fields with biscuit-shaped elements, each with a fine hair up to 0.040 mm long. Antennae 6-segmented subequal to length to body, pale with apices of segments III, IV, V and area around primary rhinarium of segment VI dark ; segment III with 7-15 oval secondary rhinaria, arranged in a row and restricted to the middle portion of the segment ; flagellum gradually more distinctly imbricated apicad ; hairs on flagellum sparse, 0.015 mm long or $\frac{1}{2}$ — $\frac{2}{3}$ $\times$ the basal diameter of antennal segment III ; processus terminalis 0.29-0.33 $\times$ as long as base of segment VI. Rostrum almost reaching to middle coxae, ultimate rostral segment 0.69 $\times$ as long as second segment of hind tarsus and bears 10 accessory hairs besides the preapicals. Pronotum with 3 pairs of fields of wax gland pore elements similar to those on vertex. Abdominal tergites 1-5 with one pair each of spinal wax gland pore fields which appear confluent on tergites 1-2, those on tergites 3-5 rather small and separated ; tergites 1-6 each with a pair of lateral wax pore fields ; 8th tergite with a single dorsomedian wax gland field ; each of the wax gland pore fields, except on tergite 8, bears a single fine hair, 0.033-0.055 mm long, equal or up to 1.75 $\times$ as long as the basal diameter of antennal segment III. Tergite 8 with 6 hairs. Siphunculi very short cylindrical, about 0.030 mm, raised above surface. Cauda pale, scabrous, bearing 6-8 hairs on a globular knob. Subanal plate bilobed, each lobe with 8-9 hairs. Legs pale, but hind femur with a dark subapical spot ; fore coxae enlarged ; hairs on femora fine, acute, on tibiae stiff, up to 0.068



Shivaphis celticola Nevsky. 466-474, alate vivipara : 466, body ; 467, head and pronotum ; 468, antennal segment III ; 469, apical rostral segment ; 470, hind tarsus ; 471, spinal sclerite of abdominal tergite I with compound wax gland pore elements ; 472, siphunculus, dorsal view ; 473, siphunculus, lateral view ; 474, cauda and anal plate.

mm long ; first tarsal segments with 6 ventral and 2 dorsal hairs ; second tarsal segments spinulose. Forewings with pterostigma and veins bordered with dusky pigmentation which is confluent between branch 3 of the media and the first cubital vein.

Colour.—Pale green covered with white flocculence.

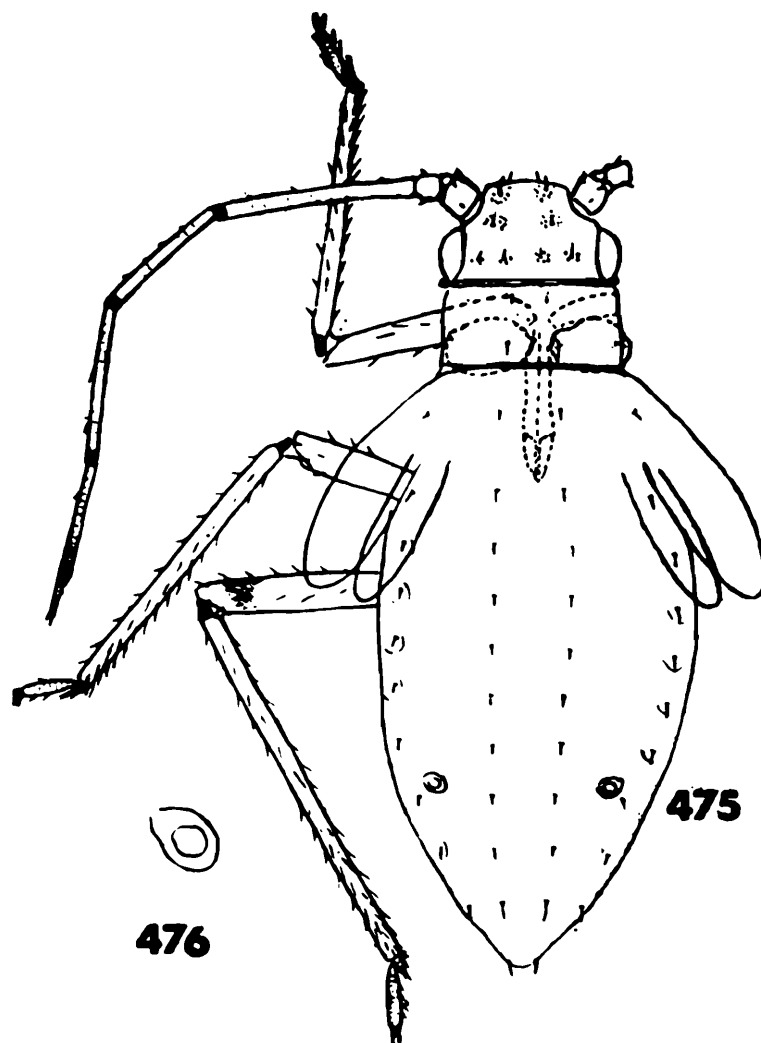
Measurements in mm.—

	Length	Width	Antenna
1.	2.22	0.78	1.97
2.	2.02	0.70	1.69

III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.66	0.42	0.43	(0.32+0.09)	0.10	0.15
0.58	0.33	0.37	(0.28+0.09)	0.10	0.14

(1, ex *Celtis* sp., Muminadaisk, Tadshikistan, U.S.S.R., 5. vii. 1957, British Museum Coll. ; 2, ex *Celtis* sp., Srinagar, Kashmir, India, 11. vii. 1981, British Museum Coll.).

Alatoid nymph.—Body 1.82 mm long with 0.69 mm as maximum width. Wax gland pore fields on head and pronotum arranged in a similar pattern as in the alate vivipara. Wax gland pore fields on the remainder of the tergites not discernible. Dorsal hairs on body arranged as in alate vivipara, 0.030-0.038 mm long, but tergite 8



Shivaphis celticola Nevsky. 475-476, alatoid nymph : 475, body ; 476, siphunculus.

only with 4 hairs. Antennae and legs pale with markings as in the alate form. Tibial hairs fine. Apices of tibiae with very few spinules, but whole of tarsi spinulose ; first tarsal segments with 6 ventral and no dorsal hairs.

Colour.—As in alate vivipara.

Measurements in mm.—

Length	Width	Antenna			
1.85	0.72	1.59			
Ant. segments					
III	IV	V	VI	urs	ht ₂
0.49	0.31	0.38	(0.29+0.10)	0.10	015.

(ex *Celtis* sp., Muminadaisk, Tadshikistan, U.S.S.R., 5. vii. 1957, British Museum Coll.).

Material examined.—Four alate viviparae from *Celtis* sp., Srinagar (Univ. of Kashmir), Kashmir, India, 11. vii. 1981, CIE. A. 13 294 No. 16, British Museum Coll. (MB, 204/81) ; alate viviparae from *Celtis* so., Muminadaisk, Tadshikistan, U.S.S.R., 5. vii. 1957, BMNH Coll.

Discussion.—Originally described from the U.S.S.R., this species has been recently collected in Kashmir, India. It is easily distinguished from *S. celti* Das as outlined in the key.

Distribution.—India ; Kashmir ; Central Asia.

Types.—Location of types not known.

Genus 23. *Subtakecallis* Raychaudhuri & Pal 1974

1974. *Subtakecallis* Raychaudhuri, D. N. and Pal, P.K. *Orient. Insects*, 8 : 96 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980. In *Aphids of North East India and Bhutan*, 300. Type species : *Cranaphis pilosa* David, Rajasingh and Narayanan.

Morphology.—All viviparae alate. Medium sized aphids upto 2.8 mm long. Head with small frontal tubercles, bearing a wax-

pore field around setae, clypeus with a median nose-like process ; dorsal cephalic hairs fine. Antennae 6-segmented, shorter or distinctly longer than the body ; flagellum imbricated, bearing wax pores, secondary rhinaria transversely oval, ciliated, restricted to antennal segment III ; hairs on flagellum fine, upto equal to the basal diameter of segment III ; processus terminalis distinctly shorter than base of segment VI. Rostrum hardly reaches beyond fore-coxae, ultimate rostral segment much shorter than second segment of hind tarsus ($0.32\times$, in *pilosa*) and bears 2-4 accessory hairs. Abdominal dorsum with variably developed sclerotic patches on 1st-5th and on 8th tergites ; marginal processes present on 1st-7th tergites ; hairs on dorsum long, fine ; spinal hairs arranged in 2 parallel rows, those on 7th tergite shifted to pleural region ; marginal hairs single ; 8th tergite with 2 hairs ; abdominal dorsum with minute wax pore elements developed as cribriform discs and these are also discernible on lateral processes. Siphunculi small, smooth, cylindrical without any apical flange. Cauda knobbed at apex. Subanal plate bilobed. Rudimentary gonapophyses 2 or fused. Subgenital plate with 4 hairs in two rows on anterior margin besides a row of hairs on posterior margin. Legs with minute wax pores on femora and tibiae ; tibiae with spinulose imbrications ; apical tibial hairs differentiated into 4 spines ; tarsi spinulose ; first tarsal segments with 5 ventral and 2 dorsal hairs ; empodial hairs flabellate. Wing venation normal. Forewings with radial sector normal, pterostigma with a basal, brownish blotch.

Embryo not available.

Sexual forms not known.

Discussion.—The genus appears close to *Takecallis* Matsumura but in the latter, unlike in *Subtakecallis*, spinal hairs on 5th tergite are somewhat shifted laterally, marginal hairs on 5th-7th tergites are shortened in alatoid nymphs, etc. Both the species of this genus are endemic to India and have been recorded from Darjeeling hills in Eastern Himalaya.

Biology.—The members of the genus appear to lead parthenogenic viviparous life cycles on *Bambusa* sp. The alatae viviparae have only been recorded in October—November. No other information on biology is available.

Distribution.—India.

Type species.—*Cranaphis pilosa* David, Rajasingh and Narayanan, 1970. Deposited in the collection of S. Kanakraj David, Madras, Tamil Nadu, India and the British Museum (Nat. Hist.) London, England.

Key to the species of *Subtakecallis* Raychaudhuri and Pal

Alate viviparous females :

Spinal hairs on abdominal tergites 1-7 0.030-0.032 mm long, those on 8th tergite up to 0.035 mm long, at most equal to the basal diameter of antennal segment III. Processus terminalis about 0.55 × as long as base of antennal segment VI. Spinal abdominal sclerites small, not coalescing. Longest tibial hairs as long as apical width of tibia

brevisetosus Raychaudhuri
& Pal

—Spinal hairs on abdominal tergites 1-7 up to 0.70 mm long and on 8th tergite 0.095 mm long, always much longer than basal diameter of antennal segment III. Processus terminalis 0.24-0.30 × as long as base of segment VI. Spinal sclerites of abdominal tergites 3 and 4 large and coalescing. Longest tibial hairs two to three times as long as the apical width of tibia

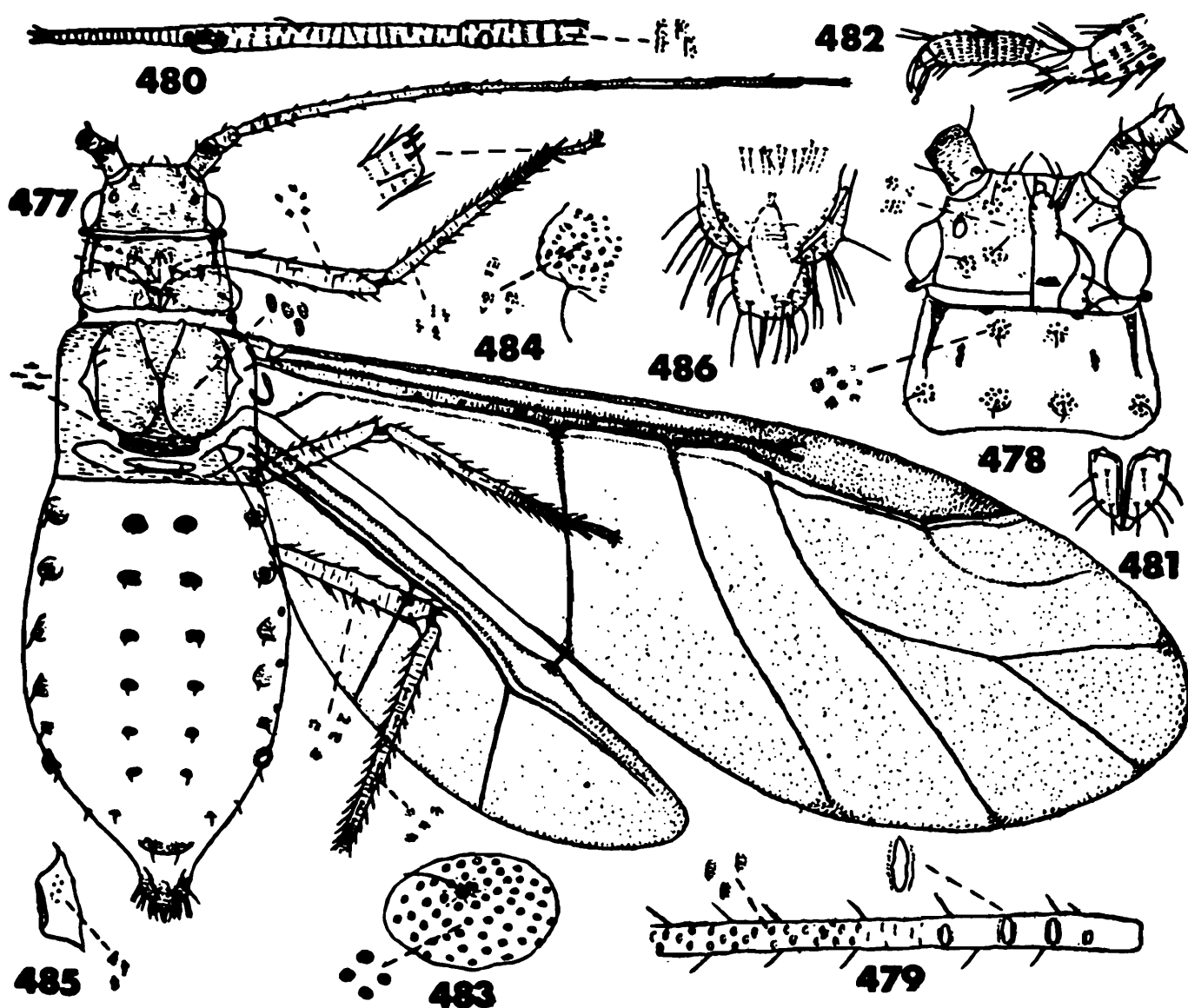
pilosus (David,
Rajasingh and Narayanan)

35. *Subtakecallis brevisetosus* Raychaudhuri & Pal, 1974
(Figs. 477-486)

1974. *Subtakecallis brevisetosus* Raychaudhuri, D. N. and Pal, P. K., *Orient. Insects*, 8 : 96.
1978. (1975) *Subtakecallis brevisetous*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 28 (2) : 89.
1980. *Subtakecallis brevisetosus*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 301.

Alate viviparous female.—Body 1.93-2.28 mm long with 0.83-0.84 mm as maximum width. Head light brown bearing minute wax gland pores developed as cribriform discs ; dorsal cephalic hairs

fine, up to 0.032 mm long and $0.7-0.9 \times$ as long as the basal diameter of antennal segment III ; epicranial suture developed ; clypeus with an anteriorly directed noselike process bearing 2 long hairs. Antennae 6-segmented, $0.81 \times$ as long as the body ; basal segments



Subtakecallis brevisetosus Raychaudhuri & Pal. 477-486, alate vivipara : 477, body ; 478, head and pronotum ; 479, base of antennal segment III ; 480, antennal segment VI ; 481, apical rostral segment ; 482, hind tarsus ; 483, spinal abdominal sclerite ; 484, lateral abdominal process ; 485, siphunculus. 486 cauda and anal plate.

smooth with hardly discernible wax gland pores ; basal half of segment III pale, rest of flagellum may be a little darker, gradually more distinctly imbricated apicad ; wax pores present in clusters ; anten-

nal segment III with 3-6 circular to transversely oval ciliated secondary rhinaria present on pale basal area ; hairs on flagellum fine, the longest one on segment III similar to the longest cephalic hair ; processus terminalis $0.54-0.55\times$ as long as base of segment VI. Rostrum barely reaches beyond fore coxae ; ultimate rostral segment bearing 2 pairs of accessory hairs. Abdominal dorsum pale bearing one pair each of brown sclerotic spinal sclerites on 1st-6th tergites, besides a pair of similar paler sclerites on the 7th tergite ; each of these sclerites contain numerous wax gland pores and a long hair, of which those of tergite 7 are laterally displaced ; each of abdominal tergites 1-7 bears a pair of marginal hairs arising from distinct processes, of which those on the posterior tergites are more flattened, but all bear minute wax gland pores ; longest hair on anterior tergites 0.030-0.032 mm long, equal to the basal diameter of antennal segment III, those on 8th tergite upto 0.035 mm long. Siphunculi cylindrical with hardly perceptible wax pores. Cauda knobbed, bearing 12 hairs. Subanal plate bilobed, each lobe with 7-9 hairs. Legs pale but distal 0.50 portion of tibiae and tarsi darker ; fore coxae enlarged ; femora and tibiae with spinulose imbrication and wax pores ; apical tibial hairs differentiated into 4 thick spines ; tarsi spinulose ; first tarsal segments with 5 ventral hairs and two dorsal hairs. Forewings with a dark brown spot near base of pterostigma.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna			
2.28	0.82	1.87			
III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.12	0.37	0.37	(0.22+0.12)	0.07	0.10

(ex *Bambusa*, Jore Bungalow, Darjeeling District, W.B. 25.xi.1970).

Apterous viviparous female.—Not known.

First instar nymph.—Body pale, 0.55 mm long with 0.27 mm as maximum width. Head with 4 stiff hairs with acute apices upto 0.016 mm long, ultimate rostral segment 0.046 mm long bearing 2 accessory hairs, 0.016 mm long ; dorsal hairs arranged in 4 longitudinal rows (2 spinal, 2 marginal) and on 1st-5th abdominal tergites up to 0.013 mm long. Siphunculi developed as rings on small elevated lobes.

Material examined.—Two alate viviparous females from bamboo, Jore Bungalow, Darjeeling district, West Bengal, India, 25.xi.1970, coll. S.D. Chakrabarti (Types : C.U. Coll.).

Discussion.—The short spinal hairs, and ratio of processus terminalis to base, besides weak pigmentation of dorsal sclerotic spots help to separate this species from the only other species of the genus, *pilosus* (David et al.). The species appears to be rare in the area of its distribution, unlike *pilosus* which is known from a wider area.

Distribution.—India : West Bengal (Jore Bungalow).

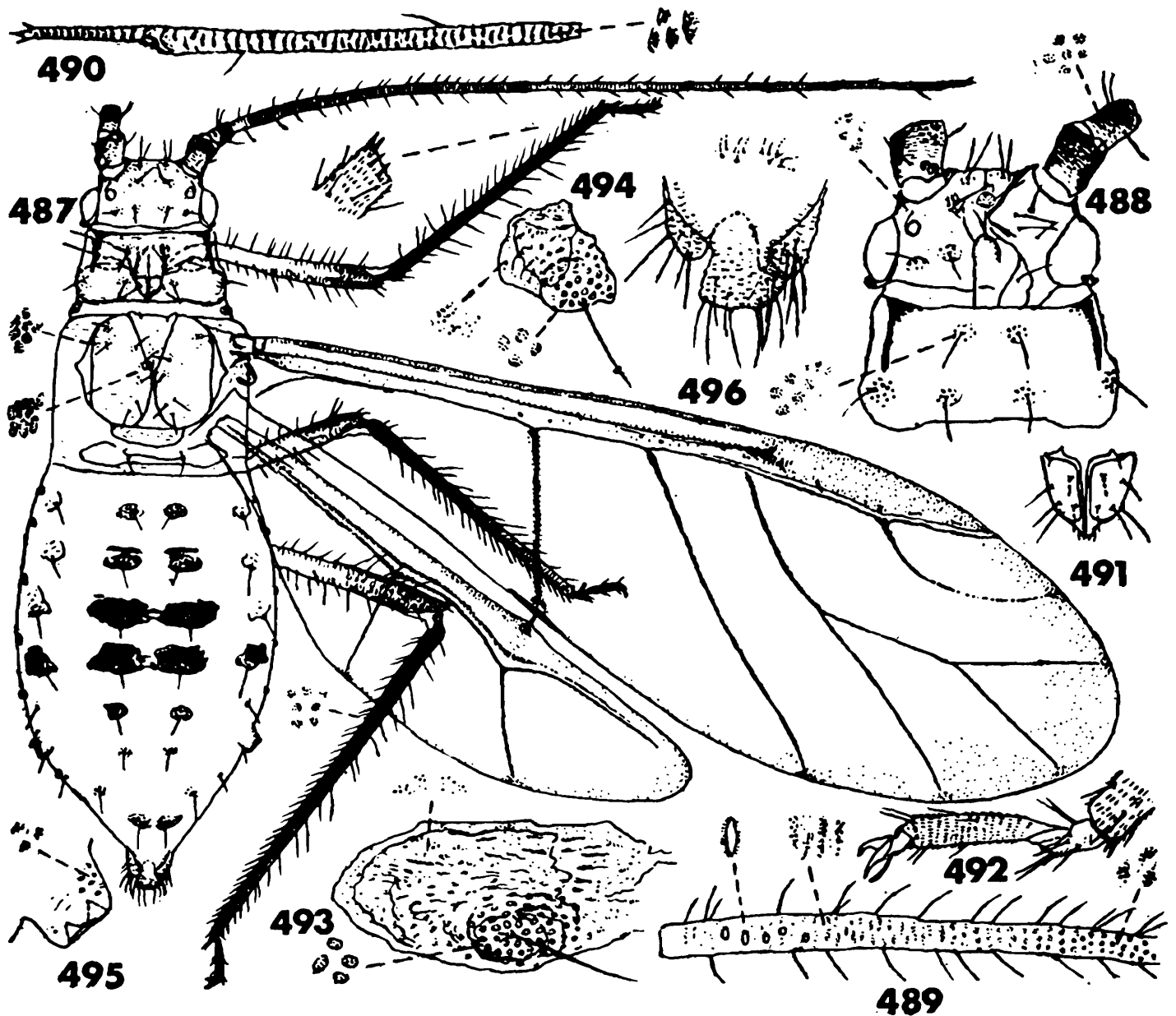
Types.—In the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India.

36. *Subtakecallis pilosus* (David, Rajasingh & Naryanan)
(Figs. 487–499)

1970. *Cranaphis pilosus* David, S. Kankaraj, Rajasingh, S. G. and Narayanan, R., *Orient. Insects*, **4** : 409.
1974. *Subtakecallis pilosus* Raychaudhuri, D. N. and Pal, P. K. *Orient Insects*, **8** : 98.
1978. (1975) *Subtakecallis pilosa*, Chakrabarti, S. and Raychaudhuri, D. N. *Proc. zool. Soc. Calcutta*, **28** : 90.
1980. *Subtakecallis pilosus*, Raychudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 301.

Alate viviparous female.—Body elongate pear-shaped, 2.31-2.71 mm long with 0.90-1.20 mm as maximum width. head pale bearing a V-shaped epicranial suture on ventral side ; dorsal hairs fine, 0.060-0.080 mm long, subequal to or longer than the basal diameter

of antennal segment III. Eyes large, pale. Antennae 6-segmented, mostly pale, except for apices of segments III-V which are dark, 1.15-1.25 $\times$ as long as the body; flagellum gradually more distinctly imbricated after apical half portion of segment III, apicad often with pale circular to elongate clusters of wax-gland pores on the ridges of imbrications, segment III with 4-8 small oval secondary rhinaria distributed on basal 0.25 portion of the segment, hairs on



Subtakecallis pilosus (David, Rajasingh & Narayanan). 487-496, alate vivipara : 487, body ; 488, head and pronotum ; 489, base of antennal segment III ; 490, antennal segment VI ; 491, apical rostral segment ; 492, hind tarsus ; 493, spinal abdominal sclerite ; 494, lateral abdominal process ; 495, siphunculus ; 496, cauda and anal plate.

flagellum fine, 0.013-0.047 mm long, longest on segment III about $0.60\times$ as long as the basal diameter of the segment ; primary rhinaria round, processus terminalis $0.25-0.30\times$ as long as base of segment VI. Rostrum pale, reaches little beyond forecoxae, ultimate rostral segment shorter than wide, obtuse, $0.35-0.37\times$ as long as second segment of hind tarsus and bears 2 pairs of fine accessory hairs (0.020 mm) besides preapicals which are thicker and longer (0.026-0.033 mm). Abdominal dorsum pale except for sclerotic areas, which are always present as paired broad spinal, often confluent patches on tergites 3 and 4 bearing minute wax glands and a single hair ; besides, much smaller and often indistinct, paired, light brown spots, each bearing single hair occur on 2nd and 5th tergite; 4th tergite also with a marginal sclerotic patch on each side bearing wax glands and a hair ; each of the tergites 1-7 bearing a pair of spinal hairs and a pair of marginal hairs. 0.063-0.070 mm long, $1.0-1.5\times$ as long as the basal diameter of antennal segment III ; 8th tergite with only a pair of spinal hairs 0.083-0.095 mm long. Siphunculi small, pale, half as long as basal width, without apical flange. Cauda pale, constricted, bearing 8-11 hairs. Subanal plate bilobed, each lobe with 5-7 hairs. Subgenital plate with 16 hairs on posterior margin. Legs slender ; hairs on femora long and fine, on tibiae somewhat stiff and acute, apical tibial hairs differentiated as thick spines ; apices of tibiae and whole of tarsi spinulose ; first tarsal segments with 5-6 ventral hairs and 2 dorsal hairs. Wing venation normal, radial sector faint, pterostigma sometimes with dark spot.

Colour.—Whitish with powdery wax covering the body except the antennae, legs and dorsal sclerotic spots which appear dark brown.

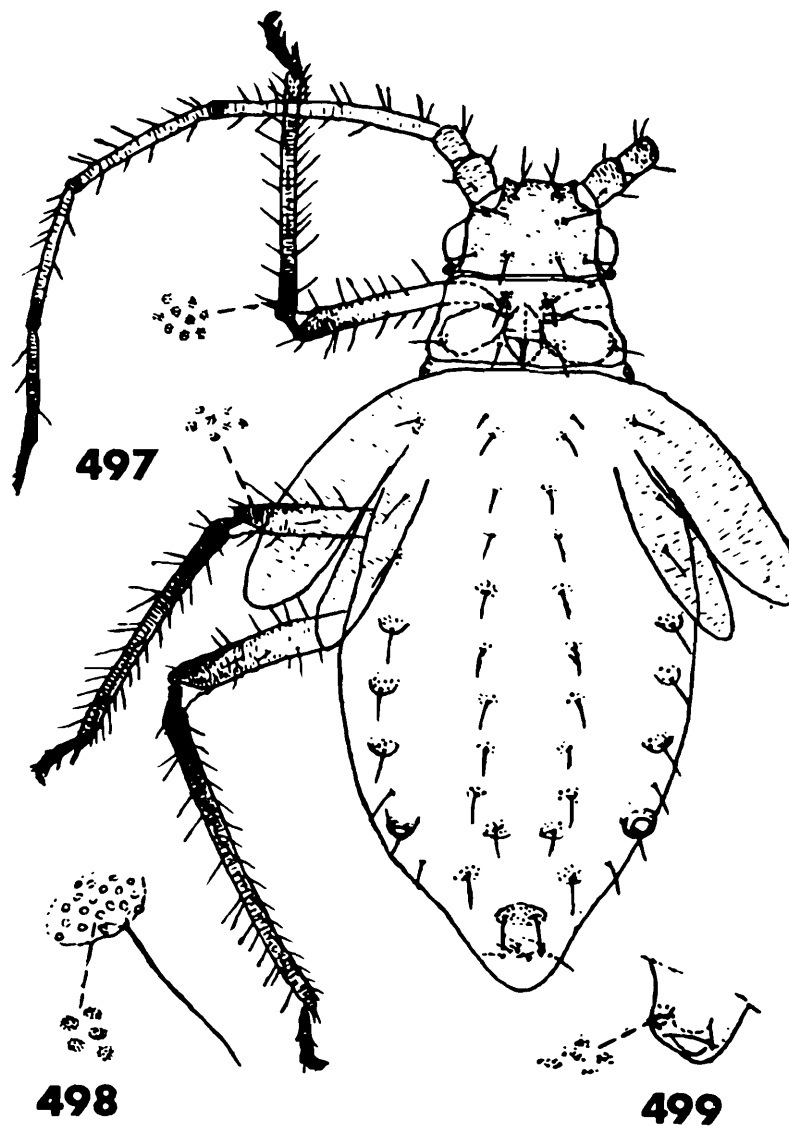
Measurements in mm.—

	Length	Width	Antenna
1.	2.60	0.99	2.90
2.	2.71	—	—

III	Ant. segments				urs	ht ₂	Siph.
	IV	V	VI				
1.10	0.59	0.48	(0.33+0.09)		0.05	0.14	0.03
1.07	0.66	0.52	(0.25+?)		0.05	0.13	0.04

(1, ex bamboo, Darjeeling, West Bengal, 13.xi.1969, coll. S. G. Rajasingh & K. Narayanan ; 2, from holotype, data of David et al. 1970).

Alatoid nymph.—Body pale, 2.05 mm long with 0.89 mm as maximum width. Frontal and anterior discal setae of vertex fine, pointed with wavy apices, 0.076-0.085 mm long. Antennae with brown annuli at apices of flagellar segments. Setae on antennal segments



Subtakecallis pilosus (David, Rajasingh & Narayanan). 497-499, alatoid nymph : 497, body ; 498, lateral hair of abdominal tergite IV ; 499, siphunculus.

fine, pointed, with wavy apices, the longest on segment III 0.071 mm long. Pronotum and mesonotum each with two pairs of spinal and one pair of marginal setae of same shape and length as discal setae. Metanotum and abdominal tergites 1-7 each with one pair of pointed spinal and marginal setae, of which the spinals are laterally shifted on tergites 5 and 7. These setae are a little longer than the discal setae of vertex, the longest spinals on tergite 7 measuring 0.114 mm and the longest marginals up to 0.100 mm. Marginal setae of tergites 2-4 on low mammiform processes. 8th tergite with 2 setae. First tarsal segments with 5-6 ventral and no dorsal setae. Otherwise as in slate vivipara.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna			
1.	2.06	0.89	1.94			
	Antennal segments					
	III	IV	V	VI	urs	ht ₂
	0.57	0.39	0.36	(0.29+0.11)	0.06	0.14

(ex Bamboo, Sinchal, India, 27.i.1970. C.U. Coll.).

Material examined.—One alate viviparous female from *Bambusa* sp. Darjeeling, West Bengal, India, 13.xi.1969, coll. S. G. Rajasingh and K. Narayana (N.Z.C.); one alatoid nymph from bamboo, Anchal, Darjeeling, West Bengal, India, 27, ii. 1970, C.U. Coll.

Discussion.—This species as well as *brevisetosus* Raychaudhuri and Pal, are only known from restricted areas of eastern India, although bamboo is growing over wide areas of entire northeastern India. *S. pilosus* differs from the only other known species in having longer spinal hairs on anterior tergites and in the ratio of base of antennal segment VI to processus terminalis. Most of the collection data indicate a period of occurrence between October to December.

Distribution.—India : Meghalaya ; West Bengal.

Types.—In the collection of Dr. Kanakraj David. 22 Kamaraj Avenue, Madras, Tamil Nadu, India ; One paratype in the collection of British Museum (Nat. Hist.), London, England.

Genus 24. *Taiwanaphis* Takahashi 1934

1934. *Taiwanaphis* Takahashi, R., *Stylops*, **36** : 56 ; Tao, Charles Chia Chu, 1963. *Sc. Yb. Taiwan Mus.*, **6** : 70 ; Chakrabarti, S. and Raychaudhuri, D. N., 1978 (1975). *Proc. zool. Soc. Calcutta*, **28** : 90 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980. In *Aphids of North East India and Bhutan*, 301. Type species : *Taiwanaphis decaspermi* Takahashi.
1964. *Parcallipterus* Raychaudhuri, D. N. and Ghosh, A. K., *Zool. Medded. Leiden*, **39** : 258

Morphology.—Body small, 1.2-1.8 mm long. Head smooth without wax glands, with weakly developed frontal tubercles and fused with pronotum in apterae ; frons slightly elevated in the middle ; dorsal cephalic hairs short and acute, ventral hairs longer and fine. Antennae 4-segmented in apterae, 6-segmented in alatae, much shorter than the body, flagellum imbricated ; secondary rhinaria absent in apterae, in alatae transversely oval to elongate non-ciliated secondary rhinaria occur only on segment III ; primary rhinaria transverse, ciliated, hairs on flagellum short, sparse and acute, processus terminalis much shorter than or subequal to base of last antennal segment. Eyes with ocular tubercles. Rostrum reaches little beyond mid-coxae without sclerotic stiffening on base of segment II ; ultimate rostral segment short, blunt, shorter than second segment of hind tarsus and without any accessory hairs. In alatae, venter of prothorax may be spinulose. Abdominal dorsum in apterae pale or with sclerotic bands ; in alatae, with variably developed sclerotic areas on spinal, pleural and marginal regions on 1st-7th tergites besides a sclerotic band on 8th tergite ; marginal sclerotic areas may bear small flattened processes, at least on presiphuncular tergites and also on 6th tergite ; dorsal hairs short, arising from varying sclerites on each of 1st-7th tergites ; 8th tergite with 6-9 hairs ; post-siphuncular sclerites spinulose. Siphunculi short, wider than long, striated near apical flange, on abdominal tergite V and with hairs present near the base. Cauda elongate, distinctly constricted, distal part appears triangular. Subanal plate short, deeply bilobed, each lobe with 5-8 hairs. Rudimentary gonapophyses 4. Subgenital plate with 4 long hairs arranged in a row on

anterior margin and 10 hairs in two groups on posterior margin. Legs short in apterae, slender in alatae ; femora and tibiae variably spinulose ; apical tibial hairs not differentiated ; first tarsal segments with 3-4 ventral hairs, without any dorsal hairs. Wing veins bordered brown and appear heavy ; forewings with media twice branched, hind wings with both obliques.

Embryos not available.

Sexual forms not known.

Discussion.—The absence of wax-pores, capitate hairs and conspicuous processes combined with presence of short antennae, short dorsal hairs, bordered wing veins, shape of cauda etc., makes the genus distinctive among related genera. Only three species, viz. *decaspermi* Takahashi from Taiwan and *randiae* A. K. Ghosh, Banerjee, Raychaudhuri and *Kalipadi* Raychaudhuri and Ghosh from India are known under the genus. The three species appear to be endemic to respective regions and are rare in occurrence.

Biology.—Only apterous and alate parthenogenetic viviparous morphs are known. Some members of this genus are known from young leaves and shoots of *Decaspermum fruticosum* (*decaspermi* Takahashi). The viviparae are known to occur in January and June in Taiwan and in November in India. Red ants are known to visit *T. randiae*.

Distribution.—India ; Taiwan.

Type species.—*Taiwanaphis decaspermi* Takahashi, 1934. Deposited in the Agricultural Research Institute, Taipei, Taiwan.

Key to the species of *Taiwanaphis* Takahashi

Alate viviparous females :

Head and pronotum uniformly brown.
Antennal segment III brown at base, the remainder pale Processus terminalis 0.5-0.6× as long as base of segment VI. On abdomen spinal and pleural hairs 15-19 μ m long and often more than one pair each per tergite. Knob of cauda with 11-14 hairs. First tarsal segments with 5 hairs. On fore wing all veins heavily bordered with brown.
On Combretaceae

.dineni Mandal, Agarwala and Raychaudhuri

—Head and pronotum pale with dark bands at sides. Antennal segment III completely dark brown. Processus terminalis $0.9.11 \times$ as long as base of segment VI. On abdomen spinal and pleural hairs $4-8 \mu\text{m}$ long and usually only one pair each per tergite. Knob of cauda with 8-9 hairs. First tarsal segments with 4-5 hairs. On forewing first cubital vein without bordering except at apex. On Rubiaceae

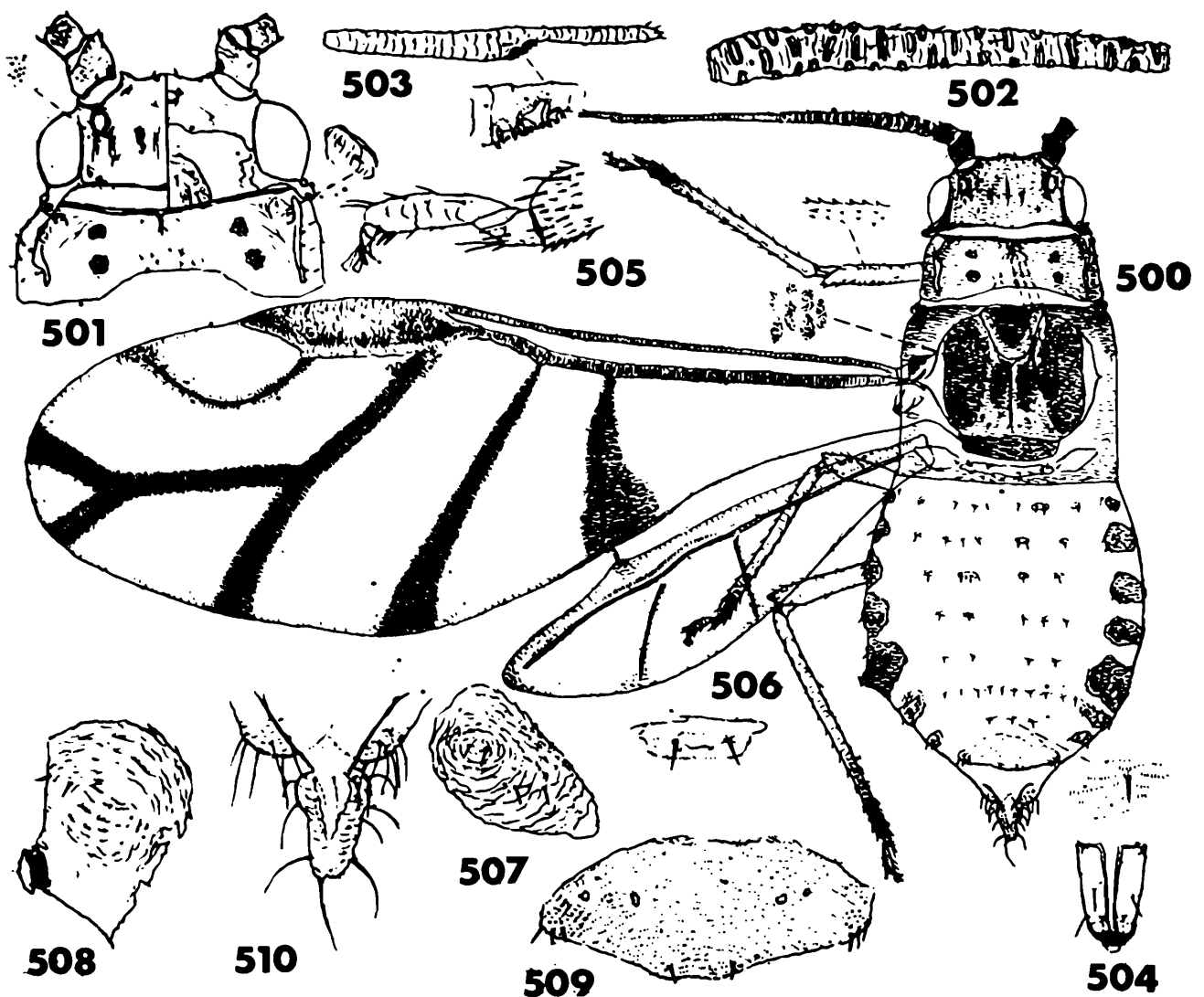
.randiae Ghosh, Banerjee and Raychaudhuri

Note : Alatae of *T. kalipadi* (Raychaudhuri and A. K. Ghosh) and apterous viviparae of *T. dineni* and *T. randiae* are not known.

37. **Taiwanaphis dineni** Mandal, Agarwala & Raychaudhuri, 1973
(Figs. 500-523)

1979. *Taiwanaphis dineni* Mandal, P. K., Agarwala, B. K. and Raychaudhuri D. N., *Entomon*, 4 (2) : 189.

Alate viviparous female.—Body 1.80-1.95 mm long with 0.80-0.93 mm as maximum width. Head brown to dark brown ; dorsal cephalic hairs acuminate, sparse 0.010-0.013 mm long, $0.33 \times$ as long as basal diameter of antennal segment III. Antennae 6-segmented $0.56-0.60 \times$ as long as the body, segments I-II and base of segment III brown, rest of flagellum pale ; segment I and II scabrous ; flagellum imbricated ; segment III with 30-38 secondary rhinaria ; hairs on flagellum short, sparse, similar to those on dorsum of head ; processus terminalis $0.51-0.59 \times$ as long as the base of segment VI. Rostrum hardly reaches midcoxae, ultimate rostral segment short and blunt, $0.7-0.8 \times$ as long as second segment of hind tarsus and without accessory hairs. Abdominal dorsum pale, each of tergites 1-6 bearing marginal sclerites with low elevations, surface of elevations shows minute cribiform wax gland pore like structures ; hairs on the dorsum of abdomen stiff, short, acuminate, hardly 0.015-0.019 mm long, arising from small roundish sclerotic bases ; spinal and pleural hairs often more than 2 per segment, marginal hairs may be 2-3 on each side ; 7th tergite with 3-4 hairs and 8th tergite with 8 hairs, these being 0.016 mm and 0.013 mm long, $0.5 \times$ and $0.4 \times$ as long as the basal diameter of antennal segment III, respectively. Siphunculi cone-shaped, brown, short, with



Taiwanaphis dineni Mandal, Agarwala & Raychaudhuri. 500-510, alate vivipara : 500, body ; 501, head and pronotum ; 502, antennal segment III ; 503, antennal segment VI ; 504, apical rostral segment ; 505, hind tarsus ; 506, spinal abdominal hairs ; 507, lateral abdominal sclerite, 508, siphunculus ; 509, abdominal tergite VIII ; 510, cauda and anal plate.

a wide base, the apical part bearing 7-8 striae. Cauda elongated, brownish, scabrous, constricted near middle, apical elongate part bearing 11-14 hairs. Subanal plate bilobed, each lobe with 5-6 hairs. Subgenital plate with 11-12 hairs on posterior margin. Legs brown with apical 0.20 portion of tibiae with numerous stiff short hairs appearing as spines; first tarsal segments with 5 ventral and no dorsal hairs. Wing venation normal, all veins of forewing distinctly bordered with brown.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna			
1.	1.97	0.92	1.16			
2.	1.83	0.73	1.12			
	Ant. segments			urs	ht ₂	Siph.
III	IV	V	VI			
0.47	0.16	0.18	(0.15+0.08)	0.06	0.09	?
0.44	0.15	0.16	(0.15+0.08)	0.06	0.09	0.09

(1, 2, ex undet. Combretaceae, Tinbong, Sikkim 10.x.1975, C.U. Coll.).

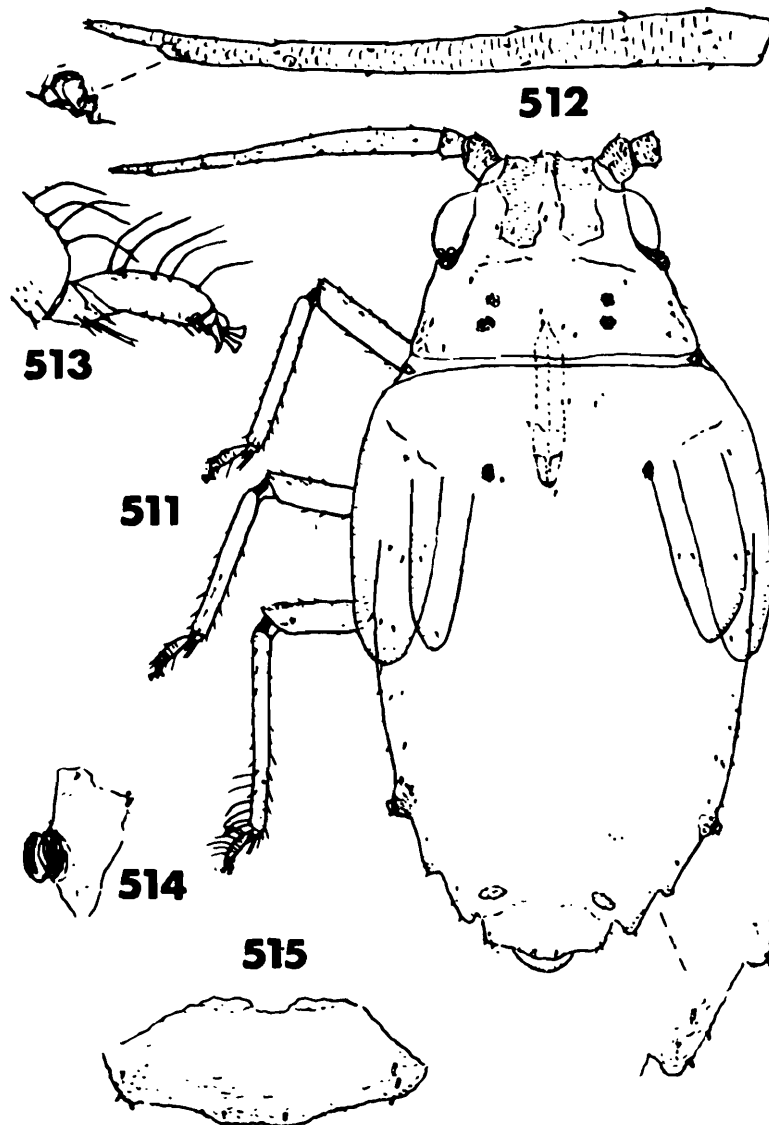
Alatoid nymph.—Body pale, ovoid, 1.50 mm long with 0.82 mm as maximum width. Frons slightly protruded in the middle, dorsal cephalic hairs hardly discernible. Antennae 4-segmented, with segment I and II about as long as wide ; segment III swollen, on basal half ; processus terminalis $0.62\times$ as long as base of last antennal segment. Eyes large with distinct ocular tubercles. Ultimate rostral segment 0.06 mm long, accessory hairs not discernible. Dorsum pale ; dorsal hairs minute ; post siphuncular tergites with a pair each of blunt scabrous, wart-like marginal processi ; siphunculi short with striate apical part. Legs brown, stout ; hairs on legs sparse, short except apices of hind tibiae and second segments of hind tarsi, which bear long hairs with acute wavy apices on outer margin (6 on tibia and 6 on tarsus), 0.04-0.05 mm long ; inner margin of hind tibiae (near apices) with 5-6 short, stiff, acute hairs hardly 0.013 mm long , apical tibial hairs stiff, acute, 3 in number, of similar length as those on inner margin.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna			
1.50	0.82	0.70			
	Ant. segments			urs	ht ₂
I	II	III	IV		
0.07	0.05	0.49	(0.10+0.008)	0.06	0.08

(ex undet. Combretaceae, Tinbong, Sikkim, 10.x.75, C.U. Coll.).



Taiwanaphis dineni Mandal, Agarwala & Raychaudhuri. 511-515 alate nymph : 511, body ; 512, antennal flagellum ; 513, hind tarsus ; 514, siphunculus ; 515, abdominal tergite VIII.

Alate male.—Body 1.78 mm long with 0.69 mm as maximum width. Antennae 6-segmented, $0.71\times$ as long as the body, segment III with 59-60, IV with 8, V with 8 and base of segment VI with 3-4 non-ciliated, elliptical secondary rhinaria ; processus terminalis $0.53\times$ as long as base of segment VI. Ultimate rostral segment $0.75\times$ as long as second segment of hind tarsus. Siphunculi with smaller opening than in viviparae. Cauda distinctly shorter (0.13 mm) than in vivipara (0.17 mm) with 12 hairs. Legs with femora ventrally spinulose. Other characters as in alate viviparous female.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna			
1.76	0.69	1.26			
		Ant. segments	urs	ht ₂	
III	IV	V	VI		
0.51	0.20	0.18	(0.18+0.09)	0.06	0.08

(ex undet. Combretaceae. Tinbong, Sikkim, 10.x.75, C.U. Coll.).

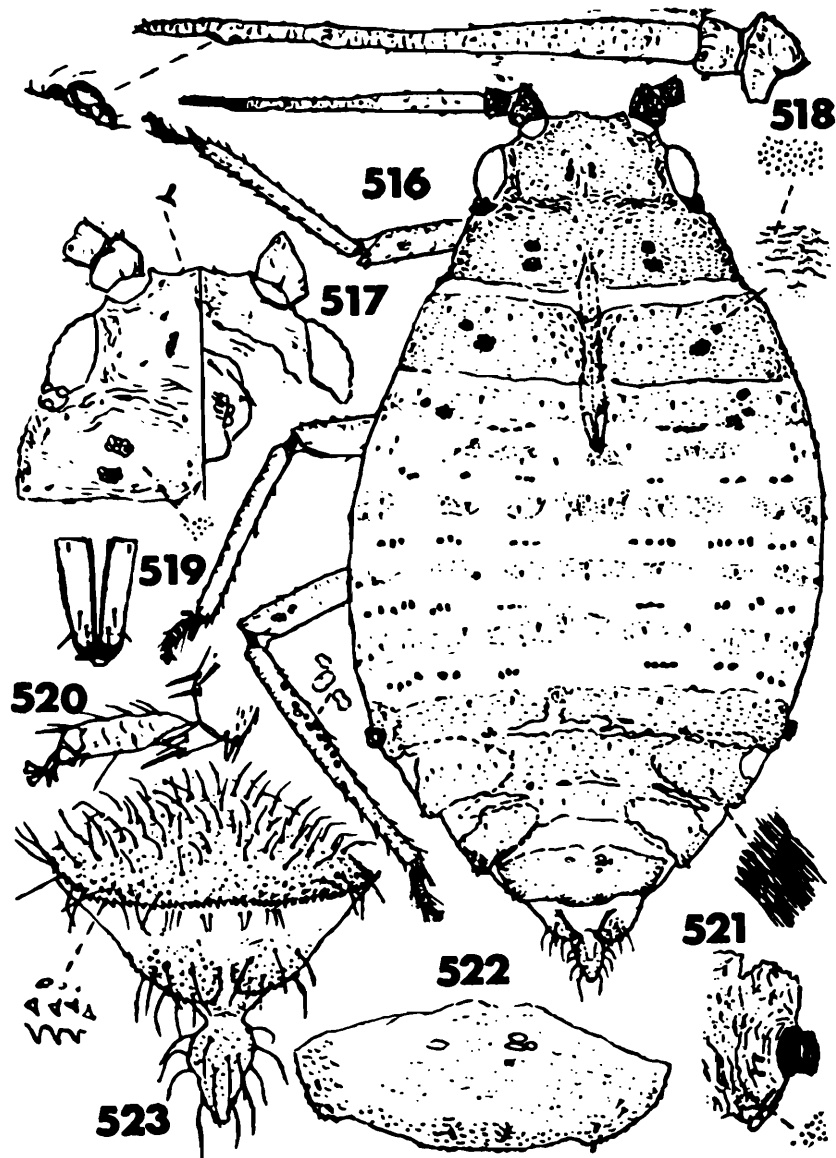
Apterous oviparous female.—Body 1.62 mm long with 0.83 as maximum width. Head brownish, rugose. Antennae 4-segmented, $0.43\times$ as long as the body, pale, except for segment I, II and processus terminalis which are brown, hairs on flagellum sparse, short and blunt; processus terminalis $0.82\times$ as long as base of last antennal segment. Ultimate rostral segment $0.60\times$ as long as second segment of hind tarsus and without any accessory hairs. Abdominal dorsum pale, with a few scattered intersegmental muscle-plate like structure besides on each tergite with transverse, scabrous, weakly sclerotic bars that are often broken into marginal, pleural and spinal sclerites; each tergite with 10-15 hairs, tergites 6-8 with brown sclerotic bands fused in part. Cauda with distinct median constriction and knobbed at apex. Legs with femora and tibiae pale except at bases and apices which are dusky; apical 0.33 portion of tibiae densely spinulose; hind tibiae bearing 25 pseudosensoria.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna		
1.62	0.83	0.70		
		Ant. segments	urs	ht ₂
III	IV			
0.40	(0.10+0.08)		0.06	0.09

(ex undet. Combretaceae, Tinbong, Sikkim, 10.x.75, C.U. Coll.).



Taiwanaphis dineni Mandal, Agarwala & Raychaudhuri. 516-523, ovipara : 516, body ; 517, head and pronotum ; 518, antenna ; 519, apical rostral segment ; 520, hind tarsus ; 521, siphunculus ; 522, abdominal tergite VIII ; 523, cauda and anal plate.

Material examined.—Three alate viviparae, two alatoid nymphs, one alate male, one apterous oviparous female (paratypes) from unidentified plant of Combretaceae, Tinbong (c 100 m), North-Sikkim, 10.x.1975, coll. P.K. Mandal ; C.U. Colls.

Discussion.—The present species appears close to the other endemic species, *randiae* Ghosh et. al., but can be separated from the former in having a shorter processus terminalis and more

caudal hairs besides a different host association. The presence of both viviparae and sexuales on the same plant suggests a monoecious holocyclic life cycle. The only other Drepanosiphine species known from Combretaceae in India is *Paolliela nirmalae* (David) on *Terminalia arjuna* in South India. Both the species appear to be rare in their respective area of distribution.

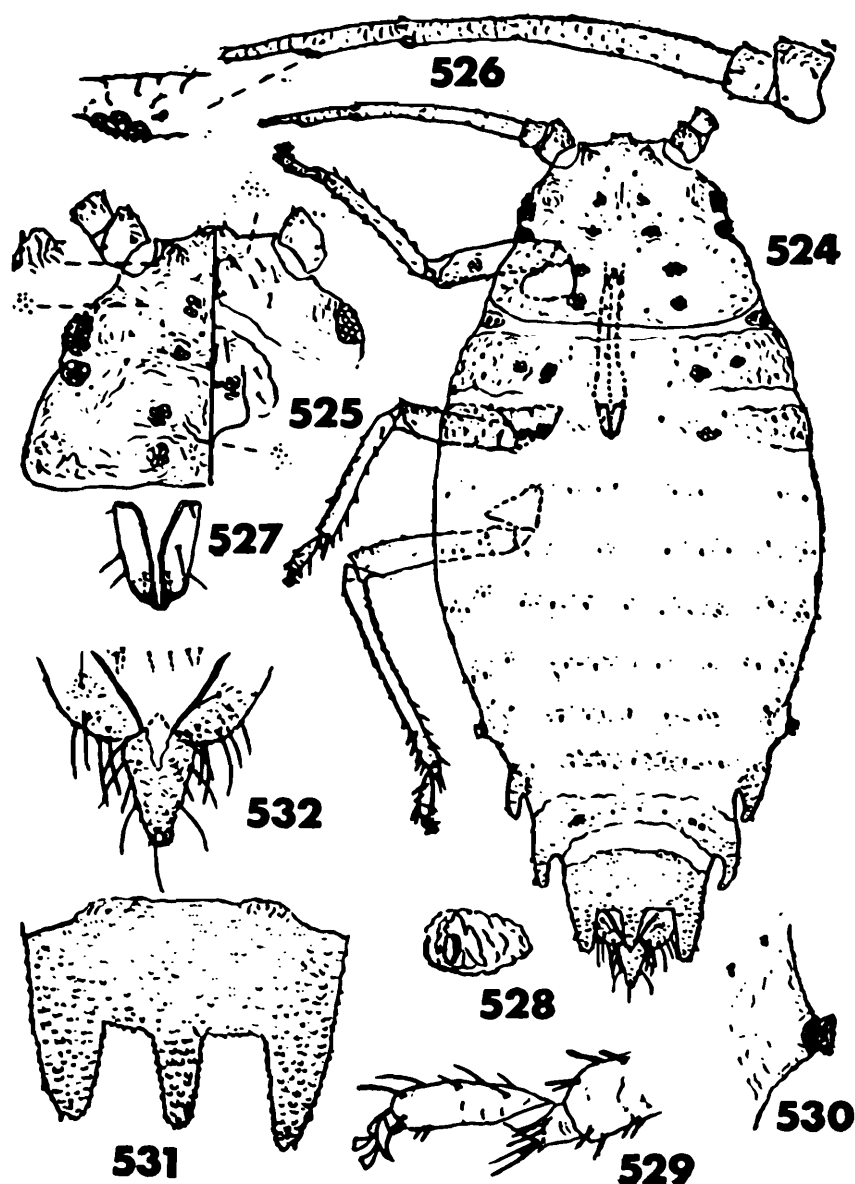
Distribution.—India : Sikkim.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India.

38. **Taiwanaphis kalipadi** (Raychaudhuri & A. K. Ghosh)
(Figs. 524-532)

1964. *Paracallipterus kalipadi* Raychaudhuri, D. N. and Ghosh, A. K., *Zool. Meded.*, Leiden, **39** : 260.
1976. *Paracallipterus kalipadi*, Eastop, V.F. and Hille Ris Lambers, D., Survey of the World's Aphids, 333.
1980. *Paracallipterus kalipadi*, Raychaudhuri, D. N., Chakrabarti, S., Basu R. C. and Ghosh, A. K. *In* Aphids of North East India and Bhutan, 296.
1985. *Taiwanaphis kalipadi*, Noordam and Hille Ris lambers, D. *Zool, verh.*, Leiden, **219** : 9.

Apterous viviparous female.—Body pale, elongate oval, 1.2-1.45 mm long with 0.54-0.75 mm as maximum width. Head with a frontal median prominence bearing two hairs, which are blunt, 0.010 mm long, besides a pair of dorsolateral processes, each bearing a very short hair present near the bases of antennae ; both median and dorsolateral processes wrinkled ; 4-6 posterior discal hairs, all very short and blunt, present on the vertex. Antennae 5-segmented, $0.33-0.36\times$ as long as the body ; flagellum imbricated, basal half of segment III broader than rest of the flagellum ; hairs on flagellum short, sparse, blunt, hardly $0.25\times$ as long as the basal diameter of segment III ; processus terminalis $0.71-0.76\times$ as long as base of last segment. Rostrum reaches to mid-coxae, ultimate rostral segment $0.80-0.85\times$ as long as second segment of hind tarsus, without secondary hairs. Dorsum pale yellowish, segmental pigmented sclerotisation not evident except on marginal areas in a few



Taiwanaphis kalipadi (Raychaudhuri & A. K. Ghosh), 524-532, apterous vivipara : 524, body ; 525, head and pronotum ; 526, antenna ; 527, apical rostral segment ; 528, stigmal plate of prothorax ; 529, hind tarsus ; 530, siphunculus ; 531, abdominal tergite VIII ; 532, cauda and anal plate.

specimen. Dorsal hairs sparse, blunt, very short, hardly 0.010-0.012 mm long. Each of the post-siphuncular segments with a pair of scabrous marginal processes, which become gradually longer and stouter caudad (0.066 on 6th, 0.115 mm on 7th and 0.198 mm on 8th tergite) ; 8th tergite, in addition to marginal processes, with a supracaudal process of similar nature. Siphunculi short $0.33 \times$ as long as basal width with a wide rim and preapical striae. Cauda distinctly knobbed bearing 5-9 hairs. Subanal plate bilobed, each

lobe with 5-6 hairs. Legs pale, of median length ; femoral hairs short, stout ; tibiae with a few spinules near apices, otherwise smooth ; first tarsal segments with 5 ventral hairs ; empodial hairs flattened.

Colour.—Not recorded

Measurements in mm.—

	Length	Width	Antenna
1.	1.43	0.73	0.55
2.	1.38	0.69	0.55

	Ant. segments			urs	ht ₂
	III	IV	V		
	0.14	0.16	(0.086+0.066)	0.058	0.075
	0.14	0.15	(0.070+0.050)	0.053	0.076

(1, 2, ex *Annona squamosa* Alipurduar, W.B.,—vi. 1962; 1 holotype; 2, paratype).

Other morphs.—Not known.

Material examined.—15 apterous viviparous females from *Annona squamosa* Alipurduar, West Bengal, India, vi. 1962, coll. K. P. Chakrabarti (N.Z.C. and C.U. Coll. ; Holotype and Paratypes).

Discussion.—The species, following Noordam and Hille Ris Lambers (1986) is now placed in *Taiwanaphis*. The segmental sclerotisation and pigmentation is very weakly developed in *T. kalipadi* ; the presence of a caudo-spinal tubercle is also known from *T. pseudocaudata* Noordam & Hille Ris Lambers. In considering the combination of other morphological characters of *Taiwanaphis* as redefined by Noordam and Nille Ris Lambers (op. cit.), the systematic position of *kalipadi* in this genus appears rational. No further records of the species since its original description are available but as to the question of host-plant posed by Noordam and Hille Ris Lambers (op. cit.) it can be definitely stated that *Annona squamosa* (which is a common fruit tree in some parts of the country and might have been introduced from tropical America)

was the host-plant of the insect in its type locality in the northern part of West Bengal.

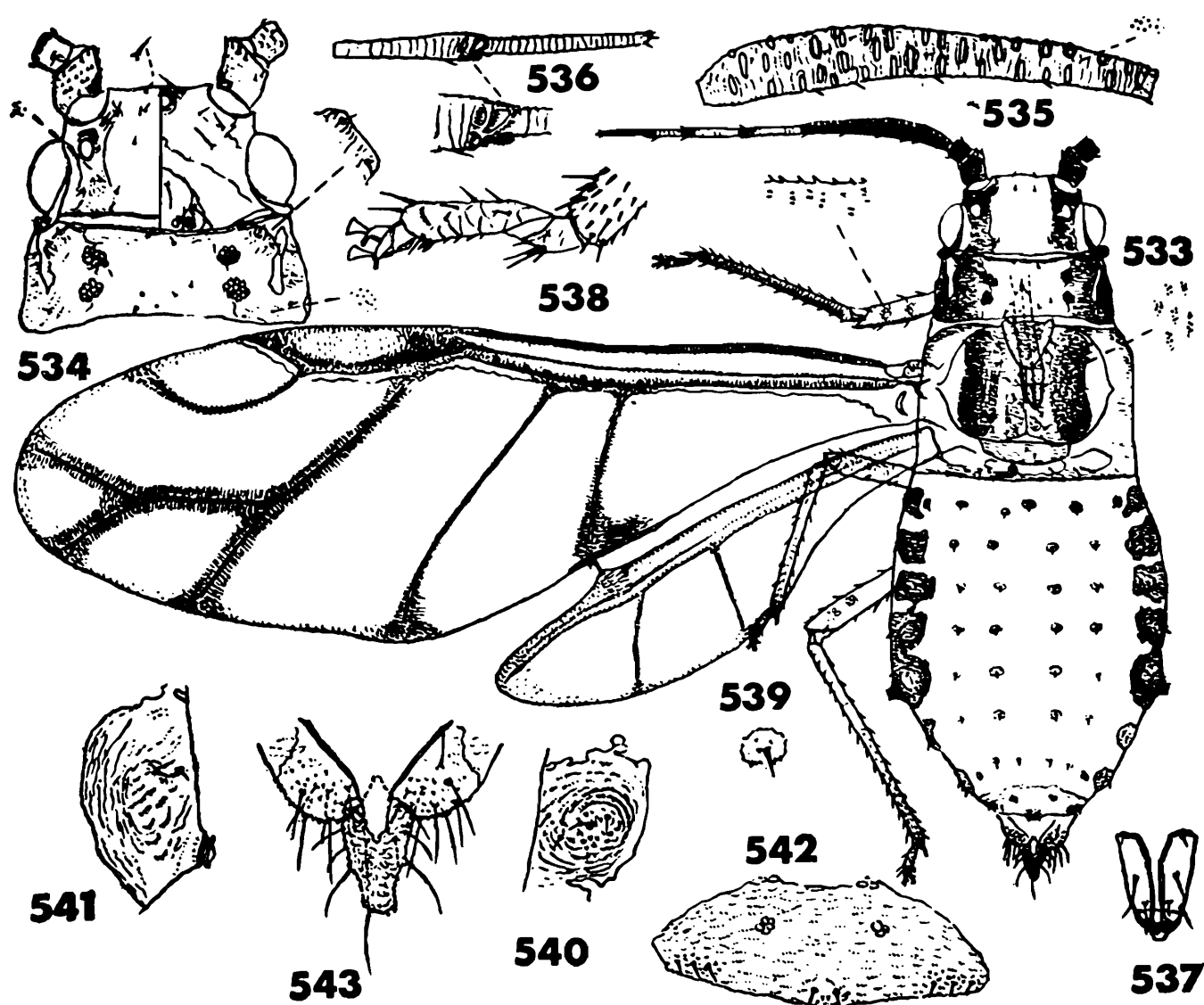
Distribution.—India : West Bengal (Alipurduar)

Types.—Holotype (now designated) and 5 paratypes in the National Zoological Collections, Zoological Survey of India, Calcutta, India and other paratypes deposited in the collections of Entomology Laboratory Department of Zoology, University of Calcutta, Calcutta, India.

39. *Taiwanaphis randiae* Ghosh, Banerjee & Raychaudhuri
(Figs. 533-548)

1971. *Taiwanaphis randiae* Ghosh, A. K., Banerjee, and Raychaudhuri, D. N., *Orient. Insects*, 5 : 108.
1978. *Taiwanaphis randiae*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 28 : 90.
1980. *Taiwanaphis randiae*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 302.

Alate viviparous female.—Body 1.75-2.01 (-1.85) mm long with 0.72-0.74 mm as maximum width, with antennal segment I-III, lateral sides of head and thorax, marginal sclerites on 1st-5th abdominal tergites dark brown, rest pale. Head without antennal tubercles, slightly protruded in the middle of frons ; dorsal cephalic hairs sparse, short, hardly 0.06 mm long, $0.20 \times$ as long as basal diameter of antennal segment III. Antennae little over $0.66 \times$ as long as body; segment III swollen, dark brown, bearing 32-46 transversely oval to elliptical secondary rhinaria, never exceeding more than half the circumference of the segment, these are arranged irregularly over its entire length ; hairs on flagellum similar to these on dorsum of head ; processus terminalis about equal to base of segment VI. Rostrum reaches mid-coxae, ultimate rostral segment short, blunt, $0.83 \times$ as long as second segment of hind tarsus and without secondary hairs. Abdominal dorsum pale bearing dark brown spinulose marginal sclerites on tergites 1-5 and much smaller marginal sclerites on 6th and 7th tergites ; each of marginal sclerites 1-5 bearing a flat tubercle with minute wax gland pores ; hairs on the dorsum



Taiwanaphis randiae A. K. Ghosh, Banerjee & Raychaudhuri. 533-543, alate vivipara : 533, body ; 534, head and pronotum ; 535, antennal segment III ; 536, antennal segment VI ; 537, apical rostral segment ; 538, hind tarsus ; 539, spinal abdominal hair ; 540, lateral abdominal sclerite ; 541, siphunculus ; 542, abdominal tergite VIII ; 543, cauda and anal plate.

of abdomen 0.04-0.06 mm long, arranged in one spinal and one pleural pair and 3-4 marginal pairs on each tergite, these being at most $0.33\times$ as long as the basal diameter of antennal segment III; 8th tergite with 2 spinal hairs placed closely to one another and in length similar to the hairs on the anterior tergites. Siphunculi dark brown, short, striate at apex with a wide apical rim, the bases of siphunculi being incorporated in the marginal sclerites of the 5th tergite. Cauda brown, distinctly constricted in the middle, apical part broader at base, bearing 8-9 hairs. Subanal plate bilobed, spinulose, each lobe with 6-8 hairs. Legs pale but front tibiae sometimes light brown ; coxae normal ; femora ventrally spinulose ;

tibiae with scattered spinules on basal 0.66 portion, apically densely spinulose and bearing many short stiff spiny hairs ; first tarsal segments with 4-5 ventral and no dorsal hairs ; second segment of hind tarsus with spinulose imbrications. Wing veins with media broadly bordered with brown but cubital veins and radial sector not much bordered.

Colour.—Yellowish green in life with dark markings on abdomen and clouded wing veins.

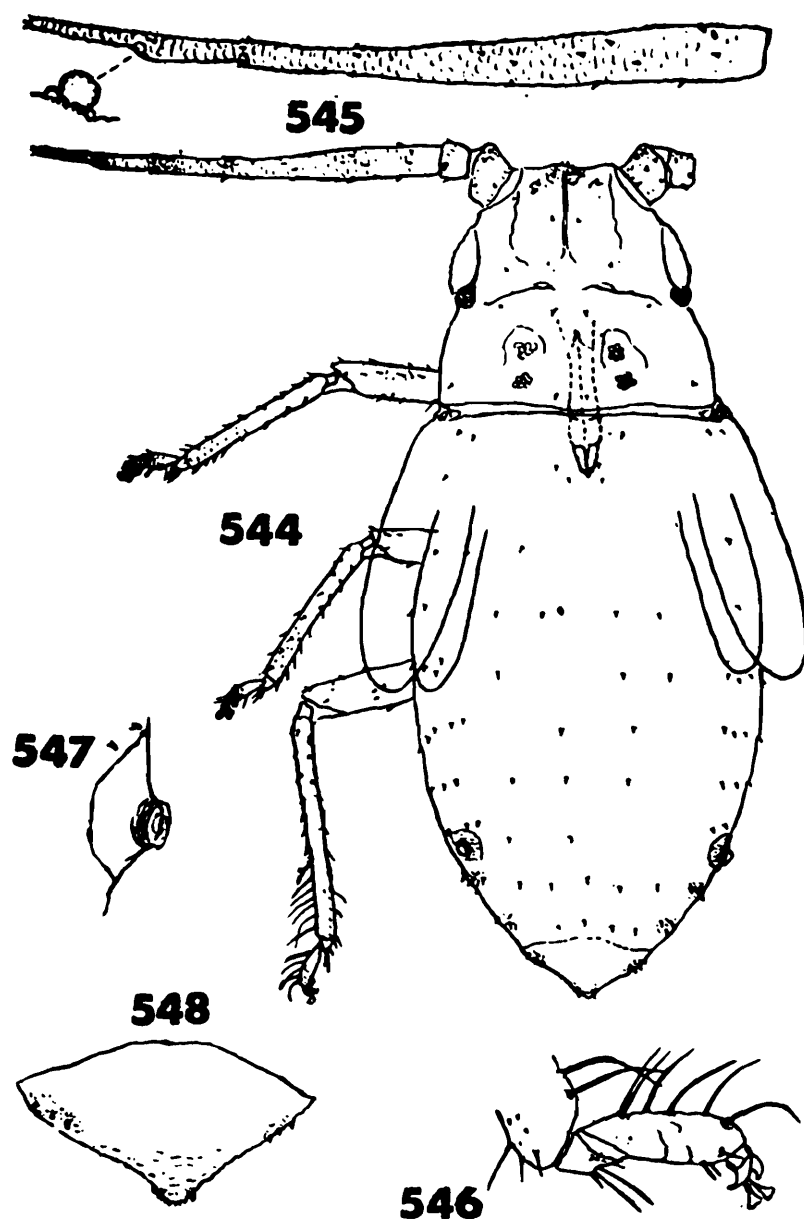
Measurements in mm.—

	Length	Width	Antenna		
1.	2.01	0.82	1.13		
2.	1.98	0.75	0.99		
III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.44	0.18	0.16	(0.12+0.10)	0.06	0.07
0.41	0.18	0.15	(0.12+0.11)	0.06	0.07

(1, 2, ex *Randia* sp. Bhalukpong, Arunachal Pradesh 30.xi.1969, N.Z.C.).

Alatoid nymph.—Body pale. Head with a median frontal prominence ; dorsal cephalic hairs hardly discernible ; ventral hairs distinct, acuminate, 0.016 mm long. Antennae pale, 4-segmented, segment III distinctly swollen on basal 0.60 portion ; flagellum imbricated ; processus terminalis dusky equal to base of segment IV. Eyes large with ocular tubercle. Dorsum pale without any trace of sclerotic patch. Siphunculi small, pale. Legs pale ; femora and tibiae with scattered spinules ; outer margin of hind tibiae near apices and second segment of hind tarsi with 6 to 7 fine hairs, up to 0.060 mm long.

Colour.—Pale in life.



Taiwanaphis randiae A. K. Ghosh, Banerjee & Raychaudhuri. 544-548, alatoid nymph : 544, body ; 545, antennal flagellum ; 546, hind tarsus ; 547, siphunculus ; 548, abdominal tergite VIII.

Measurements in mm.—

Length	Width	Antenna			
1.79	0.69	0.89			
I	Ant. segments				ht ₂
	II	III	IV	urs	
0.08	0.05	0.48	0.19	0.05	0.06

(ex *Randia* sp., Bhalukpong, Arunachal, 30.xi.1969, N.Z.C.).

First instar nymph.—Body pale, 0.51 mm long. Antennae pale, 4-segmented, 0.21 mm long with spinulose imbrication. Ultimate, rostral segment 0.05 mm long. Dorsal hairs minute, blunt, hardly discernible. Legs pale, stumpy ; second tarsal segment of fore and mid-legs with a single hair on outer margin, flattened at apex (0.016 mm) ; second tarsal segment of hind legs with 4 long hairs of which one with flattened apex, the others being acute.

Material examined.—Three alate viviparous females, one alatoid nymph and one first instar nymph (Paratypes) from *Randia* sp. Bhalukpong (c. 250 m), Arunachal Pradesh, India 30.xi.1969, Coll. H. Banerjee, (N.Z.C.)

Discussion.—These insects are known to infest under and upper surface of apical leaves of host plant and are visited by red ants. The host association appears unusual (Rubiaceae) but the presence of adults and nymphs are positive indication of colony formation during the winter month on this plant. The species can be separated from *T. decaspermi* Takahashi in having more rhinaria on antennal segment III, in the ratio of processus terminalis to base of segment VI and in the shape of the 8th abdominal tergite besides different host association. It can be separated from *T. dineni* as indicated in the key to the species.

Distribution.—India : Arunachal Pradesh.

Types.—In National Zoological Collections, Zoological Survey of India, Calcutta, India.

Genus 25. *Takecallis* Matsumura 1917

1917. *Takecallis* Matsumura, S., *J. Coll. Agric. Tohoku imp. Univ.*, 7 : 373 ; Higuchi, H., 1968. *Ins. matsum.*, 31 (4) : 25 ; Stroyan, H.L.G., 1977. *Handbk. Ident. Br. Insects.*, II 4 (a) : 71 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K. 1980. *In Aphids of North East India and Bhutan*, 303. Type species : *Takecallis bambusae* Matsumura = *Callipterus arundicolens* Clarke.

Morphology.—All viviparae alatae, 1.8-2.2 mm long. Head with poorly developed lateral frontal tubercles ; dorsum without any suture ; clypeus with an anteriorly directed nose-like projec-

tion bearing 2 hairs, posterior discal hairs 4, arranged in a single row, all hairs fine. Antennae 6-segmented, $0.8-1.2\times$ as long as the body, flagellum with spinulose imbrications; secondary rhinaria oval to transversely oval, ciliated and confined to antennal segment III, primary rhinaria ciliated; hairs on flagellum distinctly shorter than basal diameter of antennal segment III; process terminalis subequal to the base of segment VI, base of antennal segment VI provided with 1 hair only. Rostrum very short, hardly reaches beyond forecoxae, ultimate rostral segment not longer than basal width, shorter than second segment of hind tarsus bearing 2 accessory hairs. Abdominal dorsum pale, bearing small wart-like paired flat spinal elevations, sometimes on sclerites and similar marginal processes on pre-siphuncular tergites; spinal and marginal hairs on abdomen single, spinal hairs on 7th tergite laterally displaced (in larvae also those of tergite 5), 8th tergite with 2-5 hairs, all dorsal hairs short, acute. Siphunculi short, truncate, without a distinct apical flange, with or without a hair appended to the base. Cauda with oval or trapeziform knob bearing 10-16 hairs. Subanal plate bilobed. Rudimentary gonapophyses 2. Subgenital plate with 17-26 hairs. Legs with fore coxae greatly enlarged, femora and tibiae normal; apical half of tibia and whole of tarsi spinulose; apical tibial hairs differentiated as spines; first tarsal segments with 5-6 ventral hairs and 2 dorsal hairs; empodial hairs flattened. Wax glands minute or absent. Wing venation normal, forewings with media twice branched, hind wings with both obliques.

Embryos with long capitate dorsal hairs; spinal and marginal hairs single, pleural hairs absent, siphunculi appear ring like; lateral hairs on tergites 5-7 much smaller.

Sexual forms not known.

Discussion.—Four species are known under the genus from the world, most of which are found in Japan and at least three of these species, *arundicolens* (Clerks), *arundinariae* (Essig) and *taiwanus* (Takahashi) are widely distributed on bamboos in the holoartic and oriental regions. However, the genus seems to have originated in the eastern palaearctic region. The genus seems close to *Myzocallis* Passerini but can be separated by the clypeal

processus, ratio of p.t : base of antennal segment VI, very short rostrum, reduced number of hairs on the abdomen and enlarged fore-coxae. The allied genus *Subtakecallis*, differs from *Takacallis* in having more hairs on the base of anterior segment VI, shorter processus terminalis and also in the presence of cribriform wax pore elements on the dorsum. Higuchi (1972) has considered *Takecallis* under the *Myzocallis* group of genera. Quednau (1954) considered *Takecallis* as under Myzocallidini, as opposed to more primitive group of genera of Callaphidini with presence of few hairs on supra-anal segment and 3 segmented antennae.

Biology.—The members of this genus are pale yellow to pale green in life and infest leaves of bamboo (*Arundinaria*, *Phyllostachys*, *Pleioblastus*, *Sasaella*, *Sasa* spp.). Only alate viviparae are known, and the species appear to lead anholocyclic life cycles throughout the year. At least one species of the parasitoid *Betuloxys* is known from the members of *Takecallis*.

Distribution.—India ; Japan ; Korea ; Taiwan ; Europe ; North America ; New Zealand.

Type species.—*Takecallis bambusae* Matsumura 1917 which is considered synonym of *arundicolens* Clarke, 1903. Location of types of *bambusae* not known. Types of *arundicolens* are reported to have been destroyed in earthquake (Smith, 1978).

Key to the species of *Takecallis* Matsumura

Alate viviparous females :

Antennal flagellum pale with base of segment III and apices of III-VI and middle of VI infuscated; secondary rhinaria 4-9. Mesonotum with dark stripes and abdomen with two rows of segmentally separated spinal black spots from tergite 1-7. Siphunculi with marginal hair of abdominal tergite 6 appended. On Bamboo (*Arundinaria*, *Bambusa*)

.arundinariae Essig

—Antennal flagellum black except for its very base; secondary rhinaria 11-14. Mesonotum and abdomen pale. Siphunculi without any hair. On Bamboo (*Arundinaria*, *Bambusa*).

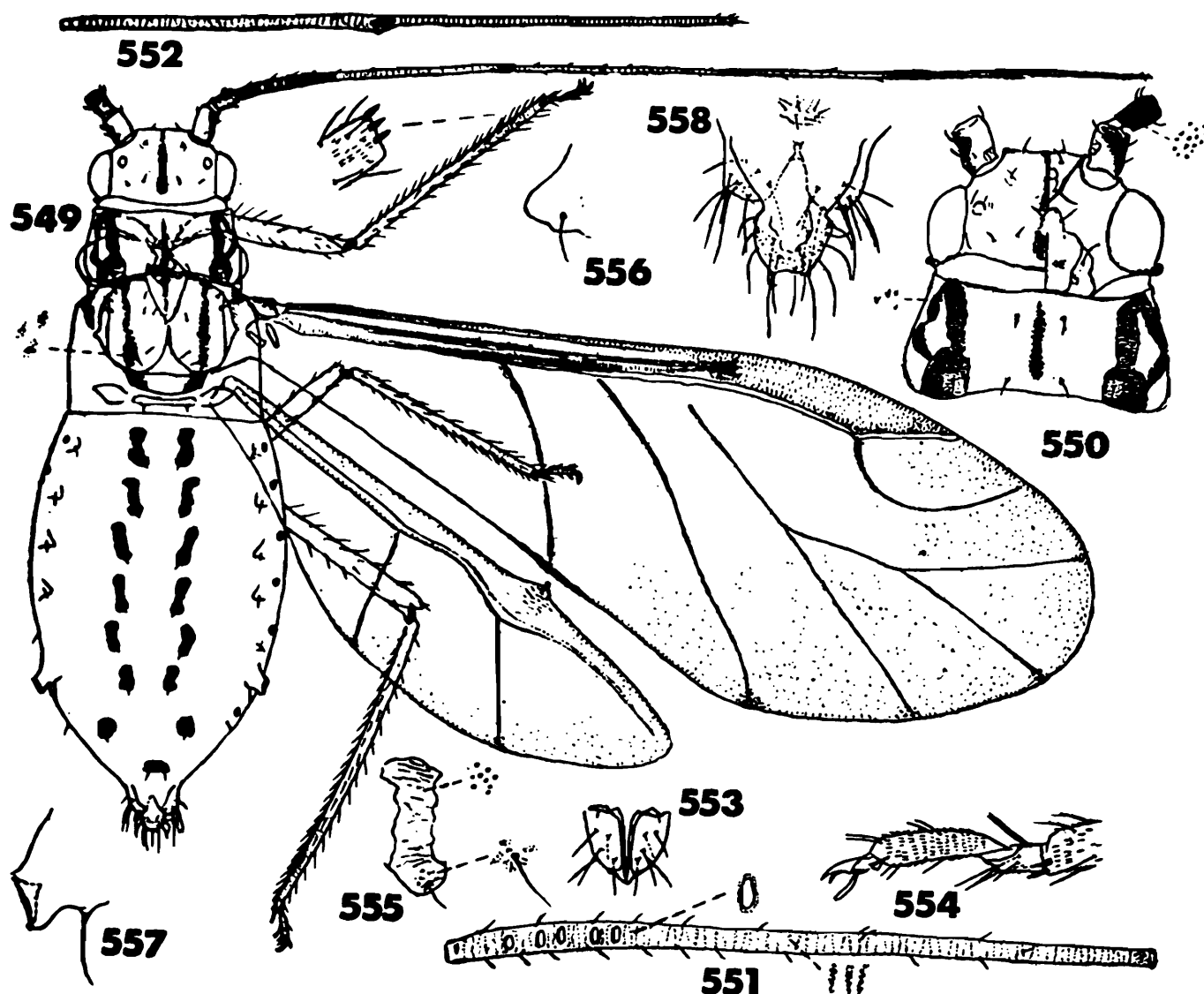
himalayensis Chakrabarti

40. *Takecallis arundinariae* (Essig)

(Figs. 549-561)

1917. *Myzocallis arundinariae* Essig, E.O., *Univ. Calif. Publs. Ent.*, **1** : 308.
1921. *Myzocallis bambusifoliae* Takahashi, R., *Agr. Expt. Stn., Formosa, Spec. Rept.*, **20** : 73.
1931. *Agrioaphis bambusifoliae*, Takahashi, R. *Govt. Res. Inst. Formosa, Rept.* **10** : 63.
1947. *Takecallis arundinariae*, Hille Ris Lambers, D., *Mitt. Schweiz. Ent. Ges.*, **20**.
1953. *Takecallis arundinariae*, Cottier, W., *Aphids of New Zealand*, **87** (misid.).
1962. *Myzocallis bambusifoliae*, Ghosh, A. K. and Raychaudhuri, D. N., *J. Bombay nat. Hist. Soc.*, **59** : 246.
1968. *Takecallis arundinariae*, Higuchi, Hiromichi, *Ins. matsum.*, **31** (4) : 27.
1978. (1975) *Takecallis arundinariae*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, **28** : 91.
1984. *Takecallis arundinariae*, Agarwala, Basant K. and Ghosh, A. K. *Rec. Indian Mus. Misc. Publ. Occ. Paper*, **50** : 27.

Alate viviparous female.—Body elongate 1.97-2.76 mm long with 0.82-1.10 mm as maximum width. Head without antennal tubercles. A short finger-like process present on postclypeus. Vertex with a dark median stripe. Dorsum of head smooth; cephalic hairs fine, up to 0.036 mm long, $0.66 \times$ as long as basal diameter of antennal segment III. Antennae 6-segmented $0.9-1.0 \times$ as long as body, dusky to dark brown; flagellum imbricated; antennal segment III with 7-9 small elongate-oval secondary rhinaria arranged in a line on basal 0.33 portion; hairs on flagellum sparse, hardly 0.011 mm long, $0.25 \times$ as long as the basal diameter of antennal segment III, processus terminalis subequal to base of segment VI. Rostrum barely reaches past fore-coxae, ultimate rostral segment $0.50-0.55 \times$ as long as second segment of hind tarsus and bears 4 accessory hairs. Pronotum with 3 dark longitudinal stripes and also mesonotum with 5 similar stripes. Abdominal dorsum with a pair of dark brown spinal sclerites ending in a low elevation on each of the tergites 1-7, each one scabrous and bearing a minute, stiff hair surrounded by minute wax gland pores; spinal sclerites



Takecallis arundinariae (Essig). 549-558, alate vivipara : 549, body ; 550, head and pronotum ; 551, antennal segment III ; 552, antennal segment VI ; 553, apical rostral segment ; 554, hind tarsus ; 555, spinal abdominal sclerite ; 556, lateral abdominal process ; 557, siphunculus ; 558, cauda and anal plate.

of tergite 7 laterally displaced ; besides spinal elevations, each of the tergites 1-4 also bears a pair of pale cone-shaped hair-bearing marginal processes with a stiff acuminate hair upto 0.019 mm long ; marginal hairs on 5th-7th tergites not on processes, longer, fine, upto 0.060 mm long ; 8th with a dark spinal sclerite bearing 2 hairs, 0.030-0.033 mm long. Siphunculi pale, truncate, with marginal hair of tergite 6 attached at base. Cauda constricted at the middle, bearing at least 10-12 hairs of which one apical pair longer than the others. Subanal plate bilobed, each lobe with 10

hairs. Subgenital plate with 20-22 hairs. Legs pale, forecoxae enlarged ; hairs on femora and tibiae fine, pointed, apical 0.33 portion of tibiae spinulose ; apical tibial hairs differentiated as thick spines, tarsi densely spinulose ; first tarsal segments with 5-6 ventral and 2 dorsal hairs. Wing hyaline, venation normal.

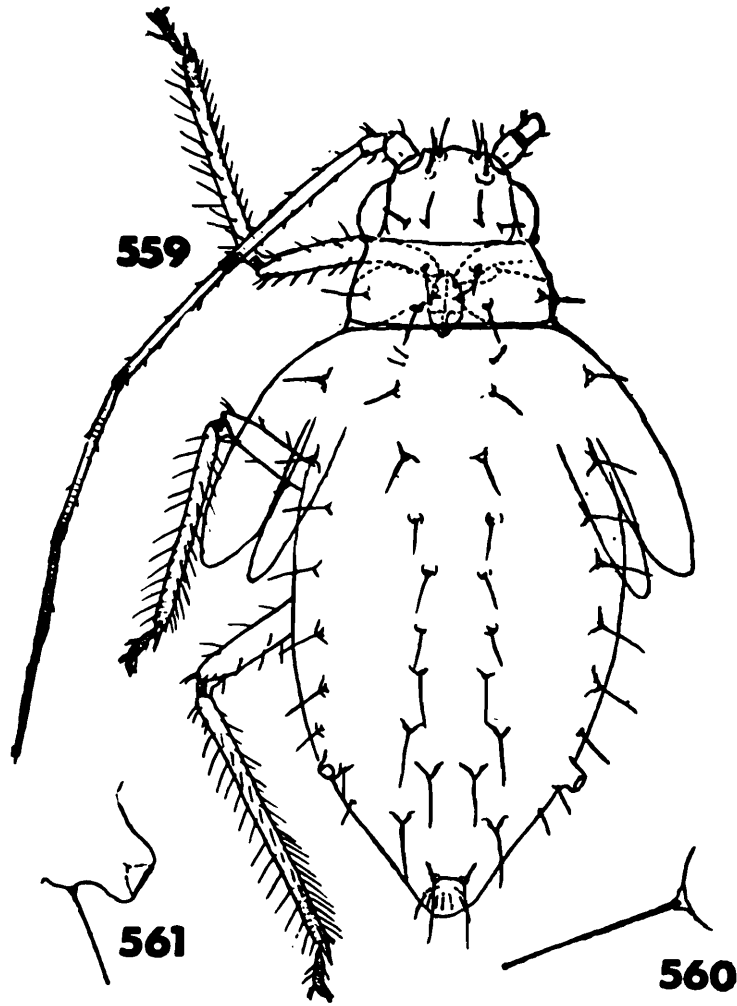
Colour.—Yellowish green with dusky antennae, red eyes.

Measurements in mm.—

	Length	Width	Antenna			
1.	2.76	1.10	?			
2.	1.97	0.82	2.82			
3.	2.48	0.94	2.63			
	Ant. segments			urs	ht ₂	Siph.
	III	IV	V VI			
	1.31	0.75	0.63 —	0.065	0.12	0.09
	0.96	0.60	0.53 (0.30+0.25)	0.065	0.12	0.09
	1.13	0.69	0.60 (0.31+0.29)	0.070	0.11	0.09

(1, ex *Bambusa* sp. Lowshtun, Khashi Hills, Meghalaya, 9.xii.1965 , 2, ex *Bambusa* sp. Shillong, Meghalaya, 30.vii.1969 , 2, ex. *Bambusa* sp. Shillong, Meghalaya, 16.xii.1968, N.Z.C.).

Alatoid nymph.—Body pale 1.79 mm long with 0.81 mm as maximum width. Discal hairs of vertex arranged in 4 pairs, stiff, capitate, 0.078 mm long, arising from strongly tuberculate bases. Antennae 6-segmented, pale, except for dusky tips of segments III, IV and V Thoracic tergites and abdominal tergites 1-8 each with a pair or stout capitate spinal hairs arising from strongly tuberculate bases, up to 0.138 mm long , spinal hairs of abdominal



Takecallis arundinariae (Essig). 559-561, alate nymph : 559, body ; 560, lateral abdominal hair ; 561, siphunculus.

tergite 5 and 7 laterally displaced ; similarly, each of thoracic tergites and abdominal tergites 1-4 with a single, long, capitate marginal hair on each side ; marginal hairs on 5, 6 and 7 tergite shorter and pointed ; those on 5th and 6th, 0.93 mm long, on 7th 0.066 mm long ; 8th tergite with only 2 spinal hairs. Siphunculi short, truncate without apical flange. Legs pale ; forecoxae enlarged ; tibiae spinulose on apical 0.33 to 0.50 portion (in hind tibiae) ; tarsi finely spinulose.

Colour.—Pale green in life.

Measurements in mm.—

Length	Width	Antenna
1.79	0.75	1.95

III	Ant. segments			urs	ht ₂
	IV	V	VI		
0.58	0.43	0.41	(0.25+0.24)	0.06	0.12

(ex *Bambusa* sp. Shillong, Meghalaya, 30.vii.1979, N.Z.C.).

Material examined.—16 alate viviparous females and 4 alatoid nymphs from *Bambusa* sp. Lowshtun, Khasi Hills, Meghalaya, India, 9.xii.1965, coll. S. N. Prasad ; one alate viviparous female from *Bambusa* sp. Shillong, Meghalaya, India, 16.xii.1978, coll. K. Basu , one alate viviparous female and one alatoid nymph from *Bambusa* sp. Shillong Meghalaya, India, 30.vii.1969, coll. R. Basu (N.Z.C.).

Discussion.—This species has often been recorded on bamboo in North-East India and in the Northwest Hill area. In Japan it is known from *Arundinaria graminea*, *A. japonica*, *Phyllostachys dulcis*, etc. and in England from *P. viridiglaucescens*. In India the species seems to have at least two peak periods, one in June—July and the other in November-January.

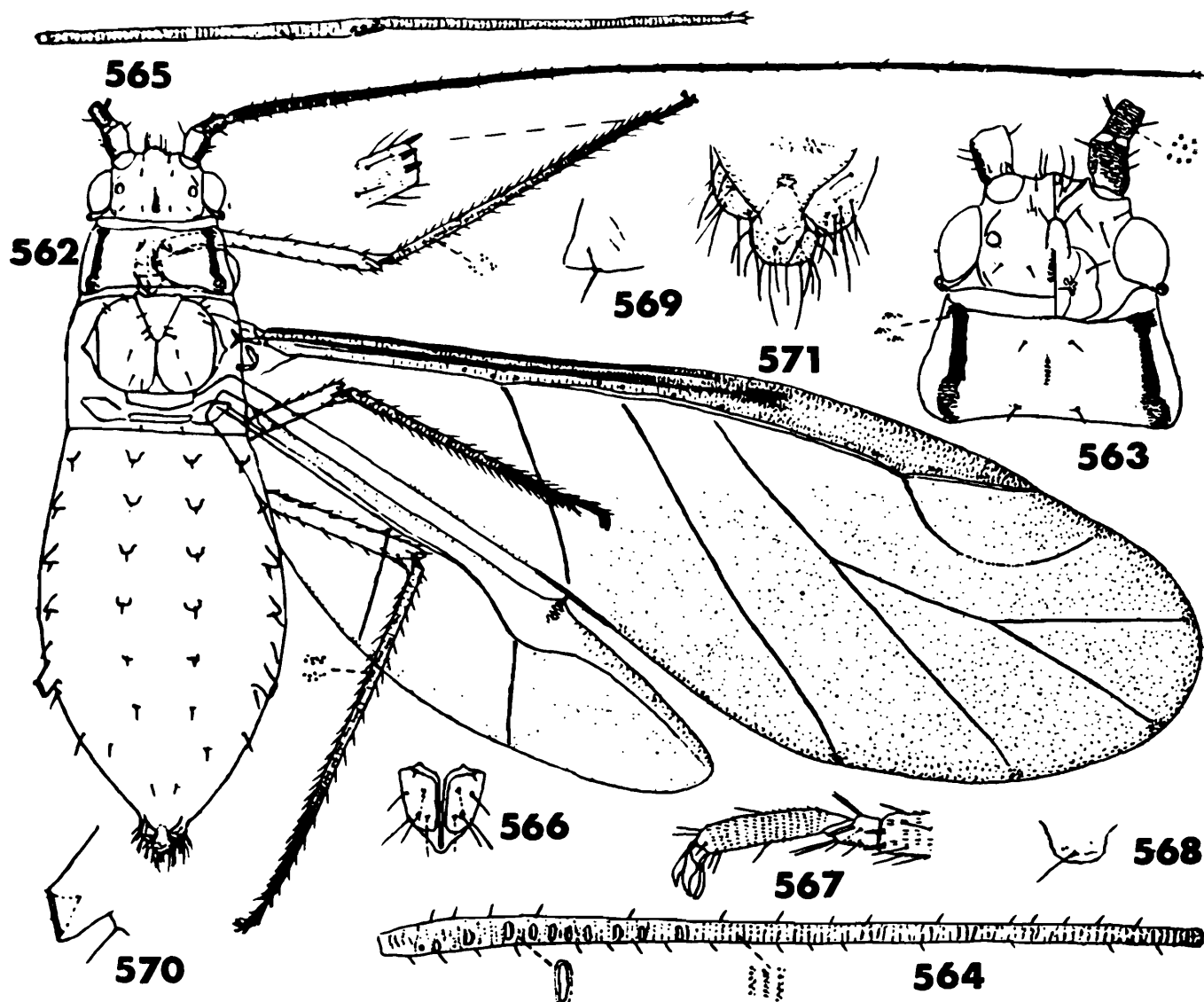
Distribution.—India ; Arunachal Pradesh, Meghalaya, Assam, West Bengal, Himachal Pradesh ; Japan ; Korea ; Formosa ; Europe North America.

Types.—Deposited in the collections of University of California, Berkeley, California, U.S.A.

41. *Takecallis himalayensis* Chakrabarti, 1988 (Figs. 562-575)

1988. *Takecallis himalayensis* Chakrabarti, S., *Orient. Insects*, **22** : 47

Alate viviparous female.—Body elongate 2.38-2.83 mm long with 0.82-0.98 as maximum width. Head without antennal tubercles. Frons a little produced in the middle. Epicranial suture developed. A short fingerlike process present on postclypeus. Vertex with an indistinct black mark near posterior margin, smooth ; dorsal cephalic hairs pointed, up to 0.022 mm long, about 0.5× as long as the greatest basal width of antennal segment III. Antennae 6-segmented, longer (1.4×) than the body, black except for segments I and II which are mottled and the very base of segment III



Takecallis himalayensis 562-571, alate vivipara : 562, body ; 563, head and pronotum ; 564, antennal segment III ; 565, antennal segment VI ; 566, apical rostral segment ; 567, hind tarsus ; 568, spinal abdominal process ; 569, lateral abdominal process ; 570, siphunculus ; 571, cauda and anal plate.

which is pale ; flagellum imbricated or with spinulose imbrications and minute wax pores inclusters ; antennal segment III with 11-13 small elongate-oval secondary rhinaria arranged in a row on basal 0.4 portion, hairs on flagellum about 0.020 mm long, $0.5\times$ as long as the basal diameter of antennal segment III, processus terminalis about equal to base of segment VI. Rostrum barely reaches past fore coxae, ultimate rostral segment $0.45\times$ as long as second segment of hind tarsus and bears 4 accessory hairs. Pronotum with a dark stripe on each side. Meso- and metanotum pale. Abdomen completely pale, spinal hairs one pair on each tergite, those of

tergite 1-4 on short mammiform elevations, about 0.20 mm high, and each of the tergites 1-4 also bearing a pair of cone-shaped processes with a hair appended sub-apically, these hairs being 0.030 mm long, marginal hairs on tergites 5-7 not on processes, 0.041-0.057 mm long; 8th tergite with 2 hairs up to 0.034 mm long. Siphunculi pale, truncate, marginal hair of tergite 6 not attached to the siphunculus but distinctly separated from its base. Cauda knobbed, bearing about 12 hairs. Subanal plate bilobed, each lobe with 9-11 hairs. Legs with femora pale and tibiae pale brown with blackish apices; tarsi black; fore coxae enlarged; hairs on femora and tibiae pointed, longest tibial hair about $1.66\times$ as long as distal width of tibia; apical 0.33 portion of tibiae spinulose; first tarsal segments with 5-6 (rarely 7) ventral and 2 dorsal hairs. Wings with extensive black markings on costal veins and with spot on base of pterostigma; venation normal.

Colour.—Not recorded.

Measurements in mm.—

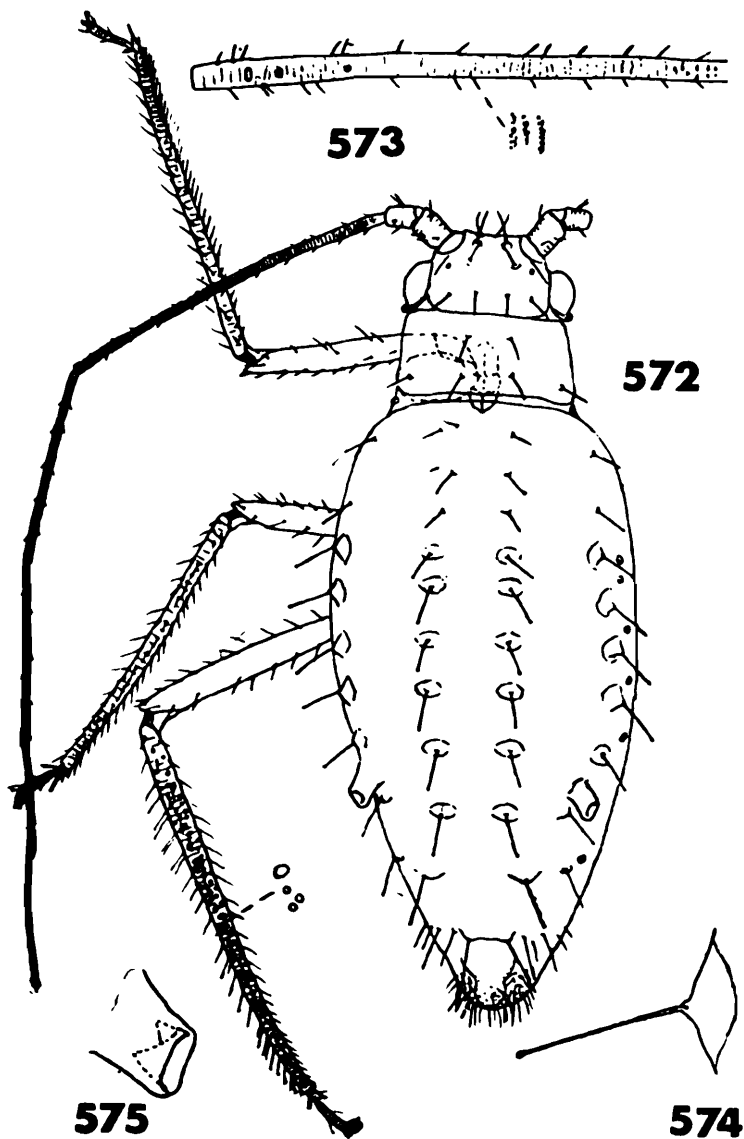
	Length	Width	Antenna
1.	2.49	0.86	3.65
2.	2.38	0.82	3.49
3.	2.83	0.98	4.15

	Ant. segments			urs	ht ₂	Siph.
III	IV	V	VI			
1.29	0.81	0.69	(0.37+0.39)	0.60	0.13	0.07
1.20	0.81	0.73	(0.35+0.40)	0.065	0.13	0.08
1.24	0.88	0.74	(0.37+0.37)	0.060	0.14	0.07

(1-3, ex *Bambusa* sp., Ghangaria, U.P. 1.vi.1980, A. Mondal, No. 934 U. of Kalyani Coll.).

Embryo.—Arrangement and shape of dorsal body hairs as in *Takecallis arundinariae* Essig, but spinal hairs from menotum to abdominal tergite 4 slightly shorter, $0.50-0.75\times$ as long as marginal hairs of respective tergites. Chaetox of antennae and rostrum as typical for *Takecallis*.

Apterous ovipara.—Body elongate, 2.36-2.56 mm long with 0.93-1.01 mm as maximum width. Discal hairs or vertex arranged in 4 pairs, stiff, weakly capitate, up to 0.072 mm long. Antennae 6-segmented, black except for segments I and II and base of segment III which are pale. Antennal segment III with 2-3 secondary rhinaria. Thoracic nota and abdominal tergites 1-8 each with a pair of stiff, weakly capitate spinal hairs, those on the abdomen arising from low elevations up to 0.114 mm long ; spinal hairs of abdominal tergite 7 laterally displaced ; similarly each of thoracic nota and abdominal tergites 1-7 with a single, long, weakly capitate hair on each side ; marginal hairs on 5th, 6th and 7th tergite a



Takecallis sp. 572-575, ovipara : 572, body ; 573, base of antennal segment III ; 574, lateral abdominal hair ; 575, siphunculus.

little shortened, those on tergites 5-7, 0.095 mm long ; 8th tergite with 2 spinal and 4-5 pairs of lateral hairs. Siphunculi cylindrical, truncate without apical flange. Cauda knobbed with about 12 hairs. Subanal plate rounded with about 50 hairs. Legs pale with apices of tibiae and tarsi dusky, fore coxae enlarged ; tibiae spinulose on apical 0.33 portion ; hind tibia with about 140 rather small roundish to suboval pseudosensoria ; tarsi finely spinulose, otherwise as in alate vivipara.

Colour.—not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.56	1.01	3.40		
2.	2.36	0.93	3.13		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
1.02	0.64	0.59	0.35+0.39	0.06	0.14
1.03	0.66	0.64	—	0.07	0.14

(1-2, ex *Arundinaria jounsarensis*, Mashobra, H.P., 17.x.1974, L. K. Ghosh H.P. 74-150 (a) U. of Kalyani Coll.).

Material examined.—6 alate viviparous females from *Bambusa* sp., Ghangaria, Uttar Pradesh (India) 1.vi.1980. Coll. A. Mondal and 2 oviparae from *Arundinaria jounsarensis*, Mashobra, Himachal Pradesh, India, 17.x. 1978, coll. L. K. Ghosh (all U. of Kalyani Coll.).

Discussion.—This species is closely related to *Takecallis arundinariae* (Essig), but differs from the latter in having a black antennal flagellum, more secondary rhinaria, completely pale abdomen and siphunculi without any hair appended.

Distribution.—India : Uttar Pradesh : Himachal Pradesh.

Genus 26. *Taoia* Quednau, 1973

1973. *Taoia* Quednau, F.W., *Can. Ent.*, 105 : 217 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 304. Type species : *Euceraphis chuansinensis* Tao.

Morphology.—Viviparae, both apterous and alate. Head with well developed frontal tubercles. Dorsal cephalic hairs fine in alatae, blunt to slightly capitate in apterae. Antennae 6-segmented, longer than body ; secondary rhinaria subcircular to oval, present on antennal segment III in both apterae and alatae ; primary rhinaria ciliated ; accessory rhinaria distributed along the margin of the primary rhinarium ; hairs on flagellum blunt or slightly capitate ; processus terminalis shorter than base of antennal segment VI. Eyes with ocular tubercles. Rostrum hardly reaches mid-coxae. Abdominal dorsum pale, without any spinopleural elevations but with lateral processes in alatae ; dorsal hairs long, blunt or slightly capitate, arranged as single spinal, pleural and marginal pairs, on each of 1st-6th and on 8th tergite (pleural hairs being absent on 7th) or spinal and pleural hairs may be more numerous. Siphunculi truncate, in apterae strongly flared at apex, in alatae bent outwards with pleural hair of tergite 6 appended at basal third of length. Cauda elongate, constricted, with a tongue-shaped knob bearing fine hairs. Subanal plate moderately to distinctly bilobed. Rudimentary gonapophyses fused. Subgenital plate with 6 hairs in two groups on anterior margin, 12 hairs on posterior margin, besides 2 hairs in paramedian region. Legs spinulose on apices of tibiae and tarsi, tibial hairs pointed to slightly capitate, apical tibial hairs differentiated ; first tarsal segments with 5-7 ventral and without any dorsal hairs ; empodial hairs expanded at apex. Wing venation normal, forewings with media once or twice branched ; hind wings with both obliques.

First instar nymph with 5-segmented antennae ; head with 4 anterior discals, dorsal hairs long, capitate, arranged in 6 longitudinal rows ; pleural hairs on 6th abdominal tergite appended to base of siphunculi.

Oviparae apterous. Antennal hairs weakly capitate, shorter than basal diameter of segment III ; 8th tergite with 2 hairs. Hind tibiae distinctly swollen bearing many pseudosensoria.

Males apterous showing vestiges of wing buds. Much smaller in size (2.00 mm) , secondary rhinaria present on segment III, IV and V Abdominal dorsum with broad band-like spino-pleural sclerites. Genitalia sclerotic, opercula and penis well developed.

Discussion.—The genus contains two species viz. *chuansiensis* (Tao, 1964) from Taiwan and *indica* (A. K. Ghosh and Raychoudhuri, 1972) from India, both being originally placed under the genus *Euceraphis*. It was Quednau (1973) who distinguished these two species from other members of *Euceraphis* by the absence of cribiform wax gland pore-discs on the dorsum of abdomen, by the presence of rounded secondary rhinaria in alatae, the peculiar shape of the cornicle and by the presence of both apterous and alate viviparae and described a new genus *Taoia* with *exotica* Quednau (which is a synonym of *indica*) as type. The genus besides being apparently similar to *Euceraphis* shows close relationship with North American genus *Cepigillettea* Granovsky (1928) but can be separated by the shape of siphunculi, presence of ciliated primary rhinaria, absence of compound accessory rhinaria, presence of many accessory hairs on ultimate rostral segment ; in *Cepigillettea* and in *Taoia* males are apterous or at most with vestiges of wing buds. This genus appears to be a member of the group of genera (*Calaphis*, *Euceraphis*, *Hannabura*, *Cepigillettea*) under Calaphidini (= *Calaphis* group) infesting Betulaceae in the holarctic and oriental regions.

Biology.—The members of the genus infest plants of Betulaceae (*Alnus* and *Betula* spp.) and have been recorded throughout the year in the temperate hill region of India and Nepal ; while parthenogenetic viviparae are found in most parts of the year, apterous males have been seen during December to April in Darjeeling-Himalaya and alate oviparae have only been recorded during December in the same region. The members of the genus can be regarded to have holocyclic life cycles on Betulaceae.

At least two species of Coccinellid predators viz. *Coleophora sexareata* Muls. and *Scymnus* sp. are known to predate on *Taoia* in India (Agarwala et al. 1980).

Distribution.—India ; Bhutan ; Nepal ; Taiwan.

Type species.—*Taoia exotica* Quednau, 1973, which is a synonym of *Euceraphis indica* A. K. Ghosh and Raychaudhuri, 1972. Types of *exotica* are deposited in the collection of British Museum (Nat. Hist.) London, England. Types of *indica* are deposited in the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Key to the species of *Taoia* Quednau

(* Not found in Indian region)

Apterous viviparous females :

Spinal and pleural hairs on abdomen more than one pair per tergite. Antennal segment V longer than VI. Femora with longest hairs $2 \times$ as long as basal diameter of antennal segment III. Cauda with knobbed part nearly twice as long as its greatest width

..**chuansiensis* (Tao)

—Spinal and pleural hairs on abdomen one pair per segment. Antennal segment V shorter than VI. Femora with longest hairs about as long as basal diameter of antennal segment III. Cauda with knobbed part $1.33 \times$ as long as its greatest width

..*indica* (A. K. Ghosh & Raychaudhuri)

Alate viviparous females :

Apex of siphunculi strongly flared. Antennal segment III with fewer than 10 secondary rhinaria. Forewings with media once branched. Pleural and spinal hairs on abdomen more than one pair each per tergite

..**chuansiensis* (Tao)

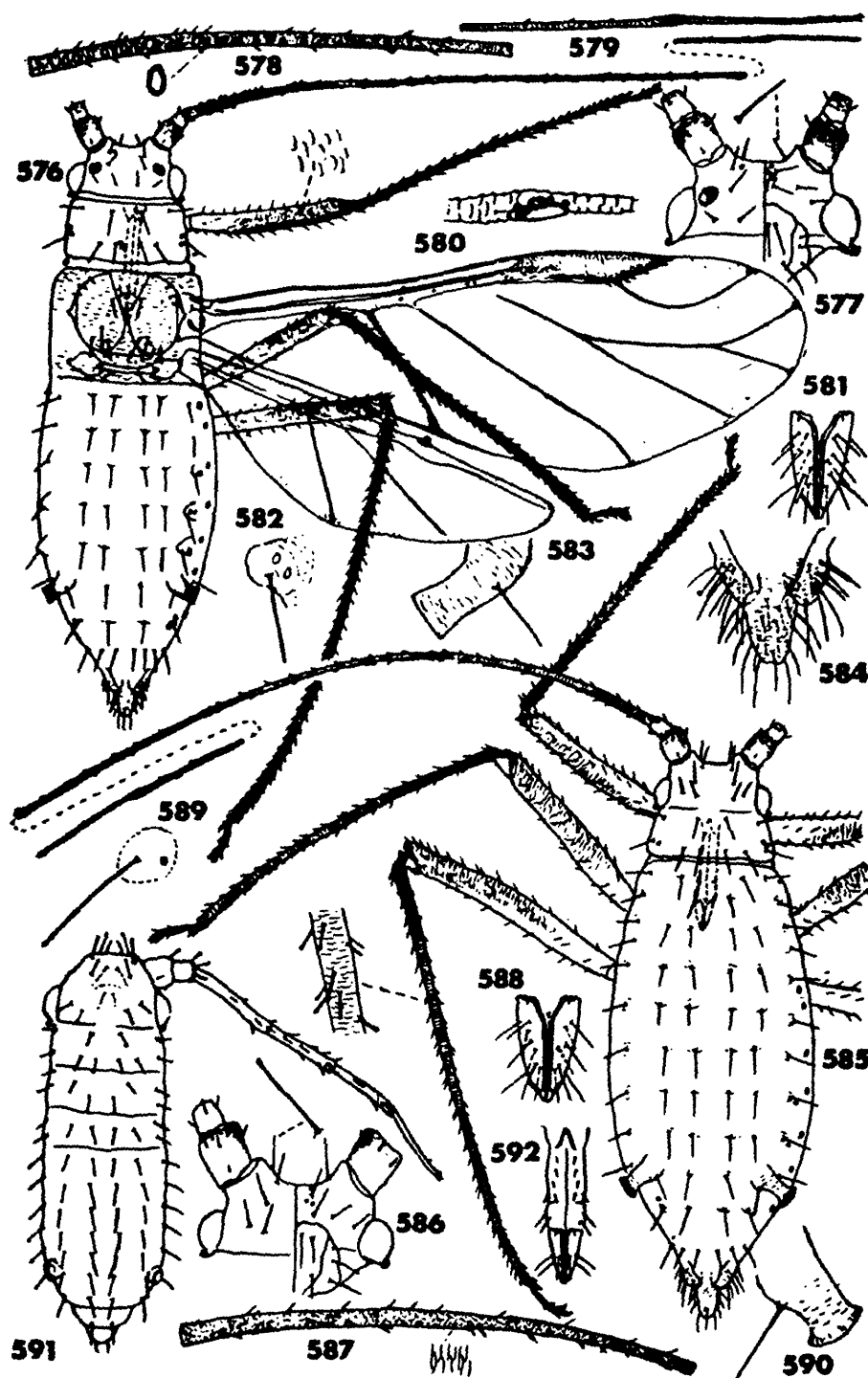
—Apex of siphunculi truncate. Antennal segment III with 25-34 secondary rhinaria. Forewings with media twice branched. Pleural and spinal hairs on abdomen one pair each per tergite

..*indica* (A. K. Ghosh & Raychaudhuri)

42. *Taoia indica* (Ghosh & Raychaudhuri)
(Figs. 576-592)

1969. *Euceraphis chuansiensis*, David, S. Kanakaraj, and Rajasingh, S.G., *Proc. zool. Soc. Calcutta* **22** : 153.
1971. *Euceraphis chuansiensis*, Ghosh, A. K., Ghosh, M. R. and Raychudhuri, D.N., *Orient Insects*. **5** (2) : 211 (misid.).
1972. *Euceraphis indica* Ghosh, A. K. and Raychaudhuri, D. N., *Orient Insects*, **6** : 373.
1973. *Taoia exotica* Quednau F.W., *Can. Ent.* **105** : 218.
1978. (1975) *Taoia indica*, Chakrabarti, S. and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, **28** : 91.
1980. *Taoia indica*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A.K., *In Aphids of North East India and Bhutan*, 305.

Alate viviparous female.—Body large, 3.2-3.6 mm long with 0.80-0.97 mm as maximum width. Head pale, frontal tubercles well developed, frontal hairs blunt to capitate about as long as (0.066 mm) basal diameter of antennal segment III; two pairs of anterior and two pairs of posterior discal hairs up to 0.083 mm long. Antennae 6-segmented, longer than the body, with segment I and II infuscated, blackish brown over the area containing 25-34 oval to elliptical secondary rhinaria on segment III, dark at apices of IV and V and variably dark brown on segment VI; hairs on flagellum (0.013-0.040 mm) blunt to weakly capitate, longest one up to $0.50\times$ as long as basal diameter of antennal segment III; processus terminalis $0.80\times$ as long as base of antennal segment VI. Rostrum reaches midway between fore and middle coxae. Dorsum pale bearing 6 longitudinal rows of hairs on tergites 1-6 which are blunt or capitate at apices up to 0.130 mm long and $2.0\times$ as long as the basal diameter of antennal segment III; lateral abdominal lobes on tergites 3-5 appear like cone-shaped processes, each bearing a single hair and 1-2 marginal papillae or tubercles, the latter being also present on 6th and 7th tergite; 8th tergite with 6-7 hairs. Siphunculi cylindrical, bent outward with pleural hair of 6th tergite appended at about midlength. Cauda knobbed bearing 14-15 hairs including one dorsoapical hair. Subanal plate indented. Rudimentary gonapophyses fused. Legs pale brown,



Taoia indica (A. K. Ghosh & Raychaudhuri). 576-584, alate vivipara : 576, body ; 577, head ; 578, antennal segment III ; 579, antennal segment VI ; 580, rhinaria of antennal segment VI ; 581, apical rostral segment ; 582, lateral abdominal process ; 583, siphunculus ; 584, cauda and anal plate. 585-590, apterous vivipara : 585, body ; 586, head ; 587, antennal segment III ; 588, apical rostral segment ; 589, lateral abdominal hair ; 590, siphunculus. 591-592, embryo : 591, body ; 592, rostrum.

sometimes tibiae darker than femora, tibial hairs stiff, weakly capitate; rostral organ well developed; first tarsal segments with 7 ventral hairs. Forewings with media twice branched, vein Cu_2 slightly bordered with brown; hind wings with both obliques.

Colour.—Pale with dark markings on head, antennae and legs.

Measurements in mm.—

	Length	Width	Antenna		
1.	3.35	0.82	4.33		
2.	3.21	0.96	4.30		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
1.10	1.07	0.97	(0.58+0.41)	0.15	0.20
1.24	1.23	1.05	(0.55+0.40)	0.15	0.20

(1, 2, ex *Alnus nepalensis*, Kalimpong, W.B. 22.iii.1971).

First instar.—(From Quednau, 1973) dorsal hairs capitate with pleural hair of 6th tergite appended to base of siphunculi. Antennae 5-segmented with chaetotaxic formula 1+1, 3, 5-6, 6-8, 2, Ultimate rostral segment with only primary hairs.

Apterous viviparous female.—Body 2.7-4.1 mm long with 1.2-4.0 mm as maximum width. Head pale, frons concave with well developed frontal tubercles; frontal and discal hairs weakly capitate, up to 0.09-0.10 mm long, $1.6\times$ (— $2.0\times$) as long as basal diameter of antennal segment III. Antennae 6-segmented, distinctly longer than the body, pale brown with infuscation around secondary rhinaria and dark tips of segments which may sometimes extend over apical 0.25 portion; flagellum densely imbricated, segment III with 4-7 subcircular secondary rhinaria; hairs on flagellum blunt or weakly capitate, 0.016-0.026 mm long, longest one on segment III up to $0.35\times$ as long as basal diameter of the segment; primary rhinaria on segment V large and oval, on VI elongate; processus terminalis $0.66-0.80\times$ long as base of segment VI. Rostrum reaches midcoxae, ultimate rostral segment $0.70-0.75\times$ as long as second segment of hind tarsus and bears 6-10

accessory hairs. Dorsum pale ; hairs on abdominal tergites arranged in 6 longitudinal rows, acuminate to weakly capitate, up to 0.145-0.151 mm long, $2.0-2.5\times$ as long as the basal diameter of antennal segment III ; lateral abdominal lobes bear 1 pair of marginal hairs and 0-1 marginal papillae which are normally evident on 4th to 7th tergites ; 7th tergite with 4 hairs up to 0.150 mm long, 8th tergite with 6 hairs up to 0.104 mm long. Siphunculi widened at base, slightly bent with a dark apical flange and 1 hair appended at basal third. Cauda distinctly knobbed bearing 15-16 long hairs. Subanal plate deeply bilobed bearing 12 hairs on each lobe. Legs pale except for brownish dorso-apical portion of femora, dark brown bases of tibiae and dark brown tarsi ; first tarsal segments with 7 ventral hairs, without dorsal hairs.

Colour.—Pale green in life.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.75	1.22	4.2		
2.	3.25	1.24	4.6		
3.	3.50	1.38	4.8		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
1.24	1.10	0.96	(0.62+0.48)	0.14	0.19
1.38	1.10	0.96	(0.62+0.48)	0.14	0.20
1.48	1.29	1.13	(0.65+0.48)	0.14	0.19

(1, 2, ex *Alnus nepalensis*, Shillong, Meghalaya, 25.xi.1972 ; 3, ex *Alnus nepalensis*, Kalimpong, West Bengal 5.ix.1971).

Apterous oviparous female.—Body pale, elongate, 3.0 mm long with 1.0 mm as maximum width at the middle of abdomen. Antennae pale (partly broken), except for apices of segments and areas around secondary rhinaria, which are dark ; segment III with 5-8 secondary rhinaria on basal half ; hairs on flagellum weakly capitate, longest one on segment III hardly $0.5\times$ as long

as the basal diameter of the segment. Dorsum of abdomen pale, with hairs $1.75-2.0\times$ as long as the basal diameter of antennal segment III ; tergites 1-6 each with 6 hairs ; 7th tergite with 4 hairs and 8th tergite with 6 hairs. Siphunculi pale, truncate, with dark apical flange. Cauda knobbed. Legs pale yellow, femora and tibiae imbricated and spinulose ; hind tibiae somewhat swollen on basal half and bear 46-48 round to oval pseudosensoria. Other characters as in apterous viviparous female.

Colour.—Green in life.

Measurements in mm.—

	Length	Width	Antenna		
1.	3.04	1.0	—		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
1.38	1.34	1.10	?	0.13	0.16

(ex *Betula alnoides*, Mongpu, W.B. 23.xii.1969).

Apterous male.—Body elongate, 1.95 mm long with 0.62 mm as maximum width. Antenna at least $1.3\times$ as long as body (partly broken) pale on basal segments ; flagellum dark brown, segment III with 35-41, segment IV with 17-18 and V with at least 9 secondary rhinaria distributed over entire length of the segments. Abdominal dorsum pale, with a band of dark brown spinopleural sclerites on each of the tergites but those on 7th and 8th tergites rather pale ; each of the sclerites bear 4 fine hairs 0.060-0.080 mm long, $2.5-3.0\times$ as long as the basal diameter of antennal segment III. Siphunculi pale brownish. Genitalia sclerotic, opercula and penis distinct. Legs with femora pale yellow and darker apices, tibiae and tarsi dark.

Colour.—Pale green with dark dorsal bands.

Measurements in mm.—

Length				Width	
1.95				0.62	
Ant. segments				urs	ht ₂
III	IV	V	VI		
1.04	0.91	0.65	?	0.12	0.15

(ex *Alnus nepalensis*, Shillong, Meghalaya, 24.vii.1970).

Material examined.—Two apterous viviparous females from *Alnus nepalensis*, Shillong, Meghalaya, India 25.xi.1972 ; two apterous viviparous females from *Alnus nepalensis* Kalimpong, West Bengal, India, 5.ix.1971 (N.Z.C.) ; 10 apterous viviparous female from *Alnus nepalensis*, Kalimpong, West Bengal, India, 28.xi.1970 (C.U. Colls) ; two alate viviparous females from *Alnus nepalensis* and *Betula alnoides* Kalimpong, West Bengal, India, 22.iii.1971 (N.Z.C.) and Mongpu, West Bengal, India, 23.xii.1969 (C.U. Coll.) respectively. One apterous male from *Alnus nepalensis*, Shillong, Meghalaya, India, 24.vii.1970 (C.U. Coll).

Discussion.—The species can easily be separated from the only other known species of the genus, *Taoia chuansiensis* (Tao) by the fewer number of pleural and spinal hairs on abdomen, ratio of antennal segment V : VI (VI being longer than V), twice branched media in forewings and greater number of secondary rhinaria on segment III in the alatae. In India, *T indica* has been recorded during March-May and during November-December, while in Nepal it has been recorded during June-August. The species appears to have a monoecious holocycle on *Alnus* and *Betula*.

Distribution.—India : Sikkim, West Bengal, Meghalaya, Manipur, Nepal.

Types.—Types of *T indica* are deposited in the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India ; types of *T exotica* Quednau are deposited in the British Museum (Nat. Hist.) London, England.

Genus 27. *Therioaphis* Walker 1870

1870. *Therioaphis* Walker, F., *Zoologist* (2) 5 : 1999 ; Hille Ris Lambers, D., 1964. *Zool. ver.*, Leiden, 68 : 3 ; Richards, W.R., 1965. *Mem. ent. Soc. Can.*, 44 : 92 ; Stroyan. H. L. G., 1977. *Handbk. Ident. Br. Insect.*, II 4 (a) : 107. Type species : *Aphis ononidis* Kaltenbach.
1915. *Rhizoberlesia* des Guercio, G. *Redia*, 10 : 246. Type species : *Rhizoberlesia trifolii* del Guercio.
1949. *Myzocallidium* Börner, C., *Beitr. tax. zool.*, 1 : 49. Type Species : *Myzocallidium riehmii* Börner.
1949. *Pterocallidium* Börner, C., *Beitr tax. Zool.*, 1 : 49. Type species : *Chaitophorus maculatus* Buckton.
1949. *Triphyllaphis* Börner, C., *Beitr. tax. Zool.*, 1 : 214. Type Species : *Triphyllaphis luteola* Börner, (also in Brohmer, P., *Fauna von Deutschland*, ed., 5 : 214, (1944).

Morphology.—Viviparae apterous and alate or all may be alate (as in *T. riehmii*). Body elongate oval, 1.7-2.7 mm long. Frons flat or slightly convex in the middle and with a dark transverse band on ventral side. Dorsal cephalic hairs may arise from tuberculate bases ; frontal hairs arranged in two pairs ; anterior discals arranged in two pairs, one behind the others ; four posterior discals arranged in a row. Antennae 6-segmented, shorter or rarely as long or longer than body ; flagellum with spinulose imbrications ; secondary rhinaria transversely oval, non-ciliated, restricted to antennal segment III ; primary rhinaria small ; processus terminalis subequal to or slightly longer than the base of antennal segment VI. Base of antennal segment VI with 1 seta that is far apart from the primary sensorium. Eyes with ocular tubercles. Pronotum with single lateral and anterior spinals, posterior spinal hairs sometimes more numerous. Rostrum hardly reaches mid-coxae, but may reach hind coxae, ultimate rostral segment usually shorter than second segment of hind tarsus, (longer in *alatina* H.R.L. and van den Bosch, *ononidis* Kalt., *natricis* H.R.L. and van den Bosch, and *astragalica* Narzikulov and Umarov), and may bear 6-27 accessory hairs. Marginal hairs often arise from short lateral processes but are always single. Abdominal dorsum

often with dark scleroites bearing hairs. Hairs on the dorsum of abdomen blunt or capitate, more strongly capitate in apterae than in alate viviparae, arranged in spinal, pleural (sometimes absent) and marginal rows (2, 2, 2) ; spinal hairs on 5th and 7th tergites laterally displaced ; sometimes spinal and pleural hairs may be more numerous ; spinal and pleural hairs often on small processes or wart-like elevations ; 8th tergite with 2-6 hairs, mostly arising from dark scleroites. Siphunculi mostly truncate without distinct flange nor hair appended to base, variably rugose. Cauda large, constricted and with an elongate apical knob. Subanal plate deeply bilobed. Rudimentary gonapophyses 2. Legs with forecoxae greatly enlarged ; femora sparsely spinulose ventrally ; tibiae spinulose along entire length ; apical tibial hairs differentiated as spines ; tarsi spinulose ; first tarsal segments with 5-6 ventral and 2 dorsal hairs, the midventral one often appear as a sense peg ; empodial hairs flattened.

Embryos with two pairs of hairs on frons, 2 pairs of anterior discal and 2 pairs of posterior discal hairs ; marginal and spinal hairs in single pair per segment ; spinal hairs on 5th and 7th tergites laterally displaced ; all hairs capitate ; pleural hairs seldom developed.

Males alate. Dorsal sclerotic pattern sometimes more distinct than in viviparae. Secondary rhinaria present on antennal segment III-V

Oviparae apterous. Secondary rhinaria present on antennal segment III. 8th abdominal tergite with more hairs than in viviparae. Subanal plate entire. Hind tibiae swollen with round, convex pseudosensoria.

Discussion.—Eastop and Hille Ris Lambers (1976) listed 18 species under *Therioaphis* and 2 species under the subgenus *Rhizoberlesia* del Guercio ; subsequently *Therioaphis beijingensis* Zhang, and *T. astragalica* Narzikulov & Umarov have been described from China and Afghanistan respectively.

The subgenus *Rhizoberlesia* differs from *Therioaphis* s.s. in having somewhat sclerotic tergum in apterae, very short siphunculi

and in the absence of hair bearing processes in apterae. Hille Ris Lambers and van den Bosch (1964) have dealt with 14 species of *Therioaphis* and one of *Rhizoberlesia* and provided the most extensive account of the genus. Some species, like the spotted alfalfa aphid, *Therioaphis trifolii* (Monell, 1802) on *Medicago sativa* in North America causes considerable damage and is known to exist in more than one form or subspecies in its wide area of distribution.

Quednau (1954) has grouped *Therioaphis* and *Rhizoberlesia* with *Triphyllaphis* Börner, *Pterocallidium* Börner and *Myzocalidium* Börner, all of which are now considered synonyms of the first named genus. Considering the larval characters of this group of genera as provided by Quednau (op. cit.) it may be seen that pleural hairs are almost always totally absent, or present from 1st instar (seldom) or from 2nd instar, formula of hairs on rostrum may be 4, 2, 1+5 or 1+7 and ultimate rostral segment may be short or long.

The members of this genus are known to have aphidiid parasitoids especially of the genera *Praon*, *Trioxy*s and *Lipolexis*. Ants are not known to visit these aphids.

Biology.—The members of *Therioaphis* are known to infest leguminous plants and can live holocyclic life cycles on the same. However, *Therioaphis* (*Rhizoberlesia*) *brachytricha* H.R.L. and van den Bosch infests the upper surface of leaves of tender growths of *Lotus*. Sexuales may appear in August-September in the palaearctic region. Graham (1959) has dealt with the effects of temperature on *Therioaphis trifolii* forma *maculata* Buckton and stated that specimens developed in 11°C had black dorsal sclerotic spots, while those reared in 35°C had almost no spots.

Distribution.—India ; holarctic region.

Type species.—*Aphis ononidis* Kaltenbach 1846. Location of types not known.

Key to the species of *Therioaphis* Walker
(*Not found in Indian region)

Apterous viviparous females :

Abdominal dorsum with 2 spinal and 2 marginal hairs per tergite. Ultimate rostral segment as long or longer than second segment of hind tarsus and with several secondary hairs (but rarely more than 12). On *Ononis* spp.

.**ononidis* (Kaltenbach)

—Abdominal dorsum at least with 5-6 hairs besides one pair of marginal hairs per tergite. Ultimate rostral segment shorter than second segment of hind tarsus and never with more than 6 secondary hairs. On Papilionaceae

.*trifolii* (Monell)

Alate viviparous females :

1. Abdominal dorsum with never more than four hairs per tergite (i.e. one pair of spinal and one pair of marginal hairs). First and second instar larvae with same dorsal chaetotaxy

.2

—Abdominal dorsum, at least on tergites 1-4 with more than 6 hairs, often irregularly arranged. First and second instar with different dorsal chaetotaxy. Hairs on dorsum arising from variably pigmented sclerotic plates. Antennal segment III with 6-17 oval secondary rhinaria. On Papiolinaceae

.*trifolii* (Monell)

2. Ultimate rostral segment as long as or longer than second segment of hind tarsus with at least 8 but rarely more than 12 secondary hairs. Spinal sclerotic plates of abdominal tergites 1-5 bearing thick capitate hairs on cone-shaped processes. 8th tergite with 4 (rarely 5) hairs. On *Ononis* spp.

.**ononidis* (Kaltenbach)

—Ultimate rostral segment shorter than second segment of hind tarsus and with 4-6 secondary hairs. Spinal sclerotic plates of abdominal tergites 1-5 bearing minute hairs on very low elevations. 8th tergite with 2 (rarely 3) hairs. On *Melilotus* spp.

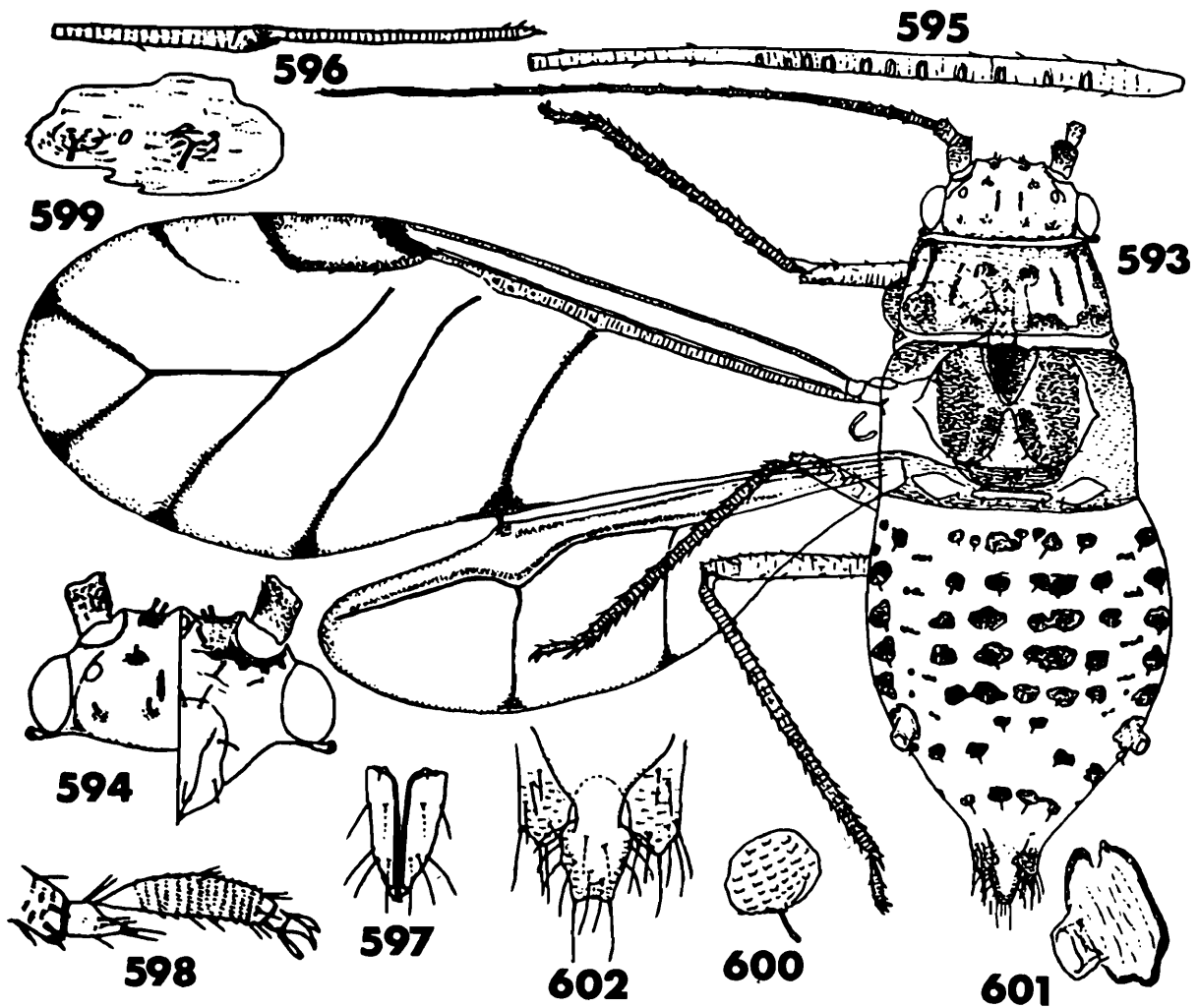
.**riehmi* (Börner)

43. *Therioaphis trifolii* (Monell)

(Figs. 593-612)

1882. *Callipterus trifolii* Monell, S., *Can. Ent.*, **14** : 14.
1899. *Chaitophorus maculatus* Buckton, G. B., *Indian Mus., Notes*, **4** : 277.
1918. *Callipterous trifolii*, Das, N., *Mem. Indian Mus.*, **6** : 244.
1928. *Therioaphis ononidis*, Krishnamurty, B., *J. Bombay nat. Hist. Soc.* **33** : 214 (misid.).
1937. *Therioaphis ononidis*, Deshpande, V. G., *J. Bombay nat. Hist. Soc.*, **39** : 741 (misid.).
1940. *Therioaphis ononidis*, Gulamullah, *Ind. J. Ent.*, **2** : 21 (misid.).
1952. *Pterocallidium maculatum* Börner, C., *Mitt. thüring Bot. Ges.*, **3** : 63.
1957. *Pterocallidium maculatus*, David, S. Kanakaraj, *Ind. J. Ent.*, **19** : 173.
1959. *Therioaphis maculata*, Dickson, R. C. *Ann. ent., Soc. Ann.* **52** : 63.
1964. *Therioaphis trifolii*, Hille Ris Lambers, D. and van den Bosch, R., *Zool. Verh.*, Leiden, **68** : 36.
1968. *Therioaphis trifollii*, David, S. Kanakaraj, Rajasingh, S. G. and Narayanan, K., *J. Bombay nat. Hist. Soc.*, **65** (2) : 508.
1969. *Therioaphis rieghi*, Chowdhury, A. N., Basu, R. C. and Raychaudhuri, D. N., *Sci. Cult.* : **35** : 334 (misid.).
1976. *Therioaphis trifolii* forma *maculata*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the Worlds Aphids*, 424.

Alate viviparous female.—Body stout, elongate oval, 2.0-2.2 mm long with 0.75-0.085 mm as maximum width. Frontal tubercles ill developed. Discal hairs stout, on low elevations, 0.010-0.013 mm long, shorter than basal diameter of antennal segment III. Ventral side of head with blackish transverse band. Antennae 6-segmented, slender, slightly shorter than the body ; segment III with 6-17 oval secondary rhinaria ; hairs on flagellum short, less than half as long as the basal diameter of antennal segment III ; processus terminalis nearly equal to or slightly longer than base of segment VI. Rostrum reaches halfway to midcoxae, ultimate rostral segment $0.65\times$ as long as second segment of hind



Therioaphis trifolii (Monell). 593-602, alate vivipara : 593, body ; 594, head ; 595, antennal segment III ; 596, antennal segment VI ; 597, apical rostral segment ; 598, hind tarsus ; 599, spinal abdominal sclerite ; 600, lateral abdominal sclerite ; 601, siphunculus ; 602, cauda and anal plate.

tarsus and bears 4 accessory hairs. Pronotum with one lateral hair on each side, two anterior spinals and 3-5 posterior spinals, all arising from tuberculate bases. Abdomen on each tergite with one pair of marginal and 1-2 pairs of spinal and pleural brown sclerites, each bearing a single hair on low elevations which gradually become indistinct on the posterior tergites ; on the anterior tergites, spinopleural hairs vary between 4-7 but on 6, 7th and 8th their number decreases to 2, ; all dorsal hairs blunt or expanded at apices, 0.016 to 0.023 mm long. Siphunculi, cauda and subanal plate as in the apterous morph. Legs with forecoxae greatly enlarged ; tibiae spinulose apically and with rastral organ consisting of 3-5 spinelike hairs ; first tarsal segments

with 2 dorsal and 5-6 ventral hairs, empodial hairs flabellate. Wings with pterostigma bordered and with a black spot at its base, veins slightly bordered and ending in pigmented tips.

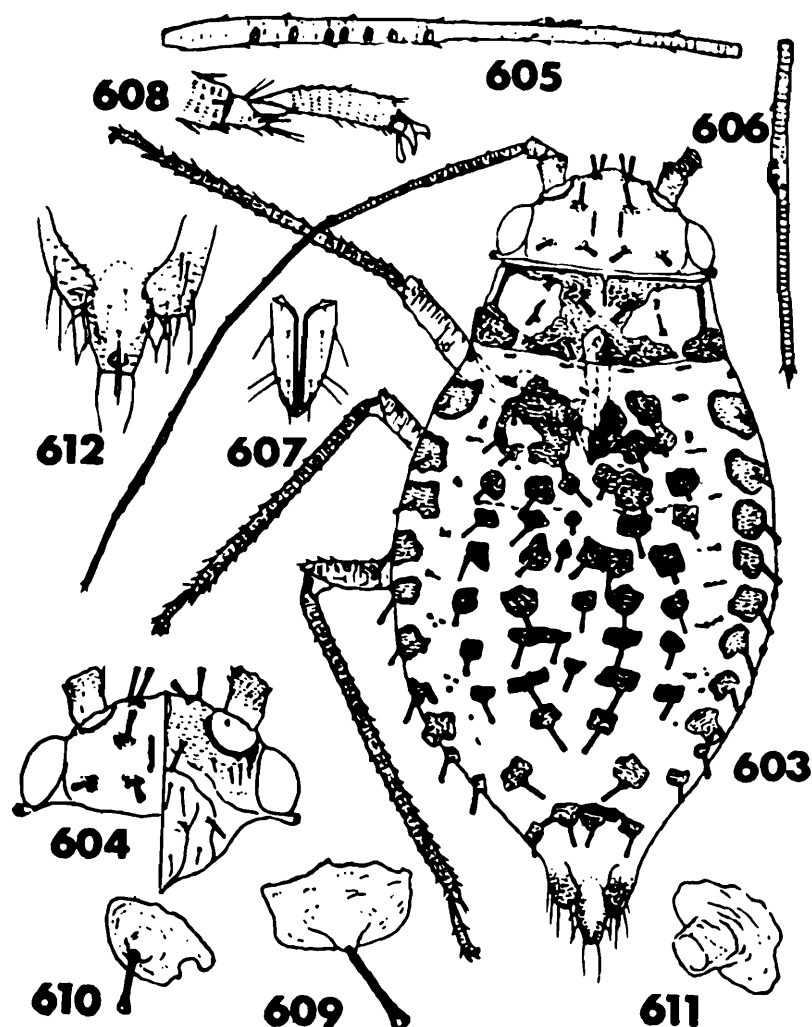
Colour.—Yellowish with brownish spots.

Measurements in mm.—

Length		Width		Antenna	
2.20		0.82		1.93	
Ant. segments				urs	ht ₂
III	IV	V	VI		
0.07	0.41	0.38	(0.18+0.17)	0.09	0.11

(ex Lucerne, Delhi, 22.iii.1964, IARI Coll.)

Apterous viviparous female.—Body elongate oval, 1.77-1.9 mm long with 0.90-1.1 mm as maximum width. Frontal tubercles ill developed. Discal hairs of vertex strongly capitate, thick, 0.020-0.023 mm long, on somewhat tuberculate bases, longer than basal diameter of antennal segment III. Antennae pale brown, slender, 6-segmented, about equal to length of body ; segment III-VI finely spinulose ; antennal segment III with 8-12 secondary rhinaria on basal half ; hairs on flagellum pointed or blunt, small ; processus terminalis equal to or slightly longer than base of segment VI. Rostrum reaches midcoxae, ultimate rostral segment $0.75\times$ as long as second segment of hind tarsus and bears 2-4 accessory hairs. Pronotum with one marginal hair on each side besides two anterior spinal hairs and 2-5 posterior spinal hairs (0.026 mm). Mesothorax, metathorax and abdomen on each tergite with isolated, brownish sclerites around bases of hairs. Thoracic nota and abdominal tergites 1-6 with a single lateral hair on each side besides 4-6 spinopleural hairs , 7th and 8th tergite each with a pair of spinal and a pair of marginal hairs ; all dorsal hairs strongly capitate, 0.04-0.06 mm long ; besides the brown sclerotic plates carrying hairs, small brown muscle attachment plates occur in the intersegmental region , ventral hairs capitate. Siphunculi short



Therioaphis trifolii (Monell). 603-612, apterous vivipara ; 603, body ; 604, head ; 605, antennal segment III ; 606, antennal segment VI ; 607, apical rostral segment ; 608, hind tarsus ; 609, spinal abdominal sclerite ; 610, lateral abdominal sclerite ; 611, siphunculus ; 612, cauda and anal plate.

cylindrical, brown, smooth, without any hairs, arising from a sclerotic base. Cauda with elongate knob, spinulose, bearing two very long fine apical hairs, besides 8-10 shorter hairs. Subanal plate spinulose, bilobed, each lobe with 5-7 hairs. Legs with forecoxae greatly enlarged, femora may be finely spinulose ; tibiae strongly spinulose at least on apical 0.50 portion bearing acute hairs ; first tarsal segments with two dorsal hairs and 5-6 ventral hairs ; empodial hairs flabellate.

Colour.—Yellow with conspicuous reddish brown spots on thorax and abdomen.

Measurements in mm.—

	Length	Width	Antenna		
1.	1.79	0.96	1.74		
2.	1.93	1.08	1.88		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.59	0.34	0.35	(0.18+0.18)	0.09	0.12
0.63	0.39	0.41	(0.20+0.18)	0.09	0.13

(ex 1, 2, on Lucerne, Delhi, 22.iii.1964, coll. R. Menon, IARI Coll.).

First instar larva.—Quednau (1954) mentioned that absence of pleural hairs, antennal hair formula 1+1, 1, 2, 1, hairiness of apical rostral segment (hair formula 1+7 or 1+5) and enlarged forecoxae characterises young larvae of *Therioaphis* (a genus which was at that time considered under Therioaphidinae, sensu Börner).

Material examined.—Four apterous and four alate viviparous females, from Lucerne, Delhi, IARI, India, 24.xiii.1956 coll. R. Menon ; six apterous and one alate viviparous females from Lucerne, Delhi. IARI, India, 22.iii.1964, coll. R. Menon ; 8 apterous viviparous females from Lucerne, Delhi, IARI, India. 1.v. 1968 ; (all IARI Coll.) ; two alate viviparous females from *Trifolium* sp. Pune, Maharashtra, India, 3.vii.1976, coll. R. Rediah (K.U. Coll.) ; also type collections (See under Types).

Discussion.—The name *Callipterus trifolii* Monell was used by Das (1918) for aphids infesting Lucerne (*Medicago sativa*) in the Punjab region, although a few years later Buckton described the same species as *Chaitophorus maculatum* on *Medicago sativa* in Rajasthan, India. Subsequent authors from India. viz. Deshpande (1927) Krishnamurty (1937) and Gulamullah (1940) recorded the Lucerne aphid under *Therioaphis ononidis* (from Maharashtra, Karnataka and Delhi respectively) but pointed out that Das (op. cit.) has used the name *Callipterus trifolii* for the same species. This can perhaps be attributed to Theobald who believed that

Chaitophorus maculatus Buckton and *Callipterus trifolii* Monell were the same species as *T. ononidis* (which is only known to infest *Ononis*) and also recorded *ononidis* from a number of host plants on which it almost certainly cannot live (Hille Ris Lambers and van den Bosch, 1964). The only record of *T. riehmii* (Börner) by Chowdhury et al. (1969) from Simla Hills also appears doubtful ; it was recorded on the basis of a vagrant alate from *Prunus puddum* whereas the species is normally known to infest *Melilotus* spp. At least two species of *Melilotus* viz. *alba* and *indica* are known to be infested by aphids in the Indian region but never by any *Therioaphis*. No further record of *riehmii* could be located from Indian region. Thus it can be assumed that in the region under study, only one species, *Therioaphis trifolii* occurs.

T. trifolii seems to be widely distributed in the region extending from Punjab (in Pakistan and India), Himachal Pradesh through Rajasthan, Delhi, Maharashtra to Karnataka in southern India. In all likelihood the species occurs in the entire Lucerne growing belt of the country except in Tamil Nadu and Kerala (David et al. 1968).

This aphid is usually found singly or in a small group on the lower surface of the leaves of host plants and jumps off when disturbed. It is not attended by ants but is actively predated upon by a least two Coccinillid species viz. *Coccinella transversalis* Fabr., and *C. septempunctata* Linn. Period of occurrence is between May to January in the Indian region.

In North America one strain, (regarded by some authors as a distinct species or subspecies) *maculata* (Buckton) s. str., infests *Medicago sativa* besides a great number of other Papilionaceae including *Trifolium* spp. and leads a parthenogenetic, anholocyclic life cycle. The other strain, called *trifolii* s. str., has more rhinaria on antennal segment III and an unadorned underside of abdomen. It lives on *Trifolium* in the more eastern part of North America and produces normal sexuales and hibernates as eggs (H.R.L. and van den Bosch, 1964). Dickson (1959) while working on the identity of the alfalfa aphid which became a serious pest in North America during 50's, used number and arrangement of the secondary rhinaria in combination with ventral sclerotisation of abdomen

in alatae as major characters for the separation of *maculata* from *trifolii* and named the former as "Spotted Alfalfa Aphid" (SAA) and the later Yellow Clover Aphid (YCA). H.R.L. and van den Bosch (op. cit.), on the basis of examination of global material, opined that SAA and YCA are not separable as suggested by Dickson (op. cit.). They however supported Dickson's hypothesis that SAA in North America may be descendents from a single specimen alone accidentally introduced (perhaps from India).

The species after causing considerable damage to *Medicago sativa* in North America, became the subject of interest to various investigations, including work on its integrated control.

Distribution.—India : Punjab, Haryana, Delhi, Rajasthan, Maharashtra, Karnataka ; wide parts of Asia, Europe and North America.

Types.—In National Zoological Collections (ZSI)—one alate viviparous female (morphotype) No. 6766/H7 ; one apterous viviparous female (lectotype) No. 6768/87 ; one larva (paratype) 6767/H7 ; two apterous viviparous females (cotypes) 6767/H7 ; all collected on lucerne grass, Marwar, Jodhpur—6,1897, Re. Det. J.P. Doncaster (N.Z.C.).

Genus 28. *Tinocallis* Matsumura 1919

1919. *Tinocallis* Matsumura, S., *Trans. Sapporo nat. Hist. Soc.*, 7 : 100 ; Richards, W. R., 1967. *Can. Ent.*, 99 : 536 ; Higuchi, H., 1972. *Insecta matsum.*, 35 (2) : 39 ; Stroyan, H. L. G., 1977. *Handbk. Ident. Br. Insects*, II 4 (a) : 66 ; Chakrabarti, S. and Raychaudhuri, D., 1978. *Proc. zool. Soc. Calcutta*, 28 : 93 ; Raychaudhuri, D. N. Chakrabarti, S., Basu, R. C. and Ghosh, A. K. 1980. *In Aphids of North East India and Bhutan*, 305 ; Type species : *Tinocallis ulmiparvifoliae* Matsumura.
1924. *Lutaphis* Shinji, G. O., *Zool. Mus.*, Tokyo, 36 : 396. Type species : *Lutaphis nirecola* Shinji.
1929. *Tuberocallis* Nevsky, V. P., *Zool. Anz.*, 82 : 221. Type species : *Tuberocallis saltans* Nevsky.

Morphology.—All viviparae alate. Body, 1.4-2.6 mm long. Head with poorly defined frontal tubercles ; dorsum of head may bear

hair-bearing finger-shaped processes on vertex and occiput. Dorsal cephalic hairs fine, acute. Antennae 6-segmented, shorter than body ; secondary rhinaria transversely oval or much narrowed and elongated and almost annular, restricted to antennal segment III ; primary rhinaria ciliated ; flagellum usually spinulose or denticulate or with spinulose imbrications ; hairs on flagellum short, acute, shorter than basal diameter of antennal segment III ; processus terminalis subequal to or slightly longer than the base of segment VI. Rostrum usually with sclerotic stiffening near base of segment II, reaches mid coxae, ultimate rostral segment shorter or longer than second segment of hind tarsus and bears a few accessory hairs. Thorax may be with paired hair-bearing spinal processes on pronotum and mesonotum. Abdominal dorsum pale, typically with one pair of spinal and one pair of marginal hairs on each of 1st-7th tergites, spinal hairs on 3rd, 5th and 7th tergites being laterally displaced ; 8th tergite with only one pair of hairs ; sometimes spinal hairs may be duplicated, specially on 3rd-5th tergites ; all dorsal hairs fine, acute ; spinal hair-bearing processes occur on anterior 2 to 4 tergites, or rarely also on 6th tergite ; marginal processes almost always present on 1st-5th tergites. Siphunculi truncate, sometimes with a hair (of 6th tergite) appended to base. Cauda knobbed with 8-18 hairs. Subanal plate deeply bilobed. Rudimentary gonapophyses fused. Subgenital plate with a row of 8 hairs on posterior margin besides two rows of hairs on anterior margin. Legs with front coxae greatly enlarged for leaping ; apices of tibiae spinulose, apical tibial hairs differentiated as spines ; tarsi spinulose ; first tarsal segments with 5-7 ventral and 2 dorsal hairs ; empodial hairs flattened. Wing venation normal, sometimes pigmented (e.g. *kahawaluokalani*), forewings with media twice branched, rarely once branched.

Embryos with dorsal hairs long, capitate, those on abdominal tergites 3rd, 5th and 7th displaced laterally ; pleural hairs absent ; marginal hairs single. Siphunculi evident.

Oviparae apterous, usually smaller than viviparae. Dorsal hairs capitate, may arise from cone-shaped processes. Hairs on 8th tergite may be multiplied and pointed (e.g. *khonkaenensis* Danielson & Robinson, 1978) ; hind tibiae swollen, with 9-45 pseudo-sensoria.

Males alate, with secondary rhinaria on antennal segments III-VI. Spinal hairs arising from tuberculate bases on 1st-8th tergites of abdomen, those on 3rd, 5th and 7th, laterally shifted. Genitalia with distinct penis and opercula.

Discussion.—A genus of about 18 species originating in the oriental and palaearctic region but later introduced to North America and Australia. *Tinocallis* appears very close to the genus *Myzocallis* Passerini, differing from the latter in the elongate shape of secondary rhinaria, reduced number of dorsal hairs, strongly enlarged fore coxae and host association with Ulmaceae. The genus can easily be separated from all related genera in having spinal hairs on 3rd, 5th and 7th tergites laterally displaced both in adults and in the embryos. Richards (1965), considering the position of spinal hairs on 3rd, 5th and 7th abdominal tergites being similar in both *Tinocallis* Matsumura and *Melanocallis* Oestlund, regarded the latter as a subgenus, differing from *Tinocallis* s.s. in not having the marginal hair on 6th tergite appended to the base of siphunculus but that distinction seems to have been overruled because Richards (1967) writes that in *Tinocallis* there are no hairs on the cornicle. However, Stroyan (1977) rightly pointed out that there is a hair appended to the siphunculus in *T. platani*, but not in other *Tinocallis* species. Eastop and Hille Ris Lambers (1976) however considered *Melanocallis* as a distinct genus. Quednau (1954) considered the genus under Myzocallidini of Phyllaphidinae on the basis of larval characters. The genus *Sarucallis* Shinji, 1922, has been used by Eastop Hille Ris Lambers (1976) and Smith (1978) for accommodating *kahawaluokalani* (Kirkalady) although, both Richards (1967) and Higuchi (1972) demonstrated that this species clearly belongs to *Tinocallis* Matsumura. On the other hand if *Sarucallis* is considered a synonym of *Tinocallis*, the species *nigropunctata* Tao, in having different morphology of alatoid nymph has to be accommodated in a new genus for which the name *Pseudotinocallis* n.g. is proposed.

Of the 18 species from the world, five have been recorded from India including 4 endemic species. Richards (1967) has reviewed the genus from the world. Higuchi (1972) has dealt with the species found in Japan. Stroyan (1977) has provided a key to the

species recorded in England. Raychaudhuri et al. (1980) have dealt with four of the five species known from India.

Biology.—The members of this genus are typically considered to have holocyclic life cycles on Ulmaceae but association with other plant families viz. Sapindaceae, Lythraceae, Lauraceae, Magnoliaceae are also known ; many of the species are however known only from alate viviparae and nymphs, mostly occurring during November to February in temperate hills of India, or during May-August in Japan.

Distribution.—India ; Central Asia ; China ; Thailand ; Hawaii ; Philippines ; Australia ; Middle East ; Europe ; North and South America.

Type species.—*Tinocallis ulmiparvifoliae* Matsumura 1917. Location of types not known.

Key to the species of Tinocallis Matsumura

Alate viviparous females :

1. Thoracic nota without mammiform or fingerlike spinal processes. Spinal processes of 2nd abdominal tergite dark sclerotic, united at base on a dark spinopleural sclerotic band. Forewing with extensive pigmentation over almost the whole pterostigma, the costal field and the area below at the wing base, besides dark spots over apices of media and 1st cubital vein. Wings held horizontally in repose. On *Lagerstroemia indica*

kahawaluokalani (Kirkaldy)

- Thoracic nota with short mammiform or fingerlike spinal processes. Spinal processes of 2nd abdominal tergite only occasionally united at base and not on a dark spinopleural sclerotic band. Forewing at most with posterior margin of pterostigma and branches of media pigmented. Wings held roof-like in repose

2. Fingerlike spinal processes developed on abdominal tergites 1-4. Antennal flagellum dark brown with only sometimes bases of segments IV and V a little paler. Antennal segment III with 19-29 secondary rhinaria distributed over almost entire segment. Marginal abdominal sclerites often with marginal papillae. Radial sector indicated as a stippled line. On *Leguminosae*

distinctus M. R. Ghosh, A. K. Ghosh & Raychaudhuri

—Fingerlike spinal processes developed on abdominal tergites 1-2. Antennal flagellum pale with apices of segments III-V and middle of VI black

3

3. Forewing with radial sector absent and branches of media bordered with brown. Spinal abdominal processes of tergites 1 and 2 pale brown or brownish, those of tergite 2 sometimes united at base, of same colour as spinal sclerites of the following segments. Lobes of mesonotum with minute wax gland pores. Processus terminalis up to 1.3× as long as the base of antennal segment VI. On *Duabanga* and *Lythraceae*

himalayensis A. K. Ghosh, M. R. Ghosh & Raychaudhuri

—Forewing with radial sector developed and only apices of veins with dusky spots. Spinal abdominal processes much paler than the spinal sclerites of the following segments, never united at base. Mesonotum without wax gland pores. Processus terminalis subequal to or shorter than the base of antennal segment VI

.4

4. Pronotum and mesonotum with short mammiform elevations that are not longer than their basal width. Secondary rhinaria confined to basal third of antennal segment III. Apical rostral segment distinctly shorter than hind tarsus II. On *Magnolia*

.. *magnoliae* A. K. Ghosh & Raychaudhuri

Pronotum and mesonotum with fingerlike elevations that are longer than their basal width. Secondary rhinaria extending over at least basal half of antennal segment III. Apical rostral segment as long as hind tarsus II. On unknown host (probably *Ulmus*)

nevskyi Remaudiere &
Quednou

Apterous oviparous females :

Small marginal hairs of abdominal tergites 5-7 about $2/3 \times$ as long as the greatest basal width of antennal segment III. Processus terminalis longer than base of antennal segment VI and up to $0.5 \times$ as long as segment III. On *Duabanga* and Lythraceae.

himalayensis A. K. Ghosh,
M. R. Ghosh &
Raychaudhuri

— Small marginal hairs of abdominal tergites 5-7 about $1 \frac{1}{3} \times$ as long as the greatest basal width of antennal segment III. Processus terminalis at most equal to base of antennal segment VI and $0.3 \times$ as long as segment III. On *Leguminosae*

distinctus M. R. Ghosh,
A. K. Ghosh &
Raychaudhuri

44. *Tinocallis distinctus* Ghosh, Ghosh & Raychaudhuri
(Figs. 613-624)

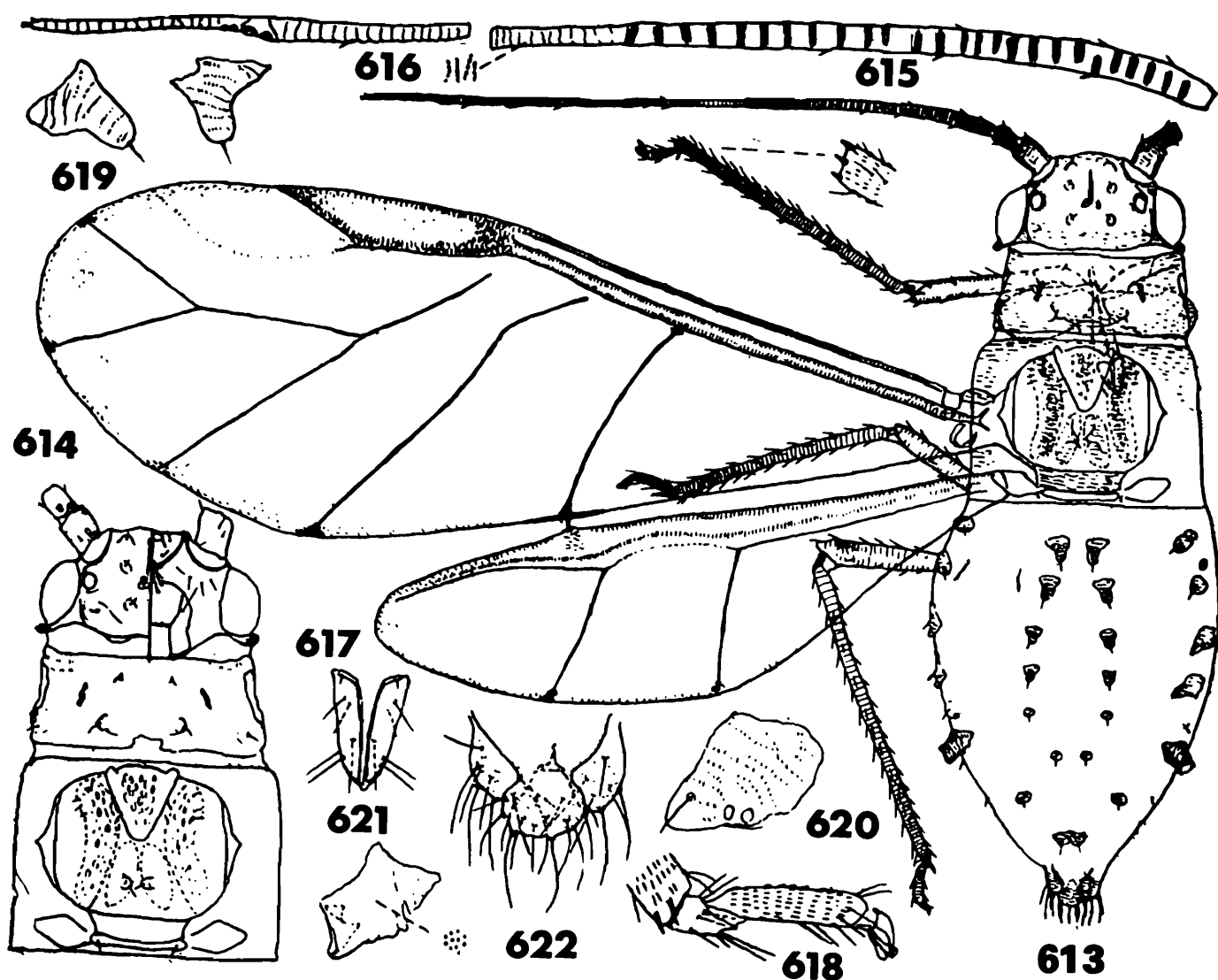
1970. *Tinocallis distincta* Ghosh, M. R., Ghosh, A. K. and Raychaudhuri, D. N., *Orient. Insects*, A (A) : 389.

1972. *Tinocallis distincta*, Ghosh, A. K., Ghosh, M. R., and Raychaudhuri, D. N., *Orient. Insects*, 6 : 339.

1980. *Tinocallis distincta*, Raychaudhuri, D. N., Chakrabarti S., Basu, R. C., and Ghosh, A. K. *In Aphids of North East India and Bhutan*, 307.

Alate viviparous female.—Body pale, except on head, antennae, abdominal processes, siphunculi and cauda which are variably brown to dark brown, 1.8-2.2 mm long with 0.66-0.82 mm as maximum width. Frons convex ; vertex with low paired elevations, each bearing a single hair, 0.019 mm, little over $0.50 \times$ the basal diameter of segment III. Antennae 6-segmented, $0.80 \times$ as long

as the body ; flagellum smooth on basal 0.75 of segment III, the rest gradually more distinctly imbricated ; antennal segment III with 19-28 transversely narrowed secondary rhinaria distributed almost over entire length ; hairs on flagellum minute and sparse, on segment III up to 0.010 mm, 0.30 as $\times$ long as the basal diameter of the segment. Rostrum reaches between fore-and midcoxae, ultimate rostral segment nearly equal to the second segment of hind tarsus and with a pair of secondary hairs. Pronotum with one pair of posterior spinal hairs on small processes and also mesonotum with 1 pair of similar processes. Abdominal dorsum



Tinocallis distinctus M. R. Ghosh, A. K. Ghosh & Raychaudhuri. 613-622, alate vivipara : 613, body ; 614, head and thoracic nota ; 615, antennal segment III ; 616, antennal segment VI ; 617, apical rostral segment ; 618, hind tarsus ; 619, spinal abdominal processes ; 620, lateral abdominal process ; 621, siphunculus ; 622, cauda and anal plate.

pale bearing brown to dark brown spinal scabrous processes on tergites 1-8, those on the anterior tergites being longer than others ; processes on 5th and 7th tergites laterally displaced, tergites 1-4 also bear scabrous marginal processes ; spinal and marginal hairs one pair per tergite, on processes, except the marginal hairs on tergites 5-7 which arise from dusky or pale sclerotic bases ; dorsal hairs stiff, acuminate, on anterior tergites 0.010-0.013 mm long, on 8th tergite up to 0.033 mm long and nearly equal to the basal diameter of antennal segment III. Siphunculi dark brown, truncate, without hair appended to base, $0.4 \times 0.05 \times$ as long as as the body. Cauda brown, bearing 10-12 long hairs. Subanal plate bilobed, each lobe with 8-10 hairs. Subgenital plate with about 12 stiff hairs on posterior margin. Legs yellowish brown, forecoxae enlarged, apical 0.25 portion of tibiae and whole of tarsi densely spinulose ; wing venation normal ; radial sector faintly indicated ; subscosta and tips of veins dusky.

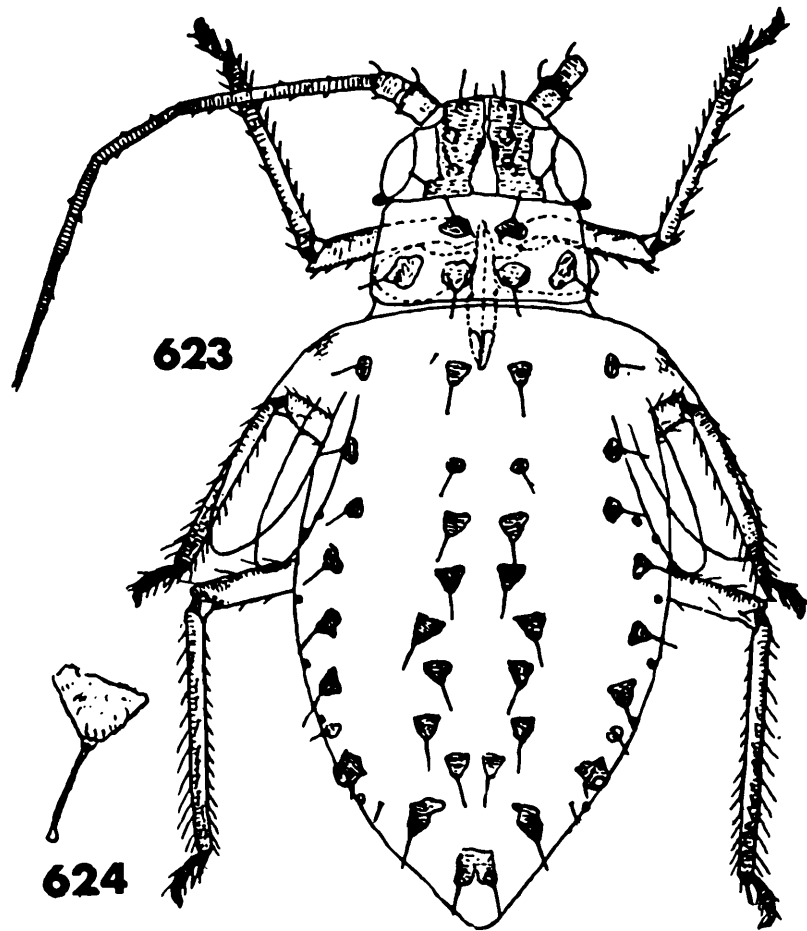
Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	2.20	0.93	1.72		
2.	2.19	0.82	1.90		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.67	0.28	0.31	(0.21+0.19)	0.09	0.09
0.67	0.30	0.29	(0.18+0.18)	0.09	0.10

(1, 2, ex Leguminosae, Kalimpong, W.B. 51.ii.1971).

Alatoid nymph.—Discal hairs of vertex in 4 pairs, capitate, 0.065 mm long, up to $1.6 \times$ as long as the basal diameter of antennal segment III. Antennae brown, 6-segmented. Meso- and meta-notum and abdominal terga 1-7 each with 2 marginal and 2 spinal hairs, all arising from cone-shaped processes except marginal hairs on 5-7 which arise from pale flat bases ; 8th tergite with



Tinocallis distinctus M. R. Ghosh, A. K. Ghosh & Raychaudhuri. 623-624, alate nymph : 623, body ; 624, spinal abdominal processus.

2 hairs ; all hairs capitate, 0.065-0.078 mm long, except marginal hairs on 5-7 which are thin, slightly capitate, up to 0.055 mm long ; spinal hairs on tergites 3, 5 and 7 laterally displaced. Legs normal, mostly with pointed hairs ; first tarsal segments with 5 ventral hairs.

Apterous oviparous female.—Body pale, 1.7 mm long. Antennae 6 segmented, subequal to the body, yellowish on basal segments, rest brown. Dorsal hairs arranged as a pair each of spinal and marginal hairs on meso and metanotum and abdominal tergites 1-7, all arising from dark sclerotic cone-shaped processes and capitate, except for minute marginal hairs of abdominal tergites 5-7. Siphunculi short and dark. Legs swollen on hind tibiae which bear 14-16 round to oval pseudosensaria on basal 0.75 portion.

Colour.—Not recorded.

Measurements in mm.—

Length	Antenna	Ant. segments				urs	ht ₂
		III	IV	V	VI		
1.7	1.4	0.51	0.23	0.23	(0.16+0.16)	0.08	0.09

(ex plant of Leguminosae, Kalimpong, W.B., 20.i.1969).

Material examined.—8 alate viviparous females and 2 alatoid nymphs from a plant of Leguminosae, Government Agricultural farm, Kalimpong, West Bengal, India, 15.ii.1971 N.Z.C. ; one apterous oviparous female, 20.i.1969, same data.

Discussion.—The species can be separated from other endemic species following the key. It differs from other species of *Tinocallis* by a combination of characters concerning dorsal chaetotaxy and size and coloration of dorsal processes on thorax and abdomen. The species has so far been recorded only from Kalimpong hills during December to February.

Distribution.—India : West Bengal (Kalimpong).

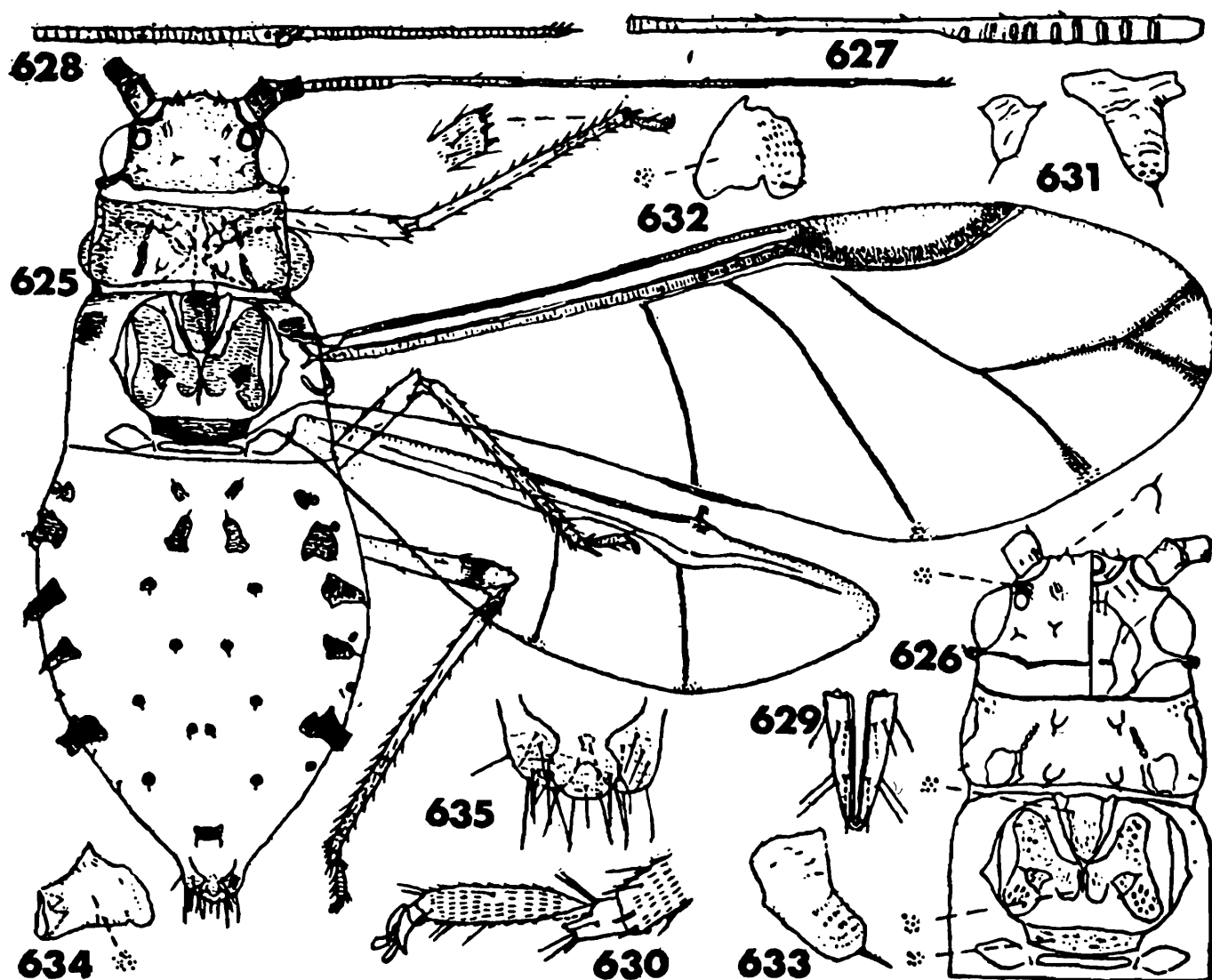
Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India.

45. *Tinocallis himalayensis* Ghosh, Ghosh & Raychaudhuri
(Figs. 625-637)

1971. *Tinocallis himalayensis* Ghosh, A. K., Ghosh, M. R. and Raychaudhuri, D. N., *Orient. Insects*, 5 (2) : 218.
1971. *Tinocallis himalayensis*, Ghosh, M. R., Ghosh, A. K. and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 24 : 166.
1978. *Tinocallis khonkaenensis* Danielsson & Robinson, *Can. Ent.* 110 : 101. New Synonymy.
1980. *Tinocallis himalayensis*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Sikkim*, 307.

Alate viviparous female.—Body elongate, 1.4-1.9 mm long with 0.59-0.82 mm as maximum width. Head with a pair of frontal

prominences and three pairs of very low elevations on vertex, each bearing a single hair up to 0.016 mm long. Antennae 6-segmented, slender, subequal to the length of body, pale except for the apices of segment III, V and middle of segment VI which are dusky ; segment III with 5-10 narrow elliptical secondary rhinaria restricted on basal 0.50 portion ; flagellum gradually more distinctly imbricated apicad from base of segment V, these imbrications may carry minute spinules ; hairs on flagellum scarce, minute, hardly discernible. Rostrum stout, reaches midway between fore- and midcoxae, ultimate rostral segment at least equal in length to



Tinocallis himalayensis A. K. Ghosh, M. R. Ghosh & Raychaudhuri. 625-635, alate vivipara : 625, body ; 626, head and thoracic nota ; 627, antennal segment III ; 628, antennal segment VI ; 629, apical rostral segment ; 630, hind tarsus , 631, spinal abdominal processes ; 632, lateral process of abdominal tergite II ; 633, lateral processus of abdominal tergite III ; 634, siphunculus ; 635, cauda and anal plate.

the second segment of hind tarsus and bears 6 accessory hairs besides the preapical ones. Thorax with 2 pairs of spinal processes on pronotum and 1 pair of spinal processes on mesonotum the latter being the largest and darker than the others, each one bearing a short hair at the apex. Abdominal dorsum pale bearing a pair of brown hair-bearing spinal sclerites on tergites 1-7, those on tergites 1 and 2 finger-shaped, the others small and flat, the ones on 3rd, 5th and 7th tergite laterally displaced ; marginal processes one pair each on abdominal tergites 1-4, the ones on 1st-2nd shorter and the others finger-shaped, each process bearing a single hair, on anterior tergites 0.012 mm long and on posterior tergites 0.018 mm long, these being $0.66\times$ and $1.0\times$ as long as the basal diameter of antennal segment III, respectively ; large spinal and marginal processes scabrous or with spinulose striae. Siphunculi dark brown, truncate, $0.05\times$ as long as the body, smooth dorsally but minutely spinulose on ventral side. Cauda knobbed, bearing 7 hairs. Subanal plate bilobed. Legs pale, hind femur may be infuscated ; fore coxae enlarged ; apical 0.25 portion of tibiae and whole of tarsi spinulose. Fore wings with veins bordered brown, radial sector absent.

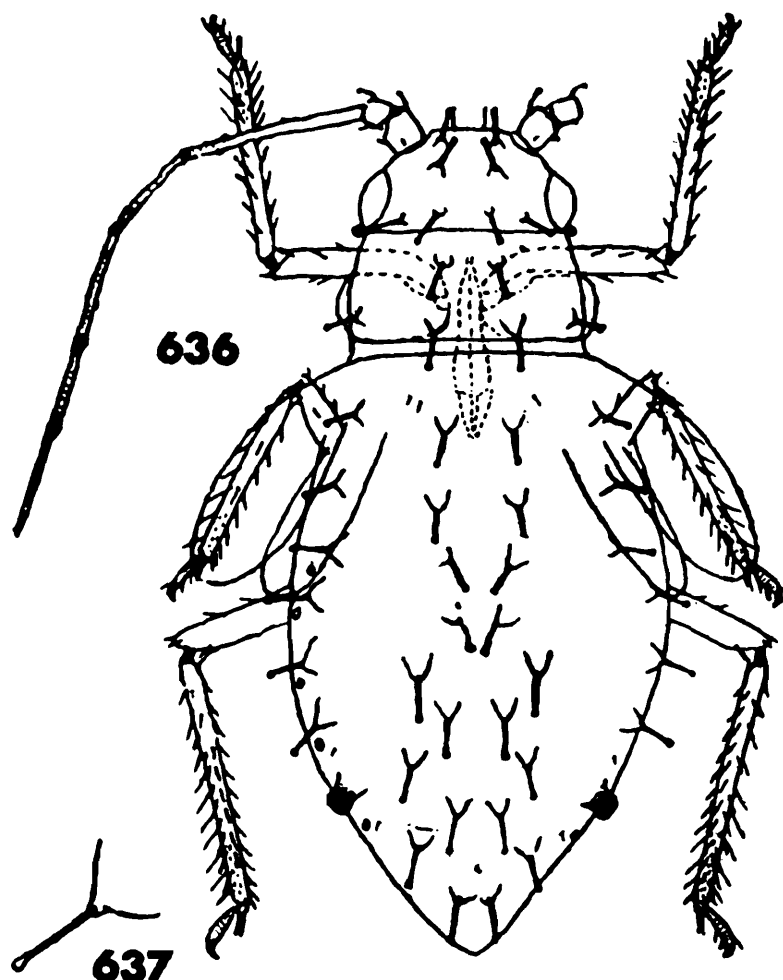
Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	1.93	0.82	1.38		
2.	1.60	0.69	1.60		
	Ant. segments				
	III	IV	V	VI	
					urs ht ₂
	0.50	0.29	0.30	(0.19+0.21)	0.09 0.09
	0.50	0.30	0.27	(0.18+0.23)	0.08 0.08

(1, ex *Duabanga sonnaritoides*, Singtam, Sikkim, 24.xii.1970 ;
2 ex undet. Leguminosae, Kalimpong, W.B., 26.xii.1969).

Alatoid nymph.—Frontal tubercles poorly developed. On vertex, discal hairs with capitate or funnel-shaped apices up to 0.060 mm



Tinocallis himalayensis A. K. Ghosh, M. R. Ghosh & Raychaudhuri. 636-637, alate nymph : 636, body ; 637, lateral abdominal process.

long, $1.5\times$ as long as the basal diameter of antennal segment III and $0.75\times$ as long as antennal segment I. Antennal segment I and II each with a single capitate hair 0.033-0.036 mm long, other hairs on antennae short, fine and acute at apices ; processus terminalis $1.2\times$ as long as base of segment VI. Rostrum reaches near midcoxae, ultimate rostral segment with 5-6 accessory hairs. Thoracic nota 2-3 and abdominal tergites 1-7 each with a pair of spinal hairs and a pair of marginal hairs arising from cone-shaped processes, except for marginal hairs of tergites 5-7 ; spinal hairs on 3rd, 5th and 7th tergite laterally displaced ; dorsal hairs with capitate or funnel-shaped apices, 0.065-0.078 mm long ; but marginal hairs on tergites minute (0.04 mm long), those on 6th very near to the base of siphunculi. Siphunculi short, smooth without a distinct flange, as long as antennal segment I. Forecoxae enlarged, first tarsal segments only with 5-6 ventral hairs ; empodials flabellate.

Measurements in mm.—

Length		Width		Antenna	
1.78		0.79		1.24	
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.57	0.20	0.20	(0.17+0.19)	0.09	0.08

(ex *Duabanga sonnaritoides*, Singtam, Sikkim, 24.xii.1970)

Apterous oviparous female.—Body elongate oval, 1.3-1.5 mm long with 0.67-0.69 mm as maximum width. Head dark brown on frons and bears 8 stout capitate hairs arising from short processes which may be up to $2.5\times$ as long as the basal diameter of antennal segment III. Antennal segment III nearly equal to the length of segments IV+V taken together ; processus terminalis $1.1\times$ as long as base of segment VI and $0.50\times$ as long as segment III. Thoracic nota 2 and 3 and abdominal tergites 1-7 each with one pair of hair-bearing spinal processes, the ones on 3rd, 5th and 7th being laterally displaced ; besides a pair of marginal processes bearing a single capitate hair present on thoracic terga and abdominal tergites 1-4 ; dorsal hairs similar to those on head. Siphunculi dark brown, $0.04-0.045\times$ as long as the body. Subanal plate rounded. Hind tibiae with 9-13 pseudosensoria on basal 0.50 portion. Otherwise as in alate viviparous female.

Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
1.38		0.69		1.31	
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.41	0.20	0.23	(0.18+0.20)	0.08	0.08

(ex undet. Leguminosae, Dongra, Kalimpong, W.B. 26.xii.1969).

Material examined.—8 alate viviparous females and 2 alatoid nymphs from *Duabanga sonnaritoides*, Singtam, Sikkim, India, 24.xii.1970, coll. M.R. Ghosh (N.Z.C.); one alate viviparous female and two apterous oviparous females from a plant of Leguminosae, Dongra, Kalimpong, West Bengal, India 21.xii.1969 (holotype and paratype) (C.U. Coll.).

Discussion.—The pigmented wing veins, absence of radial sector, relatively long processus terminalis, short spinal tubercles on head, thorax and abdomen, spinulose striae on the ventral side of siphunculi and occurrence of wax gland pores makes the species distinguishable from others. It has been recorded only from Sikkim and Darjeeling, Himalaya, during winter months. This species is probably identical with *T. khonkaenensis* Danielsson & Robinson from *Lagerstroemia*. An examination of the types of the latter species has shown that fusion of sclerotic bases of spinal processes on abdominal tergite 2, which may be seasonal variation, is the only difference against *T. himalayensis*. Also Dutta & Agarwala (Study report 1978) mention Lythraceae as host for *T. himalayensis*.

Distribution.—India : West Bengal, Sikkim.

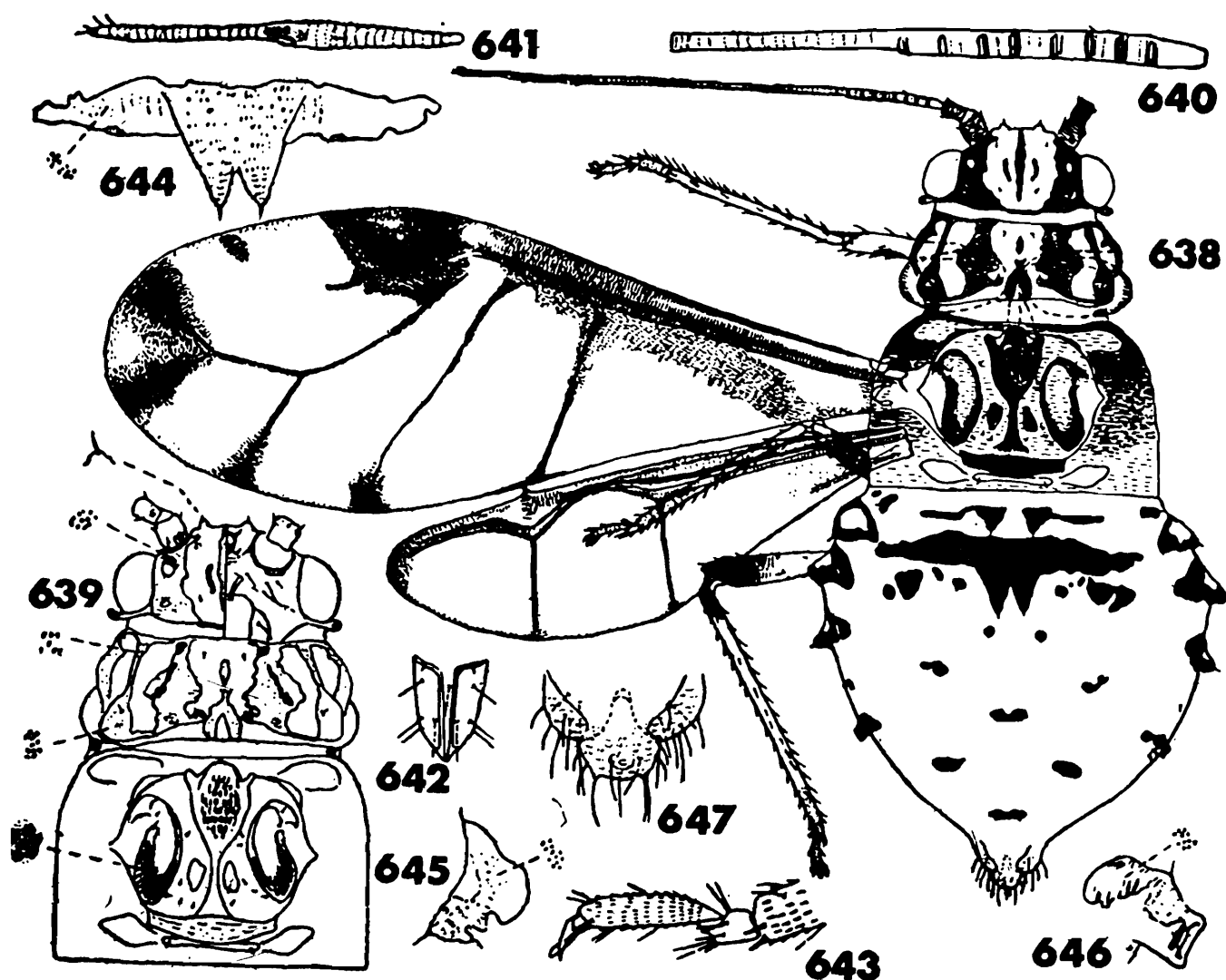
Types.—Deposited in the collections of Entomology Department of Zoology, University of Calcutta, Calcutta, India.

46. *Tinocallis kahawaluokalani* (Kirkaldy)
(Figs. 638-649)

1907. *Myzocallis kahawaluokalani* Kirkaldy, G. W., *Proc. Hawaii. ent. Soc.*, 1 : 101.
1920. *Monellia lagerstroemiae* Takahashi, R., *Zool. Mag., Tokyo* 378 : 118.
1921. *Callipterus kahawaluokalani*, Takahashi, R., *Agric. Exp. St. Formosa, spec. Exp.* 20 : 74.
1922. *Sarucallis lythrae* Shinji, G. O., *Dobuts zasshi*, 34 (496) : 731.
1957. *Tinocallis kahawaluokalani*, Börner, C. and Heinze, K. In Sorauer, *Handb Pflkrankh.* 5 : 85.
1961. *Myzocallis kahawaluokalani*, Basu, A. N., *Curr. Sci.* : 30 : 390.

1963. *Sarucallis kahawaluokalani*, Tao, Charles, Chia-chu, *Sc. Yb. Taiwan Mus.*, 6 : 68.
1967. *Tinocallis kahawaluokalani*, Richards, W. R., *Can. Ent.* 99 (5) : 540.
1972. *Tinocallis kahawaluokalani*, Higuchi, Hiromichi, *Ins. matsum.*, 35(2) : 41.
1970. *Sarucallis kahawaluokalani*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*: 386.
- 1978 (1975). *Tinocallis kahawaluokalani*, Chakrabarti, S. and Raychaudhuri, D. N. *Proc. zool. Soc. Calcutta*, 28 : 94.
1984. *Sarucallis kahawaluokalani*, Agarwala, Basant, K. and Ghosh, A. K., *Rec. zool. Surv. India, Misc. Publ., Occ. Paper*, 50 : 26.

Alate viviparous female.—Body stout, 1.6-1.8 mm long with 0.65-0.75 mm as maximum width. Head with a distinct pigmented pattern of 3 longitudinal stripes. Frontal tubercles poorly developed, anterior discals of head on two small processes. Dorsal cephalic hairs acute, 0.013-0.016 mm long, $0.50-0.55\times$ as long as the basal diameter of antennal segment III. Antennae pale, with segment I and II and apices of segments III-V as well as middle of segment VI dark, $0.68-0.70\times$ as long as the body ; flagellum gradually more strongly imbricated apicad ; segment III with 6-8 narrow elliptical secondary rhinaria ; processus terminalis about equal to base of segment VI. Rostrum reaches near mid-coxae, ultimate rostral segment subequal or equal to the second segment of hind tarsus and bears 2-5 accessory hairs. Pronotum with brown stripes and one pair of marginal and 2 pairs of spinal hairs not on processes, of similar length as discal hairs. Meso- and metathorax mottled, dark brown. Abdominal dorsum pale, bearing 4 pairs of brown, sclerotic lateral processes on each of tergite 1-4 and a pair of spinal processes on each of 1st and 2nd tergites, those of the 2nd tergite are the largest ; spinal hairs of abdominal tergites 3-8 on small dark sclerites ; in addition, dark sclerotic spots developed in pleural region of abdominal tergites 1-3, of which those of tergite 2 are fused with the processes to form a dark sclerotic transverse band (as shown in the figure). Integument of processes spinulose and with minute wax gland pores. Hairs on dorsum of abdomen acute, spinal hairs on 3rd, 5th and 7th tergite placed much further apart than others ; marginal hairs



Tinocallis kahawaluokalani (Kirkaldy). 638-647, alate vivipara : 638, body ; 639, head and thoracic nota ; 640, antennal segment III ; 641, antennal segment VI ; 642, apical rostral segment ; 643, hind tarsus ; 644, spinal processes of abdominal tergite II ; 645, lateral abdominal process ; 646, siphunculus ; 647, cauda and anal plate.

one pair per tergite, present on processes of tergites 1-4. Siphunculi dark, small, truncate without any hair appended to the base. Cauda knobbed, bearing 8-10 hairs. Subanal plate indented, each lobe with 7-8 hairs. Legs with fore coxae enlarged, pale, except dark apical part of middle and hindlegs ; first tarsal segments with 5 ventral and two dorsal hairs. Wings strongly pigmented, dark over stigmal and costal areas and the wing base, sometimes dark spots on tips of media and 1st cubital vein may be present.

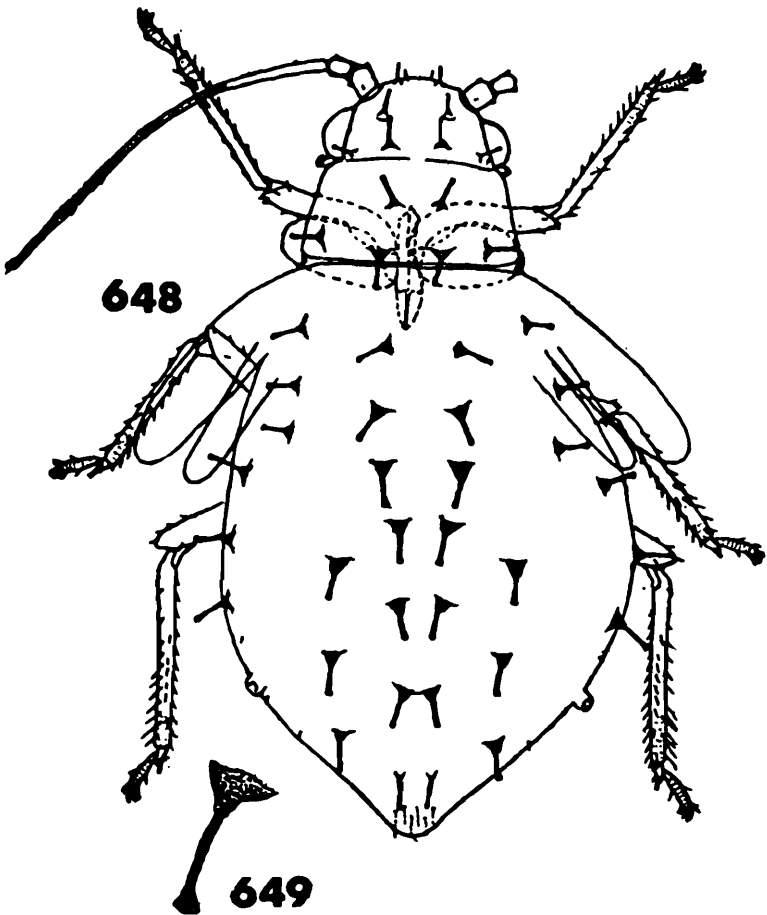
Colour.—Pale with dark markings.

Measurements in mm.—

	Length	Width	Antenna			
1.	1.65	0.75	1.10			
2.	1.60	0.69	1.10			
	Ant. segments			urs	ht ₂	Siph.
III	IV	V	VI			
0.34	0.23	0.21	(0.09+0.10)	0.065	0.065	0.03
0.35	0.23	0.20	(0.10+0.10)	0.070	0.078	0.04

(1, 2, ex *Lagerstroemia indica*, Dibrugarh, Assam, 12.xi.1969 N.Z.C.).

Alatoid nymph.—Body pale, 1.60 mm long with 0.82 mm as maximum width. Frontal tubercles poorly developed ; dorsal cephalic hairs (10) capitate, longest 0.065 mm long, all arising



Tinocallis kahawaluokalani (Kirkaldy). 648-649, alatoid nymph : 648, body ; 649, spinal abdominal hair.

from cone-shaped bases. Antennae 6-segmented ; hairs on flagellum inconspicuous. Rostrum reaches little beyond fore coxae, ultimate rostral segment (0.065 mm) equal to second segment of hind tarsus and bears 2-3 accessory hairs. Each of thoracic tergites and abdominal tergites 1-4 with a single marginal hair on each side ; spinal abdominal hairs and also marginal hairs except on tergites 5-7 thick, capitate, spinal hairs of tergites 3, 5 and 7 laterally displaced. Siphunculi pale, small, smooth. Cauda and anal plate rounded.

Colour.—Pale with dark sclerotic bases of hairs.

Measurements in mm.—

Length		Width		Antenna	
1.60		0.82		0.87	
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.23	0.23	0.15	(0.10+0.10)	0.065	0.68

(ex *Lagerstroemia indica*, Dibrugarh, Assam, 12.xi.1969, N.Z.C.).

Embryo (from Richards, 1967).—Dorsum with one pair each of long capitate marginal hairs on thorax and abdominal tergites 1-5 and one pair of similar spinal hairs on all segments, except abdominal tergite 1 where these are minute, those on 3rd, 5th and 7th laterally displaced ; marginal hairs of abdominal tergites 5-7 minute, pointed.

Material examined.—Six alate viviparous females and one alatoid nymph from *Lagerstroemia indica*, Dibrugarh, Assam, India, 12.xi.1969, coll. H. Banerjee, N.Z.C.

Discussion.—This species is widespread in the distribution range of its host plant *Lagerstroemia indica* and can easily be identified by the combination of morphological characters and colour pattern of head, pronotum and wings.

Distribution.—India : West Bengal, Assam, Kerala ; Formosa ; Japan ; Hawaii ; North America.

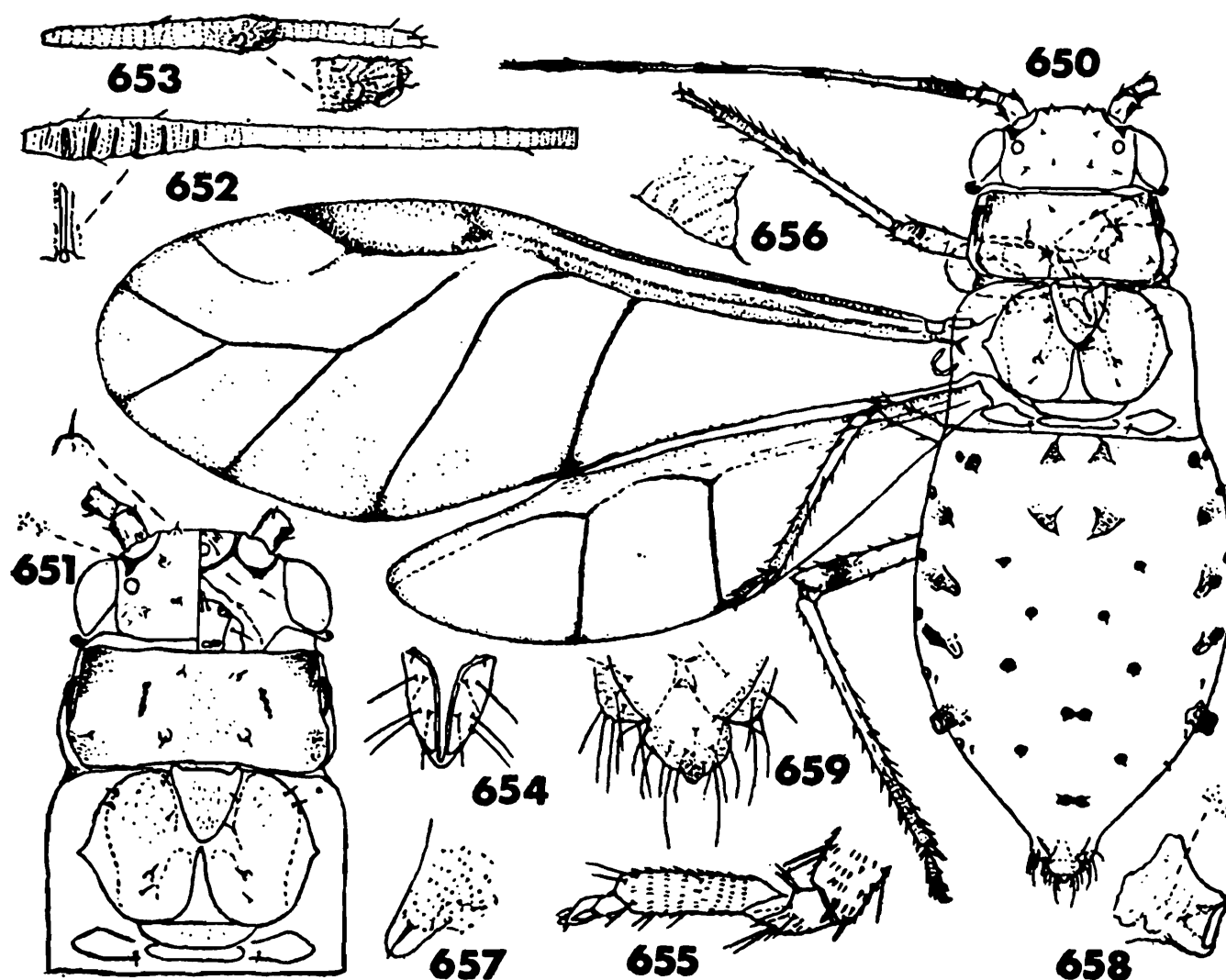
Types.—Smith and Parron (1978) in the annotated list of Aphididae of North America, listed the species under *Sarucallis* Shinji, 1922 and mentioned Honolulu, Oahu, Hawaii as “Type locality” but did not indicate the location of type.

47. *Tinocallis magnoliae* A. K. Ghosh & Raychaudhuri
(Figs. 650-661)

1977. *Tinocallis magnoliae* Ghosh, A. K. and Raychaudhuri, D. N. *Orient. Insects*, 6(3) : 379.

1980. *Tinocallis magnoliae*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C., Ghosh, A. K., *In Aphids of North East India and Bhutan*, 308.

Alate viviparous female.—Body 1.7 mm long with 0.62 mm as maximum width. Head pale, with 1 pair of anterior discals on short processes. Antennae 6-segmented, pale, except a spot on basal third of segment III, apices of segment I-V and middle of VI which are dusky, spinulose, and shorter than the body ; hairs on flagellum minute, sparse ; segment III with 5-6 narrow transverse almost linear secondary rhinaria which are almost occupying half the circumference of the segment ; processus terminalis $0.55\times$ as long as base of segment VI. Rostrum reaches little beyond forecoxae, ultimate rostral segment shorter than second segment of hind tarsus and bears 4 secondary hairs. Abdominal dorsum pale except for hair-bearing processes of sclerites which are brown ; spinal hairs one pair each per segment ; those on 3rd, 5th and 7th tergite laterally displaced ; spinal hairs on 1st and 2nd tergite on a pair of fingerlike process, the remainder on small dark sclerotic spots ; marginal hairs one pair on each tergite, those on tergites 1 and 2 arising from spinulose mammi-form elevations, those on 3rd-4th, arising from short, finger-shaped processes ; dorsal hairs 0.010-0.013 mm long, stiff, acute or bluntish. Siphunculi brown, truncate, nearly smooth, hardly $0.03\times$ as long as the body. Cauda pale brown, distinctly knobbed and bearing 8-10 hairs. Subanal plate bilobed, each lobe with 6-7



Tinocallis magnoliae A. K. Ghosh & Raychaudhuri. 650-659, alate vivipara : 650, body ; 651, head and thoracic nota ; 652, antennal segment III ; 653, antennal segment VI ; 654, apical rostral segment ; 655, hind tarsus ; 656, spinal abdominal process ; 657, lateral abdominal process ; 658, siphunculus ; 659, cauda and anal plate.

hairs. Legs with forecoxae enlarged ; apical 0.25 portion of tibiae densely spinulose. Forewings with margin of pterostigma and tips of veins dusky.

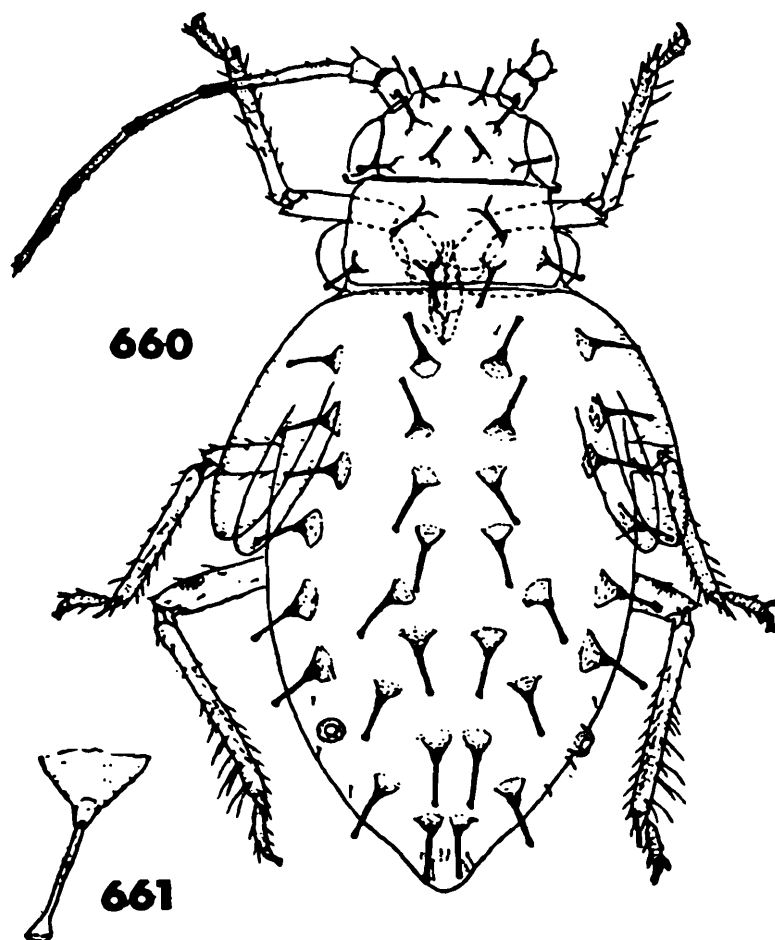
Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna	Ant. segments				urs	ht ₂
			III	IV	V	VI		
1.70	0.62	1.05	0.37	0.21	0.18	(0.11+0.06)	0.06	0.07

(ex *Magnolia* sp., Shillong, Meghalaya, 7.vii.1970).

Alatoid nymph.—Frontal tubercles poorly developed. Vertex with discal hairs on cone-shaped processes. Discal hairs stout, capitate, 0.066 mm long, $1.65\times$ as long as basal diameter of antennal segment III. Antennae 6-segmented, shorter than body, finely spinulose ; hairs on flagellum minute, 0.008 mm long, sparse, hardly $0.25\times$ as long as the basal diameter of antennal segment



Tinocallis magnoliae A. K. Ghosh & Raychaudhuri. 660-661, alatoid nymph : 660, body ; 661, spinal abdominal process.

III. Ultimate rostral segment with 6 hairs. Dorsal hairs of body capitate, arising from pale brown cone-shaped processes, of similar length as those on vertex, spinal hairs on 3rd, 5th and 7th tergite laterally displaced. Legs pale, hind femora may be infuscated sub-apically, forecoxae enlarged ; apices of tibiae and whole of tarsi ; spinulose ; first tarsal segment with 5-6 ventral hairs ; arolia flabellate.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Antenna	Ant. segments				urs	ht ₂
			III	IV	V	VI		
1.25	0.48	0.83	0.28	0.14	0.14	(0.09+0.06)	0.06	0.06

(ex *Magnolia* sp., Shillong, Meghalaya 7.vii.1970).

Material examined.—One alate viviparous female (holotype) and one alatoid nymph (paratype) from *Magnolia* sp., Shillong, Meghalaya, India, 7.vii.1970, coll. S. Sarkar (C.U. Coll.).

Discussion.—The species appears very rare in occurrence and distribution. The host association appears unusual but finding of both alate adult and nymph indicates the plant as an accepted host. This aphid can be separated from other endemic species by the key. It can be separated from *T. ulmifolii* (Monell), to which it appears very close (following the key provided by Richards, 1967), by absence of small spinal processes on the mesonotum, by the ratio of antenna to body, processus terminalis to base of segment VI, the shorter apical rostral segment, dusky base of antennal segment III and very narrow, not oval secondary rhinaria and also by absence of mottling on vertex and pronotum. *T. magnoliae* is almost indistinguishable from *T. insularis* (Takahashi) from which it may be separated by the more narrow shape of the secondary rhinaria and a more cylindrical siphunculus.

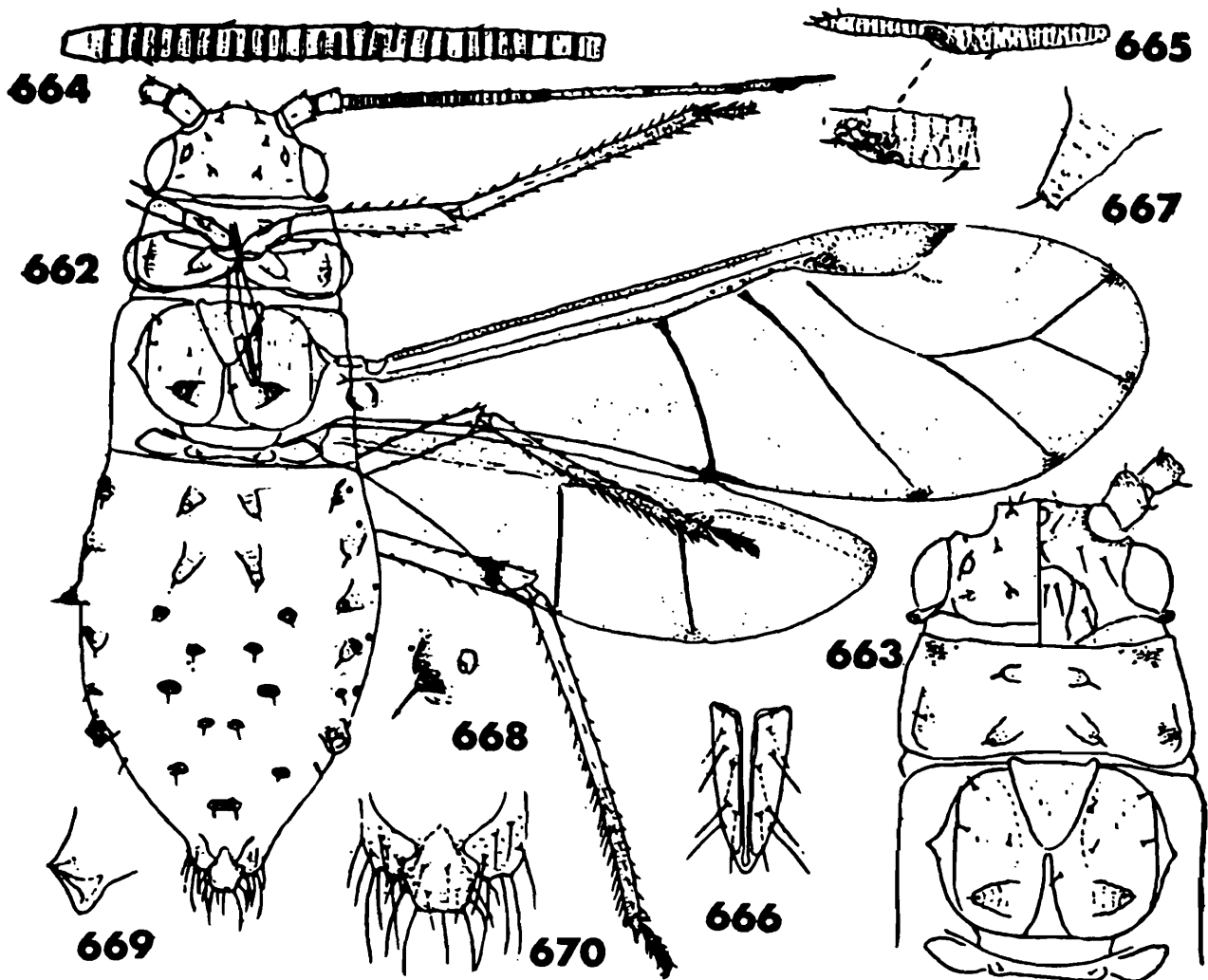
Distribution.—India : Meghalaya (Shillong).

Types.—In the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India.

48. ***Tinocallis nevskyi*** Remaudière & Quednau
(Figs. 662-670)

1988. *Tinocallis nevskyi* Remaudière, G and Quednau, F.W., *Can. Ent.* 120 : 211.

Alate viviparous female.—Body 1.5 mm long with 0.59 mm as maximum width. Head pale, epicranial suture weakly indicated. Hairs on vertex about 0.015 mm long, placed on very low elevations



Tinocallis nevskyi, alate vivipara : 662, body ; 663, head and thoracic nota ; 664, antennal segment III ; 665, antennal segment VI ; 666, apical rostral segment ; 667, spinal abdominal process ; 668, lateral process of abdominal tergite I with stigma ; 669, siphunculus ; 670, cauda and anal plate.

of which the posterior spinal one is the largest. Antennae 6-segmented, pale except for apices of segments III-V and the middle of VI which are dusky, spinulose and shorter than the body ; hairs on flagellum minute, sparse ; segment III with 27-28 narrow transverse almost linear secondary rhinaria arranged over the whole length of segment ; processus terminalis $0.65\times$ as long as base of segment VI. Rostrum reaches between fore and middle coxae, ultimate rostral segment equal to second segment of hind tarsus and bears 6 secondary hairs. Pronotum pale with lateral lobes weakly infuscated and with 2 pairs of finger-like spinal processes of which the longest is as long as antennal segment II ; mesonotum pale with one pair of finger-like spinal processes as

long as antennal segment I. Abdominal dorsum pale except for hair-bearing processes or sclerites which are brown ; spinal hairs paired, arranged segmentally, those on 3rd, 5th and 7th tergite laterally displaced, on small dark sclerotic spots ; marginal hairs one pair on each tergite, those on tergites 1-4 arising from mammiform or short finger-like processes ; dorsal abdominal hairs stiff, acute, as long as the hairs on vertex. Siphunculi weakly infuscated, smooth, $0.03\times$ as long as the body. Cauda pale, knobbed and bearing 12 hairs. Subanal plate bilobed, each lobe with 7-8 hairs. Legs with fore coxae enlarged, apical 0.25 portion of tibiae densely spinulose. Forewings with margin of pterostigma and tips of veins dusky.

Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
1.54		0.59		1.08	
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.42	0.20	0.18	(0.11+0.08)	0.10	0.09

(ex unknown host, Bhowali, U.P. 24.v.1969, S. Chakrabarti coll., U. of Kalyani Coll.).

Material examined.—One alate viviparous female from unknown host, Bhowali, U.P. India, 24.v.1969, coll. S. Chakrabarti, U. of Kalyani Coll.

Discussion.—This species resembles *T magnoliae* Ghosh and Raychaudhuri but is easily distinguished from the latter in having more secondary rhinaria on antennal segment III, by a longer ultimate rostral segment and presence of fingerlike processes on pronotum and mesonotum (in *T magnoliae* processes on pro- and mesonotum only short mammiform elevations, not longer than their basal width). The present species also resembles *T saltans* (Nevsky) but the latter species has a more extended bordering of

the apical sections of the wing veins and less linear, more narrow oval secondary rhinaria.

Distribution : India : Uttar Pradesh.

Genus 29. *Tinocalloides* A.N. Basu 1970

1970. *Tinocalloides* Basu, A. N., *Orient. Insects*, 3 : 367 ; Quednau, F. W., 1973. *Can. Ent.*, 105 : 223 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980. *In Aphids of North East India and Bhutan*, 308. Type species ; *Tinocalloides montanus* A. N. Basu.
1970. *Tuberdefectus* Kumar, R. and Lavigne, R., *Pan. Pacif. Ent.* 46 : 120
Type species : *Tuberdefectus eastop* Kumar and Lavigne.

Morphology.—Body elongate 2.0-2.3 mm long. Head with poorly developed frontal tubercles ; median suture absent in alate vivipara ; dorsal cephalic hairs fine, shorter than basal diameter of antennal segment III. Antennae 6-segmented, shorter than body ; secondary rhinaria narrowly oval, not ciliated, restricted to antennal segment III ; primary rhinaria large, elongate oval and ciliated ; hairs on flagellum fine, less than half the basal diameter of segment III ; processus terminalis subequal to base of segment VI. Eyes large with ocular tubercles. Rostrum hardly reaches midcoxae, ultimate rostral segment shorter than second segment of hind tarsus and bears 4 accessory hairs. Abdominal dorsum pale, with segmentally separated spinopleural sclerites on 1st—7th tergites ; marginal hairs single, on sclerites bearing a small raspberry like process, specially on 2nd-4th tergites ; spinal hairs on 7th and 8th decidedly longer than others, those on 8th being longest and varying between 4-6 in number. Siphunculi short, truncate, arising from lateral sclerites on 6th tergite with a hair appended to apical part. Cauda short, constricted. Subanal plate bilobed. Rudimentary gonapophyses indistinct. Legs with forecoxae somewhat elongated, trochanters elongate and sclerotised ; apices of tibiae and whole of tarsi spinulose ; apical tibial hairs differentiated ; first tarsal segments with 5 ventral and 2 dorsal hairs ; empodial hairs flattened at apices. Wing venation normal, forewings with media twice branched, hind wings with both obliques.

Embryos with short capitate dorsal hairs but spinal hairs on 7th and 8th tergite distinctly longer than others ; spinal hairs on 7th shifted latera ; pleural hairs absent ; marginal hairs single, those on 6th and 7th tergite smaller.

Oviparae apterous, smaller in size (± 1.75 mm). Dorsal hairs stout, capitate, arranged in rows. Flagellum spinulose, hairs on flagellum minute, fine. Ultimate rostral segment with 4-6 accessory hairs. Cauda tongue shaped. Subanal plate rounded. Hind tibiae with 35-65 small roundish pseudosensoria.

Males alate, smaller in size. Secondary rhinaria round to oval, present on antennal segments III-IV. Genitalia dark, sclerotic. Otherwise similar to alate viviparae.

Discussion.—This is a monotypic genus endemic to the Indo-Nepal region. The only member *montanus* Basu, 1969 was originally described from Darjeeling-Himalaya and later recorded under the name *Tuberdefectus eastopi* Kumar and Lavigne from Simla Hills and subsequently collections from Nepal were identified as belonging to the same species by Quednau (1973). The genus is peculiar among related genera of "Appendisetines" of Richards in being associated with Rosaceae. Quednau (op. cit.) opined that this genus, in having wax pores on appendages, somewhat elongate front coxae and spinal hairs of only 7th tergite being displaced, appears closer to *Cranaphis* Takahashi rather than to *Tinocallis*, which has enlarged fore coxae, no wax pores on appendages and characteristic displacement of spinal hairs of 3rd, 5th, and 7th tergite.

Basu (1969) described in details the alate vivipara, apterous ovipara and alate male of the type species *montanus*. Quednau (1973), redescribing the ovipara and alate vivipara, also described the alatoid nymph and first instar larva; Raychaudhuri et. al. (1980) while discussing the genus mentioned the characters of embryo (p. 309).

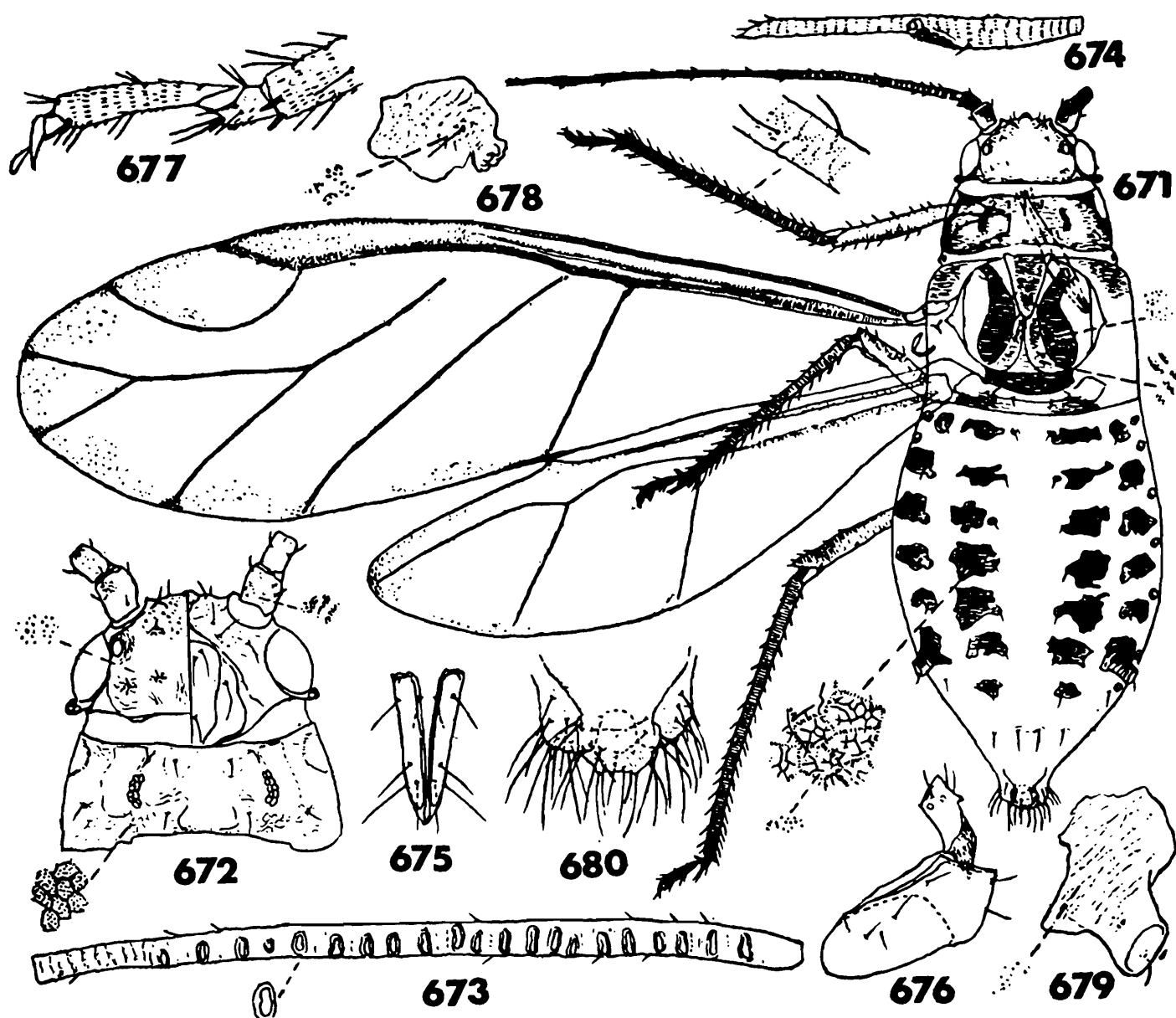
Biology.—The only species *montanus*, leads a holocyclic life cycle on *Prunus* sp. in the region. While viviparae have been recorded in preautumn months, sexuales have been noted during December to February. Details on the biology remain unknown. Although Basu (1969) mentions that sexuparae migrate from middle of November and the species seems to leave its 'primary host' in early March it has been recorded even during August on *Prunus* sp. and seems to be autoecious on the same.

Type species.—*Tinocalloides montanus* Basu, 1969. Deposited in the collections of Dr. A.N. Basu., IARI, New Delhi.

49. *Tinocalloides montanus* Basu, 1969
(Figs. 671-690)

1969. *Tinocalloides montanus* Basu, A. N., *Orient. Insects*, 3 : 367.
1970. *Tuberdefectus eastopi* Kumar, R. and Lavigne, R., *Pan Pacific Ent.* 46 : 120.
1974. *Tinocalloides montanus*, Ghosh, M. R., Ghosh, A. K., Raychaudhuri D. N., *Proc. zool. Soc. Calcutta*, 24 : 50.
1980. *Tinocalloides montanus*, Raychaudhuri, D. N., Chakrabarti S. Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 309.
1984. *Tinocalloides montanus*, Agarwala, Basant, K. and Ghosh A. K., *Rec. zool. Surv. India, Misc. Publ., Occ. Paper*, 50 : 27.

Alate viviparous female.—Body elongate oval, about 2.10-2.60 mm long with 0.75-1.0 mm as maximum width. Head pale brown, scabrous ; anterior discal hairs on a pair of very low elevations ; dorsal cephalic hairs fine, 0.016-0.023 mm long, $0.50-0.66\times$ ($-1.0\times$) as long as the basal diameter of antennal segment III. Antennae 6-segmented, uniformly brown, $0.72\times$ as long as the body ; flagellum distinctly imbricated except basal part of segment III which is faintly imbricated ; hairs on the flagellum sparse, minute, with acute apices, less than $0.50\times$ as long as the basal diameter of segment III ; antennal segment III with 12-24 transversely oval to narrow elliptical secondary rhinaria arranged in a row ; processus terminalis a little longer than base of antennal segment VI. Rostrum reaches near midcoxae, ultimate rostral segment elongate triangular, a little shorter than second segment of hind tarsus and bears 4-6 accessory hairs. Abdominal dorsum pale, bearing on each tergite a pair of marginal and a pair of spinopleural, sclerotic patches (on tergites 1-7) besides smaller marginal sclerites on tergites 1-5, the integument of which shows fine reticulations of scabrous to spinulose sculpturing ; all sclerites with clusters of minute wax gland pores similar to those on head and appendages. Dorsal abdominal hairs acute, arranged as one pair each on spinopleural sclerites 1-7 and one pair each on the marginal sclerites, usually as long as the dorsal cephalic hairs, but on 7th tergite up to 0.036 mm long and 8th tergite with 2-6 hairs up to 0.062 mm long, the latter being $2.0\times$ as long as the basal diameter of antennal segment III. Siphunculi dark brown, truncate, fused with the marginal sclerites of tergite 6, with a hair



Tinocalloides montanus A. N. Basu. 671-680, alate vivipara : 671, body ; 672, head and pronotum ; 673, antennal segment III ; 674, antennal segment VI ; 675, apical rostral segment ; 676, fore coxae ; 677, hind tarsus ; 678, lateral abdominal process ; 679, siphunculus ; 680, cauda and anal plate.

appended latero-subapically. Cauda short, knobbed, paler than siphunculi and bears 11-17 long hairs. Subanal plate bilobed, each lobe bearing 9-11 hairs. Rudimentary gonapophyses indistinct : gonchaetae in two groups. Legs with apices of tibiae and tarsi dusky ; forecoxae weakly enlarged, tronchanters prolonged and sclerotised ; tibial hairs pointed, up to equal to the width at middle of tibiae ; apices of tibiae spinulose ; first tarsal segments with 5 ventral and 2 dorsal hairs ; empodial hairs flattened. Wing venation normal.

Colour : Brown head and thorax, light yellow abdomen with pattern of blackish sclerites, in life.

Measurements in mm.—

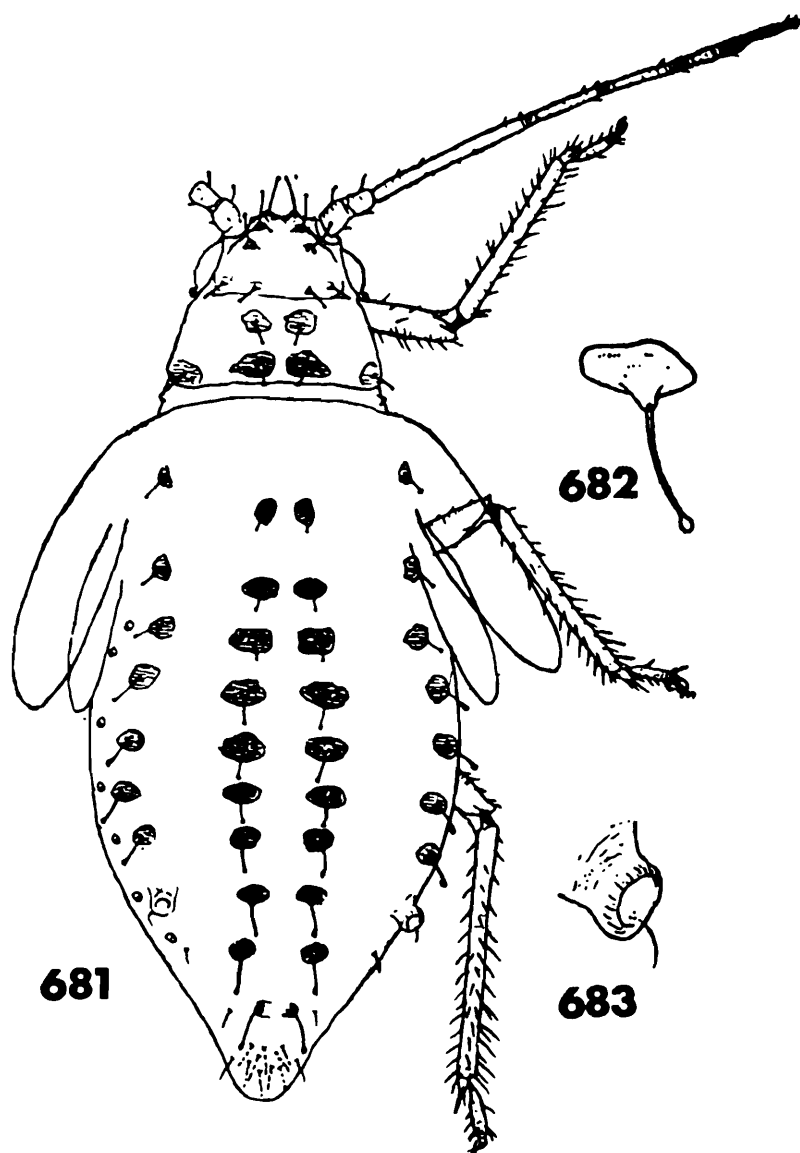
	Length	Width	Antenna		
1.	2.54	0.96	1.98		
2.	2.32	0.75	2.08		
3.	2.10	0.75	1.80		
	Ant. segments			urs	ht ₂
III	IV	V	VI		
0.75	0.34	0.30	(0.17+0.20)	0.14	0.15
0.75	0.39	0.34	(0.17+0.20)	0.12	0.14
0.71	0.33	0.29	(0.18+0.19)	0.12	0.13

(1,2,3, ex *Prunus* sp., Shillong, Meghalaya, 20.i.1976).

First instar.—Head without ventral hairs. Dorsum of body with spinal and marginal hairs ; pleural hairs absent ; all hairs with capitate apices ; hairs on frons and on 7th and 8th tergites longer than the other. Spinal hairs of abdominal tergite 7 laterally displaced ; marginal hairs of tergites 5 and 6 minute, pointed. Eyes of 3-5 facets. Ultimate rostral segment with 4 accessory hairs. Cauda with 2 hairs (after Quednau, 1973).

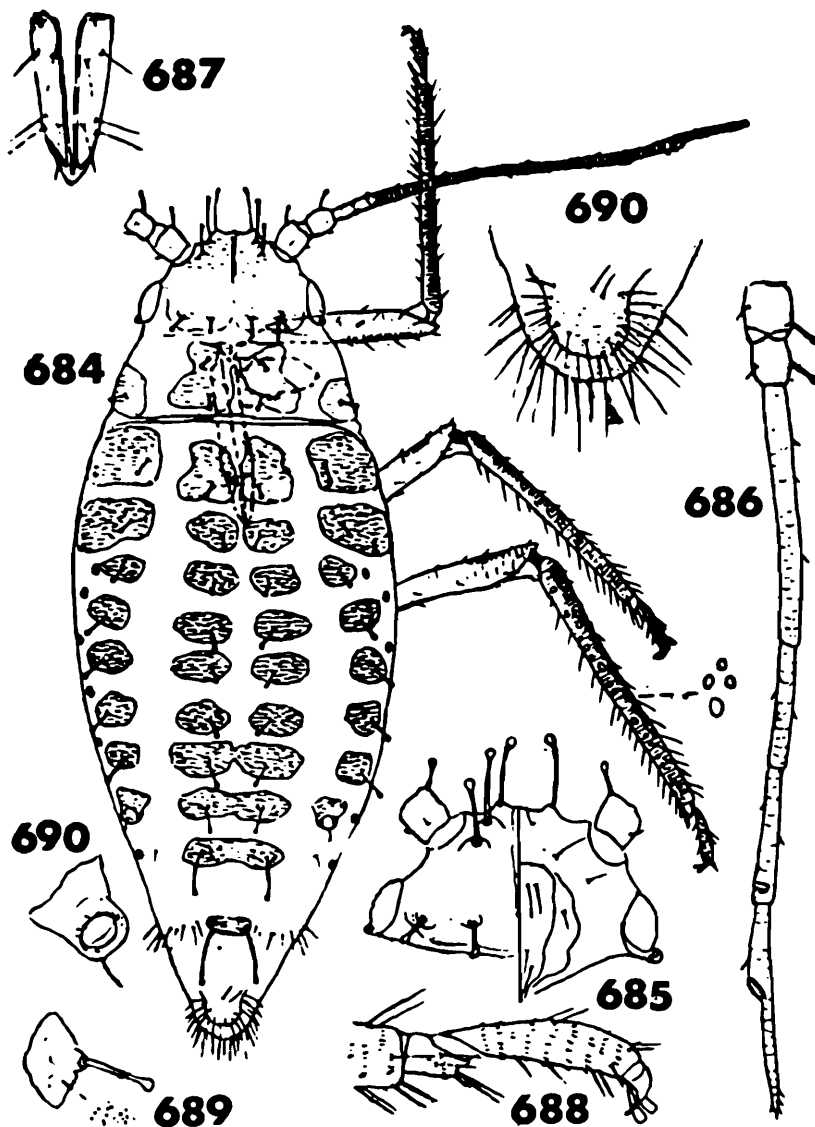
Alatoid nymph.—Frontal tubercles indistinct. Antennae 6-segmented ; segment III 0.433-0.456, IV 0.201-0.205, V 0.197-0.205 and VI 0.136+0.140 mm long. Rostrum reaches mid-coxae, ultimate rostral segment (0.110 mm) 0.85× as long as second segment of hind tarsus (0.133 mm) ; 8th tergite with 2 long capitate spinal hairs and 2 short, acute, marginal hairs (after Quednau, 1973), sometimes with only 2 long hairs.

Apterous oviparous female.—Body spindle-shaped, 1.5-1.7 mm long. Head without any evident frontal tubercles ; hairs on frons capitate, up to 3.0× as long as basal diameter of antennal segment III ; vertex with capitate hairs arising from very low elevations, up to 2.0-2.5× as long as the mentioned diameter. Antennae 0.91-1.05 mm long brown, about 0.54-0.63 as long as the body ;



Tinocalloides montanus A. N. Basu. 681-683, alatoid nymph ; 681, body ; 682, spinal abdominal hair ; 683, siphunculus.

segment I and II each with one capitate hair, up to equal to the basal diameter of segment III ; hairs on flagellum sparse, minute, fine, less than half the mentioned diameter ; flagellum with spinulose imbrication ; segment III 0.30-0.38, IV 0.13-0.16 mm, V 0.14-0.16 mm, VI 0.09-0.11+0.11-0.13 mm long ; secondary rhinaria absent ; processus terminalis slightly longer than base of segment VI. Rostrum reaches to midcoxae, ultimate rostral segment stout, blunt, 0.102 mm long, slightly shorter than second segment of hind tarsus (0.117 mm) and bears 4-6 accessory hairs. Pronotum and mesonotum each with 2 pairs and abdominal tergites 1-7 each with one pair of spinal hairs and a pair of marginal hairs, those of tergite 7 a little displaced laterally, the spinal hairs in-



Tinocalloides montanus A. N. Basu. 684-690, ovipara : 684, body ; 685, head ; 686, antenna ; 687, apical rostral segment ; 688, hind tarsus ; 689, lateral abdominal hair ; 690, cauda and anal plate.

creasing in length caudad ; 8th tergite with 2 long capitate hairs about as long as the frontal hairs and 18 short and acute hairs. Siphunculi truncate (0.05-0.06 mm long). Cauda (0.08 mm) without any constriction, tongueshaped with two dorsal hairs and at least 25-28 long fine marginal hairs. Subanal plate rounded, bearing about 40 hairs. Hind tibiae with 35-65 small pseudosensoria.

Colour.—Yellowish with dark brown sclerites in life.

Measurements in mm.—

Length		Width		Antenna	
1.61		—		0.92	
		Ant. segment		urs	ht ₂
III	IV	V	VI		
0.32	0.13	0.13	(0.11+0.12)	0.10	0.12

(ex *Prunus cerasus*, Kalimpong, W.B., 29.i.1964).

Alate male.—Body 1.61 mm long. Antennae nearly equal to the body (1.52 mm long) ; segment III with 23-25 elliptical secondary rhinaria, segment IV with 3-5, V with 6, VI with 3 round to oval secondary rhinaria arranged in a row ; processus terminalis (0.14 mm) $1.1\times$ as long as base of VI. Sclerotic pattern on dorsum of abdomen as in alate viviparae. Siphunculi 0.06 mm long, truncate. Cauda 0.08 mm long, constricted in the middle. Genitalia dark brown. Colour in life same as a late viviparae (after A. N. Basu, 1969).

Material examined.—6 alate viviparous females from *Prunus* sp. Shillong, Meghalaya, India, 20.i.1976 (N.Z.C.) ; many alate viviparous females and nymphs from *Prunus cerasus* Kalimpong, West Bengal, India. Dec.-Jan. 1965 and 1968-1972 ; one apterous oviparous female from *Prunus cerasus*, Kalimpong, West Bengal, India, 29.i.1965, coll. A.N. Basu.

Discussion.—The species leads an autoecious holocycle on *Prunus* in the temperate hill region of North West and Eastern India. Basu (1969), while describing the species from Kalimpong Hills, mentioned that migration of alate viviparous females (apparently thesexuparae) occurs towards middle of November and that sexuales are produced on the same host (*Prunus*). The species leaves the primary host in February or in early March. To date no secondary host has been found. The species has been recorded on several species of unidentified *Prunus* spp. besides on *Prunus cerasus*. Kumar and Lavigne (1970) while describing the species under *Tuberodefectus eastopi* (a synonym) from Simla Hills in North West India recorded it on wild peach during the last week of August,

alate males in the latter part of January and a population peak of alate viviparae in February ; all the morphs were found to feed near the midribs of the leaves forming dense colonies, which are often visited by ants. The species is restricted to the plants of the genus *Prunus* in both the areas of its occurrence, perhaps migrating from wild to cultivated plantations.

Distribution : India : Arunachal Pradesh, Manipur, West Bengal, Sikkim and Himachal Pradesh.

Types.—In the collection of State Agricultural Research Institute Calcutta, India and paratypes are deposited in the British Museum (Natural History), London, England ; types of *T. eastopi* Kumar and Lavigne are deposited in the British Museum (Nat. Hist.), London, England and four paratypes are in the personal collection of R. Kumar.

Genus 30. *Tuberculatus* Mordvilko 1894

1894. *Tuberculatus* Mordvilko, A. K., *Rab. Lab. zool. kab. Imp. varsh. Univ.*, 8(3) : 51 ; Richards, W. R., 1968. *Can. Ent.*, 100 : 561 ; Hille Ris Lambers, D., 1974 (1972). *Boll. zool. agr. Bachic.*, Ser II, 11 : 21 ; Higuchi, H., 1972. *Ins. matsum.*, 35(2) : 46 ; Stroyan, H. L. G., 1977. *Handbk. Ident. Br. Insects*, II 4(a) : 61 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., 1980. *In Aphids of North East India and Bhutan*, 311. Type species : *Aphis quercea* Kaltenbach.
1915. *Tuberculoides* van der Goot, P., *Beiträge zur Kenntnis der Holland. Blattläuse*, Haarlem, 31 : 2. Type species : *Aphis quercus* Kaltenbach (used as subgenus).
1917. *Acanthocallis* Matsumura, S., *J. Coll. Agric. Tohoku imp. Univ.*, 5 : 368. Type species : *Acanthocallis quercicola* Matsumura, (used as subgenus).
1965. *Pacificalis* Richards, W. R., *Mem. Ent. Soc. Can.*, 44 : 66. Type species : *Pacificalis columbiae* Richards (used as subgenus).
1974. *Camelaphis* Hille Ris Lambers, D., *Boll. zool. agr. Bachic.* (II) 11 : 24. Type species : *Tuberculatus cornutus* Richards (used as subgenus).
1974. *Orientuberculoides* Hille Ris Lambers, D., *Boll. zool. agr. Bachic.* (11) 11 : 23. Type species : *Myzocallis yokoyamai* Takahashi (used as Subgenus).

Morphology.—Body small (1.4 mm) to medium sized (3.0 mm). Frontal tubercles poorly to moderately developed. Head with

anterior discal hairs long and conspicuous or short but posterior discal hairs often shorter and sometimes inconspicuous, anterior discal hairs sometimes on processes. Antennae 6-segmented, subequal to length of body ; secondary rhinaria roundish, not ciliated, restricted to antennal segment III , hairs on flagellum may be short, fine and inconspicuous or up to two times as long as basal diameter of segment III ; processus terminalis usually distinctly longer than base of segment VI. Pronotum at least with 2 pairs of spinal hairs and 1-2 pairs of marginal hairs and with one or more lateral papillae and often also with spinal hairs on processes. Rostrum hardly reaches midcoxae, ultimate rostral segment shorter or longer than second segment of hind tarsus and with accessory hairs. Meso-and meta-thorax sometimes with paired spinal tubercles. Dorsum of abdomen always with paired spinal processes and often with marginal processes which may be small, but bearing hairs of which some are often right at the apex of processus. Dorsal spinal processes may be large, fingerlike bifid or otherwise. Hairs on the dorsum of abdomen usually arranged in sparse transverse rows or in clusters ; 8th tergite with 5-7 hairs. Siphunculi without any hair appended to base, but lateral sclerite may sometimes be fused with siphunculus. Cauda knobbed. Subanal plate bilobed. Rudimentary gonapophyses 2. Legs normal, variably pigmented on femora and tibiae, may be spinulose apically as also tarsi ; apical hairs of fore tibia differentiated as spines ; first tarsal segments with 5-7 ventral hairs and 2 dorsal hairs ; Empodial hairs flattened. Wing venation normal, forewings with media twice branched, hindwings with both obliques ; pterostigma may be pigmented and often cubitus bordered with brown and apices of veins may be with dusky spots.

Embryos with dorsal and lateral hairs pointed or capitate, spinal hairs arranged in parallel rows. First instar nymph may be with long hairs on frons and on 8th tergite.

Oviparae apterous ; spinal elevations reduced to low bosses. Secondary rhinaria mostly suppressed on segment III. Dorsal hairs acute or slightly capitate. Cauda semioval. Subanal plate rounded. Hind tibiae with numerous pseudosensoria. Subventral wax gland area near siphunculi absent.

Males alate. Secondary rhinaria present on antennal segment III-V and base of segment VI. Dorsum of abdomen may be with dark sclerotic bands and sclerites or these may be absent. Dorsal and lateral processes much reduced. Wings may be less pigmented than in alate viviparae. Cauda knobbed. Genitalia well developed.

Discussion.—This is perhaps one of the largest genus under Drepanosiphinae with 43 species, now recognised under 7 subgenera viz. *Tuberculatus* Mordv., 1894 (2), *Acanthocallis* Mats. 1917 (5), *Camelaphis* Hille Ris Lambers, 1974 (3), *Orienttuberculoides* Hille Ris Lambers, 1974 (11 species and 3 subspecies), *Pacificallis* Richards, 1985 (7), *Tuberculoides* van der Goot, 1915 (12) and *Toltecallis* Remaudière and Quednau, 1983 (3). Hille Ris Lambers (1972) has provided an extensive key to the species along with a key to the five of the seven subgenera. Besides separating the subgenera on morphological basis, a characteristic distribution range can also be used viz.

<i>Tuberculatus</i> S. Str.	: European Species
<i>Pacificallis</i>	: Western North American Species
<i>Tuberculoides</i>	: European, Mediterranean, Near Eastern, may be introduced to other countries
<i>Orienttuberculoides</i>	: Oriental Species
<i>Camelaphis</i>	: Near Eastern Species
<i>Acanthocallis</i>	: Oriental Species
<i>Toltecallis</i>	: North American (Mexican) Species

Richards (1965) opined that this group of aphids originated on temperate zone species of oaks in upper creataceous time and as this flora moved southward during the Tertiary, the aphids invaded Asia and western North America and then reached Europe. More apomorphic body chaetotaxy and plesiomorphic tarsal chaetotaxy occur in palaearctic species and the reverse is noted in Nearctic species.

Earlier revisionary works on the genus include the well illustrated revision of World's species by Richards (1968) and of the Japanese species by Higuchi (1969). Chakrabarti and Raychaudhuri (1976) while describing a new species *nervatus* from India provided a

key of the alates of three species so far known from the region. At least 4 species are now known, three of which belong to *Orientuberculoides* and one to *Acanthocallis*; a fifth species, has been recorded as a new species and is awaiting description.

Biology.—These aphids usually live on the underside of leaves of more than 20 species of *Quercus*, and may lead holocyclic life cycles on the same host. Most of the alate viviparae are recorded during April to June while alatae from subsequent generations may also appear as late as in October or December. Sexuales, both oviparae and males have largely been recorded during October—December in various parts of the world. At least one species is known from *Lithocarpus* from North America. Ant attendance is not documented. Aphidiid parasitoids of the genera *Praon* and *Trioxys* are known from at least 4 species including *indicus* L. K. Ghosh from India.

Distribution.—India, Korea; Japan, Europe, North America.

Type species.—*Aphis quercus* Kaltenbach 1843. Location of types not known. Type species of the Oriental subgenus *Acanthocallis* Matsumura 1917 is *Acanthocallis quercicola* Matsumura 1917 and of *Orientuberculoides* Hille Ris Lambers 1974 *Myzocallis yokoyamai* Takahashi 1923; while location of Matsumura's material is not known, Hille Ris Lambers (1974) designated lectotypes of *yokoyamai* and deposited the same in the collection of Agricultural Research Institute, Taipei, Taiwan.

Key to the species of *Tuberculatus* Mordvilko

Alate viviparous females :

1. Mesonotum with one pair of fingerlike spinal processes. Pronotum with two pairs of fingerlike spinal processes. Abdominal tergites 1-3 with a few hairs near the bases of spinal processes. Pterostigma with broad dark brown bordering. Tibial hairs mostly fine and pointed, a few just perceptibly capitate

indicus L. K. Ghosh

—Mesonotum without spinal processes. Abdominal tergites 1-3 without hairs near the bases of spinal processes. At least outer tibial hairs predominantly capitate

.2

2. Pronotum with two pairs of fingerlike spinal processes. Spinal abdominal processes and cornicles more or less strongly infuscated. Media of forewing with narrow diffuse brown bordering

nervatus Chakrabarti &
Raychaudhuri

—Pronotum with 1 pair of fingerlike spinal processes. Media of forewing not bordered with brown

.3

3. Siphunculi with at least distal half black. Spinal processes on abdominal tergite 3 completely black, often on a joint blackish sclerite ; also on tergite 4 sometimes blackish, very small spinal processes, but the spinal processes on tergites 1 and 2 paler or less strongly infuscated. Longest hair on antennal segment III 0.030-0.037 mm long. Ultimate rostral segment 0.104-0.110 mm long, about as long as second segment of hind tarsus

konaracola (Shinji)

—Siphunculi mostly pale with only apical 0.25 portion weakly infuscated. Spinal processes on abdominal tergites 1-3 normally pale or at most with brownish apex on tergite 3, no dark processes on tergite 4. Longest hair on antennal segment III 0.045-0.060 mm long. Ultimate rostral segment 1.10-1.20× as long as second segment of hind tarsus

paiki H.R.L.

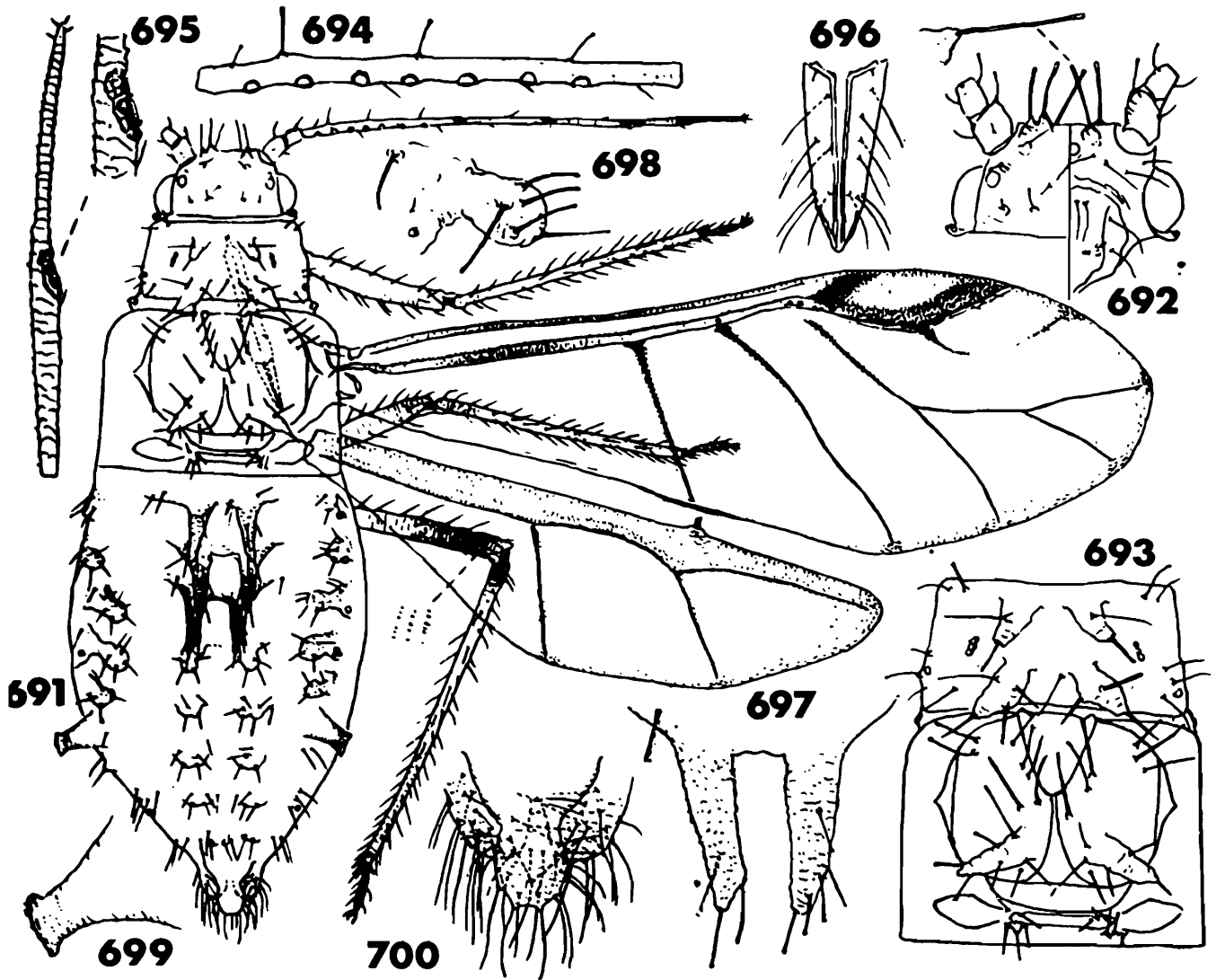
50. *Tuberculatus indicus* Ghosh (Figs. 691-700)

1969. *Tuberculoides quercicola*, Biswas, S., Chakrabarti, S., Basu, R. C., and Ghosh, A. K., *Sci. Cult.*, 35 : 640 (misid).

1972. *Tuberculatus indicus* Ghosh, L. K., *Orient. Insects*, 6(3) : 299.

1974. (1972). *Tuberculatus (Acanthocallis) indicus*, Hille Ris Lambers, D., *Estr. Boll. zool. agr. Bachic.*, (2) 11 : 49.
1980. *Tuberculatus indicus*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East and Bhutan*, 312.
1984. *Tuberculatus (Acanthocallis) indica*, Agarwala, Basant, K. and Ghosh, A. K., *Rec. zool. Surv. India, Misc. Publ., Occ. Paper*, 50 : 27.

Alate viviparous female.—Body 2.20-2.85 mm long with 1.3-1.30 mm as maximum width, pale, except sclerotic areas on mesothorax, spinal processes of abdomen and siphunculi which are brown to dark brown. Head with poorly developed frontal tubercles ; frontal hairs capitate, 0.112-0.130 mm long, anterior discal hairs of vertex 0.038-0.078 mm long with acuminate apices , hairs on the posterior part of vertex 0.025-0.040 mm long and with similar apices ; all dorsal cephalic hairs arising from more or less tuberculate bases. Antennae $0.58-0.72\times$ as long as the body, 6-segmented, pale except for dark apices of the segment III-V and the middle of VI , segment I and II each with a single capitate hair on inner margin, up to 0.056-0.060 mm long and one fine hair on outer margin 0.030-0.040 mm long, these being $2.0\times$ and $1.0\times$ as long as the basal diameter of antennal segment III ; flagellum imbricated , segment III with 5-10 large round secondary rhinaria arranged in a row and with 3-4 slightly capitate hairs (0.078-0.098 mm long) on inner margin and 3-4 fine short hairs (0.026 mm) on outer margin ; segment IV-V with 1-2 short, stiff hairs with slightly capitate apices , processus terminalis 1.50-1.70 ($1.1\times$) as long as base of segment VI. Rostrum stout, reaches to midcoxae, ultimate rostral segment $1.1-1.2\times$ as long as second segment of hind tarsus and bears 6-7 accessory hairs. Dorsum of thorax and abdomen with processes arranged as follows : pronotum with an anterior pair of spinal processes 0.100-0.125 mm long, each bearing 1-2 hairs, a posterior pair of spinal processes up to 0.160 mm long, with 2-4 hairs , mesonotum with a spinal pair up to 0.110 mm long , abdominal tergites 1-3 with large brown to dark brown paired spinal processes up to 0.276 mm long and tergites 4 to 6 with very low, pale processes up to 0.035-0.040 mm long , marginal processes on tergites 1-5 scabrous (0.065 mm) each bearing 3-5 fine hairs (up to 0.036 mm) , dorsal hairs on processes very slightly capitate to acuminate, stiff, 0.037-0.043 mm long,



Tuberculatus indicus L. K. Ghosh, 691-700, alate vivipara : 691, body ; 692, head ; 693, thoracic nota ; 694, antennal segment III ; 695, antennal segment VI ; 696, ultimate nastral segment ; 697, spinal abdominal processes ; 698, lateral abdominal process ; 699, siphunculus ; 700, cauda and anal plate.

up to $1.4\times$ as long as the basal diameter of antennal segment III. Siphunculi truncate, dusky, with a distinct flange and without any hair. Cauda pale, knobbed bearing about 20 hairs. Subanal plate bilobed, each lobe with 10-15 hairs. Legs pale to brownish yellow, with hind femora dusky ; hairs on femora fine, acute, sometimes a solitary one may be thick and blunt ; hairs on tibiae fine, acute except 1-2 thin blunt or faintly capitate hairs on hind tibiae, most of the tibial hairs longer than diameter of tibiae ; apices of tibiae specially of hind tibiae and whole of tarsi spinulose ; first tarsal segment with 6 ventral besides the dorsal hairs. Wing

venation normal, pterostigma with broad dark margins, bases of veins may be bordered light brown.

Colour.—Yellowish green with dark processes and bordered wing veins.

Measurements in mm.—

	Length	Width	Antenna			
1.	2.64	1.24	1.67			
2.	2.22	1.03	1.29			
3.	2.34	1.05	1.70			
	III	IV	Ant. segment V	VI	urs	ht ₂
	0.57	0.30	0.27	(0.14+0.24)	0.15	0.12
	0.39	0.22	0.19	(0.14+0.20)	0.15	0.12
	0.52	0.33	0.24	(0.16+0.25)	0.16	0.13

(1, 2, ex *Quercus griffithi*, Shillong, Meghalaya, 8.vi.1973 ; 3, ex *Quercus griffithi*, Shillong, Meghalaya, 29.iv.1975 N.Z.C.).

Embryos.—Spinal hairs and marginal hairs one pair each per tergite, stout, long, arranged in rows, distinctly knobbed, up to 0.100 mm long ; spinal hairs crossed , pleural hairs absent.

Alatoid nymph.—Dorsum pale. Frontal hairs stout, capitate, up to 0.10-0.11 mm long, on vertex up to 0.065 mm long. Spinal hairs on abdomen stout and capitate, increasing in length from 0.10 mm on 1st tergite to 0.164 mm on 6th tergite. Pleural hairs irregularly present, 0.039-0.065 mm long , marginal hairs in clusters, or variable length, shorter ones up to 0.052 mm and longer ones 0.138 mm. Hairs on flagellum as in alate vivipara. Hind tibiae thicker than others, apices of tibiae and tarsi spinulose.

Material examined.—Five alate viviparous females from *Quercus griffithi*, Shillong, Meghalaya, India 8.vi.1973 ; two alate viviparous females, 3.vi.1973, four alatoid nymphs, 21.viii.1974,

four alate viviparous females and 4 alatoid nymphs, 29.iv.1975, 3 alate viviparous females 6.ix.1975, from same host locality (N.Z.C.).

Discussion.—Described from a single alate in 1972, the species is now known to be common on *Quercus* in North East India, during April-June and August-October. Hille Ris Lambers (1974) mentioned that specimens from Korea and Japan, while agreeing in general, vary in some respect, notably in the shape of hairs, and material from *Quercus alienus* and *Quercus acutissima* in Korea appear to bridge the gap between Japanese and Indian material. While the species is very close to *T. japonicus* Higuchi, it can be separated by the dorsal chaetotaxy of embryo, shape of hairs on femora and tibiae and on frons of head, pigmentation of siphunculi and by being associated with a wider range of *Quercus* species. Besides, there is also a pair of spinal processes on the metanotum in *T. japonicus* which is lacking in the other species. The variations in antennal hairs (acute to knobbed), femoral hairs (wavy to blunt or knobbed), apices of hairs in embryo (just knobbed to balloon-shaped) as mentioned by Hille Ris Lambers (op. cit.) must be taken into account when extraterritorial material is to be identified.

Distribution.—India ; Meghalaya, Manipur, Arunachal Pradesh ; Japan, Korea.

Types.—In the collections of British Museum (Nat. Hist.), London, England.

51. *Tuberculatus konaracola* (Shinji)
(Figs. 701-711)

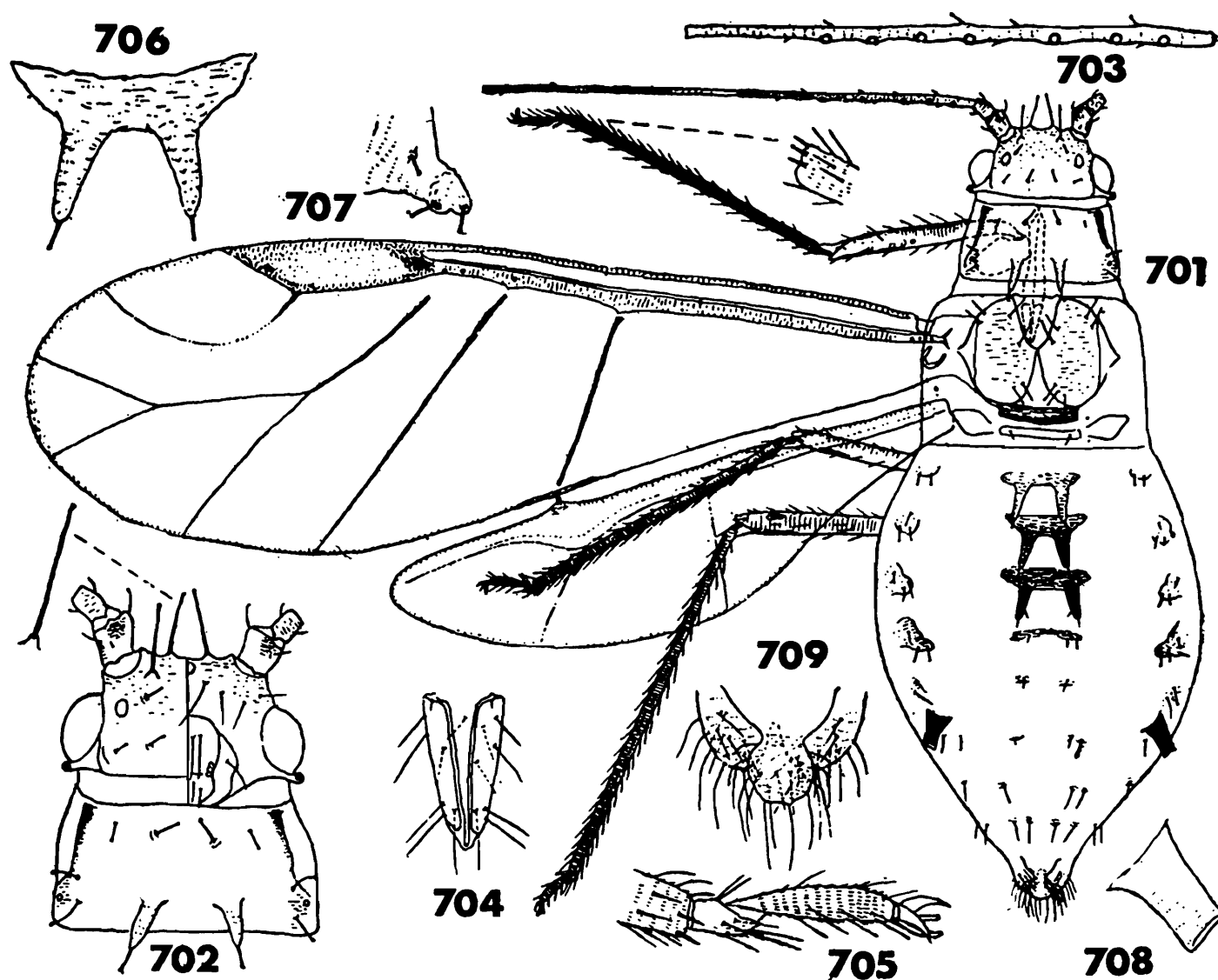
1941. *Tuberculoides konaracola*, Shinji, O., *Monog. Japanese Aphididae*, 374.

1972. *Tuberculatus konaracola*, Higuchi, H. *Ins. Matsum.*, 35 (2) : 49.

1974. (1972). *Tuberculatus (Orientuberculatus) konaracola*. Hille Ris Lambers, D., *Boll. zool. Agr. Bachic.* (II), 11 : 51.

Alate viviparous female.—Body 2.38-2.78 mm long with 1.11 mm as maximum width, mostly pale, but with light brown stripes on

pronotum, blackish brown spinal processes placed on an equally dark sclerite on abdominal tergites 2 and 3 and sometimes also tergite 4, and apical 0.60 portion (or more) of the siphunculi. Frontal tubercles poorly developed ; frontal hairs stout, capitate, 0.100 mm long, $4.0-4.5\times$ as long as the basal diameter of antennal segment III ; three pairs of much thinner shorter discal hairs present on vertex, slightly knobbed, 0.022-0.028 mm long. Antennae 6-segmented, pale, with apices of segments III-V and area around rhinarium on segment VI brownish, shorter ($0.84\times$) than the body ; segment III with 4-7 round, secondary rhinaria ; hairs on inner margin of segment III thick, capitate, the longest 0.030-0.037 mm long, $1.16-1.7\times$ the basal diameter of the segment ;



Tuberculatus konaracola (Shinji). 701-709, alate vivipara : 701, body ; 702, head and pronotum ; 703, antennal segment III ; 704, apical rostral segment ; 705, hind tarsus ; 706, spinal abdominal processes ; 707, lateral abdominal process ; 708, siphunculus ; 709, cauda and anal plate.

hairs on outer side thinner and shorter ; processus terminalis $2.0 \times (1.95-2.17 \times)$ as long as base of segment VI. Rostrum reaches between fore- and midcoxae ; ultimate rostral segment acute, subequal to $(0.96 \times)$ 2nd segment of hind tarsus and bears 6-8 accessory hairs. Pronotum with one pair of posterior spinal processes (0.035-0.074 mm) ; mesonotum without processes but with thick dorsal hairs ; abdominal tergites 1-3 each with a pair of fingerlike processes up to 0.140 mm long (0.120-0.160 mm) and on tergite 4 a low pair 0.030 mm long ; each process with 1-2 capitate hairs near the apex, 0.019-0.026 mm long ; 8th tergite with about 10 hairs. Siphunculi 0.12-0.13 mm long, blackish as stated above, with hardly indicated flange. Cauda 0.14 mm long, pale, distinctly knobbed, bearing 13-15 hairs up to 0.073 mm long. Subanal plate deeply bilobed, each lobe with about 13 hairs. Legs with femora mottled brownish ; tibiae much darker than femora with brown, apicad, narrower and paler longitudinal stripes ; hairs on tibiae weakly capitate, longest one on hind tibiae $1.5 \times$ distal width of tibia ; first tarsal segments with 6 ventral and 2 dorsal hairs. Wing venation normal, media and radial sector almost colourless in comparison to the dark brown, narrowly bordered veins Cu_1 and Cu_2 .

(Description largely based on Hille Ris Lambers, 1972).

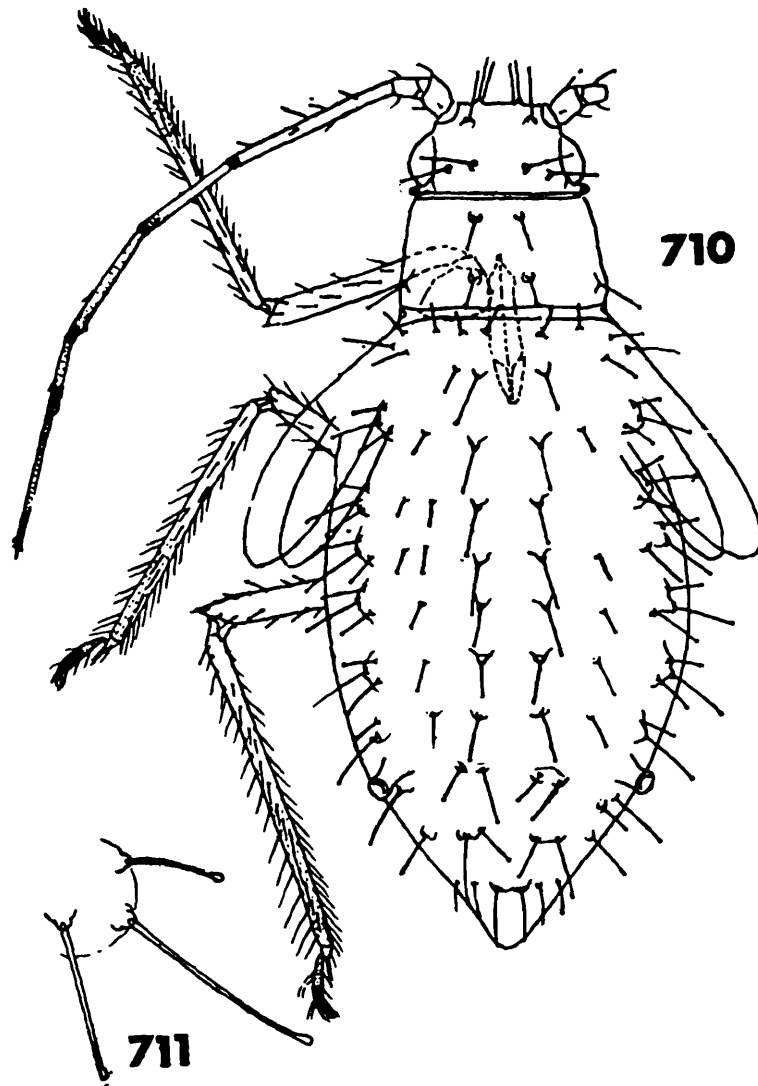
Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
2.78		1.09		2.22	
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.66	0.46	0.36	0.19+0.38	0.110	0.110

(ex Yellow traps, Suwon, Korea, 17.x.1967, W.H. Paik, neoholotype, British Museum, Hille Ris Lambers Coll.).

Alatoid nymph.—Body pale, 1.72 mm long with 0.73 mm as maximum width. Frontal and anterior discal setae of vertex with



Tuberculatus konaracola (Shinji). 710-711, alate nymph : 710, body ; 711 lateral abdominal hairs.

minutely capitate apices, the longest 0.121 mm long. Antennae with brown annuli at apices of flagellar segments. Inner setae of antennal segment III capitate, the longest 0.064 mm long. Pronotum with two pairs of spinal and one pair of marginal setae of same shape as but slightly shorter than discal setae of vertex. Mesonotum with 3 pairs of spinal, one pair of pleural and 3 pairs of marginal setae. Metanotum and abdominal tergites 1-7 each with one pair of spinal, mostly 3 pairs of marginal setae and with pleural setae single (rarely 2) on each side ; however on tergites 5-7 only 1-2 pairs of marginal setae developed. These setae of same shape as cephalic setae, the longest spinals measuring 0.152 mm. Marginal setae until tergite 5 on low elevations 0.030 mm high. Tergite 8 with 6 setae. Femora and tibiae pale, with pointed setae, the longest measuring 1.75 times distal width of tibia.

Rostral organ undeveloped. First tarsal segments with 6 ventral and no dorsal setae. Siphunculi pale, smooth. Otherwise as in alate vivipara.

Colour.—Not recorded.

Measurements in mm.—

	Length		Width	Antenna	
1.	1.72		0.73	1.39	
	Antennal segments				
III	IV	V	VI	urs	ht ₂
0.37	0.23	0.27	(0.17+0.28)	0.10	0.13

(ex Myrtaceae, not host, Raphei, Manipur, India, 11.xii.1972 T K. Singh coll. C.U. Coll.).

Embryo.—Dorsal hairs long, stout, arising from strong sockets and strongly capitate. Spinal hairs on tergite 2-7 gradually increasing in length from 0.060 to 0.080 mm and on tergite 8, 0.060 mm long (after Hille Rie Lambers, 1972-74).

Material examined.—One alate vivipara from yellow traps, Suwon, Korea, 17.x.1967, Coll. W.H. Paik (British Museum Colls.) and one alate vivipara, on undet. Myrtaceae, Raphei, Manipur, India, 11.xii.1972, Coll. T.K. Singh, E.D. 46 (1) (C.U. Colls).

Discussion.—This species seems to be rare and has been collected only once in India (one alate vivipara and one alatoid nymph). The Indian specimen has the siphunculi entirely black and also a smoky mesoscutellum and a dark first pair of spinal abdominal processes but this appears to be seasonal variation.

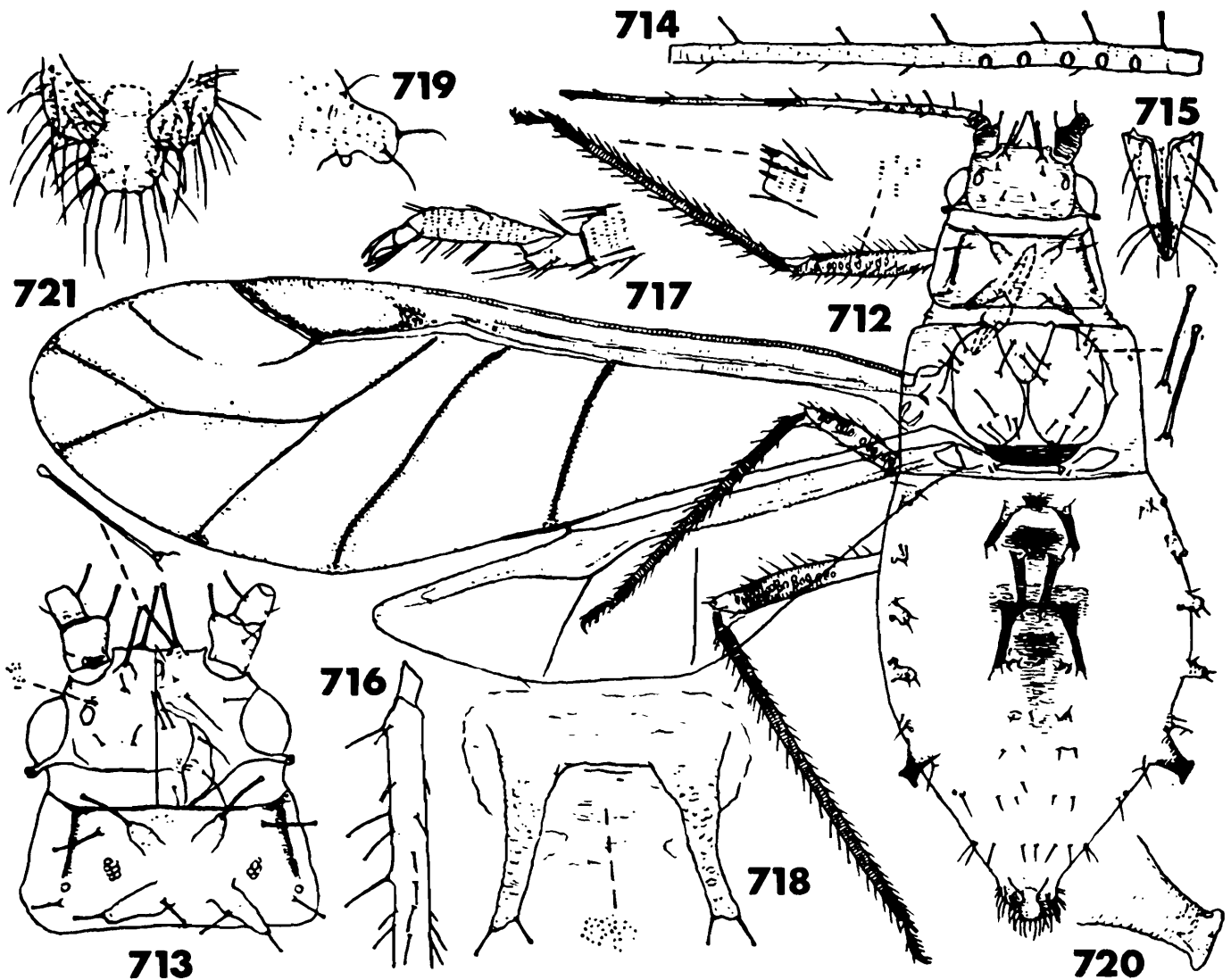
Distribution.—India : Manipur ; Korea.

Types.—In the collection of British Museum (Nat. Hist.) London, England.

52. *Tuberculatus nervatus* Chakrabarti & Raychaudhuri
(Figs. 712-721)

1974. *Tuberculatus capitatus*, Basu, R. C., Ghosh, M. R., Raychaudhuri, D. N., 1976 *Sci. Cult.*, **40** : 43 (misid.).
1976. *Tuberculatus nervatus* Chakrabarti, S. and Raychudhuri, D. N., *Orient. Insects*, **70** : 446.
1980. *Tuberculatus nervatus*, Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan* : 313.

Alate viviparous female.—Body 3.5-3.6 mm long with 1.5-1.55 mm as maximum width. Head pale yellow to pale brown ; frontal tubercles low , hairs on the dorsum of head of two types, 4 hairs on anterior margin thick, capitate, arising from tuberculate bases, 0.131-0.138 mm long up to $3.3-3.6\times$ as long as the basal diameter of the segment III and 3 pairs on posterior part of vertex with acuminate to bluntish apices up to 0.034-0.038 mm long, at most $0.80\times$ as long as the mentioned diameter ; ventral cephalic hairs fine, wavy, up to 0.100 mm long. Antennae 6-segmented, pale yellow to pale brown but with apical parts of segments III-V distinctly dark brown ; flagellum gradually more distinctly imbricated from apical part of segment III, which bears 3-5 round secondary rhinaria on basal third ; hairs on flagellum sparse, those on inner margin capitate, more distinctly so on antennal segment III (which has 4-6 such hairs) and others with incrassate apices, longest capitate hair on segment III up to 0.038-0.041 mm long, $1.20-1.25\times$ as long as the basal diameter of the segment, but the incrassate hairs up to 0.020 mm long, and $0.60\times$ as long as the mentioned diameter , processus terminalis broken in all specimens. Rostrum pale, reaches between fore and midcoxae, ultimate rostral segment $0.92-1.1\times$ as long as second segment of hind tarsus and bears 8-9 accessory hairs. Prothorax with two pairs of scabrous, pale brown dorsal processes (anterior pair 0.069-0.076 mm long, posterior pair 0.104-0.114 mm long) each bearing a capitate hair (0.100-0.120 mm) at the tip ; besides, on the posterior processes a small hair (0.04-0.06 mm) present near the base ; mesothorax dark sclerotic on the postscutum, but without spinal processes. Abdominal dorsum smooth, pale except for dark brown to dusky median sclerotic patches, confluent in part on tergites 1-5, tergites



Tuberculatus nervatus Chakrabarti & Raychaudhuri. 712-721, alate vivipara : 712, body ; 713, head and pronotum ; 714, antennal segment III ; 715, apical rostral segment ; 716, base of hind tibia ; 717, hind tarsus ; 718, spinal abdominal processes ; 719, lateral abdominal process ; 720, siphunculus ; 721, cauda and anal plate.

1-3 each with a pair of long, fingershaped dark and rugose spinal processes (0.177-0.229 mm), of these the one on 2nd tergite little shorter than others ; tergites 4 and 5 with small (0.03-0.05 mm) elevations ; lateral processes scabrous, small, pale, becoming largest on 4th tergite and then decreasing in size and hardly discernible on posterior tergites ; dorsal hairs on abdominal tergites capitate, bluntish or acuminate, the longest one on anterior tergites up to $1.0\times$ as long as the basal diameter of antennal segment III ; 7th tergite with 6-7 hairs, 0.079-0.107 mm long, and 8th tergite with 8-9 hairs, 0.058-0.060 mm long and $1.4-2.8\times$ as long as the

mentioned diameter, each of the spinal processes on abdomen bears 2 stout, capitate hairs 0.024-0.038 mm long and each of the lateral processes on ante-siphuncular segments provided with at least 3 hairs, usually 0.030-0.030 mm long and with bluntish to acuminate apices. Siphunculi dusky, truncate, striate, imbricated with a wide apical flange, about twice as long as minimum width before apical flange. Cauda dusky, distinctly knobbed with 15-17 fine hairs. Subanal plate bilobed, each lobe with 16-17 hairs. Gonapophyses fused. Legs pale brown to mottled brown; femora sparsely spinulose bearing fine wavy hairs; tibial hairs on inner margin acute, on outer margin mostly bluntish; apical 0.50 portion of tibiae and whole of tarsi spinulose; apical tibial hairs differentiated; first tarsal segments with 6-7 ventral and 2 dorsal hairs. Wing venation normal; all veins with narrow diffuse brown bordering; radial sector strongly curved.

Colour.—Not recorded.

Measurements in mm.—

	Length	Width	Antenna		
1.	3.15	1.26	?		
2.	3.21	1.38	?		
	Ant. segments				
	III	IV	V	VI	urs ht ₂
	0.74	0.45	0.33	?	0.13 0.14
	0.76	0.45	0.33	(0.16+?)	0.12 0.13

(1, 2 ex *Quercus* sp. Shillong, Meghalaya, 16.xii.1968, holotype, 1 and paratype, 2).

Embryo.—Dorsal hairs long, stout, capitate, arising from strong sockets, arranged in four longitudinal rows (2 spinal and 2 marginal) on dorsum of body; spinal hairs increasing in length from 1st (0.052 mm) to 8th tergite (0.098 mm) those on 1st tergite not much shortened, those on 7th tergite shifted laterad, pleural hairs absent.

First instar nymph.—Dorsal hairs as in embryo. Antennae 4 segmented, segment I and II each with a single hair with capitate apices up to 0.041 mm long ; flagellum imbricated, segment III with 2 hairs up to 0.012 mm long ; ultimate rostral segment 0.043 mm long.

Material examined.—Two alate viviparous females and 3 nymphs from *Quercus* sp. Shillong, Meghalaya India, 16.xii.1968, coll. R.C. Basu (holotype and paratypes ; C.U. Coll.).

Discussion.—The species can be distinguished from other related species by the dark patch on the postscutum, brown patches on abdomen, and dusky wing venation. The measurements of holotype as provided by Chakrabarti and Raychaudhuri (1976) appear erroneous with regard to length of body, width of body and antennal segment III-V. The species seems to have a restricted distribution in Khasi Hills of Meghalaya.

Distribution.—India : Meghalaya.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

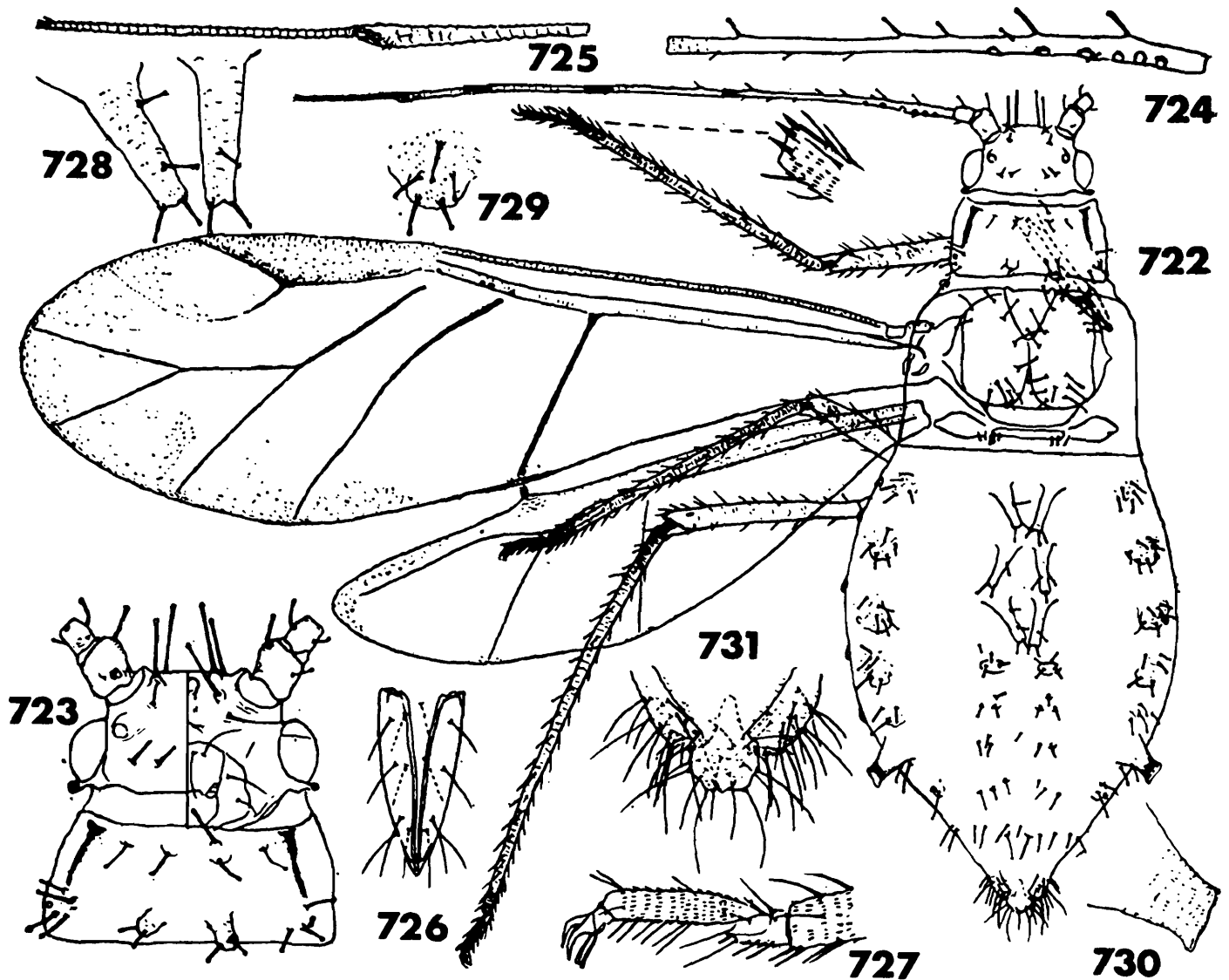
53. *Tuberculatus paiki* Hille Ris Lambers
(Figs. 722-733)

1974. (1972). *Tuberculatus (Orientuberculoïdes) paiki* Hille Ris Lambers, D., *Boll. zool. Agr. Bachic.* (II), 11 : 68.

1978 (1975). *Tuberculatus paiki*, Chakrabarti, S., and Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 28 : 98.

1980. *Tuberculatus paiki*, Raychaudhuri, D. N., Chakrabarti, S. Basu, R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 313.

Alate viviparous female.—Body 2.10 mm long (2.39-3.15 mm) with 0.75-1.0 mm as maximum width, pale with only two thin, brown longitudinal stripes on pronotum. Frontal tubercles poorly developed ; frontal hairs thick, capitate 0.083-0.100 mm long, (0.120-0.130 mm) up to $3.0\times$ as long as the basal diameter of antennal segment III ; three pairs of much thinner shorter discal hairs on vertex, hairs, measuring up to 0.040 mm (0.03-0.045 mm). Antennae 6-segmented, pale, with apices of segments III-V and



Tuberculatus paiki Hille Ris Lambers. 722-731, alate vivipara : 722, body ; 723, head and pronotum ; 724, antennal segment III ; 725, antennal segment VI ; 726, apical rostral segment ; 727, hind tarsus ; 728, spinal abdominal processes ; 729, lateral abdominal process ; 730, siphunculus ; 731, cauda and anal plate.

area around rhinarium on segment VI brownish, about equal to the length of the body ; segment III with 3-4 (2-7) round, secondary rhinaria ; hairs on inner margin of flagellum, thick capitate, the longest one on segment III 0.033 mm (0.045-0.060) long, equal to or longer than the basal diameter of the segment , hairs on outer side thinner and shorter ; processus terminalis $1.33\times$ ($1.2-1.5\times$ in different generations) as long as base of segment VI. Rostrum reaches near midcoxae, ultimate rostral segment acute $1.2\times$ ($1.1-1.2\times$) as long as second segment of hind tarsus and bears 7 accessory hairs (7-8). Spinal processes pale ; pronotum with one posterior

pair of processes (0.030-0.075 mm) ; mesonotum without any processes but with thick dorsal hairs ; abdominal tergites 1-3 each with a pair of fingerlike processes up to 0.130 mm long (0.120-0.180 mm) ; each process with 1-2 capitate hairs near the apex, 0.023-0.033 mm long ; 8th tergite with 10-12 hairs. Siphunculi 0.12-0.13 mm long, pale, except for dusky apices and with a distinct flange. Cauda (0.14-0.18 mm) pale, distinctly knobbed bearing 12-15 hairs up to 0.073 mm long. Subanal plate deeply bilobed, each lobe with 12-15 hairs. Legs pale yellowish, hairs on tibiae slightly capitate, longest one on hind tibiae 0.033 mm long (0.038-0.061 mm) ; first tarsal segments with 6 ventral and 2 dorsal hairs. Wing venation normal (may be faintly infuscated or bordered near bases).

(Figures within parenthesis from Hille Ris Lambers 1972-73).

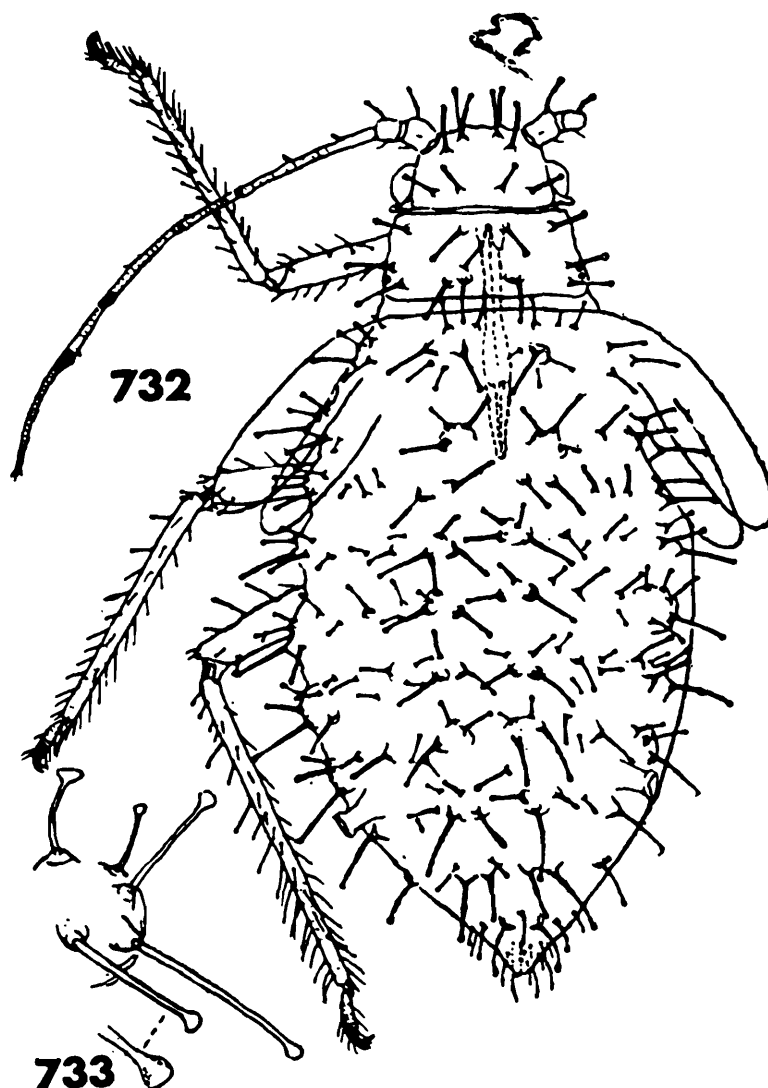
Colour.—Not recorded.

Measurements in mm.—

Length		Width		Antenna	
2.10		0.75		1.70	
III	Ant. segments		VI	urs	ht ₂
	IV	V			
0.55	0.34	0.33	(0.27+0.31)	0.14	0.18

(ex *Quercus* sp. Shillong, Meghalaya, 19.iv.1969, K.U. Coll.)

Alatoid nymph.—Body 2.05 mm long with 0.85 mm as maximum width. Frontal hairs 0.09-0.12 mm long, capitate. Antenna 1.65 mm long, with apices of segments III-V and area of rhinarium on VI dark. Spinal hairs on abdomen with tuberculate bases arising from low bosses which are arranged as one pair per segment in two longitudinal rows on tergites 1-7 and these hairs are up to 0.14 mm long ; pleural hairs and also smaller hairs placed in between the paired spinals without such bosses, up to 0.065-0.078 mm long, marginal hairs 4-6 on each side arising from strongly



Tuberculatus paiki Hille Ris Lambers, 732-733, alate nymph : 732, body ; 733, lateral abdominal hairs.

tuberculate bases on low bosses, up to 0.140 mm long ; 7th tergite with 4 spinals and a single marginal hair on each side ; 8th tergite with 4 hairs. Siphunculi pale, flared at apex, 0.104 mm long. Legs pale ; hairs on femora fine, sparse ; on tibiae numerous, thicker and partly with weakly capitate apices partly pointed, on hind tibiae up to 0.104 mm long, nearly $3.0\times$ as long as middle width of tibia.

Embryo.—Dorsal hairs long, stout, arising from strong sockets and strongly capitate at apices. Spinal hairs on tergites 1-7 gradually increasing in length from 0.059 to 0.095 mm and on 8th tergite 0.060 mm ; marginal hairs on 6th tergite 0.59-0.91 mm but on the 7th 0.043 mm long, (after Hille Ris Lambers, 1972-73).

Material examined.—One alate viviparous female and one alatoid nymph from *Quercus* sp. Shillong, Meghalaya, India, 19.iv.1969, coll. R. Basu, det. F.W. Quednau (K.U. Coll.).

Discussion.—The specimens recorded here differ from Korean material in having shorter hairs on body and appendages and in the shorter length of dorsal processes. Hille Ris Lambers (1972-73) has discussed in detail the affinities of this species, the most closely related being *yokoyamai* Takahashi, from which it differs in having longer hairs on antennal segment III. Hille Ris Lambers (op. cit.) mentions that specimens, intermediate in antennal hair length between *paiki* (0.645-0.060 mm) and *yokoyamai* (0.026 mm) have not been found. The present specimen with antennal hairs 0.033 mm long, seems to bridge that gap.

Distribution.—India : Meghalaya ; Korea.

Types.—In the collection of British Museum (Nat. Hist.) London, England.

Genus 31. *Yamatocallis* Matsumura 1917

1917. *Yamatocallis* Matsumura, S., *J. Coll. Agric. Hokkaido Imp. Univ.*, 7 : 366 ; Higuchi, H., 1972. *Ins. matsum.*, 35(2) : 78 ; Raychaudhuri, D. N., Chakrabarti, S., Basu, R. C., and Ghosh, A. K., 1980. *In Aphids of North East India and Bhutan*, 313. Type species : *Yamatocallis hirayamae* Matsumura.
1923. *Chaitophoraphis* Shinji, G. O., *Zool. Mag. Tokyo*, 35 : 307. Type species : *Chaitophoraphis acerifloris* Shinji.
1927. *Dichaitophorus* Shinji, G. O., *Bull. Morioka imp. Coll. For. Agric.*, 11 : 48. Type species : *Chaitophoraphis acerifloris*.
1963. *Megalocallis* Takahashi, R., *Kontyu*, 31 : 160. Type species : *Megalocallis takagii* Takahashi.
1971. *Megalophyllaphis* Ghosh, M. R., Ghosh, A. K., Raychaudhuri, D. N., *Orient Insects*, 4 : 383. Type species : *Megalophyllaphis obscurus* M.R. Ghosh, A. K. Ghosh & Raychaudhuri (used as subgenus of *Yamatocallis*).

Morphology.—All viviparae alatae. Body medium to large, 2.4-4.7 mm long. Head with moderately to well developed frontal tubercles. Antennae 6-segmented, distinctly longer than body,

secondary rhinaria transversely elongate, ciliated, restricted to antennal segment III ; primary rhinaria ciliated, accessory sensoria not separated from primary rhinarium, hairs on flagellum with acuminate apices, processus terminalis $1.5-2.9\times$ as long as base of antennal segment VI. Eyes with ocular tubercles. Rostrum short, hardly reaches midcoxae, ultimate rostral segment distinctly shorter than second segment of hind tarsus ($0.6-0.8\times$) and bears 4-8 accessory hairs. Base of rostral segment II not provided with sclerotic stiffening. Abdominal dorsum pale, without any spinal or marginal processes ; hairs on the dorsum of abdomen long, fine or blunt arising from somewhat tuberculate bases ; spinal hairs arranged in two parallel rows ; pleural hairs smaller, variable, (evident on 1st-2nd tergite in *takagii*) ; marginal hairs multiple, including one long and other short hairs ; 8th tergite with 4 hairs. Siphunculi smooth or scabrous, cylindrical or distinctly swollen, always longer than wide and with distinct apical reticulation. Cauda elongate, knobbed. Subanal plate slightly indented. Rudimentary gonapophyses 3. Subgenital plate with 15-16 hairs near hind margin. Legs with fore femora enlarged or distinctly stouter than other femora ; tibiae with spinules near apices ; apical tibial hairs differentiated as short spines ; first tarsal segments with 6-7 ventral and 2 dorsal hairs ; empodial hairs flattened. Wing venation normal, sometimes bordered brown ; forewings with media twice branched, hind wings with both obliques.

Embryos with dorsal hairs of variable lengths, blunt or with incrassate apices ; spinal hairs in two parallel rows, single ; pleural hairs present ; marginal hairs sometimes longer than spinal and pleural hairs. Siphunculi present.

Sexual forms not known.

Discussion.—The genus has been described under different names from eastern Asia. Takahashi (1963) while describing *Megalocallis* stated that the new genus differs from *Yamatocallis* in having elongated siphunculi with distinct reticulation and slender fore-femora, but apical reticulation of siphunculi is evident in members of *Yamatocallis* and fore-femora are enlarged in *Megalocallis* and appear stouter than the others. Ghosh et al. (1970)

while describing *Megalophyllaphis* mentioned about its closeness to *Megalocallis* Takahashi but apparently were not aware of *Yamatocallis* Matsumura. Higuchi (1972) considered *Yamatocallis* as representative of a distinct group (=Drepansosiphini of Börner) closely related to *Drepanaphis* del Guercio of North America. It can perhaps be considered as a link between Drepanosiphinae and Chaitophorinae.

Eastop and Hille Ris Lambers (1976) listed 5 species from the world under *Yamatocallis* and considered *Megalophyllaphis* as a subgenus with a single species *obscurus* from India. However, it is considered here as a full synonym of *Yamatocallis*. Higuchi (1972) has provided an account of 5 Japanese species.

Biology.—The members of this genus are associated with plants of Aceraceae. In absence of sexual forms, it is difficult to ascertain the nature of life-cycle. Most of the species in Japan have been collected during May-June in mountain areas and the single species from India has been collected during April-May in eastern Himalaya.

Distribution—India ; Taiwan ; Japan.

Type species.—*Yamatocallis hirayamae* Matsumura, 1917. Location of types not known.

Key to the species of *Yamatocallis* Matsumura

Alate viviparous females

Siphunculi 0.1 × as long as body, swollen at base, recitulated on dark apical 0.2 portion. Spinal abdominal hairs two on each of the tergites 1-7. Processus terminalis at most 1.5 × as long as the base of ant. segment VI. Ultimate rostral segment 0.7 × as long as second segment of hind tarsus. Tarsi imbricated. Embryo with minute spinal and pleural hairs. On unknown host (probably *Acer*)

obscura, A. K. Ghosh, M. R. Ghosh, & Raychaudhuri

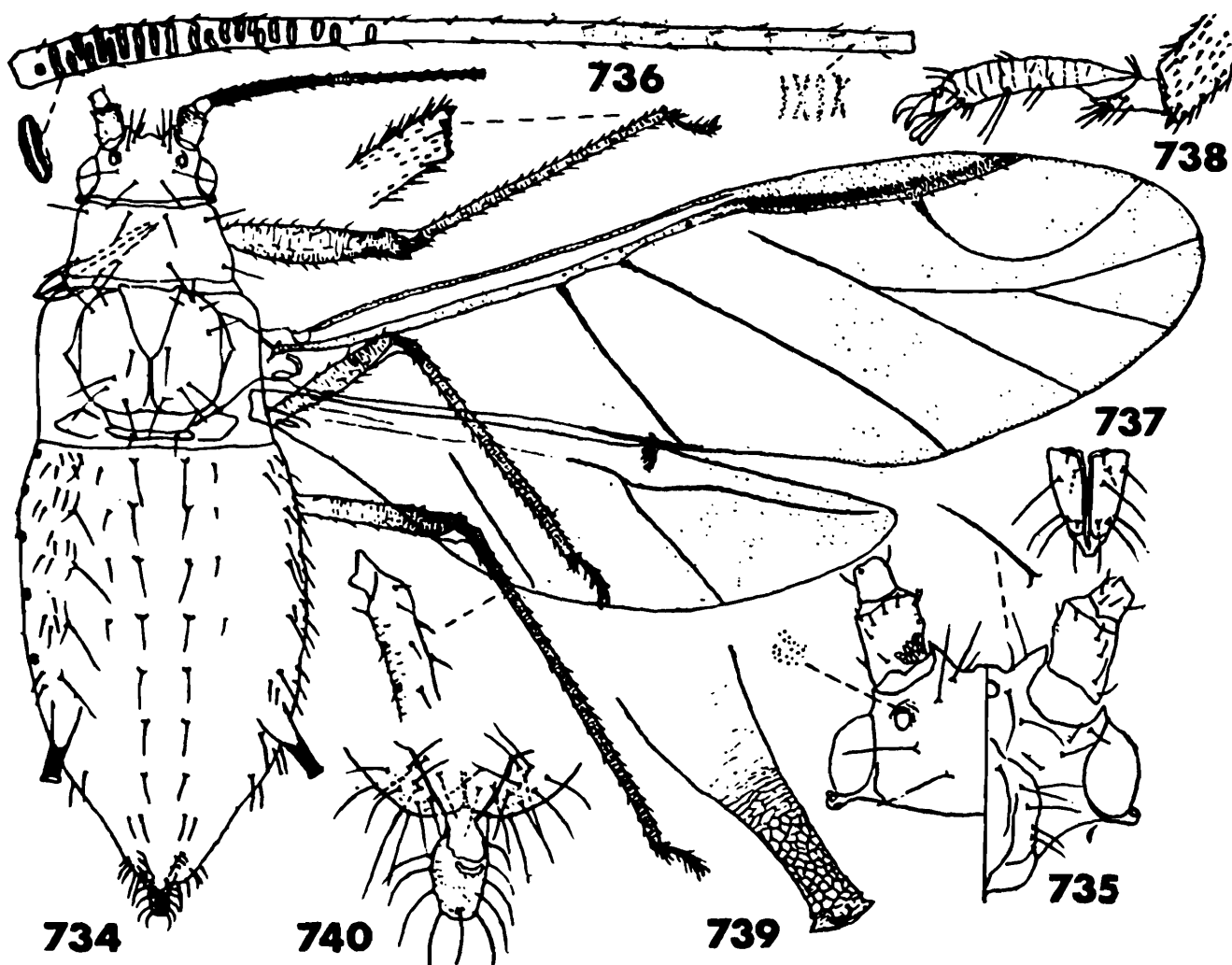
—Siphunculi $0.25\times$ as long as the body, evenly tapering, reticulated on dark apical 0.1 portion. Spinal abdominal hairs three on each of the tergites 1-7. Processus terminalis at least $4.0\times$ as long as the base of ant. segment VI. Ultimate rostral segment $1.4\times$ as long as second segment of hind tarsus. Tarsi spinulose. Embryo with elongate spinal and pleural hairs. On *Acer villosum*

brevicauda, Chakrabarti

54. *Yamatocallis obscura* (Ghosh, Ghosh & Raychaudhuri)
(Figs. 734-746)

1970. *Megalophyllaphis obscura* Ghosh, M. R., Ghosh A. K. and Raychaudhuri, D. N., *Orient. Insects*, 4 : 383.
1976. *Yamatocallis (Megalophyllaphis) obscurus*, Eastop. V. F., and Hille Ris Lambers, D., *Survey of the World's Aphids*, 460.
1980. *Yamatocallis obscura* Raychaudhuri, D. N. Chakrabarti, S., Basu R. C. and Ghosh, A. K., *In Aphids of North East India and Bhutan*, 314.

Alate viviparous female.—Body pale, elongate oval, 3.4-4.1 mm long with 1.0-1.4 mm as maximum width. Head smooth, frontal tubercles diverging, hairs on vertex long and pointed 0.136-0.152 mm long. Dorsal ocelli weakly infuscated. Compound eyes large with distinct ocular tubercle. Antennae 6-segmented (as evident from alatoid nymph ; broken in all adult specimens) dark except segments I and II and basal half of III which are pale brown, flagellum with segment III smooth and bearing 14-22 elliptical secondary rhinaria, distributed over basal 0.3 portion, other antennal segments broken ; hairs on antennae short, pointed, the longest one 0.023 mm long, $0.2\times$ as long as the greatest basal diameter of antennal segment III ; processus terminalis (as evidenced from alatoid nymph) at least $1.1-1.25\times$ as long as base of segment VI. Rostrum reaches not quite to midcoxae, ultimate rostral segment stout, shorter than ($0.7\times$) second segment of hind tarsus and bearing 4-5 accessory hairs. Dorsum pale membranous ; spinal and pleural hairs in pairs, the latter only on tergites 1-4 ; marginal hairs in clusters of 3-6 on each lobe of 1st-5th tergites and 2-3 pairs each on 6-7 tergite ; spinal hairs elongated, or



Yamatocallis obscura (A. K. Ghosh, M. R. Ghosh & Raychaudhuri). 734-740, alate vivipara : 734, body ; 735, head ; 736, antennal segment III ; 737, apical rostral segment ; 738, hind tarsus ; 739, siphunculus ; 740, cauda and anal plate.

pointed with slightly expanded apices; marginal hairs similar, mostly with one hair longer than others on each lobe and arising from a somewhat tuberculate base; longest hairs on abdomen up to 0.182 mm long or 3.0 as long as the greatest basal diameter of antennal segment III; 8th tergite with 4 hairs. Siphunculi elongate (0.38 mm), pale with apical two fifths brown, $0.07-0.09\times$ as long as the body, $1.3\times$ as long as cauda, swollen at base and somewhat constricted before the apex, reticulated over apical 0.47 portion. Cauda dusky (0.30 mm long) with elongate knob, constricted near the middle and bearing 9-11 hairs. Subanal plate shallowly indented. Legs brown, femoral and tibial hairs normal, fore femora enlarged; tibia with apical 0.25-0.33 portion bearing short spinules.

First tarsal segment with 6-7 ventral and 2 dorsal hairs, second tarsal segments imbricated, not spinulose. Forewings with radial sector strongly curved, veins normal.

Colour.—Green in life.

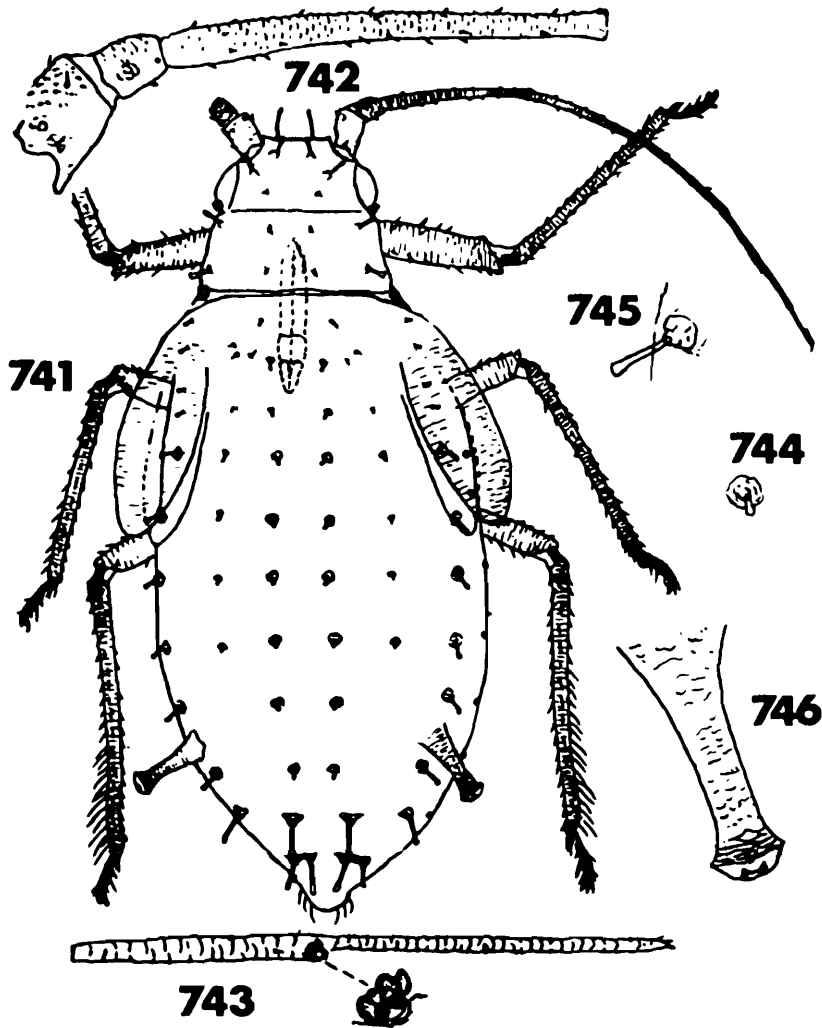
Measurements in mm.—

Length	Width	Ant. segments				urs	ht ₂
		III	IV	V	VI		
3.6	1.2	1.2	—	—	—	0.12	0.15

(ex undet. plant, Darjeeling, W.B., 5.xi.1969, holotype).

Embryo.—Dorsal hairs mostly minute except on frons and abdominal tergites 7 and 8. Head with 1 pair of hairs on frons and 2 pairs on vertex besides 4 posterior discal hairs. Spinal and pleural hairs arranged in 4 longitudinal rows, the former from pronotum to 8th abdominal tergite, the latter from mesonotum to 5th tergite; marginal hairs 2 pairs each on thoracic segments and 1 pair each on abdominal tergites 1-7. Siphunculi short cylindrical. Antennae shorter than the body, accessory rhinaria not separated from primary rhinarium. Apical rostral segment without secondary hairs.

Alatoid nymph.—Body pale, elongate oval. Antennae 6-segmented, shorter than the body, scabrous; processus terminalis 1.1-1.25× as long as base of segment VI. Dorsal cephalic hairs arranged in 4 pairs, of which the 3 anterior pairs elongate with expanded apices, 0.052-0.091 mm long, but one posterior pair minute. On abdominal tergites 1-6, spinal and pleural hairs very short (0.010-0.020 mm), the marginal ones up to 0.065 mm long and stout, arising from tuberculate bases; tergites 7 and 8 each with 2 pairs of long hairs (up to 0.100 mm long) arising from tuberculate bases and with expanded apices. Siphunculi elongate, wrinkled, 0.30 mm long, dusky and with a few rows of striae near apices. Anal segment rounded. Tibiae spinulose at apical 0.25 portion.



Yamatocallis obscurus (A. K. Ghosh, M. R. Ghosh & Raychaudhuri). 741-746, alatoid nymph : 741, body, 742, antennal segments I-III ; 743, antennal segment VI ; 744, spinal abdominal hair ; 745, lateral abdominal hair ; 746, siphunculus.

Measurements in mm.—

Length		Width		Antenna	
3.20		1.45		2.64	
		Ant. segments		urs	ht ₂
III	IV	V	VI		
0.69	0.49	0.50	(0.28+0.34)	0.14	0.16

(ex undet. host, Darjeeling, W.B. 5.iv.1969, paratype).

Material examined.—Two alate viviparous females and 4 alatoid nymphs from unidentified host, Birch Hill, Darjeeling, West Bengal, India, 5.IV 1969, (holotype and paratypes : C.U. Coll.).

Discussion.—The green coloured aphids were recorded from the undersurface of leaves of the host plant (probably *Acer* sp.) only once during the last 16 years. The species seems to be rare. The original description was incomplete with regard to the shape of the dorsal hairs. Following the key for 3 other species of *Yamatocallis* from Japan provided by Higuchi (1972), the Indian species appears to be closest to *Y. hirayamae* Matsumura, but differs in having longer dorsal body hairs, longer and more tapered siphunculi with a more extended reticulated zone and by the absence of a diffuse brown pigmented band over the disc of the forewing.

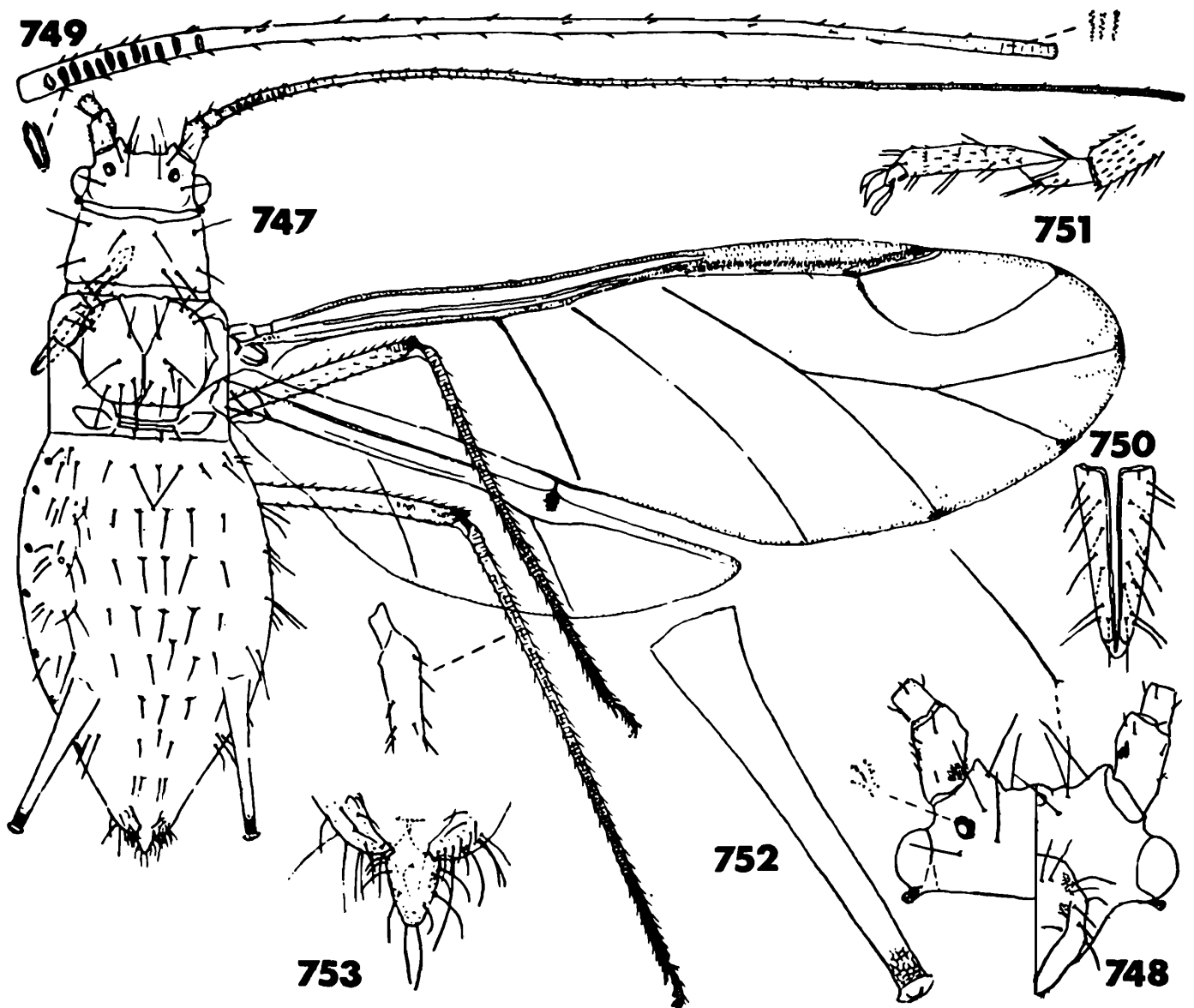
Distribution.—India ; West Bengal (Darjeeling).

Type.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

55. *Yamatocallis brevicauda* Chakrabarti, 1988
(Figs. 747-753)

1988. *Yamatocallis brevicauda* Chakrabarti, *Orient. Insects*, **22** : 62.

Alate viviparous female.—Body pale elongate, 3.3-3.8 mm long with 1.2-1.3 mm as maximum width. Head smooth, frontal tubercles diverging, hairs on vertex long and pointed, 0.121-0.174 mm long. Dorsal ocelli marked with black. Compound eyes large with distinct ocular tubercles. Antennae 6-segmented (segment VI broken in all specimens), pale with extreme apices of segments III and IV black, segment V brownish ; segment III smooth with faint imbrications on apical 0.25 portion with 12-17 elliptical secondary rhinaria, distributed over basal 0.2 portion ; hairs on antennae short, pointed, the longest one 0.015 mm, about $0.3\times$ as long as the greatest basal diameter of antennal segment III ; processus terminalis (as evidenced from embryo) about $3.0\times$ as long as base of segment VI. Rostrum reaches midcoxae, ultimate rostral segment longer ($1.39\times$) than second segment of hind tarsus and bearing 16 accessory hairs. Dorsum pale, membranous ; abdominal dorsum with as 3 spinal of hairs on each of the tergites 1-7 and with one pair of pleural hairs on tergites 1-5 ; marginal hairs in clusters



Yamatocallis brevicauda 747-753 alate vivipara : 747, body ; 748, head ; 749, antennal segment III ; 750, apical rostral segment ; 751, hind tarsus ; 752, siphunculus ; 753, cauda and anal plate.

of 3(2)-6 on each lobe of tergites 1-7; spinal hairs elongated, pointed, those on tergites 1-5 measuring 0.152-0.209 mm, on tergites 6-7, 0.076-0.110 mm long ; marginal hairs of various lengths, the longer ones 0.171-0.209 mm, the shorter ones 0.076-0.136 mm long ; tergite 8 bearing 4 hairs. Siphunculi elongate (0.82 mm), pale with dark tips, $0.23-0.25\times$ as long as the body, $3.7\times$ as long as cauda, wider at base and evenly tapering and reticulated over apical 0.10 portion. Cauda pale (0.22 mm long), with heart-shaped knob, constricted near the middle and bearing 11 hairs. Subanal plate indented. Legs with femora pale except black apices ; tibiae and

tarsi brownish ; femoral and tibial hairs normal ; tibiae with apical halves bearing short spinules. First tarsal segments with 6 ventral and 2 dorsal hairs ; second tarsal segments spinulose. Forewings with radial sector strongly curved and with small dusky spots at apices of radial sector and branches of media.

Colour.—Not recorded.

Measurements in mm.—

Length	Width	Ant. segments				urs	ht ₂
		III	IV	V	VI		
3.5	1.2	1.81	1.76	1.37	—	0.21	0.15

(ex *Acer villosum*, Hanumanchoti, U.P., 13.6. 1980, coll. A. Mondal No. 979, U. of Kalyani Coll.).

Embryo.—Dorsal hairs elongate, knobbed. Head with 1 pair of hairs on frons and 2 pairs on vertex besides 4 posterior discal hairs ; spinal and pleural hairs arranged in 4 longitudinal rows, the former from pronotum to 8th abdominal tergite, the latter from mesonotum to 5th tergite ; marginal hairs 2 pairs each on thoracic segments and 1 pair each on abdominal tergites 1-7. Siphunculi short cylindrical. Antennae longer than the body ; accessory rhinaria not separated from primary rhinarium. Apical rostral segment elongate, with 4 secondary hairs.

Material examined.—Two alate viviparous females from *Acer villosum*, Hanumanchoti, Uttar Pradesh, India, 13.vi.1980, coll. A. Mondal, U. of Kalyani Coll.

Discussion.—This species belongs to *Yamatocallis* as evidenced by the presence of reticulation near the apices of the siphunculi and by the fact that the accessory rhinaria are not separated from the primary rhinarium (as seen in the embryo). It is easily distinguished from *Y. obscura* Ghosh, Ghosh, Raychaudhuri in having longer siphunculi with a shorter reticulated zone, longer apical rostral segment, presence of more spinal hairs on the abdomen, presence of spinules on the second tarsal segment and by elongated body hairs in the embryo.

HOST PLANTS OF DREPANOSIPHINAE
RECORDED IN INDIAN
REGIONHOST PLANTS OF DREPANOSIPHINAE RECORDED
IN INDIAN REGION

Acer caesium

Drepanosiphum platanoides

Acer oblongum

Drepanosiphum oregonensis

Acer villosum

Yamatocallis brevicauda

Alnus nepalensis

Mesocallis alnicola

Mesocallis obtusirostris

Neobetulaphis chaetosiphon

Neobetulaphis pusilla

Taoia indica

Anona squamosa

Taiwanaphis kalipadi

Arundinaria sp.

Cranaphis indica

Shivaphis arundinariae

Takecallis arundinariae

Arundinaria jounsarensis

Takecallis himalayensis

Bambusa sp.

Neocranaphis bambusicola

Takecallis himalayensis

Bamboo (undet. species)

Subtakecallis brevisetosus

Subtakecallis pilosa

Betula alnoides

Betulaphis hissarica

Betula utilis

Neobetulaphis chaetosiphon

Neobetulaphis pusilla

Betula sp.

Betulaphis longicornis

Clethrobis vermai

Celtis australis

Shivaphis celti

Celtis sp.

Shivaphis celticola

Celtis trandia

Shivaphis celti

Combretaceae (undet. species)

Taiwanaphis dineni

Corylus colurna

Pterocallis sp.

Cyperus sp.

Saltusaphis scripus

Dalbergia sp.

Pseudotinocallis nigropunctata

Duabanga sonnaritoides

Tinocallis himalayensis

Juglans regia

Chromaphis hirsutustibis

Chromaphis juglandicola

Panaphis juglandis

Panaphis nepalensis

Lagerstroemia indica

Tinocallis kahawaluokalani

Leguminosae (undet. species)

Tinocallis distinctus

Machilus odoratissima

Machilaphis machili

Phyllanthus sp.

Chuansicallis chengtuensis

Pseudotinocallis nigropunctata

Prunus cerasus

Betacallis prunicola

Tinocalloides montana

- Quercus dealbata*
Globulicaudaphis pakistanica
- Quercus griffithi*
Tuberculatus indicus
- Quercus incana*
Hoplocallis microsetosus
- Quercus semicarpifolia*
Myzocallis polychaetus
- Quercus* spp.
Betacallis querciphaga
Betacallis sikkimensis
Serratocallis takahashii
Tuberculatus nervatus
Tuberculatus paiki
- Randia* sp.
Taiwanaphis randiae
- Rosaceae (Indet. species)
Neobetulaphis immaculata
- Terminalis arjuna*
Paoliella nirmalae
- Trifolium* sp.
Therioaphis trifolii
- Ulmus wallichiana*
Indiochaitophorus furcatus

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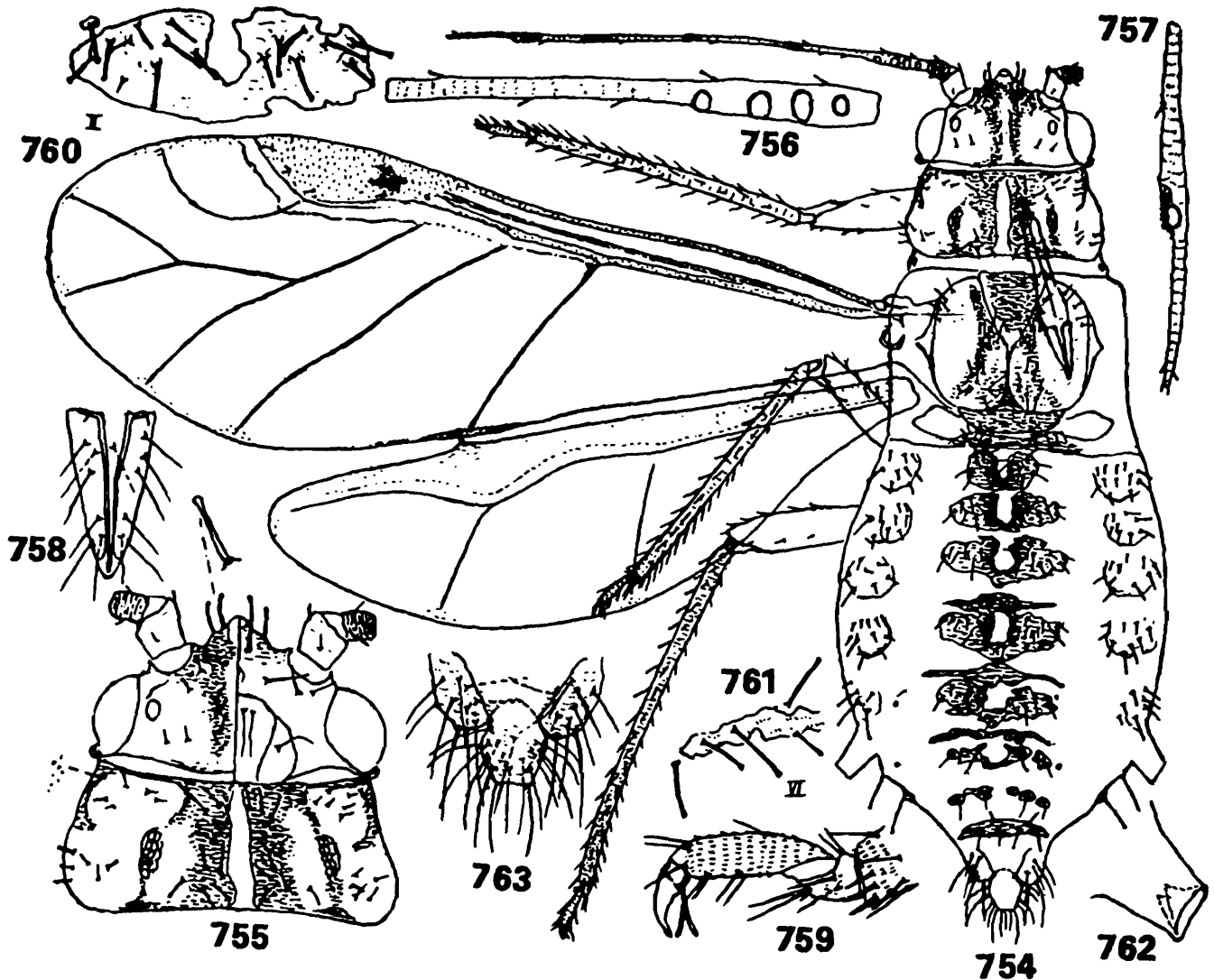
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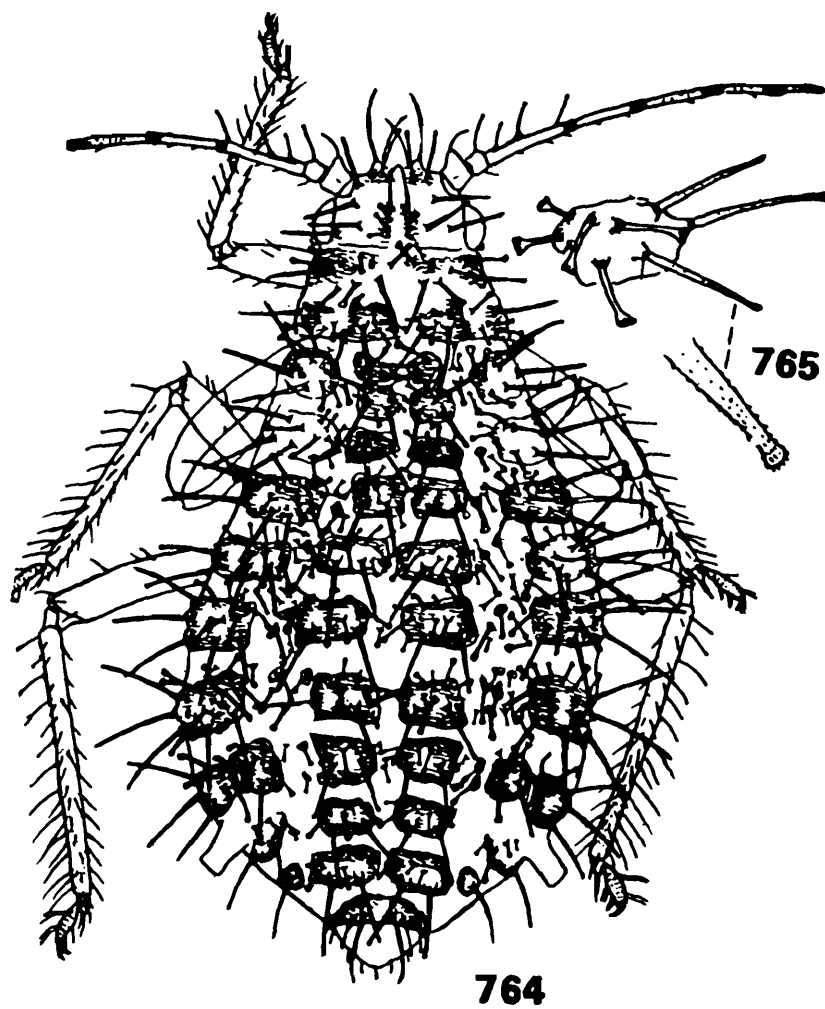
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ADDENDUM

REMAUDIERE, G. and QUEDNAU, F.W. 1988. Un nouveau *Tinocallis* sur *Ulmus*, originaire d'Asie Centrale et semblable à *T. saltans* (Nevsky) (Homoptera : Aphididae). *Can. Ent.* 120 : 211-219.



Hoplocallis pictus (Ferrari). 754—765, Alate vivipara : 754, body; 755, head and thoracic nota; 756, antennal segment III; 757, antennal segment VI; 758, apical rostral segment; 759, hind tarsus; 760, spinal abdominal Sclerite; 761, ventral abdominal setae; 762, siphunculus; 763, cauda and anal plate.



Hoplocallis pictus (Ferrari). 764-765, Altoid nymph.
764, body ; 765, spinal abdominal sclerite.

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Valid names of species and genera are printed in Roman type ; names given in synonymy, preoccupied or changed generic assignment etc., or given in italic type ; Numbers in bold indicate page containing detailed description.

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