

Fauna of India

HOMOPTERA : APHIDOIDEA

PART—I

GENERAL INTRODUCTION
AND
SUBFAMILY CHAITOPHORINAE



A. K. GHOSH

Aphidoidea forms one of the most important group of Phytophagous insects because of their polymorphism, host alternating heteroecious behaviour, reproductive habits and above all for their role as largest group of insect vector of plant viruses. The fauna of India and the adjacent countries, in this group, constitutes about 16% of the world fauna, including a large number of rare, endemic species. However, no consolidated account of Indian aphids was so far available and the present work was started in 1976 and has been so planned as to be published in several parts. The first part deals with an introductory chapter on Aphidoidea leading to subfamily Chaitophorinae. The entire superfamily is expected to be covered under at least eight separate parts. Besides, taxonomic accounts, the volumes will also provide information on host plant association, association with ants, natural enemies of aphids, distribution etc.

THE FAUNA OF INDIA
AND
THE ADJACENT COUNTRIES

HOMOPTERA
APHIDOIDEA

Part 1

GENERAL INTRODUCTION

AND

SUB-FAMILY *CHAITOPHORINAE*

by

A. K. GHOSH



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Dedicated to the memory of my parents

EDITOR'S PREFACE

APHIDOIDEA form one of the most important group of Phytophagous insects because of their polymorphism, host-alternating heteroecious behaviour, reproductive habits, and above all their role as largest group of insects Vectors of plant-viruses. The Fauna of India and adjacent countries, in this group, constitutes about 16% of the World fauna, including a large number of endemic species and so far no consolidated account was available on this economically important group of insects. The present work, started in 1976, has been so planned as to be published in several parts. The present volume deals with an introductory chapter on Aphidoidea, leading to the subfamily Chaitophorinae, one of the smaller groups of the family Aphididae. The second and third parts would deal with the Lachninae and Pemphiginae. The entire superfamily is expected to be covered under at least 8 separate parts. Besides taxonomic aspects the work also provides information on host plant association, association with ants, natural enemies of aphids and other related fields of interest. The author, Dr. A. K. Ghosh, has been engaged in aphidological studies for the past two decades and it is expected that present work, the first of the series on "Aphidoidea" under "Fauna of India and adjacent countries" would be of use to entomologists, plant-pathologists and members of public interested in the study of natural-history.

CALCUTTA

15th April, 1980

T N. ANANTHAKRISHNAN

Director

Zoological Survey of India

AUTHOR'S PREFACE

It is surprising to observe that although excellent systematic accounts of many Insect-groups from Indian region are available, no account of soft bodied Homopterans (Aphidoidea, Psylloidea, Coccoidea and Aleuroidea) has never been published under any monographic series. Only recently published, R. N. Mathur's (1975) "Psyllidae of the Indian Subcontinent" and S. Mohammad Ali's (1970-1974) 'A Catalogue of Oriental Coccoidae', may be regarded as significant contributions to our knowledge about this group. 'Aphidoidea' remains the only other part for which no such comprehensive account is available. The present volume deals with one of the smaller subfamily i.e. 'Chaitophorinae', out of 9 subfamilies of Aphidoidea. The material for the present study was rather scanty even after sincere efforts of several workers to collect specimens from Northern temperate region.

My sincere thanks are due to Dr. V F. Eastop and the authorities of British Museum (Natural History) London, Dr. D. Hille Ris Lambers, Bennekom, The Netherlands; Dr. H. Szelegiewicz, Institute of Zoology, Warsaw, Poland, Dr. A. Pintera, Czechoslovak Academy of Sciences, Praha, Czechoslovakia, Dr. H. Higuchi, Oyama City, Japan, Dr. (Miss) Louise M. Russell, Co-operating Scientist, Systematic Entomology Lab., USDA-ARS, Beltsville, U.S.A., Dr. D. N. Raychoudhuri, Department of Zoology, University of Calcutta, Dr. K. D. Verma, Central Potato Research Institute, Simla; Dr. S. Kanakaraj David, Madras, Dr. S. Chakrabarty, Department of Zoology, University of Kalyani, for their continuous help during the course of this work by making their material available, and by their comments etc.

I am indebted to Dr. T N. Ananthkrishnan, Director and to Dr. S. Khera, former Joint Director-in-Charge, Zoological Survey of India, Calcutta for offering working facilities. I would also like to record my deep sense of appreciation to my colleagues, Dr. R. C. Basu and Dr. L. K. Ghosh in Zoological

Survey of India, Calcutta for their assistance, to Sri Salil Roychoudhuri, and Sri Santwana Goswami, Artists, to Sri Ahmed Hossain and Sri Bijan Dhar, Photographers, for conscientious execution of the drawings and photographic work. My thanks are also due to Dr. S. Roy and Dr. R. N. Khanna, Central Potato Research Institute, Shillong, without whose help many of the earlier microphotographic works would not have been possible.

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INTRODUCTION

The study of aphids in Indian subcontinent may be traced back to the last decade of 19th Century, when a series of small notes started appearing in the now discontinued "Indian Museum Notes" (Barlow 1896, 1899; Buckton, 1896-1899; Cotes, 1891-1896). Later van der Goot (1916-1918) published some works on Indian and Ceylonese aphids, but the first consolidated work on regional fauna of aphids was published by Das (1918) on APHIDIDAE of Lahore. Between 1914-1950, a few papers were published on South Indian Aphids (Fletcher, 1914, 1920; George, 1925-1927; Theobald, 1929; Krishnanmurti, 1928, 1930, 1950), on Western Indian aphids (Deshpande 1937) and on aphids of Delhi and AFGANISTHAN (Ullah, 1940, 1941). However, Extensive survey of entire northern temperate region and some other areas of subcontinent were carried out in the last 25 years and as a result a large number of publications appeared during the period. (Alam and Hafiz, 1963; Banerjee and Basu, 1955; Basu, A. N. 1961-1969; Basu, R. C. *et al.* 1970-1976; Behura, 1963 1966; Chakrabarti *et al.* 1970-1978; Chatterjee, *et al.* 1961; Chowdhuri, A. N. *et al.* 1969-1970; David *et al.* 1956-1975; Eastop, 1966; Doncaster, 1956, 1966; Ghosh, A. K. *et al.* 1958-1978; Ghosh, L. K. 1969-1976; Ghosh, M. R. *et al.* 1970-1974; Ghani and Rao, 1966; Hille Ris Lambers, 1966, 1974; Judenko and Eastop, 1963; Kumar 1973; Menon and Pawar 1958; Quadnau, 1973; Raychaudhuri *et al.* 1958-1978 etc.; Sengupta and Behura 1962; Sharma, 1968; Verma, 1965-1971).

Ghosh, A. K. (1975) published a list of aphids of INDIA and adjacent countries known till 1968 and subsequently an addition to the list has been published (Ghosh, A. K., 1977), which taken together show a total of more than 650 species, of which 50 per cent appears endemic to the region, but no consolidated work has been published till date which could be used as a basis for taxonomic or faunistic study of the group, except a monograph by Ghosh, A. K. (1974) on aphids of economic importance in INDIA. The present work has been undertaken to provide keys for identification, descriptions with suitable figures, host plants, distribution etc. for all species found in the region; the entire work is to be published in several parts and the first part would deal with one subfamily *CHAITOPHORINAE* under family APHIDIDAE of superfamily APHIDOIDEA.

Eastop and van Emden (1972) has given a list of regionally classified monographs and check lists along with a bibliography for identification of natural enemies of aphids. Works of Takahashi (1931), Tao (1961-1970), Szelegiewicz (1968) van der Goot (1919) for oriental fauna, Bodenheimer and Swirski (1957), Shinji (1941)

and Paik (1965), Szelegiewicz (1963, 1964, 1969), Nevsky (1929), Narzikulov (1963) for parts of Palaearctic fauna, Eastop (1958, 1961) for Ethiopian fauna, van der Goot (1917), Takahashi (1951) Calilung (1967–1969) for Malayan fauna, Eastop (1966) and Cottier (1953) for Australian and New Zealand fauna, would of great help for study of aphid fauna of the Indian region as many of the elements from the above regions have been reported from various parts of this subcontinent.

Smith (1972) has published a bibliography of the APHIDIDAE of the World, [obviously APHIDIDAE actually encompasses "APHIDOIDEA", as evident from the publication] providing very useful guide for all aphidological literature published till 1972. Eastop and Hille Ris Lambers (1976) have published an extremely useful list of the World-aphids indicating the synonymy of genera and species.

SYSTEMATICS

Aphid classification has been proposed in very different ways by earlier authors, a history of which has been given by Cottier (1953) and Hsu (1965).

Most of the authors in recent times considered the group comprising aphids as a superfamily, APHIDOIDEA; Börner and Heinze (1957) recognised eight families under APHIDOIDEA, Eastop (1966) recognised four families and subsequently Eastop and van Emden (1972) recognised only three families viz. APHIDIDAE, ADELGIDAE and PHYLLOXERIDAE; the latter system has been followed in this work for higher classification of the group. Till 1968, 3689 species were described under APHIDIDAE, 47 under ADELGIDAE and 69 under PHYLLOXERIDAE. In Indian subcontinent a total of 653 species under 198 genera have been recorded till 1974 of which about 36 genera and 310 species are endemic in origin (Ghosh, 1975; Ghosh; 1977).

PHYLOGENY

Hemiptera has been considered as the most isolated phylogenetic order of insect and form the largest group of Hemimetabola. Evans (1963) postulated a prothomopteran form from which APHIDOIDEA evolved through specialization, largely originating from loss or reduction of morphological structures. As the course of evolution can not be determined by studying recent genera only, attempts have been made to draw phylogenetic tree, deriving knowledge from palaeontological studies (Heie, 1967), parasitological studies (Mackauer, 1965) and cytological studies (Kuznetzova and Shaposhnikov, 1973). It has indicated that coniferous host association of primitive aphids has been retained from the

past (as ADELGIDAE of present day) and the first aphids were associated with the plants from which the aphid hosts of present day have evolved e.g. primitive Gymnosperms as Cordaitales and Cycadophyta (Heie, 1967) ADELGIDAE and PHYLLOXERIDAE have been considered to be most primitive, arising in early Permian, followed by *HORMAPHIDINAE* and *PEMPHIGINAE* in Triassic or Jurassic, and subsequently the remaining families evolved with the 'triumphal progress of angiosperm' Both parasitological and palaeontological studies further indicate that 3 lensed larval eye is a primitive or plesiomorphic character and multilensed larval eyes evolved later, and *APHIDINAE* should be considered as the youngest branch of the phylogenetic tree to which *LACHNINAE* is most closely related (Mackauer, 1965; Heie, 1967).

MORPHOLOGY AND TERMINOLOGY

The *body* of an aphid has normally three distinct regions, (Figs. 1, 2) head, thorax and abdomen but head and prothorax may be fused or there may be various types of fusion of abdominal segments.

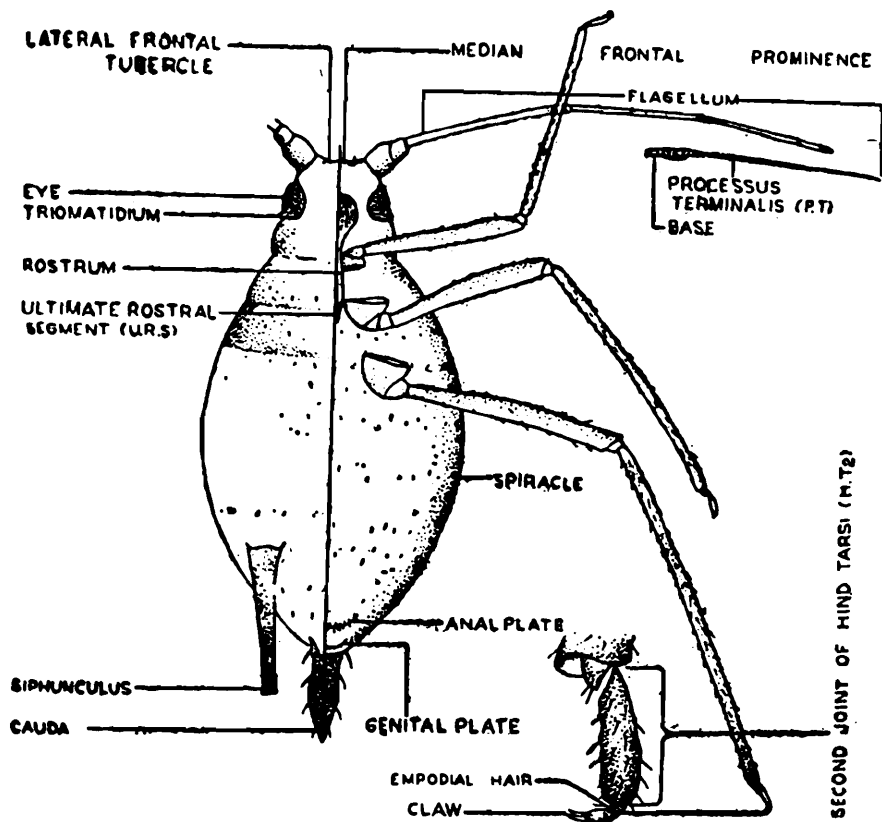


FIG. 1. An apterous viviparous ♀.

NOTE: (All figures represent apterous viviparous ♀ unless otherwise indicated.)

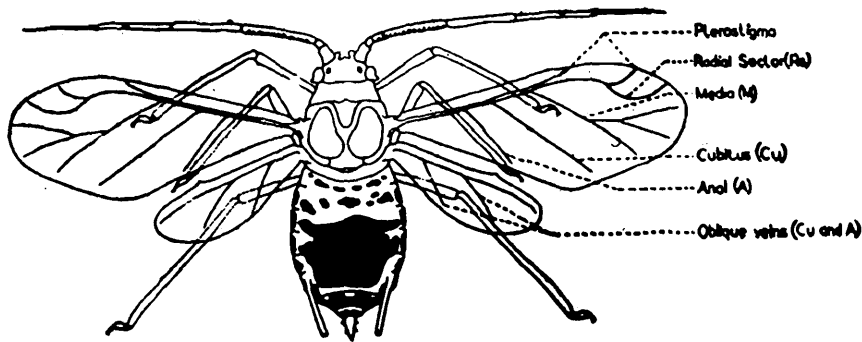


FIG. 2. An alate viviparous ♀.

The *head* bears a flat or convex frons, with or without lateral frontal tubercles, (Fig. 3) which when present may be smooth, rugose, spinulose, and parallel, converging or diverging. Eyes are normally of large, compound type, but in apterae of some primitive groups, *e.g.* ADEIGIDAE and PHYLLOXERIDAE as also in PEMPHIGINAE eyes may be represented by triommatidia. Paired lateral or dorsal tubercles may be present on the head, thoracic and abdominal segments, and three ommatidia protruding from the posterolateral margin in the eyes of alatae form "Ocular tubercles" Antennae usually consist of two short basal segments and a flagellum of 1-4 segments which may be variably smooth,

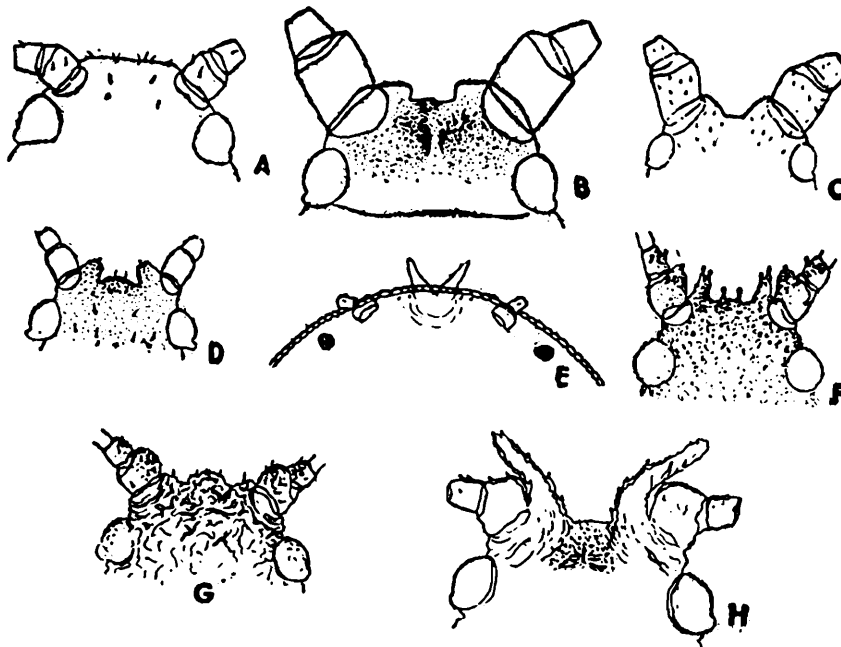


FIG. 3. Frons with various types of frontal tubercles: A. frontal tubercles smooth, inconspicuous; B. parallel and spinulose frontal tubercles; C. divergent frontal tubercles; D. convergent frontal tubercles; E, F, H. frontal processi; G. median rugose, frontal tubercle. [figs. A-D, F-H. Aphidinae; E. Hormaphidinae].

imbricated or even reticulated; the penultimate antennal segment bears a primary rhinarium at the distal end and in the last antennal segment, the primary rhinarium placed basally demarkates, the 'base' from the slender apical part, termed 'processus terminalis' which is measured from the distal apex of the primary rhinarium to the tip; secondary rhinaria may vary in shape, size and number and may be variably present on antennal segment III, IV and V and sometimes on base of VI in alatae and on antennal segment III of apterae of some APHIDIDAE. Rostrum consists of 5 segments, last segment being usually small and fused with the 4th segment, the combined structure is known as 'ultimate rostral segment', which may be of various shapes (Fig. 4) and sometimes these can be associated with particular feeding site, e.g. aphids feeding on Graminae with short ultimate rostral segment and those on Coniferae with long and distinct 5th segment of rostrum; ultimate rostral segment usually bears a variable number of accessory hairs besides a tuft of 6 primary hairs at the apex.

Thorax consists of three segments, Pro-, meso-, and metathorax, the first may fuse with the head, the others may variably fuse

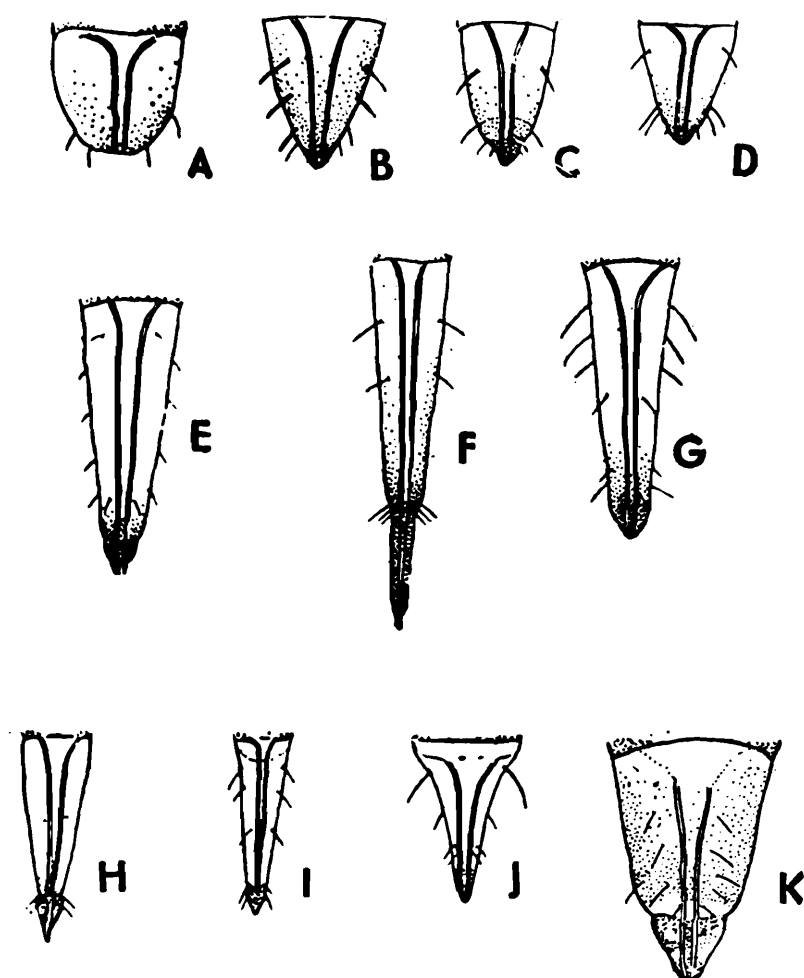


FIG. 4. Ultimate rostral segments: A. Hormaphidinae; B, C, D, G-J. Aphidinae; E. Pemphiginae; F, K. Lachninae.

among themselves or with the abdomen. Mesothorax in apterae usually show mid thoracic furca, the arms of which may be separated or connected by a sessile or stalked base. Legs consist usually of 5 segments, sometimes coxae and trochanters may be fused; femora and tibiae may be smooth or variably imbricated, the latter may bear peg-like hairs or stridulatory ridges or pseudorhinaria like structures; sometimes tibiae may be distinctly spinulose apicad or may be swollen. Tarsi are usually 2 segmented and the small first tarsal segments, bear 2-7 ventral hairs, in some groups like, *DREPANOSIPHINAE*, or *Eulachnus* of *LACHNINAE*, dorsal hairs may also be present; second tarsal segments usually imbricated, sometimes spinulose and bear dorso and lateroapical hairs and a pair of terminal claws; empodial hairs present between the claws, may be hair like, flattened or expanded at apices. Fore wings (Fig. 5) possess a variably pigmented stigma which may not extend upto the tip of the wings, a straight or curved radial sector, simple or once or twice forked media, besides anal and cubitus veins; hind wings (Fig. 5) are always much smaller than forewings, bear 2 oblique veins which may be reduced to 1 or may even be absent; wing veins may be variably infuscated or pale or partly united.

Abdomen consists of 9 segments, the terminal segment becoming modified as Cauda. Abdominal dorsum may be variably pig-

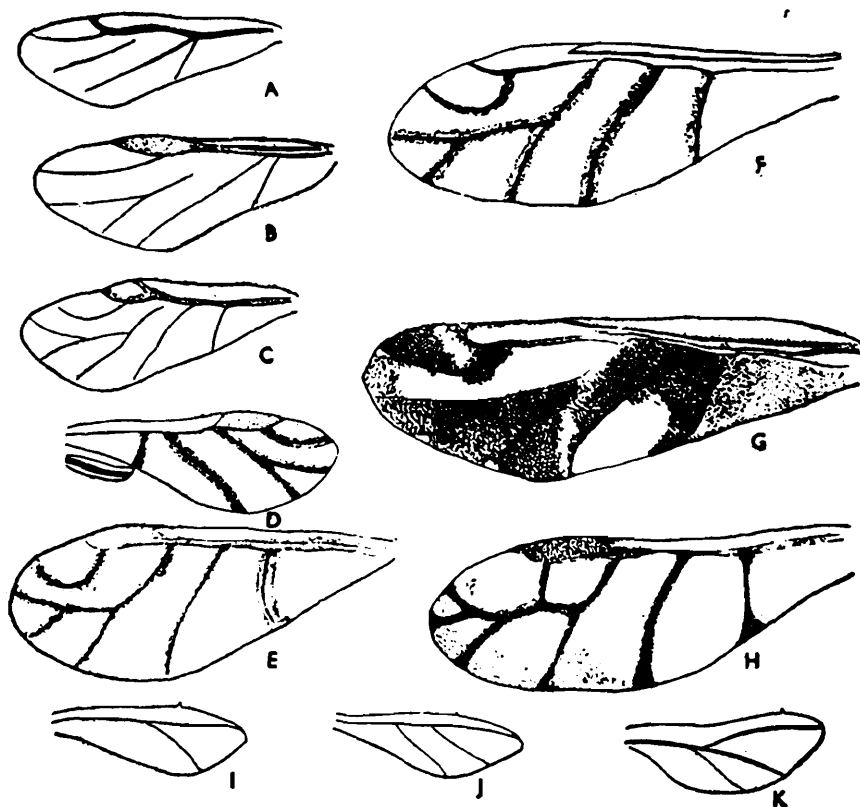


FIG. 5. Fore and Hind Wings: A, B, K. Pemphiginae; C. Drepanosiphinae; D. Greenideinae; E, F, H-J. Aphidinae; G. Lachninae; A-I. forewings, I-K, hind wings].

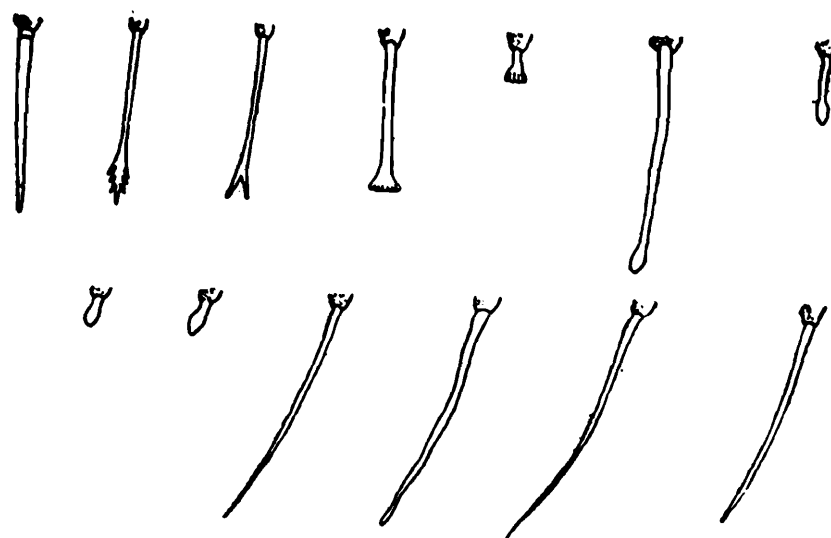


FIG. 6. Various types of dorsal hairs.

mented and sculptured; dorsal hairs (Fig. 6) may be fine, acuminate or with furcated apices and may be numerous or very sparse, extremely long or hardly discernible. Each of the abdominal segments 1-7 usually bears a pair of spiracle, which may be round, reniform and may be surrounded by a conspicuous spiracular plate. Lateral abdominal tubercles usually present on 1st and 7th tergite, those on 2nd-6th may be variably present; other tubercles may sometimes occur variably (Fig. 7), Abdominal segment 5 or 6 usually bears a pair of Siphunculi, which may be elongate, truncate, cylindrical, clavate, tapering or pore like and may be smooth, imbricated or reticulated and with or without hairs (Fig. 8); siphunculi are absent in primitive groups like ADELGIDAE and PHYLLOXERIDAE and also in some APHIDIDAE. Subanal plate (Fig. 10) situated ventral to the Cauda, may be entire, indented or bilobed; subgenital plate bears many hairs. Cauda (Fig. 9) may be elongate, oval, semioval, knobbed etc. and bears 2 to many hairs. Wax plates (Fig. 11) or pores may be variably present on head, thorax and abdomen and some species may remain completely covered with waxy secretion as in many PEMPHIGINAE.

The oviparous females are usually apterous and possess numerous pseudosensoria on swollen hind tibiae; males, usually alate but smaller in size than alate viviparae, exhibit distinct sclerotic claspers (Fig. 10).

Measurements for taxonomic study: Measurements of different morphological structures and hairs are essential in following descriptions and keys for identification. Measurements are taken with ocular micrometer under low magnification for body size etc., and under high magnification for minute structures. Measurements of the following structures are essential for any aphidological study; words in parenthesis show the abbreviations used in the text.

- | | | |
|---|---|--|
| 1. Body length | : | Distance from frons to distal end of Cauda. |
| 2. Body width | : | Maximum width at middle of abdomen. |
| 3. Antenna | : | Length from base of segment I to tip of processus terminalis. |
| 4. Base of last antennal segment | : | Length from basal articulation to the outer margin of primary rhinarium. |
| 5. Processus terminalis | : | Length from distal end of primary rhinarium of last segment to the tip of the segment. |
| 6. Basal diameter of antennal segment III | : | Diameter at the very base of the segment. |
| 7. Ultimate rostral segment (urs) | : | Length from base of segment 4 to the tip of segment 5 of rostrum. |
| 8. Second segment of hind tarsus (ht_2) | : | Length from basal articulation to the apex excluding claws. |
| 9. Siphunculus (Siph.) | : | Length from basal articulation to the tip of the siphunculus. |
| 10. Cauda | : | Length of Cauda from middle of its base to the apex. |
| 11. Hairs | : | Length of hair from socket to the tip. |

BIOLOGY

Polymorphism and reproduction

Ancestors of aphids have been considered as amphigonic oviparous insects from which the situation of extreme polymorphism evolved in present day aphids, in which each species has at least one parthenogenetic viviparous morph and in most an apterous female morph. Most of the aphids leading a holocyclic life cycle have five or six morphs viz. males, and as females, fundatrices, apterous and alate virgoparae or parthenogenetic forms, apterous and alate gynoparae that produce only oviparae. In the region under study, however, anholocyclic life cycle is the predominant pattern for most of the species, as they seem to be incapable of reproducing sexually or producing viable eggs and as a result apterous and alate parthenogenetic viviparous morphs become the most common morphs; most of the species moult 4 times before reaching maturity; males and oviparous females of a few species,

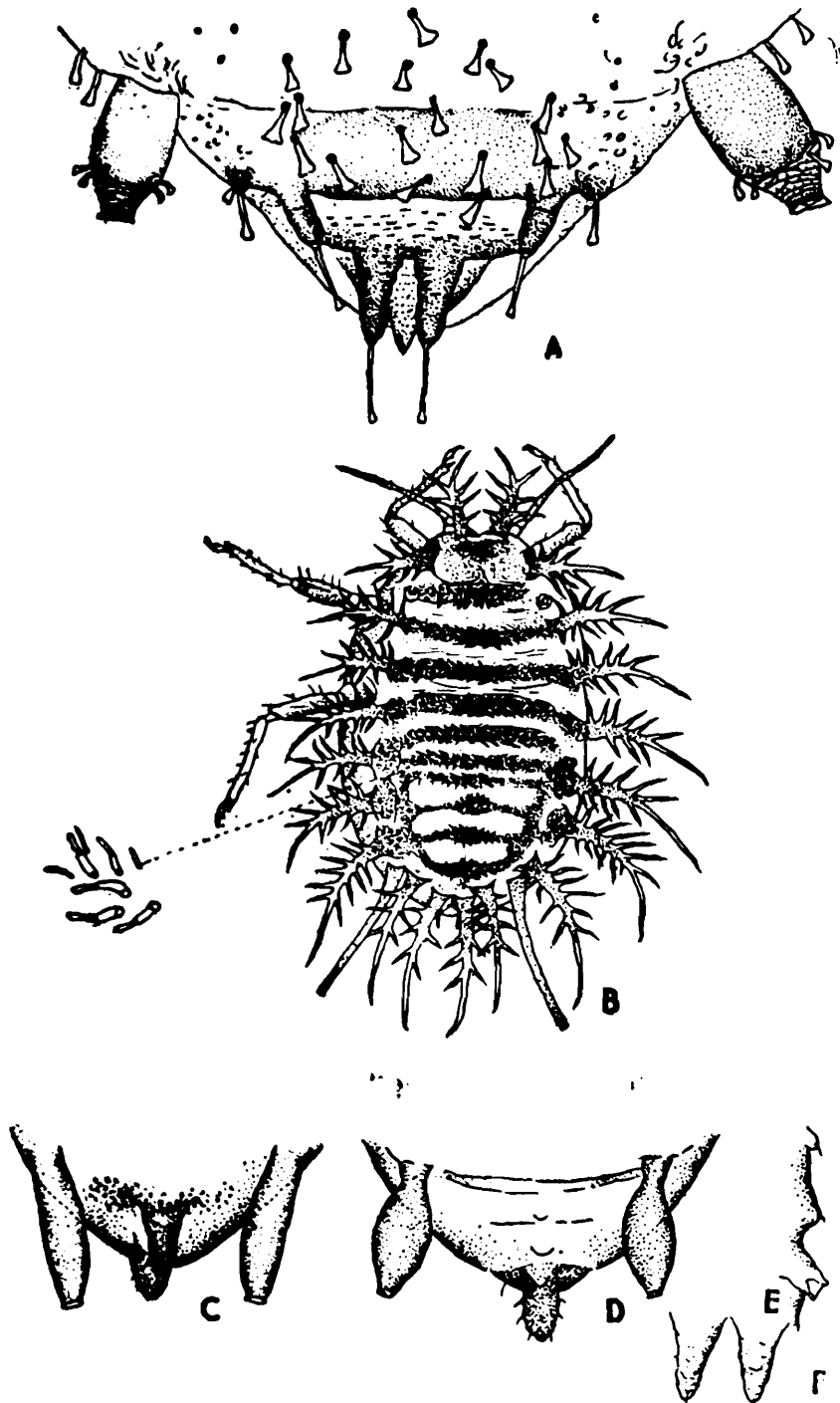


FIG. 7. Dorsal tubercles, A-B. Greenideinae; C, D. Aphidinae; E, F. Drepanosiphinae.

are met mostly in Northeast Himalaya and adjacent region, at high altitudes (*c* 2000 m–*c* 2500 m), at low temperature 6°–16°C, RH. 51%–90% and at an average day length of 8–10 hours, but their capability to produce viable eggs (0.40 mm–0.90 mm) remained mostly unknown. Parthenogenetic reproduction in aphids is achieved by thelytoky or diploid parthenogenesis and this leads to rapid population increase. Polymorphism in aphids has been reviewed by Hille Ris Lambers (1966).

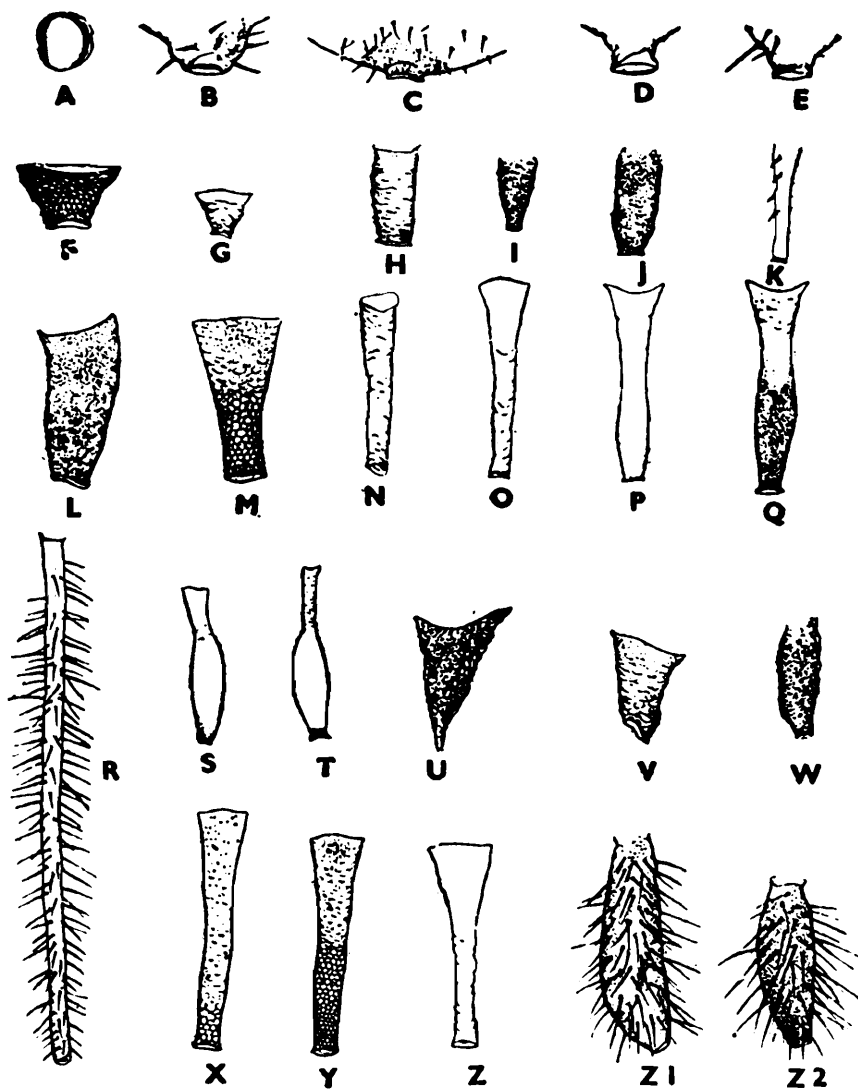


FIG. 8. Siphunculi: A. Pemphiginae; B. Hormaphidinae; C. Lachninae; D & E. Drepanosiphinae; F. Chaitophorinae; G-Q, S-Z. Aphidinae; R, Z₁, Z₂, Greenideinae.

Host-range

Most aphid species feed on plants of one genus (Monophagous) or on plants of related genera (Oligophagous) but several other species are known to feed on plants of unrelated or distantly related genera (Poly or pantophagous). Obviously, the oligophagy or polyphagy leads to the heteroecious nature, involving host alternation, as in Aphidini many species alternate between hosts of Rosaceae and Graminae. It appears that the habit of host alternation arose out of necessity i.e. in order to avoid nutritionally unfavourable host at particular season, and largely facilitated through production of alate morph for the purpose of dispersal. In some cases, aphids are known to lead complete life cycle on original secondary host and the heteroecy has been lost (Hille Ris

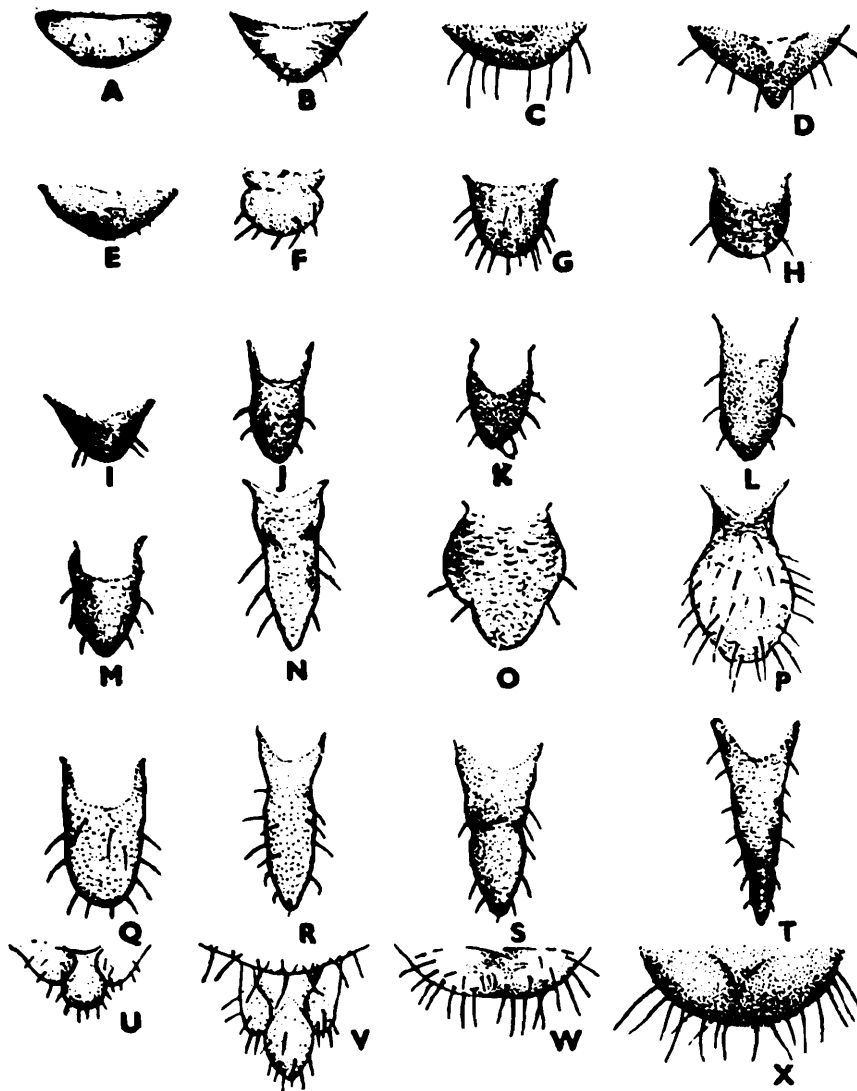


FIG. 9. Cauda: A. Pemphiginae; B, F, U. Hormaphidinae; C & D. Greenideinae; E. Lachninae; G, P, V, W. Drepanosiphinae; H-O, Q-T. Aphidinae; X. Pterocommatinae;

Lambers, 1950). Evolution of host relations in aphids have been discussed in details by Kennedy and Stroyan (1959) and Heie (1967).

Dispersal

The function of food-finding is intimately related with migration during which insect actively launches itself and once air borne, is passively transported, in some cases, for long range dispersal. Following initial take off, flight is controlled by wing speed, temperature and light, and according to the prevalent hypothesis, long-range dispersal or trivial flight is controlled by central nervous system. On alighting, which is controlled by various factors including light, sound, odour and learning, aphids start probing and acceptance or rejection of plants depend on complicated

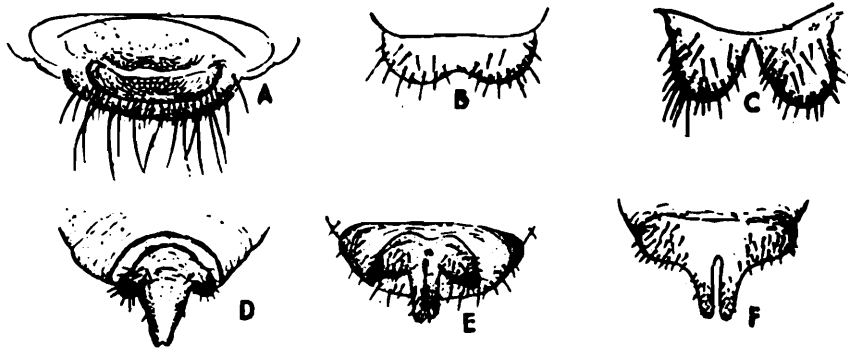


FIG. 10. Subanal plates: A. Greenideinae; B. Hormaphidinae; C. Drepanosiphinae; D. Aphidinae; E. Chaitophorinae; F. Greenideinae.

interactions of stimuli viz. colour, odour, taste etc. Taylor (1965) has dealt in details on flight behaviour and aphid migration and Kring (1972) has reviewed the works on flight behaviour of aphids. No coherent work has been done in INDIA to study the aphid-migration, except some localised study with the use of Moerick's yellow Pan Traps.

Production of alate viviparae, which ultimately affect dispersal, has been subject of much research in the aphid-biological work. Crowding of young or adult apterous viviparae may lead to development of alate viviparae but other environmental factors like temperature and day-length period may also play significant roles in alate production. In some cases, wing development has been stated to be under maternal prenatal control and governed by a humoral mechanism. Works of Bonnemaïson, Lees and Johnson, in this aspect of biology has been reviewed by Hille Ris Lambers (1966).

Association with ants

Association of ants with aphids may be casual to intimate and exhibits different forms of mutualism. It has been stated that in obligate host-association of aphids, continuous association with ants is prevented due to heterocyclic cycle, and only monoecious condition permits intimate association. Ants have been observed to drive away the natural enemies, e.g. *Lasius* spp., driving away predatory larvae of SYRPHIDAE and COCCINELLIDAE; *Formica* spp. have been observed not only to repel the enemies but also to attack and capture adult and older larvae of SYRPHIDAE; but ants' hostility and alertness is stated to decrease with increasing food supply i.e. honey dew from aphids. Aphid species, in some cases, multiply more rapidly when attended by ants and consequently, due to increased uninterrupted uptake of phloem-sap and increased excretion rate of honey, ants benefit from more supply of food from aphid source. Ants have also been involved

in the production of wings at least in some cases of *APHIDINAE* viz. *Aphis fabae* Scop., and *Aphis craccivora* Koch (El Ziady & Kennedy, 1956; Johnson, 1959).

The honey dew excreted by aphids, is a complex mixture of variable quality of many free amino acids, amides, proteins, minerals and vitamins, and provides nutrition to the ants and their solicitation probably increases the amino acid content and total amount of excreted honey dew. An excellent review on mutualism between ants and Homoptera has been given by Way (1963). Not much work however has been done in INDIA on this aspect but currently a project has been undertaken with a view to find out ant-aphid relationship in some areas of Northeast INDIA.

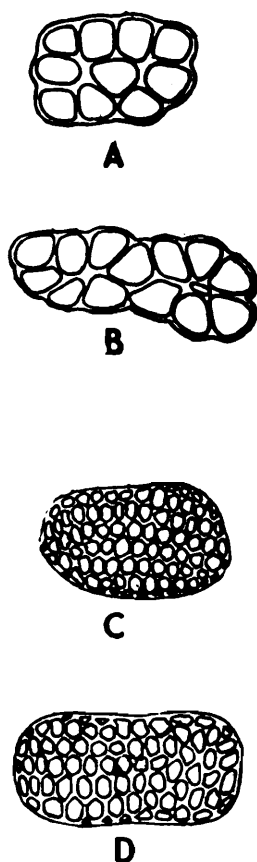


FIG. 11. Wax plates. A, B. Hormaphidinae; C, D. Pemphiginae.

Natural enemies

Aphids are preyed upon by many animals like Birds, spiders and insect groups like Neuroptera, Heteroptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera. Hymenopteran parasites viz., Ichneumonoidea, Cynopoidea, Chalcidoidea and Proctotroptoidea breed on aphids and of these, *APHIDIINAE*, and

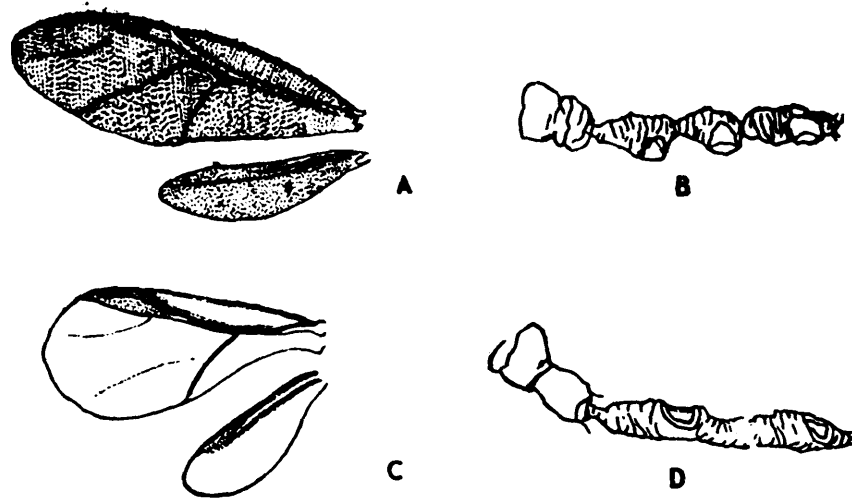


FIG. 12. A. Wings in Adelgidae, B. Antenna in Adelgidae, C. Wings in Phylloxeridae, D. Antenna in Phylloxeridae.

APHELINIDAE form the principal groups; dipterous parasites of aphids are scarce and found only among CECIDOMYIIDAE. A complete list of APHIDIIDAE of the world with distributional, host and biological data has been given by Mackauer & Sary (1967) and Mackauer (1968). It has been found that except ADELGIDAE and PHYLLOXERIDAE, all groups under APHIDIDAE could host aphidiid parasites. Species of three genera, viz. *Aphelinus*, *Mesidia* and *Mesidiopsis* of subfamily APHELININAE of Chalcidoid family APHELINIDAE are mostly known to parasitise aphids and of these, species of *Aphelinus* are well known. Besides parasites and predators, fungal pathogen of the genus *Entomophthora* can cause striking epizootics in aphid population. In INDIA, not much concentrated effort has been made to study the natural enemies and only in recent years, Commonwealth Institute of Biological Control at Bangalore surveyed natural enemies of six of the economically important species of aphids (1964–1969) and collected information on some other species; recently, Sary & Ghosh, A. K. (1975, 1978) have published preliminary results on the investigation of aphid parasites from Meghalaya in Northeast INDIA. Ghosh, A. K. (1974) has enlisted parasites, predators and fungal pathogen of aphids of economic importance in INDIA. Hagen and vanden Bosch (1968) have reviewed a large number of literature on pathogens, parasites and predators and their impact on aphids.

ECONOMIC IMPORTANCE

Aphids form the largest group of insect vectors for plant viruses and of the 247 viral diseases listed by Kennedy, Day & Eastop (1962), 159 are stated to be transmitted by nearly 200 species of aphids. As pointed out by Ossainilsson (1966), real number of potential vector is expected to be much larger, as only 9 per cent of total aphid fauna has so far been tested with any plant-virus. Aphids may transmit non-persistent viruses like Tobacco mosaic virus or TMV, (and most of the non-persistent viruses are transmitted only by aphids), semipersistent viruses like, Beet yellow stunt virus or BYV, or persistent viruses like Potato leaf roll or PLRV; Kennedy *et al.* (op. cit) listed 31 viruses as circulatively transmitted by aphids and by 1969 it has increased to 38 (Gibbs, 1969). Besides transmission of viruses, aphids cause direct damage by sucking of plant sap which may lead to yield-loss by 33 to 50 per cent in wheat (Daniels, 1957), or result in an energy drain of 19 per cent of the lime trees, annual production (Llewellyn, 1975). Some species cause leaf curling, galls and other malformation, probably through some salivary toxin. A list of virus pathogen known to be transmitted by aphids in INDIA as also list of economically important species of aphids which are known to be present in INDIA and could be regarded as potential vector of one or more plant viruses has been provided by Ghosh, A. K. (1974).

Out of 653 species of aphids found in the subcontinent, at east 149 species have been considered as definite pests or potential pests of economic plants; of the 149 species 147 belong to the family APHIDIDAE and 2 to family ADELGIDAE. The crops, they infest include cereals and grains, vegetable crops, fibre crops fruit trees, pulses, oil-seed, forest trees, sugarcane, ornamentals etc. Detailed account of all these species with host plant distribution, natural enemies and keys for identification has been provided by Ghosh (1974)

COLLECTION AND PRESERVATION

Aphids infest undersurface of leaves, young terminal shoots, flower buds and flowers, roots, stem and branches of plants and vary in colour from dirty green to dark, or pink, red, yellow etc. The best method for collection is to collect aphids alive on plant part, in polythene bags but care should be taken to avoid excessive moisture within the container; from the colony thus collected, some adults may be separated for preservation and the rest may be kept in wide mouth glass jar covered with mulmul cloth along with the host-plant material so as to allow the immature forms to develop further or to collect the winged forms from alate nymphs. This method is also useful for rearing aphid parasites, which usually

emerge within 2–3 weeks. Collection of these soft bodied homopteran from plants is to be done by hand, with a soft camel hair brush dipped in ethyl alcohol, and they may be preserved in the same fluid, concentration of which varies between 70%–95%, according to the methods preferred by various aphidologists. Some workers prefer a mixture of ethyl alcohol and 75% acetic acid (50 : 50) for the purpose of storage.

The insects preserved in alcohol, are to be cleared for mounting and permanent storage, on slides. For this purpose, insects are washed in alcohol and boiled in a water bath for 5–7 minutes; after carefully decanting off the alcohol, 10% KOH is added to the tube and the specimens are boiled again for 2–3 minutes for the purpose of clearing. After decanting off the KOH, the specimens should be boiled in a solution of chloral phenol (saturated solution of chloral hydrate in distilled liquid phenol) for 10–15 minutes [depending on size and sclerotisation of the material]. After clearing, the specimen may be mounted directly on clean glass slide in various mountant media; the one most commonly followed, is a media composed of Chloral hydrate (20 gm), powdered gum acacia (12 gm), glycerine (12 cc.) and distilled water (40 cc.). The media, as prepared above, is normally filtered through glass-wool for removing impurities. Slides with the specimens are normally kept in flat trays for natural drying or may be dried in an oven till the peripheral mountant dries up; a suitable ringing material may be used. Two labels, one incorporating data for host plant, locality, date, name of collector and the other with scientific name and name of scientist identifying the same, are pasted over the slides. Eastop and van Emden (1972) have dealt in details about various collection, preservation and mounting techniques.

It may be noted that besides collecting aphids from plant parts, several traps may be used for aerial population-study, the most common one being the Moericks yellow pan trap (a 12 × 12 × 3 inches yellow painted pan). The pan filled about two third with water may be put adjacent to cultivated field or any vegetation and aphids being attracted by yellow colour and trapped in water may be removed at regular intervals.

Some of the common traps used for sampling purposes in UNITED STATES, have been described by Melder and Ghosh (1969). Taylor and Palmer (1972) have given techniques for aerial sampling and descriptions of all aphid traps.

Key to the Families of APHIDOIDEA

1. Antennae of apterae usually 4–6 segmented, of alatae 5–6 segmented and in all morphs bearing two primary rhinaria; processus terminalis may be longer or shorter than the base of last antennal segment; eyes of apterae and alatae usually compound; siphunculi (Fig. 8) usually present and cauda (Fig. 9) often developed; forewings (Fig. 5) with distinct radial sector; aphids with parthenogenetic viviparous and oviparous morphs; mostly on dicotyledons, some on Coniferae.

APHIDIDAE

Antennae 2–5 segmented, with 1–3 primary rhinaria, processus terminalis always much shorter than the base of last antennal segment; eyes of apterae always of three facets; siphunculi absent; cauda not discernible; forewings without radial sector; all morphs oviparous.

2

2. Abdomen with 4–5 evident pairs of spiracles; antennae of apterae with 2 and of alatae with 3 primary rhinaria (Fig. 12B); forewings with cubitus 1 and 2 separated at base; hind wings without obliques; (Fig. 12A), wings held roof like in repose; all forms rostrate and bear evident wax plates; body without any conspicuous tubercles. On Coniferae, alternating between *Picea* and *Abies* or *Pinus* etc.

ADELGIDAE

Abdominal spiracle may or may not be evident; antennae of apterae with 1 and of alatae with 2 primary rhinaria (Fig. 12D); forewings with cubitus 1 and 2 united at base, (Fig. 12C) hind wings without obliques; wings held horizontally in repose; sexual forms arostrate, wax plates usually present; sometimes body with long tubercles. On dicotyledons e.g. Salicaceae, Fagaceae; host alternation not known [not recorded from India]

PHYLLOXERIDAE

Key to the Subfamilies of APHIDIDAE

1. First tarsal segments with 9 or more ventral hairs and sometimes with a pair of dorsal hairs. Body and appendages usually with many long and fine hairs. Head with a median suture, eyes of all morphs usually large. Processus terminalis always shorter than base of segment VI. Siphunculi (Fig. 8C) cone shaped or mere ring, bearing hairs. Cauda broad, (Fig. 9E) semicircular. Empodial hairs short, inconspicuous. On Coniferae or subaerial on dicotyledons.

LACHNINAE

First tarsal segments at most with 7 ventral hairs. Hairs on body and appendages very variable in length & shape; Head usually without a median suture; eyes in apterae of some groups of three facets only. Processus terminalis may be shorter or longer than base of last antennal segment. Siphunculi (Fig. 8A, B, D-Z₂) elongate, cylindrical, clavate or cone shaped or ringlike with or without hairs. Cauda of various shapes (Fig. 9 A-D, F-X). Empodial hairs usually long and conspicuous.

2

2. Siphunculi (Fig. 8R, Z₁, Z₂) usually elongate and hairy or short and truncate without any hairs but in the latter with a pair of dorsal processi arising from 7th tergite and eyes of apterae of 3 facets. Antennae 5-6 segmented, processus terminalis shorter than or upto more than 4 times as long as the base of last antennal segment. First tarsal segments with 3-7 hairs. Empodial hairs conspicuous. Cauda broad, sometimes with a short process. (Fig. 9D). On various plants, more often on Fagaceae, Moraceae, Betulaceae etc.....

GREENIDEINAE

Siphunculi of various shapes, if elongate then usually without hairs. ..

3

3. Subanal plate never indented or bilobed. Head and prothorax usually separate. Empodial hairs always fine.

4

Subanal plate usually indented or bilobed if entire, then body with wax plate (*i.e.* Pemphiginae) or body and appendages with conspicuous hairs (*e.g.* Chaitophorinae and Pterocommatinae). Head and prothorax as also other abdominal tergites may be free or variably fused. Empodial hairs may be flattened or fine. Wax glands may be variably present or absent. . 5

4. Siphunculi (Fig. 8 M-O) usually elongate and without any hairs. Cauda (Fig. 9 I-L) elongate or triangular or sometime tongue shaped etc. Processus terminalis usually longer than base of last antennal segment. Body usually with lateral abdominal tubercles. Eyes of all morphs large and with ocular tubercles. First tarsal segment with 2-5 ventral hairs. On various plants, many extremely polyphagous..

APHIDINAE

Siphunculi cone-shaped with many hairs, Cauda broader than long. Processus terminalis always shorter than base of last antennal segment. Body with or without marginal tubercles. Eyes of apterae rudimentary (Aiceonini) or large (Anoecini). First tarsal segments with 5-7 hairs. On Lauraceae, Cornaceae and on roots and aerial parts of Graminae. :

ANOECIINAE

5. Eyes in all morphs large, [if of three facets, then head fused with prothorax and processus terminalis hardly 0.25 times as long as base of segment VI and body covered with wax. *e.g.* Neophyllaphidini of Drepanosiphinae]. Siphunculi truncate, elongate or clavate, variably imbricated or reticulated. Cauda knobbed or semi-circular. Wax plates usually absent. 6

Eyes of apterae of 3 facets, Siphunculi never elongate or clavate but truncate, cone shaped or absent, never with any reticulation. Cauda knobbed or semicircular. Wax plates (Fig. 11) usually present. 8

6. Body and appendages usually with conspicuous dorsal hairs. Wax plates absent. Eyes of all forms large. Secondary rhinaria in alatae round or oval. Subanal plate entire. First tarsal segment may be with dorsal hairs. 7

Body and appendages without conspicuous hairs as above; in apterae, dorsal hairs may be capitate. Eyes of apterae sometimes 3 faceted. Antennae 5-6 segmented, secondary rhinaria in alatae round, oval or annular; processus terminalis may be shorter or longer than base of last antennal segment. Siphunculi truncate (Fig. 8E) or ring like, if elongate then cauda distinctly knobbed (Fig. 9P). Cauda knobbed or semilunar. Wax plates present or absent. First tarsal segment with 5-7 ventral hairs, and alatae may also bear a pair of dorsal hairs. Empodial hairs usually flattened. On Coniferae and Graminae and dicotyledonous trees *e.g.* Fagaceae, Ulmaceae, Corylaceae, Betulaceae etc..

DREPANOSIPHINAE

7. Antennae 5-6 segmented. Processus terminalis never shorter than base of last antennal segment. Siphunculi (Fig. 8F) truncate usually with reticulation or ring like, never clavate. Cauda knobbed or semilunar. First tarsal segment with 5-7 hairs. Gonapophyses 4. On Salicaceae, Aceraceae and Graminae.....

CHAITOPHORINAE

Antennae always 6 segmented, usually shorter than body; processus terminalis may be shorter or longer than base of segment VI. Siphunculi elongate, cylindrical or clavate, never reticulated. Cauda semicircular, never knobbed. Gonapophyses 3. On Saliaceae ..

.. *PTEROCOMMATINAE*

8. Head and pronotum fused in apterae; apterae often aleyrodiform and usually bear a pair of frontal horns (Fig. 3E). Antennae 2-5 segmented, secondary rhinaria absent in apterae, annular in alatae. First tarsal segment usually with less than 5 hairs and second tarsal segments with dorsoapical capitate hairs. Empodial hairs at least slightly expanded at the apices. Siphunculi usually present as cone or ring (Fig. 8B). Cauda weakly to distinctly knobbed or rounded (Fig. 9 B, F, U). Forewings with media once branched. On Graminae, Palmae, Betulaceae, Fagaceae, Moraceae, and Styraceae etc..

, , , *HORMAPHIDINAE*

Head and pronotum separate. Apteræ never aleyrodiform; frontal process absent. Antennæ 5-6 segmented, secondary rhinaria in alatae round or oval or annular. First tarsal segments with 2-7 hairs. Dorsopical hairs of second tarsal segments fine. Empodial hairs short or long, usually fine. Siphunculi, if present, as a mere ring or cone, without any hair. Cauda rounded (Fig. 9A). Forewings with media once branched (Fig. 5B) or simple. On Salicaceae, Ulmaceae, Anacardiaceae etc., to roots of Coniferae, Graminae, Cyperaceae, Rosaceae and other dicotyledons.

PEMPHIGINAE

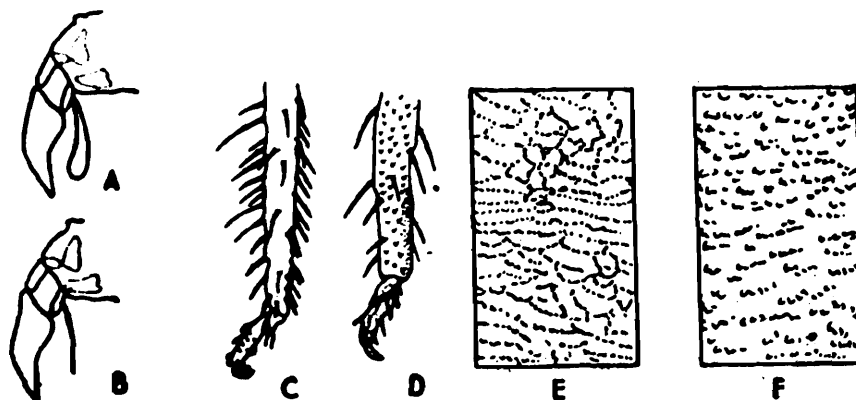


FIG. 13. A. Empodial hair in *Periphyllus*, B. Empodial hair in *Chaitophorus*, C. Hind tibia of *Chaitophorus*, D. Hind tibia of *Periphyllus*, E & F. Sculptures on tergum in *Chaitophorus*.

Subfamily CHAITOPHORINAE

Body with conspicuous hairs. Eyes normal. Antennæ 5-6 segmented, apterae without secondary rhinaria, alatae with round or oval secondary rhinaria; processus terminalis equal to or much longer than base of last antennal segment. Ultimate rostral segment with a pair to many accessory hairs. Tergum pale or variably pigmented, may be spiculose, nodulose or with reticulate pattern. Siphunculi truncate or ring like, with or without reticulation. Cauda crescent shaped or knobbed. Anal plate entire. Apical tibial hairs not differentiated from others, but apices of tibiae may be spinulose. First tarsal segments with 5-7 ventral hairs. Empodial hairs flattened or hair like. Wing venation normal. Rudimentary gonapophyaes usually 4.

The subfamily has been considered by some aphidologists as composed of three tribes viz. Tribe *Periphyllini*, containing one genus *Periphyllus* van der Hoeven, Tribe *Chaitophorini*, containing *Chaitophorus* Koch and allied genera like *Trichaitophorus* Takahashi

and Tribe Atheroidini containing *Laingia* Theobald, *Atheroides* Haliday, *Sipha* Passerini, *Chaetosiphella* H.R.L. and *Caricosipha* Börner. Till 1968, a total of 136 species were described under this subfamily (Eastop and van Emden, 1972). In INDIA, only 4 of the above genera from three tribes are known viz. *Chaitophorus*, *Trichaitophorus*, *Periphyllus* and *Sipha*.

Aphids belonging to *CHAITOPHORINAE* are known to be Monoecious and apparently lead holocyclic life cycle on plants of Saliaceae, Aceraceae, Graminae and Cyperaceae but some species are also known from Sapindaceae and Hippocastanaceae. Most of the species from the region are, however, known to lead anoholocyclic life cycle. *Chaitophorus* is the largest genus in the

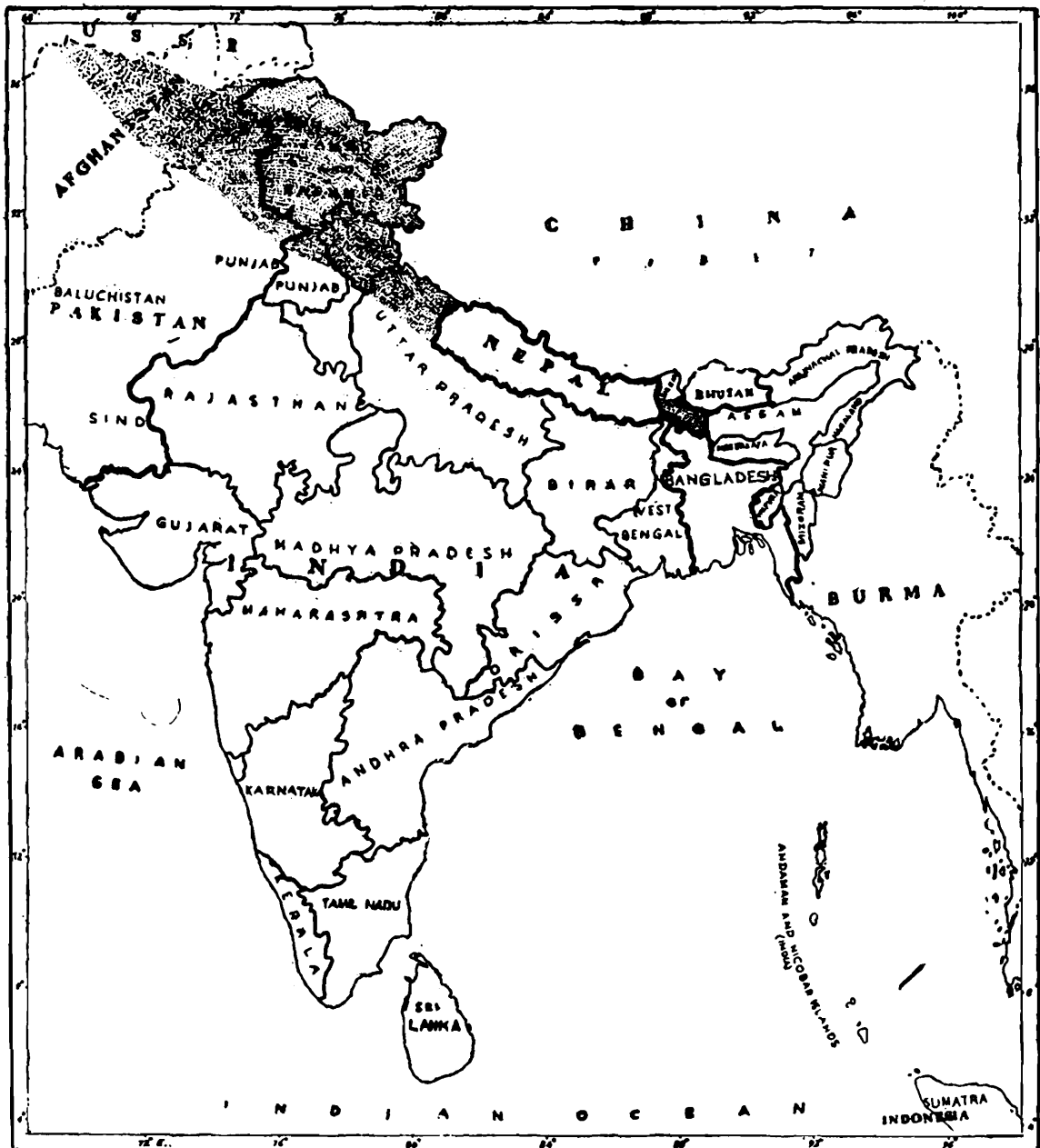


FIG. 14. Map of India and adjacent countries showing distribution of subfamily Chaitophorinae.

subfamily and is well known from EUROPE and ASIA and a number of species are also known from NORTH AMERICA (Richards 1972). Species of *Periphyllus* occur mostly in HOLOARCTIC region; *Sipha* is known from ASIA, EUROPE, NORTH AMERICA and MIDDLE EAST whereas *Trichaitophorus* is ORIENTAL in distribution.

In recent years, Higuchi (1972) has given an account of CHAITOPHORINAE of JAPAN and he has considered it under subfamily CALLIPTERINAE, Richards (1972) has dealt with CHAITOPHORINAE of CANADA, and Szelegiwicz (1974) with CHAITOPHORINAE of POLAND.

Very little attention has so far been given to the study of this group in INDIA and neighbouring countries. A total of 20 species are now known from four genera viz. *Chaitophorus*, *Periphyllus*, *Trichaitophorus* and *Sipha* and all of these have so far been recorded from northern temperate region, where evidently the availability of specific host plant groups explains its occurrence; out of 20 species, 14 are endemic to the region and it is interesting to note that all the species under *Periphyllus* are of endemic origin. Chakrabarti and Raychaudhuri (1977) have attempted to consolidate the account of CHAITOPHORINAE of INDIA.

Key to the Genera of Indian CHAITOPHORINAE

1. Siphunculi reticulated (Fig. 23F). Cauda rounded (Fig. 27E) or knobbed (Fig. 23E). First tarsal segments with 5-7 ventral hairs. Head and pronotum never fused. 2
 - Siphunculi without any reticulation, at most with a few striae and shorter than broad. Cauda distinctly knobbed or wider than long with distinct constriction. First tarsal segments with 3-5 hairs. Head and pronotum may be fused or distinct. 3
2. Cauda never knobbed, broadly rounded. Dorsum without any sculpturing other than a few spinules on 8th tergite. Apices
 - of tibiae specially in alatae, with conspicuous spinules (Fig. 13D). Empodial hairs flattened (Fig. 13A). Embryo with foliate marginal setae. On *Acer*, *Aesculus* spp. [Aceraceae, Hippocastanaceae, Sapindaceae]. *Periphyllus* van der Hoeven
 - Cauda knobbed or broadly rounded. Dorsum with distinct sculpturing of spicules, nodules or reticulations (Fig. 13E,F). Apices of tibiae without conspicuous spinules (Fig. 13C). Empodial hairs usually fine (Fig. 13B). Embryo with fine marginal setae. On *Salix* and *Populus* spp. [Saliaceae]. ... *Chaitophorus* Koch

3. Antennae 5–6 segmented. Head fused with prothorax. Frontal and marginal hairs long and stout, (Fig. 39A). Dorsal hairs inconspicuous. Siphunculi (Fig. 40C) short and truncate, at most with a few striae. Cauda broad, at most with an indistinct basal constriction. On *Acer* spp. and *Actinidia callosa*.

Trichaitophorus Takahashi

Antennae always 5 segmented (Fig. 41B). Head and prothorax never fused. All dorsal hairs thick and conspicuous. Siphunculi very short. Cauda knobbed or arc shaped. Ultimate rostral segment short and blunt. On Graminae & Cyperaceae.

Sipha s.l. Passerini

Genus *Chaitophorus* Koch 1854

1854. *Chaitophorus* Koch, Die Pflanzenlaus, Nurnberg, 1; Borner, 1949, *Beitr. tax. zool.* **1**: 53; Hille Ris Lambers, 1960, *Tijdschr. Ent.*, **103**: 1; Higuchi, 1972, *Insecta matsum.*, **35**: 81; Richards, 1972, *Mem. ent. Soc. Canada*, **87**: 10. Type-species; *Chaitophorus leucomelas* Koch.
1870. *Tranaphis* Walker, *Zoologist*, **5**: 1999. Type-species: *Aphis salicivora*.
1910. *Thomasia* Wilson, *Can. Ent.*, **42**: 386. Type-species: *Chaitophorus populicola* Thomas.
1912. *Micrella* Essig, *Pomona Coll. J. Ent.*, **4**: 716. Type-species: *Micrella monellis* Essig.
1912. *Eichaitophorus* Essig, *Pomona Coll. J. Ent.*, **4**: 721. Type-species: *Eichaitophorus populifolii* Essig.
1949. *Allarctaphis* Borner, *Beitr. tax. zool.*, **1**, 54. Type-species: *Chaitophorus nassnovi* Mordv.
1949. *Pseudomicrella* Borner, *Beitr. tax. zool.*, **1**, 55. Type-species: *Aphis vittelinae* Schrank.

Morphology: Frontal tubercles absent, frons weakly convex. Antennae usually 6 segmented, rarely five segmented, usually shorter than or at most as long as the body, without any secondary rhinaria in apterae, in alatae secondary rhinaria mostly restricted to segment III; processus terminalis always longer than base of segment VI; hairs on flagellum long and fine, usually longer than basal diameter of antennal segment III; head and prothorax never fused. Ultimate rostral segment thick or slender, usually shorter than or equal to but never longer than twice the length of second segment of hind tarsus. Abdominal tergites mutually free, more often 1st–6th tergites fused and dark sclerotic, tergite 7th sometimes fused with 6th tergite but 8th tergite always free. Dorsum smooth, or spiculate or reticulated or nodulose; in alatae, dorsum of abdomen with paired marginal sclerites and segmental sclerites,

sometimes the latter become confluent to form a solid patch. Dorsal hairs in apterae, slender, fine or thick, with acute, acuminate, blunt or furcated apices, in alatae usually fine; number of hairs on 8th tergite very variable, sometimes may be upto 20. Siphunculi short, truncate, pale or dark, $0.04-0.06 \times$ as long as the body, and variably reticulated. Cauda usually knobbed or arc shaped or tongue shaped as in many North American species. Anal plate entire. Primary gonapophyses 4. Apices of tibiae smooth, sometimes finely spinulose between hairs; hind tibiae sometimes with few pseudosensoria. First tarsal segments usually with 5, sometimes with 6 or 7 ventral hairs. Empodial hairs fine. Fore wings with media twice branched, hind wings with one oblique.

Sexual forms in many species are still unknown. Oviparae are normally apterae, with body more elongated, dorsum not as sclerotic as viviparae and hind tibiae usually swollen bearing pseudosensoria. Males also show elongated body, and may be alate or apterous and in the former morph with more secondary rhinaria on antennae than in alate viviparae. No sexual form is however known from this region except the oviparae of *C. pakistanicus* H.R.L.

Embryos normally with paired spinal, pleural and marginal hairs arranged segmentally, but in some North American species, the marginal hairs may be upto 2-7 pairs (Hille Ris Lambers, 1960).

Discussion: The genus as understood here is a heterogenous one. Morphological variability in the length of processus terminalis, apices of dorsal hairs, differential fusion of abdominal tergites, sclerotic pattern of abdomen and shape of cauda etc., have led various earlier workers (Walker, Wilson, Essig, Börner) to justify creation of number of different genera so as to accommodate different species of the heterogenous genus. Obviously, examination of material of aphid samples from different Zoogeographical area have now helped to clear up the confusion. Hille Ris Lambers, (1960) while dealing with the North American species has discussed the details of synonymy. Further, it is noteworthy that development of dorsal hairs in some species appears to be correlated with seasonal development [Hille Ris Lambers (1960) Richards (1972)] as North American specimens collected early in the season or from high altitudes or northerly parts apparently show fine hairs whereas those collected late in season or in southern warmer areas exhibit blunt, spine like hairs with furcated or toothed apices.

Biology: The genus contained 84 species (described till 1976) from the world and the members are restricted to the plants of Salicaceae (*Salix* and *Populus* species). These monoecious species appear light green to dark in life and usually form colonies on young leaves and terminal shoots although some North American species are reported to infest root or trunk (Richards, 1972).

All the ten species recorded so far from INDIA, are found between the months of October to June and only in the Northern Himalayan areas. Myrmecophily is not very common.

Distribution.—HOLOARCTIC, ORIENTAL and ETHIOPIAN regions. In recent years Hille Ris Lambers (1960) has dealt with North American species, Szelegiewiez (1961, 1974) with Polish species, Richards (1972) with Canadian species and Higuchi (1972) with Japanese species of the genus.

Type-species.—*Chaitophorus leucomelas* Koch, 1854. Koch (1854) did not designate any type. Garstaecker (1856) designated *Aphis populi* Linnaeus as its type which is actually a synonym of *Asiphum tremulae* De Geer, and was not included by Koch (op. cit.) in his work and what Koch described as *Chaitophorus populi* L. is actually *Chaitophorus populeti* Panzer. Hille Ris Lambers and Stroyan (1975) have appealed to the International Commission on Zoological Nomenclature to declare *Chaitophorus leucomelas* Koch, as the valid type [as fixed by van der Goot (1913)] for the genus.

[Figures in parenthesis in the text, from original description, unless otherwise stated.]

Key to the species of *Chaitophorus*

Apterous viviparous female:

- | | | |
|---|-----------|-------------------------------|
| 1. Dorsum of apterae pale. | | 2 |
| Dorsum dark. | | 7 |
| 2. Dorsum completely or partly smooth; ultimate rostral segment with one pair of accessory hair.. | | 3 |
| Dorsum never smooth, nodulose or spiculose, ultimate rostral segment with 4–8 accessory hairs. | | 4 |
| 3. Dorsum smooth; marginal dorsal hairs acute, rest usually with acuminate or furcated apices; tibiae sometimes with pseudo sensoria.....,..... | | <i>C. pakistanicus</i> H.R.L. |
| Dorsum partly smooth, spiculose or nodulose faintly on head thorax and lateral areas of abdomen. All dorsal hairs fine with acute apices; processus terminalis 2.0–2.6 × as long as base of segment VI. | | <i>C. himalayensis</i> (Das) |
| 4. Ultimate rostral segment with 4 accessory hairs. | | 5 |
| Ultimate rostral segment with 6–8 accessory hairs. | | 6 |

5. Dorsal hairs with acuminate or furcated apices. Dorsum pale, reticulate. Body small 1.10–1.13 mm long. *C. populiabae* (B.d.f.)
- Dorsal hairs never with furcated apices. Dorsum spiculose. Body large 2.50 mm long. *Chaitophorus* sp.
6. Dorsum of head nodulose, rest spiculose; longest hair on antennal segment III, 2.0–2.7 × as long as basal diameter of the segment and longest hair on anterior abdominal tergite 5.3–6.2 × as long as the mentioned diameter. First tarsal segments with 5, 5, 5, hairs. *C. indicus* Ghosh *et al.*
- Dorsum of head spiculose; longest hair on antennal segment III, 3.7–4.1 × as long as the basal diameter of the segment and longest hair on anterior abdominal tergite 7.1–7.5 × as long as the mentioned diameter. First tarsal segments with 7, 7, 7 hairs. *C. manaliensis* Chakrabarti
7. First tarsal segments with 7, 7, 7 hairs; processus terminalis 3.0–3.4 × as long as base of antennal segment VI; longest hair on antennal segment III, 3.0–3.2 × as long as the basal diameter of the segment and longest hair on anterior abdominal tergites 4.5–6.0 × as long as the mentioned diameter; abdominal tergites 2–6 fused. *C. kapuri* H.R.L.
- First tarsal segments with 5, 5, 5 hairs. 8
8. Dorsum without reticulation, pale on mid dorsal region; dorsal hairs with acute, acuminate and furcated apices; ultimate rostral segment 1.5 × as long as second segment of hind tarsus and bears 8 accessory hairs. *C. populeti* (Panzer)
- Dorsal hairs never with furcated apices; ultimate rostral segment equal to second segment of hind tarsus and bears 2–6 accessory hairs; dorsum nodulose or spiculose. 9
9. Dorsum evenly black, nodulose; abdominal tergites 2–6 fused; ultimate rostral segment with 2–3 accessory hairs; legs and antennae pale *C. nigrinus* H.R.L.
- Dorsum spiculose, with intermediate pale area; ultimate rostral segment with 6 accessory hairs; legs and antennae pale. *C. salijaponicus niger* Mordv.

Alate Viviparous female:

1. First tarsal segments with 7, 7, 7 hairs, antennal segment III with 10–16 secondary rhinaria .. 2
 First tarsal segments with 5, 5, 5 hairs, antennal segment III with 2–19 secondary rhinaria .. 3
2. Antennae 0.75–0.80 × as long as the body; antennal segment III with 10–12 secondary rhinaria, segment IV without any rhinaria; processus terminalis 3.0–3.3 × as long as base of segment. Wing veins with dark borders. Body 1.69–1.70 mm long. . *C. kapuri* H.R.L.
 Antennae 0.55 × as long as the body; antennal segment III with 15–16 and segment IV with 0–2 secondary rhinaria. Body 2.41 mm long. *Chaitophorus* sp.
3. Antennal segment III with 2–5 secondary rhinaria; processus terminalis 2.2 × as long as base of segment III; dorsum pale with lateral sclerotic patch. *C. himalayensis* (Das)
 Antennal segment III with 9–19 secondary rhinaria; dorsum with elaborate sclerotic pattern. 4
4. Dorsal hairs long, longest one on anterior tergites 0.130–0.150 mm long, 5.0–6.0 × as long as the basal diameter of antennal segment III; longest hair on antennal segment III 2.7–3.0 × as long as the basal diameter of the segment; antennal segment III with 12–19 secondary rhinaria .. 5
 Dorsal hairs shorter, longest one on anterior tergite 0.070–0.073 mm long, 3.3–4.4 × as long as the mentioned diameter; longest hair on antennal segment III 0.03–0.04 mm long, 2.0–2.4 × as long as the basal diameter of the segment; antennal segment III with 8–10 secondary rhinaria. 6
5. Ultimate rostral segment 1.5 × as long as the second segment of hind tarsus; siphunculi reticulated over distal half, rest striated; longest hair on dorsum of head 3.0 × as long as the basal diameter of antennal segment III *C. populeti* (Panzer)

Ultimate rostral segment $1.1 \times$ as long as the second segment of hind tarsus; siphunculi reticulated over entire length; longest hair on dorsum of head $5.0 \times$ as long as the basal diameter of antennal segment III *C. indicus* Ghosh *et al.*

6. . Processus terminalis $2.0 \times$ as long as base of segment VI; longest hair on anterior abdominal tergite $4.4 \times$ as long as the basal diameter of antennal segment III. Siphunculi dark, reticulated over entire surface. *C. salijaponicus niger* Mordv.

Processus terminalis $3.0-3.8 \times$ as long as base of segment VI; antennal segment III with 9-10, IV with 0-3 and V with 0-1 secondary rhinaria; longest hair on anterior abdominal tergite $3.3 \times$ as long as the basal diameter of antennal segment III; siphunculi nearly pale and reticulated. *C. populiabiae* (B.d.f.)

Chaitophorus himalayensis (Das)

(Figs. 15 & Pl. I)

1918. *Eichaitophorus himalayensis* Das, *Mem. Indian Mus.*, **6**: 240.
 1963. *Chaitophorus himalayensis* Tao, *Sci. Yb. Taiwan Mus.*, **6**: 46.
 1966. *Chaitophorus himalayensis*, Hille Ris Lambers, *Tijdschr. Ent.*, **109**: 196.

Apterous viviparous female: Body pale 1.2-1.5 mm long. Head pale, hairs on frons 0.090-0.0121 mm long, 3.5-5.2 as long as the basal diameter of antennal segment III. Antennae pale, $0.50-0.55 \times$ as long as the body, flagellum feebly imbricated on segment III, rest distinctly so; segment III with 3-4 hairs, 0.02-0.05 mm long, IV with 2 hairs and V with 1-2 hairs, longest hair on antennal segment III 0.03-0.04 mm long, $1.3-1.7 \times$ as long as the basal diameter of the segment; processus terminalis $2.0-2.6 \times$ as long as the base of segment VI and $0.42-0.50 \times$ as long as antennal segment III. Rostrum reaches hind coxae; ultimate rostral segment almost equal in length to the second segment of hind tarsus and bears a pair of accessory hairs. Tergum pale, spiculose to faintly nodulose on head and thorax and lateral areas of abdomen. Abdominal dorsum pale, hairs on dorsum of abdomen fine, about 12 per segment i.e. 2 spinal, 2 pleural and 8 marginal on 1st-6th tergites, longest one on anterior tergites, 0.100-0.130 mm long and shortest one 0.04-0.05 mm long, these being $3.7-5.4 \times$ and $1.4-2.1 \times$ as long as the basal diameter of antennal segment III; 7th and 8th tergite each with 7-8 hairs, longest hair on 7th, 0.106-0.130 mm long and on 8th 0.118-0.146 mm long, these being $4.0-5.5 \times$ and $4.5-6.4 \times$ as long as the mentioned diameter. Siphunculi pale,

very short, and reticulated. Cauda pale, distinctly knobbed, and bears 4–5 hairs. Legs pale; hairs on hind tibiae fine, longest one 0.04–0.08 mm long and 2.0–2.5× as long as the diameter at the middle of the tibiae. First tarsal segments with 5, 5, 5 hairs.

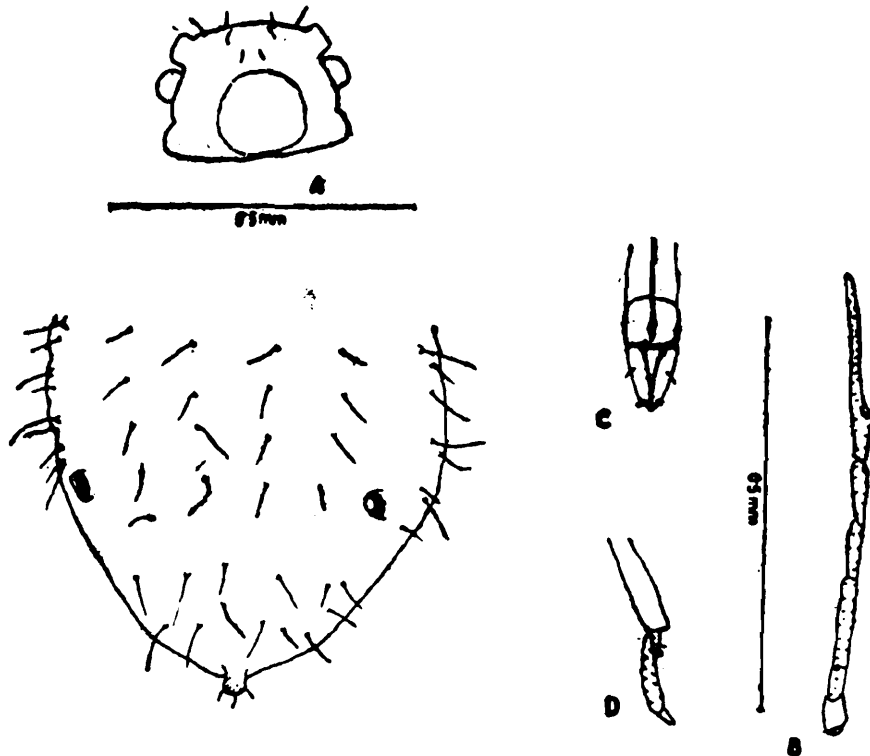


FIG. 15. *Chaitophorus himalayensis* (Das); A. Head, B. antenna, C. ultimate rostral segments, D. second segment of hind tarsus, E. abdominal dorsum.

Colour: According to Das (1918) insects appear light green or yellowish green in colour with two crescentic dark green bands around to the bases of siphunculi, meeting two elongated spots on first abdominal segment.

Alate viviparous female: Body pale, (1.05–1.45 mm long). Antennae pale yellow, usually half or little less than half the length of body; segment III with 2–3(5) secondary rhinaria; processus terminalis 2.2–(2.3)× as long as base of segment VI. Rostrum reaches hind coxae, ultimate rostral segment equal to the second segment of hind tarsus. Abdominal dorsum pale and according to original description bears lateral sclerotic patches, which could not be seen in the specimen examined; longest hair on anterior tergites 0.07 mm long, shortest on 0.04 mm long, these being 3.3× and 2.0× as long as the basal diameter of antennal segment III; longest hair on 8th tergite 0.09 mm long, 4.6× as long as the mentioned diameter. Siphunculi pale, reticulated. Cauda knobbed and bears 7 hairs. Wing venation normal, but sometimes cubitus with three forks and hind wings with one oblique (Das, 1918). Legs pale.

Chaitophorus himalayensis (Das)

Apterous viviparous female

Measurements in mm.:

	Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.	Cauda
				III	IV	V	VI				
1.	1.38	0.79	0.72	0.18	0.08	0.09	(0.08+0.10)	0.10	0.11	0.04	0.09
2.	1.33	0.74	0.65	0.14	0.09	0.08	(0.08+0.18)	0.10	0.11	0.04	0.09
3.	1.24	0.64	0.55	0.15	0.08	0.08	(0.06+ ?)	0.10	0.10	0.04	0.09
4.	1.57	0.83	0.75	0.16	0.10	0.09	(0.08+0.19)	0.11	0.12	0.04	0.10
5.	1.24	0.69	0.69	0.16	0.09	0.08	(0.08+0.16)	0.10	0.11	0.04	0.09
6.	1.17	0.66	0.69	0.16	0.09	0.08	(0.06+0.16)	0.10	0.11	?	0.09

(1-6, B. Das's Collections at Z.S.I., Calcutta.)

Colour: Light greenish or yellow (Das, 1918).

	<i>Measurements in mm</i>	
	1	2
Length	?	2.3
Width	?	?
Antenna	0.69	0.75
Antennal III	0.16	0.18
Segments IV	0.10	0.10
,, V	0.08	0.10
,, VI	(0.08+0.16)	(0.08+0.18)
urs.	0.10	0.09
ht. ₂	0.10	0.09
Siph	0.06	0.06
Cauda	?	?

(1-2, B. Das's collections at Z.S.I., Calcutta)

Sexual forms: Not known.

Nymphs: Early stage apterous nymphs; Body pale, covered with long hairs, longest one on frons 0.05-0.06 mm long, 3.5-3.7 × as long as the basal diameter of antennal segment III. Antennae 5 segmented, half or little over half the length of body; processus terminalis 0.50-0.52 × as long as base of segment VI; longest hair on segment III 0.02-0.03 mm long, 1.4-1.6 × as long as the basal diameter of the segment. Ultimate rostral segment stout, equal to or little longer than second segment of hind tarsus. Abdominal dorsum pale bearing two rows of spinal, two rows of pleural, besides marginal hairs on 1st-6th tergites; spinal and pleural, single, marginal 4 on each side, all arising from prominent bases. Siphunculi short, truncate, striated. Legs pale, tibial hairs fine, longest one 0.05 mm long, 1.5 × as long as diameter at the middle of hind tibiae.

Colour: Pale.

Measurements in mm:

	Length	Width	Antenna	Antennal segments			urs.	ht. ₂	Siph.
				III	IV	V			
1.	0.89	0.55	0.48	0.15	0.05	(0.05+0.12)	0.09	0.08	0.03

(B. Das's Collection at Z.S.I., Calcutta.)

Material examined: Fifteen apterous viviparous female, 2 alate viviparous females (damaged) and six nymphs from *Salix* sp., Rishikesh and Dehra Dun, INDIA, 25-5-1914, Coll. B. Das; from National Zoological Collections, Zoological Survey of India, Calcutta.

Discussion: Hille Ris Lambers (1966) mentioned that the characters of ratio of processus terminalis to base of VI and pigmentation of siphunculi do not agree in the species recorded under *C. himalayensis* (Das) by Takahashi from THAILAND and also to a number of *Salix* infesting specimens, collected in INDIA and PAKISTAN. Later he informed (in litt.) that his material from Willows from PAKISTAN, INDIA and NEPAL and nearby countries falls apart in two groups, one with processus terminalis $2.5\times$ as long as base of segment VI, the others with processus terminalis at most $2.0\times$ as long as base of VI and in his opinion such a difference could occur within the species if the one with short processus terminalis were fundatrices. The material of Das, examined for the present study, were all collected towards the end of May and in the same collections, processus terminalis in apterae were seen to be varying from $2.0-2.6\times$ as long as base of segment VI. As variability in size of body and antennal segments were also recorded by Das (op. cit.) in his original descriptions and the present study also confirmed the same, it may be possible, that both groups as mentioned by Hille Ris Lambers, belong to one species. The colour of siphunculi in Das's material could not be ascertained when the same was mounted for the present study after being preserved in alcohol for 60 years. Further, in a slide containing 2 apterae, labelled as *Chaitophorus himalayensis* (Das), from *Salix*, Simla, Himachal Pradesh, 18-v-1970, Coll. K. Narayanan, det. S. K. David, received from Dr. S. Kanakaraaj David, Coimbatore, processus terminalis was seen to be $3.2-3.5\times$ as long as base of segment VI and the dorsal hairs also appeared more numerous and as such, these specimens have not been considered under this species. The present specimens also show a different first tarsal chaetotaxy i.e. 5, 5, 5.

Das (1918) has mentioned about occurrence of this species on several species of *Salix* that grow along banks of canals, streams and rivers. According to him, this species could be seen from March to September and is usually attended by ants of Myrmicinae and Camponotinae. At least two natural enemies have also been recorded by him viz. *Scymnus communis* and *Menochilus sexmaculata*.

Distribution.—Northeast INDIA; PAKISTAN; TAIWAN; KOREA. Although the species recorded as *C. himalayensis* (Das) by Tao (1963) could not be examined but his figures of antennae, apparently show that the species may occur in that region. Chakrabarti and Raychaudhuri, 1977 has mentioned its occurrence in Kalimpong, Darjeeling district, West Bengal.

Types.—B. Das did not designate any type. The only material that could be traced in National Zoological Collections, Zoological Survey of India, Calcutta were preserved in alcohol. Lectotype has now been designated (No. 10143/H7) from this and all material have been deposited in Zoological Survey of India, Calcutta.

***Chaitophorus indicus* Ghosh, Ghosh, Raychaudhuri**

(Fig. 16, Pl. II, figs. 1, 2)

1970. *Chaitophorus indicus* Ghosh, A. K., Ghosh, M. R., Raychaudhuri, D. N. *Orient. Insects.*, 4(2): 196.

Apterous viviparous female: Body elongate oval, pale, 1.75–2.08 mm long. Head pale, nodulose, hairs on the frons 0.104–0.138 mm long, fine, longest one about 5.0× as long as the basal diameter of antennal segment III. Antennae pale except apical 0.50–0.75 portion of segment V and base of segment VI which are dark brown; flagellum gradually more distinctly imbricated from

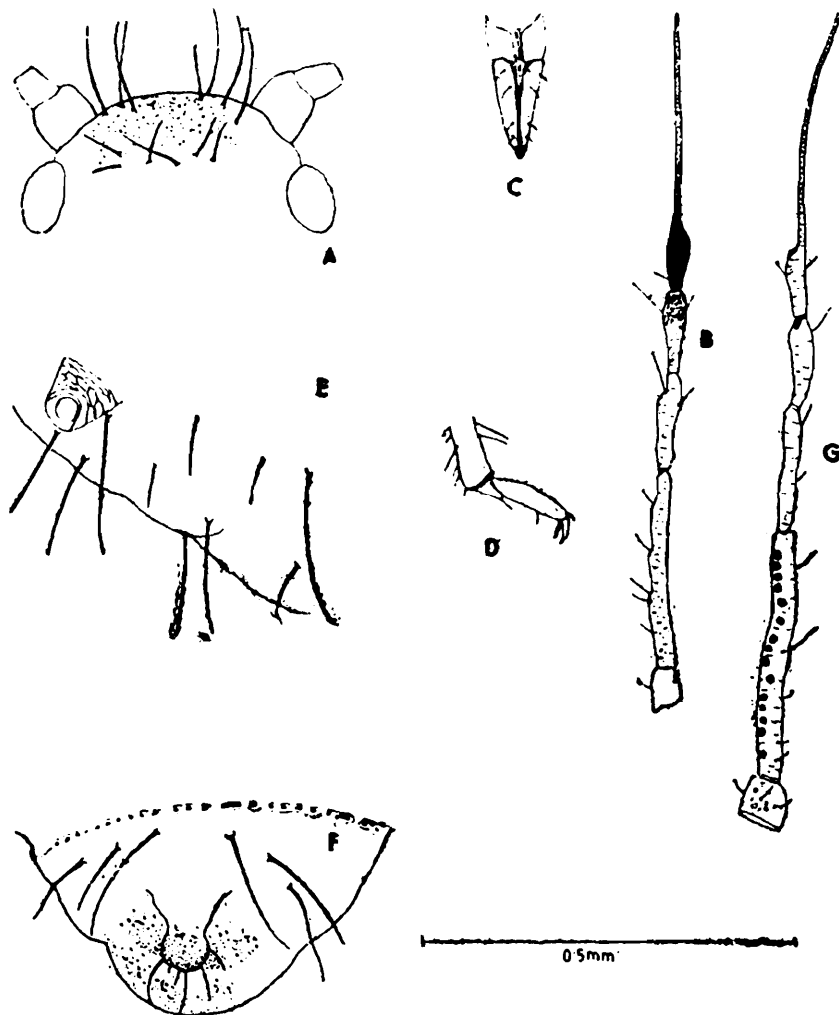


FIG. 16. *Chaitophorus indicus* Ghosh *et al.*, A. head, B. antenna C. ultimate rostral segment, D. second segment of hind tarsus, E. siphunculus, F. cauda, G. Antenna of alate viviparous ♀.

base to apex; hairs on flagellum with acuminate to acute apices, usually longer than basal diameter of antennal segment III; longest one on segment III, 0.066–0.073 mm long, shortest one 0.016–0.033 mm long, these being 2.0–2.7× and 0.60–0.90× as long as the mentioned diameter, respectively; processus terminalis 2.45–3.3× as long as the base of segment VI, equal to or little longer than antennal segment III. Rostrum reaches nearly the base of hind coxae; ultimate rostral segment 1.0–1.1× as long as second segment of hind tarsus and bears 6–8 accessory hairs. Abdominal dorsum pale, anterior tergites with spinulose imbrications which often form reticulation in the spinal area, posterior tergites with spinulose imbrications; hairs on the dorsum of abdomen conspicuous with acuminate or acute apices, longest one on anterior tergites 0.155–0.163 mm long, shortest one 0.090–0.100 mm long, these being 5.3–6.2× and 3.0–3.7× as long as the basal diameter of antennal segment III; longest hair on 7th tergite 0.178–0.184 mm long and on 8th 0.198 mm long, these being 6.3–7.0× and 6.6–7.5× as long as the mentioned diameter. Siphunculi pale to dusky brown, thick, truncated with rather small opening, reticulated almost over their entire length, 0.04× as long as the body and, 0.54–0.66× as long as the second segment of hind tarsus. Cauda somewhat dusky, distinctly knobbed in the middle, with 4–5 hairs. Legs pale except second segment of tarsi which are dusky; hairs on tibiae fine, longest one on hind tibiae 0.106–0.115 mm long, 2.0–2.1× as long as the diameter at the middle of hind tibiae; first tarsal segments with 5, 5, 5 hairs.

Colour: Light green in life.

Measurements in mm

		1	2	3
Length	.	2.0	2.08	1.99
Width	..	1.10	1.10	1.10
Antenna	.	1.0	1.0	0.96
Antennal				
segments III	.	0.26	0.28	0.28
IV	.	0.15	0.15	0.12
V		0.13	0.10	0.10
VI	.	(0.10+0.30)	(0.09+0.21)	(0.08+0.26)
urs.	..	0.12	0.13	0.12
ht. ₂		0.12	0.11	0.12
Siph.	..	0.07	0.07	0.08
Cauda	..	0.12	0.13	0.12

(1, Holotype, 2–3, Paratypes, Calcutta University Collections.)

Alate viviparous female: Body 2.03–2.20 mm long. Head dark, longest hair on frons 0.130 mm–0.137 mm long, little over $5.0\times$ as long as the basal diameter of antennal segment III. Antennae pale brown except whole of segment V and base of segment VI which are darker, flagellum imbricated, longest hair on antennal segment III 0.065–0.070 mm long, shortest hair 0.035–0.040 mm long, these being $2.8\text{--}3.0\times$ and $1.5\text{--}1.7\times$ as long as the basal diameter of the segment; segment III with 9–15 round to oval secondary rhinaria distributed over their entire length, segment IV with 0–2 similar rhinaria; processus terminalis $3.0\text{--}3.4\times$ as long as the base of segment VI. Abdominal dorsum pale, spinulose, bearing large transverse sclerotic spinopleural bands on 3rd–8th tergites besides paired marginal sclerites, these being confluent with the spino-pleural sclerites on 7th and 8th tergites; 1st and 2nd tergites with separate paired spinal and pleural sclerites besides the marginal ones; hairs on dorsum mostly arising from these sclerotic areas, longest one on anterior tergites 0.135–0.140 mm long, shortest on 0.080–0.083 mm long these being $5.9\text{--}6.0\times$ and $3.3\text{--}3.5\times$ as long as the basal diameter of antennal segment III; longest hair on 7th, 0.120 mm–0.122 mm long and on 8th 0.144–0.146 mm long, these being $5.0\text{--}5.2\times$ and $6.2\text{--}6.4\times$ as long as the mentioned diameter. Siphunculi dark brown, truncate, reticulated over entire length, $0.04\text{--}0.05\times$ as long as the body. Cauda brown, with 6–7 hairs. Legs pale with knees and second segments of tarsi brownish. Wing venation normal but veins bordered fuscous.

Colour: Light with black markings.

Measurements in mm

	1	2	3
Length ..	2.20	2.17	2.03
Width .	1.0	1.0	0.99
Antenna .	1.0	1:24	1.20
Antennal segments III .	0.30	0.34	0.34
,, IV ..	0.16	0.18	0.15
,, V ..	0.13	0.14	0.12
,, VI .	(0.10+0.30)	(0.09+0.31)	(0.09+0.30)
urs. ..	0.12	0.12	0.14
ht. ₂ .	0.12	0.12	0.12
Siph. ..	0.09	0.10	0.10
Cauda ..	0.12	0.14	0.12

(1, Paratype; 2–3, other collections No. PLK 840; Calcutta University Collections.)

Sexual forms: Not known.

Nymphs: Late stage alate nymph: Pale with apices of antennal segment V and base of segment VI, apices of siphunculi and second segment of tarsi, dark. Dorsal hairs mostly 0.164–0.190 mm long, 7th tergite with about 10 hairs and 8th with 8 hairs; tergum finely and unevenly spinulose.

Measurements in mm

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1. 1.85	0.99	0.96	0.24	0.12	0.10	(0.09+0.28)	0.12	0.12	0.06

(Calcutta University Collections.)

Material examined: Apterous viviparous female (Holotype) and 7 apterae viviparae, 1 alate vivipara (Paratypes) from unidentified plant, Kalimpong, Darjeeling district, INDIA, 27-12-1968, Coll. *M. R. Ghosh*, 4 apterae viviparae and 3 nymphs (paratypes) from *Populus* sp., Kalimpong, INDIA, 7-2-1969, Coll. *M. R. Ghosh*; Two apterae viviparae and two alate viviparae from *Populus* sp., Tashiding, Darjeeling dist, INDIA, 31-12-1969, Coll. *M. R. Ghosh*. (Slide No. PLK 840, Calcutta University Collections).

Discussion: The present species comes close to the pale *Chaitophorus* group of species but may be distinguished by nodulose dorsum of head, fine dorsal hair, long processus terminalis etc.; it comes closest to *C. manaliensis* but differs in having shorter antennal and dorsal hairs.

The species is known to occur during October to April in Darjeeling district, West Bengal.

• *Distribution.*—Darjeeling district, West Bengal, INDIA.

Types.—In the collections of Entomology laboratory, University of Calcutta, INDIA.

***Chaitophorus kapuri* Hille Ris Lambers**

(Fig. 17, Pl. II, figs. 3, 4)

1966. *Chaitophorus kapuri* Hille Ris Lambers, *Tijdschr. Entom.*, **109**: 197.

1969. *Chaitophorus kapuri*, Bindra and Sekhon, *Bull. ent. Soc. India*, **10**(1): 103.

1973. *Chaitophorus kapuri*, Kumar, *Orient. Insects.*, **7**(1): 11.

Apterous viviparous female: Body dark sclerotic, 1.52–1.65 mm long (upto 1.95 mm). Head pale laterad, hairs on frons long and fine, upto 0.130mm long, $4.0\times$ as long as the basal diameter antennal segment III. Antennae pale, except segment I and a portion near the primary rhinaria on segment VI which are brownish, $0.66\text{--}0.70\times$ as long as the body; flagellum feebly imbricated; segment III with a few fine hairs on inner margin, 0.05–0.06 mm long, longest one being $3.0\text{--}3.2\times$ as long as the basal diameter of the segment, the shortest one $0.70\text{--}1.0\times$ as long as the mentioned diameter; base of segment VI with 2–3 fine hairs, longest one being 0.05–0.055 mm and upto twice as long as the shortest one; processus terminalis $3.2 (3.0\text{--}3.4)\times$ as long as base of segment VI and little longer than antennal segment III. Rostrum reaches beyond mid

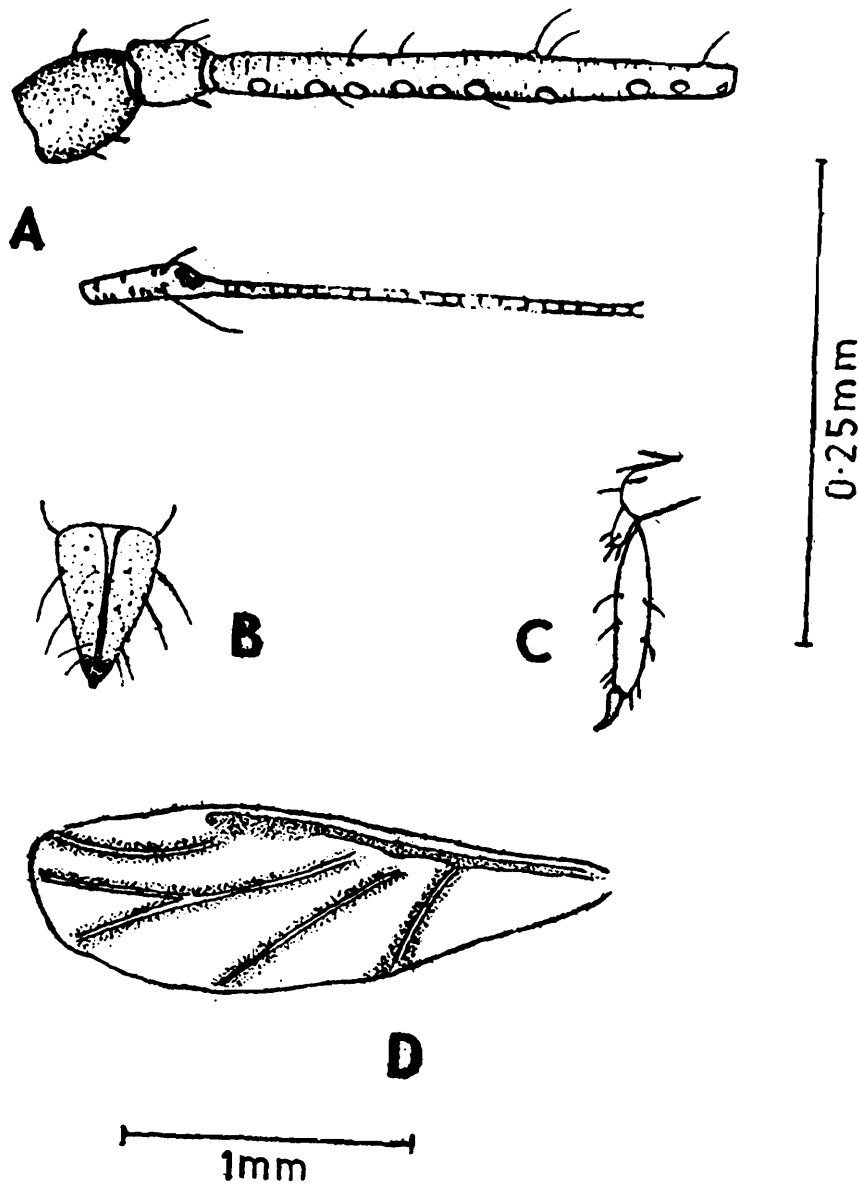


FIG. 17. *Chaitophorus kapuri* H.R.L.: A. antenna, B. ultimate rostral segment, C. second segment of hind tarsus, D. fore wing (all of alate viviparous ♀).

coxae, ultimate rostral segment stout, about equal to second segment of hind tarsus and bears 4(2) accessory hairs besides preapicals. Tergum brown sclerotic and spinulose; abdominal segment-2nd-6th fused, others mutually free and separated by almost white inter-segmental region; median area between metanotum to 3rd tergite much paler than the rest. Hairs on dorsum of abdomen stiff, with acute or acuminate apices, longest one 3rd tergite, 4.5-6.0 × as long as the basal diameter of antennal segment III, shortest one 2.0-3.0 × as long as the mentioned diameter; 8th tergite with 10-12 hairs. Siphunculi short, blackish, with 3-4 rows of reticulation, area surrounding the siphunculi much paler than other part of tergum. Cauda pale, knobbed, and bears at least 6 long curved hairs. Legs pale with tarsi a little dusky; tibiae little spinulose at the apices and bear row of long fine hairs on outer margin and much shorter ones on inner margin; first tarsal segments with 7, 7, 7 hairs.

Colour: Not known, presumably blackish (H.R.L. 1966).

Measurements in mm

		1	2
Length	..	1.52	1.65
Width	. ..	0.89	0.93
Antenna	.	1.10	1.10
Antennal segments III		0.30	0.28
„	IV	0.14	0.14
„	V	0.12	0.12
„	V	(0.09+0.32)	(0.09+0.31)
urs.	. ..	0.11	0.10
ht. ₂	..	0.11	0.11
Siph	.. ..	0.06	0.07
Cauda	.. ..	0.11	0.09

(1, D. Hille Ris Lambers's Collections; 2, S. K. David's Collections.)

Alate viviparous female: Body 1.70 mm (1.69-1.70) long, predominantly blackish with pale appendages. Head black, antennae 6 segmented, 0.75 (0.80) as long as the body, with segment I, base of segment II, apices of segment V, and area near rhinaria on segment VI blackish, rest completely pale; hairs on inner margin somewhat shorter than in apterae, on segment III 0.03-0.05 mm long, longest one being 3.0 (3.5) × as long as the diameter at constricted base of segment III; segment III with 10(12) round secondary rhinaria distributed along its entire length,

segments IV and V without any secondary rhinaria; processus terminalis 3.0(3.3×) as long as base of segment VI, longest hair at base of segment VI, 2.0× as long as the shortest one. Abdominal dorsum with segmental spinopleural transverse sclerotic bands on 2nd–8th tergites, besides paired marginal sclerites upto 5th tergite, the latter with 6(11) hairs, and a small socket like tubercle on posterior part which may often escape notice; hairs on dorsum of abdomen 3.0–5.0× as long as the basal diameter of the segment III. Siphunculi dark with rows of basal interconnected striations and few rows of apical reticulation. Cauda pale as in apterae. Legs pale. Wings bordered along veins, media of forewings once branched.

Colour: Not known.

Measurements in mm

	I
Length	1.70
Width	0.75
Antenna ..	1.25
Antennal segments III	0.35
,, IV	0.17
,, V	0.14
,, VI	(0.11+0.35)
urs.	0.10
ht. ₂	0.10
Siph	0.07
Cauda	0.10

(D. Hille Ris Lambers's Collections.)

Sexual forms: Not known.

Larvae: According to H.R.L. (1966), head and siphunculi darkish, rest pale without dark sclerites at bases of dorsal hairs; siphunculi apparently reticulated.

Material examined: One apterous and one alate viviparous female (Paratypes) from *Populus ciliata*, Muree, PAKISTAN, 20-6-1964, Coll. *v.d. Bosch*, det. D. Hille Ris Lambers; one apterous viviparous female from Poplar, Manikaran, Himachal Pradesh, INDIA, 9-6-1967, Coll. *O. S. Bindra*, det. S. K. David; one alate viviparous female collected in yellow Pantrap, Simla, Himachal Pradesh, INDIA, 4-5-1972, Coll. *A. N. Choudhuri*.

Discussion: This is the only dark *Chaitophorus* species, having 7 hairs in the first tarsal segments, found in the area; besides, the

species may easily be distinguished by spinulose black body, dark siphunculi, pale legs and dark borders of wing veins.

Distribution.—N. INDIA (Himachal Pradesh, Jammu and Kashmir) and PAKISTAN.

Types.—In the collections of D. Hille Ris Lambers, Bennekom, THE NETHERLANDS.

***Chaitophorus salijaponicus niger* Mordvilko**

(Fig. 18, Pl. III, figs. 1, 2)

1929. *Chaitophorus niger* Mordvilko, *Trudy prikl. Ent.*, Leningrad, **14**: 29.

1969. *Chaitophorus niger*, Verma, *Sci. Cult.*, **25**: 28.

1974. *Chaitophorus salijaponicus niger*, Szelegiewicz, *Fragm. faun.*, **19**(II): 306.

Apterous viviparous female: Body dark elongate with pale appendages, 1.68 mm long. Head dark nodulose; hairs on head 0.130–0.163 mm long, fine, longest one 8.0× as long as the basal

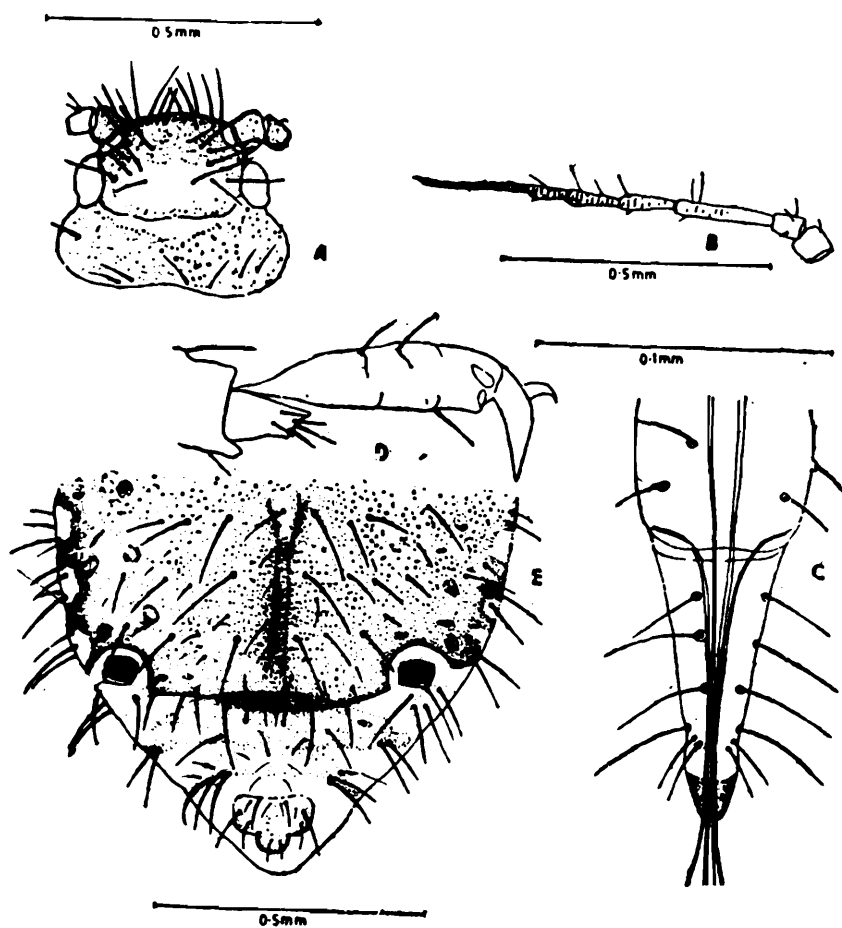


FIG. 18. *Chaitophorus salijaponicus niger* Mordv.: A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. abdominal dorsum.

diameter of antennal segment III. Antennae pale, sometimes segment I, apices of segment V and base of VI variably dark, $0.50\times$ as long as the body; flagellum nearly smooth on bases of segment III, gradually more distinctly imbricated apicad; hairs on flagellum fine, longest one on segment III, 0.070–0.090 mm long, shortest one 0.013–0.020 mm long, these being $4.0\text{--}4.5\times$ and $0.66\text{--}1.0\times$ as long as the basal diameter of antennal segment III; processus terminalis $2.4\times$ as long as the base of segment VI and equal to or little longer than antennal segment III. Rostrum reaches near hind coxae, ultimate rostral segment equal to second segment of hind tarsus and bears 6 accessory hairs. Tergum dark sclerotic with pale colourless areas between prothorax and mesothorax, between meso and metathorax and also between metathorax and fused abdominal tergites 1st–6th; areas between 6th and 7th, and also between 7th and 8th tergites pale; dorsum largely spinulose and often reticulated; 7th and 8th tergites with spinulose striae; small dark marginal scleroites present on 1st–7th tergites; hairs on the dorsum of abdomen fine, with acute apices, longest one on anterior tergites 0.106 mm–0.137 mm long, shortest one 0.040–0.050 mm long, these being $6.4\text{--}7.0\times$ and $2.0\text{--}3.0\times$ as long as the basal diameter of antennal segment III; longest hair on 7th tergite 0.163 mm long and on 8th of similar length, these being $8.2\text{--}10.0\times$ as long as the mentioned diameter. Siphunculi short, dark, reticulated, hardly $0.03\times$ as long as the body, and $0.50\times$ as long as the second segment of hind tarsus; areas around siphunculi completely pale. Cauda pale to little dusky, distinctly knobbed with 5–6 hairs. Legs pale yellow; longest hair on hind tibiae 0.106 mm long, $3.5\text{--}4.0\times$ as long as the diameter at the middle of hind tibiae; first tarsal segments with 5, 5, 5 hairs.

Colour: Dark in life.

		<i>Measurements in mm</i>	
		1	2
Length	.. .	1.68	1.68
Width	. . .	0.93	0.90
Antenna		0.82	0.87
Antennal segments	III	0.17	0.18
	IV .	0.10	0.10
	” V	0.09	0.10
	” VI	(0.08+0.20)	(0.07+0.18)
urs.		0.10	0.10
ht. ₂	. . .	0.10	0.10
Siph.		0.05	0.05
Cauda	. . .	0.08	0.08

(1, 2, K. D. Verma's Collections.)

Alate viviparous female: [Not seen from India. Description based on material received from D. Hille Ris Lambers.] Body 1.44 mm long. Head and thorax dark; hairs on frons 0.50–0.73 mm long, 3.0–4.4× as long as the basal diameter of antennal segment III. Antennae brownish, with apices of segment II and base of segment III paler, little over half as long as the body; flagellum feebly imbricated on segment III, rest distinctly imbricated; longest hair on segment III, 0.040 mm long, and shortest hair 0.026 mm long, these being 2.4× and 1.3× as long as the basal diameter of the segment, respectively; segment III with 8 small round secondary rhinaria distributed irregularly over its entire length; processus terminalis 2.0× as long as base of segment VI. Abdominal dorsum pale bearing sclerotic transverse spinopleural bands on 1st–8th tergites besides paired marginal sclerites and some scattered irregular sclerites in between the transverse bands; stigmal pori dark sclerotic; longest hair on anterior tergites, 0.073 mm long, shortest hair 0.033 mm long, these being 4.4× and 2.0× as long as the basal diameter of antennal segment III, respectively longest hair on 7th and 8th tergites almost of similar length, 0.093–0.100 mm long, these being 5.6× and 6.0× as long as the mentioned diameter respectively. Siphunculi dark, reticulated over entire surface, nearly 0.66× as long as second segment of hind tarsus. Cauda pale brown. Legs with femora, very bases of tibiae and second tarsal segments light to dark brown, rest pale; longest hair on hind tibiae 0.063 mm long, and 2.1× as long as the diameter at middle of the tibiae. Wing venation normal but second oblique in hind wings hardly visible.

Colour: Not known.

Measurements in mm

		1
Length	..	1.44
Width	.. ..	0.62
Antenna		0.78
Antennal segments III		0.20
,, IV		0.12
,, V		0.10
,, VI		(0.08+0.16)
urs.		0.09
ht. ₂		0.09
Siph.		0.06
Cauda		0.07

(D. Hille Ris Lambers's Collections)

Sexual forms: [From Szelegiewicz, 1961.]

Alate male: Body 1.53–1.83 mm long. Head and thorax dark brown. Antennae dark brown 1.27–1.51 mm long; segment III 0.37–0.44 mm long and bears 6–31 secondary rhinaria, segment IV 0.22–0.27 mm long and bears 9–20, and segment V, 0.16–0.20 mm long and bears 5–14 similar rhinaria; processus terminalis 2.5–3.1 × as long as base of segment VI. Rostrum 0.34–0.36 mm long. Abdominal tergites 1st–8th each with a transverse, brown band, Siphunculi and legs dark. First tarsal segments, each with 6–7 hairs.

Colour: Black.

Apterous oviparous female: Body spindle-shaped, 2.11–2.33 mm long. Antennae brown, half or little less than half the length of body; processus terminalis 2.4–2.8 × as long as base of segment VI and 1.5–1.6 × as long as antennal segment III; segment III 0.21–0.25 mm, IV 0.15–0.17 mm, V 0.13–0.14 mm, VI 0.09–0.10 + 0.24–0.28 mm long. Rostrum 0.34–0.37 mm long. Abdominal dorsum pale, bearing marginal sclerites on 1st–6th tergites and transverse sclerotic bands on 7th and 8th tergites, besides brown inter-segmental “muskelpplatten” and stigmal plates. Siphunculi short with bases completely colourless. Cauda knobbed, dusky. Hind tibiae stout, swollen and bear numerous pseudosensoria.

Colour: Head, antennae, pronotum and legs dark, abdomen light brown.

Nymphs: Single early instar nymph (1st instar?) shows completely pale body with head slightly dusky, 0.41 mm long; antennae 4 segmented and more than 0.66 × as long as the body; dorsal hairs on abdomen 0.060–0.073 mm long, fine, on tibiae 0.026–0.050 mm long. Ultimate rostral segment 0.080 mm long, bearing 4 accessory hairs and 1.2 × as long as second segment of hind tarsus.

Material examined: Two apterous viviparous females and 9 nymphs, from *Salix* sp., Dalhousie, Himachal Pradesh, INDIA, 6-6-1964, Coll. K. D. Verma, det. V. F. Eastop; 9 apterous viviparous female, 1 alate viviparous female and one early stage nymph, from *Salix babylonica*, Teheran, IRAN, 7-5-1960 leg. v.d. Bosch, det. D. Hille Ris Lambers.

Discussion: The species is known to form small colonies on the under surface of leaves of host-plant. In EUROPE, ants *Lassius niger* L., are reported to visit them occasionally, and sexuales are produced in the month of October. Fundatrices, as in many other species, are reported to be larger in size (1.6–2.2 mm) and appear in May.

This species known to infest a number of *Salix* species (*alba*, *fragalis*, *amygdalina* etc.) in EUROPE, is also known from MIDDLE

EAST. Szelegiewicz (1974) considers *niger* as a sub-species of asiatic *salijaponica* Essig and Kuwana, which infests *Salix integra* and *S. koriyangi*, *Salix* sp. in JAPAN and CHINA. Szelegiewicz (1961) has given detailed description of all morphs from POLAND, Eastop & Hille Ris Lambers (1976) considered *Pseudomicrella jacobi* Börner, as a synonym of *niger*.

Distribution.—N. INDIA (Himachal Pradesh), MIDDLE EAST, EUROPE.

Types.—Probably in Leningrad Museum, U.S.S.R.

***Chaitophorus nigrinus* Hille Ris Lambers**

(Fig. 19, Pl. III, figs. 3, 4)

1966. *Chaitophorus nigrinus* Hille Ris Lambers, *Tijdschr. Ent.*, **109**: 199.

Apterous viviparous female: Body 1.15–1.42 mm long, blackish with appendages pale. Head pale along the frons and laterad

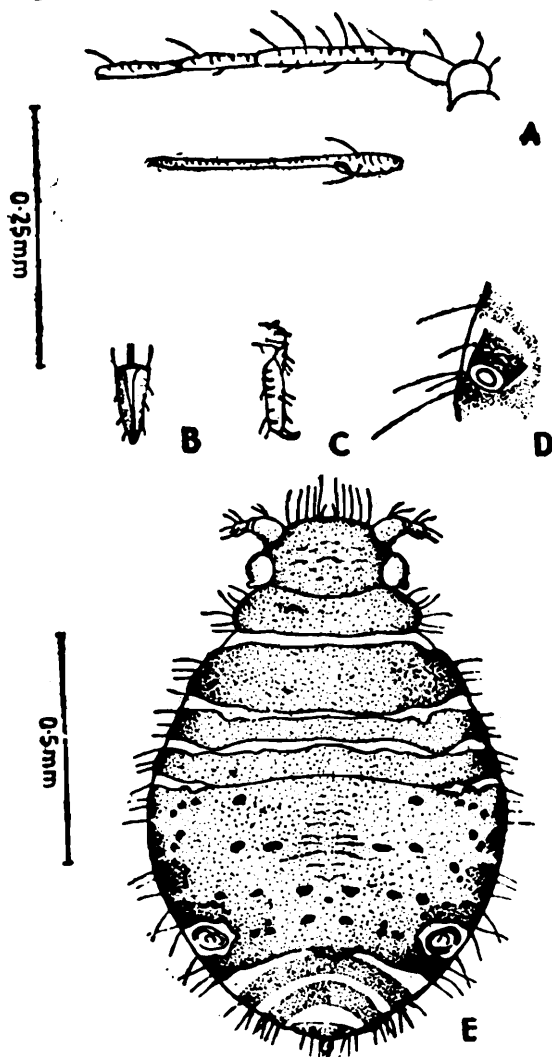


FIG. 19. *Chaitophorus nigrinus* H.R.L.: A. antenna, B. ultimate rostral segment, C. second segment of hind tarsus, D. siphunculus, E. whole body of apterous viviparous ♀.

upto eyes, rest dark. Antennae 6 segmented, pale except segment I which is dusky, 0.50–0.60× as long as the body; hairs on the flagellum long and fine on inner margins, those on outer margins much shorter and hardly exceeds the basal diameter of antennal segment III; longest hair on segment III 0.05–0.08 mm long, 3.0–4.0× as long as the mentioned diameter; longest hair at the basal part of segment VI, 0.05–0.07 mm long and 2.5–3.0× as long as the shortest one; processus terminalis 2.3–2.8× as long as the base of segment VI and 1.2–1.6× as long as segment III. Rostrum reaches near the base of hind coxae; ultimate rostral segment nearly equal to second segment of hind tarsus and bears 2–3 hairs besides preapical ones. Dorsum evenly black, abdominal tergites 2nd–6th completely fused, others mutually free and separated by paler zones. Dorsum of abdomen as also thorax, with many bluntish nodules arranged in lines or reticulations. Hairs on the dorsum of abdomen long and fine, longest one on 3rd tergite 0.11–0.13 mm long, 5.0–6.0× as long as the basal diameter of antennal segment III; shortest one 1.5–2.0× as long as the mentioned diameter; 8th tergite mostly with long hairs (apparently 8 in number) as those on 3rd. Siphunculi dark, very small with a distinct colourless membraneous area around, and with 3–4 rows of reticulation. Cauda pale, distinctly knobbed, the knobbed portion being wider than long and with 5–6 hairs. Legs completely pale except at dusky tarsi; apex of tibiae finely spinulose; first tarsal segments with 5, 5, 5 hairs; empodial hairs setaceous.

Colour: Black with pale legs and antennae (H.R.L. 1966).

Alate viviparous female: Not known.

Sexual forms: Not known.

Larvae: Dorsal hairs with black scleroites from birth (H.R.L. 1966).

Material examined: 5 apterous viviparous females (Paratypes) and 2 nymphs, from *Salix* sp., Muree, PAKISTAN, 27-6-1964, leg. v.d. Bosch, det. D. Hille Ris Lambers.

Discussion: The black body with pale legs, ultimate rostral segment with few accessory hairs and the pale membraneous area around siphunculi are characteristics of this species.

These aphids are reported to infest around galls of *Salix* in close colonies. No report of ant association is known.

Distribution.—PAKISTAN. This aphid may also be present in Himachal Pradesh, Punjab and Jammu & Kashmir of Indian subcontinent.

Types.—In the collections of D. Hille Ris Lambers, Bennekom, THE NETHERLANDS.

Chaitophorus nigrinus Hille Ris Lambers

Apterous viviparous female

Measurements in mm.

	Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.	Cauda
				III	IV	V	VI				
1.	1.38	0.74	0.74	0.18	0.07	0.08	(0.08+0.23)	0.10	0.10	0.04	0.05
2.	1.42	0.82	0.77	0.16	0.09	0.09	(0.08+0.23)	0.10	0.10	0.05	0.05
3.	1.15	0.62	0.60	0.10	0.08	0.07	(0.07+0.18)	0.09	0.09	0.04	0.04
4.	1.24	0.64	0.69	0.16	0.09	0.08	(0.08+0.19)	0.08	0.09	0.04	0.05
5.	1.24	0.64	0.63	0.12	0.07	0.07	(0.08+0.20)	0.09	0.09	0.06	0.05

(1-5, D. Hille Ris Lambers's Collections.)

Chaitophorus pakistanicus Hille Ris Lambers

(Fig. 20, Pl. IV, figs. 1, 2)

1966. *Chaitophorus pakistanicus* Hille Ris Lambers, *Tijdschr. Ent.*, **109**: 200.1969. *Chaitophorus pakistanicus*, Verma, *Sci. Cult.*, **35**: 28.

Apterous viviparous female: Body pale, 1.40–1.65 (1.72) mm long. Head pale, hairs on frons and vertex long and stiff. Antennae 6 segmented, 0.45–0.55 \times as long as the body, pale except the area near the rhinaria on segment VI and distal half of processus terminalis which are dusky; sometimes segment I, apex of segment V and whole of segment VI dusky; hairs on flagellum few and much thinner than on body, longest one on segment III 0.04–0.05 mm long, 1.3–2.0 \times as long as the basal diameter of the segment, the shortest one 0.50–0.80 as long as the mentioned diameter; basal part of segment VI with 2 hairs, 0.016–0.020 mm long; processus terminalis 2.0–2.2 (1.6–2.2) \times as long as the base of segment VI and 0.66–0.75 as long as segment III. Rostrum reaches at least mid coxae, ultimate rostral segment nearly equal to the second segment of hind tarsus and bears a pair of long fine accessory hairs besides 3 pairs of preapicals of which one pair is placed far basad. Abdominal dorsum pale, smooth; hairs on dorsum of abdomen 10–14 per segment on 1st–6th tergites; 7th tergite with 8–9 and 8th tergite with 6–7 hairs; marginal hairs with acute apices, others with acute, acuminate or furcated apices, longest hair on anterior tergites 0.11–0.16 mm long, 5.0–7.0 \times as long as the basal diameter of antennal segment III, shortest ones 1.8–2.0 \times as long as the mentioned diameter; longest hair on 8th tergite 6.0–8.0 \times as long as the mentioned diameter. Siphunculi pale, truncated, shorter than its maximum width, with 2–4 rows

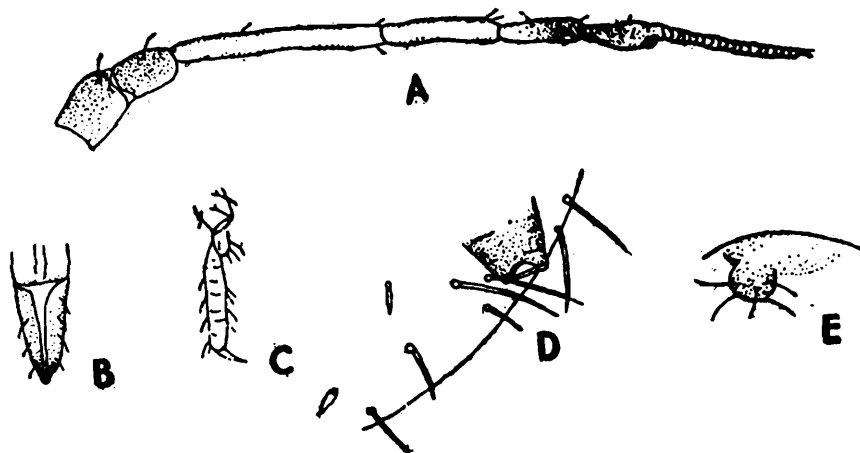


FIG. 20. *Chaitophorus pakistanicus* H.R.L.: A. antenna, B. ultimate rostral segment, C. second segment of hind tarsus, D. siphunculus, E. cauda.

of apical reticulation. Cauda pale, knobbed, the knob broader than long and with 6–8 hairs. Legs pale, sometimes little dusky, tarsi always so; tibiae smooth, the specimens from Kashmir sometimes with 2–3 pseudosensoria in the median portion; first tarsal segment with 5, 5, 5 hairs; empodial hairs setaceous and thin.

Colour: Not known, presumably green or yellowish (H.R.L.).

Alate viviparous form: Not known.

Sexual forms: *Oviparous female* According to Hille Ris Lambers (1966) similar to apterous viviparous female but with larger body, Cauda not constricted and swollen hind tibiae bearing about 40 pseudosensoria.

Measurements in mm:

	Length of body	Antenna	Antennal segments				Siphunculus	Cauda
			III	VI	V	VI		
1.	1.98	0.92	0.25	0.14	0.12	(0.10+0.10)	0.04	0.10

(D. Hille Ris Lambers's Collections.)

Larvae: Antennal segments I & II often brownish. Dorsal hairs, as in adult, without segmental basal sclerites.

Material examined: Two apterous viviparous females (No. 1, 2) and six nymphs (Paratypes) from *Salix acmophylla*, Hangu, PAKISTAN, 9-12-1962, leg. C.I.B.C., det. D. Hille Ris Lambers; Ten apterous viviparous (No. 3, 4, 5) females from *Salix* sp., Jammu, INDIA, 24-2-1964, Coll. K. D. Verma, det. D. Hille Ris Lambers.

Discussion: The present species with its short processus terminalis and last rostral segment and smooth tergum and pale siphunculi, can be separated from closely related ones, *Chaitophorus himalayensis* (Das) and *Chaitophorus saliceti* (Shrank). According to Hille Ris Lambers, few records of *Chaitophorus himalayensis* (Das) may also be related to this species.

No biological data has been given by any of the earlier authors. At least two species of *Salix* viz. *acmophylla* and *tetrasperma* serve as host plants.

Distribution.—INDIA (Jammu); PAKISTAN (Mardan and Hangu area).

Types.—In the collections of D. Hille Ris Lamber, Bennekom, THE NETHERLANDS (Holotype and Paratype); K. D. Verma's Collections, Simla, INDIA (Paratype).

Chaitophorus pakistanicus Hille Ris Lambers

Apterous viviparous female

Measurements in mm:

	Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.	Cauda
				III	IV	V	VI				
1.	1.65	0.90	0.75	0.22	0.10	0.09	(0.08+0.16)	0.11	0.12	0.06	0.10
2.	1.58	0.82	0.78	0.23	0.12	0.09	(0.08+0.15)	0.11	0.12	0.06	0.10
3.	1.44	0.80	0.72	0.19	0.12	0.10	(0.05+0.14)	0.10	0.11	0.05	0.10
4.	1.40	0.80	0.63	0.16	0.10	0.09	(0.05+0.11)	0.10	0.11	0.05	0.10
5.	1.47	0.82	0.77	0.21	0.14	0.10	(0.06+0.14)	0.10	0.11	0.06	0.10

(No. 1, 2, D. Hille Ris Lambers's Collections, 3, 4, 5, K. D. Verma's Collections.)

Chaitophorus populeti (Panzer)

(Fig. 21, Pl. IV, figs. 3, 4 & Pl. V, figs. 1, 2)

1805. *Aphis populeti* Panzer, *Fauna Insect Germaniae, Nurnberg*, **95**: 6.
1915. *Chaitophorus betulinus* v.d. Goot, *Beitrage zur Kenntnis der hollandischen Blattlause*, 354.
1919. *Chaitophorus populisiebaldi* Matsumura, *Trans. Sapporo nat. Hist. Soc.*, **7**(2): 354.
1926. *Chaitophorus coreanus* Okamoto and Takahashi, *Insecta matsum.*, **1**: 142.
1941. *Chaitophorus yamanarashi* Shinji, *Monog. Japanese Aphididae*, 418.
1961. *Chaitophorus populeti*, Szelegiewicz, *Annles Zool.*, **19**(7): 278.
1969. *Chaitophorus populeti*, Verma, *Sci. & Cult.*, **35**: 28.
1972. *Chaitophorus populeti*, Higuchi, *Insecta matsum.*, **35**: 87.

Apterous viviparous female: Body 1.93 mm long, black brown with middle of abdomen pale. Dorsum of head little imbricated, hairs on head 0.104–0.164 mm long with acute or furcated apices, longest one nearly $5.0\times$ as long as the basal diameter of antennal segment III. Antennae 6 segmented with segment III and basal 0.60 portion of segment IV pale, rest dark brown, $0.71\times$ as long as the body; flagellum imbricated, hairs on flagellum fine, longest one on segment III 0.083 mm long and shortest one 0.030 mm long, these being $3.5\times$ and $1.3\times$ as long as the basal diameter of the segment; processus terminalis little over twice as long as the base of segment VI and nearly $0.60\times$ as long as antennal segment III. Rostrum reaches 1st abdominal segment, ultimate rostral segment long, slender about $1.5\times$ ($1.2\text{--}1.6\times$) as long as second segment of hind tarsus and bears 8 (6–10) accessory hairs. Abdominal tergites 1st–7th fused; dorsum without any reticulation, dark sclerotic, except mid dorsal region of anterior tergites which is pale; hairs on dorsum of abdomen with acute, acuminate and furcated apices, longest one on anterior tergites 0.100 mm long and shortest one 0.050 mm long, these being $4.3\times$ and $2.1\times$ as long as the basal diameter of antennal segment III respectively; longest hair on 7th, 0.137 mm long, and on 8th tergite, 0.187 mm long and these being $6.0\times$ and $8.3\times$ as long as the mentioned diameter, respectively; 8th tergite with a brown transverse band. Siphunculi very short, truncate, dark brown, reticulated, about $0.66\times$ as long as second segment of hind tarsus. Cauda pale brown, knobbed and bears about 8 hairs. Legs dark brown except most part of fore femora, apices of mid femora and apical 0.70 portion of tibiae which are pale; hind tibiae with 7–13 small, round pseudosensoria widely scattered over its length; hairs on tibiae slender, longest one on hind tibiae about 0.093 mm long and $2.5\times$ as long as the

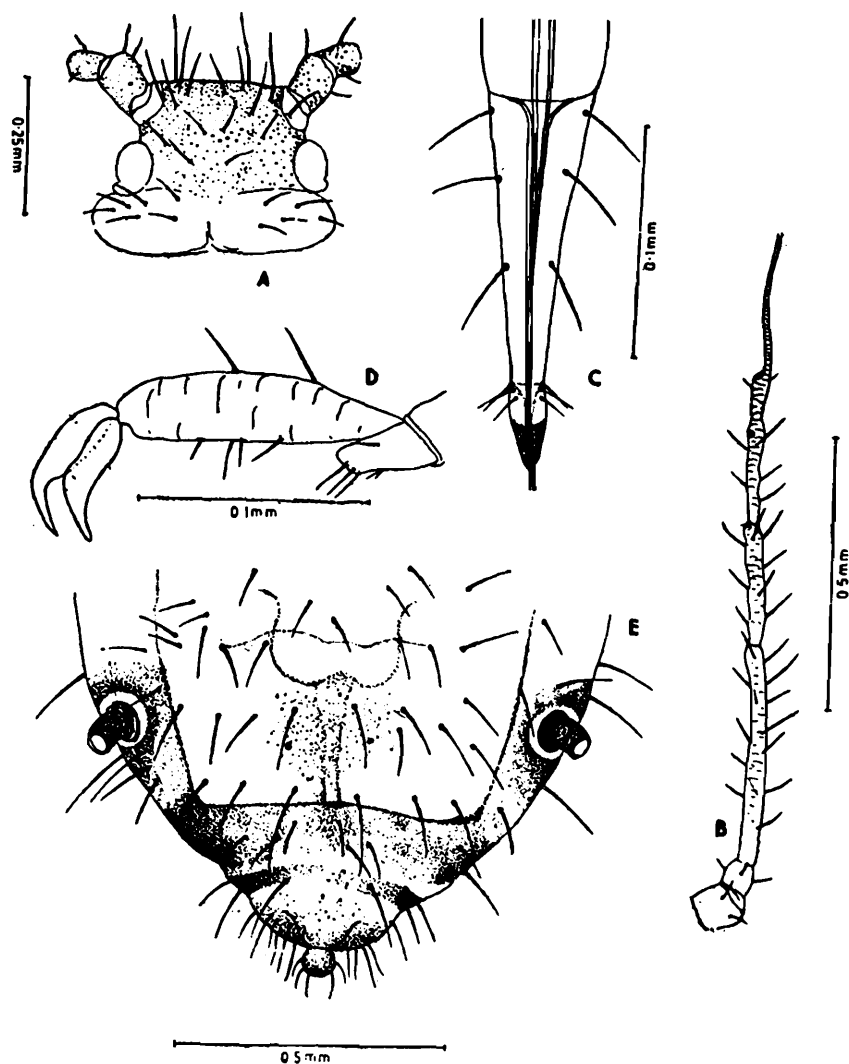


FIG. 21. *Chaitophorus populeti* (Panzer): A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. abdominal dorsum.

diameter at middle of hind tibiae. First tarsal segments with 5, 5, 5 hairs (6).

(* Figures in parenthesis, from Higuchi, 1972.)

Colour: Evidently dark in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.	
			III	IV	V	VI				
1.	1.93	1.0	1.44	0.45	0.25	0.21	(0.12+0.25)	0.18	0.12	0.08

(K. D. Verma's Collections, Simla.)

Alate viviparous female: Body about 1.80–1.85 mm long. Head and thorax black, sclerotic. Antennae 0.75× as long as the body; longest hair on antennal segment III 0.073–0.076 mm long, shortest one 0.026–0.033 mm long, these being 3.0× and 1.0–1.2× as long as the basal diameter of antennal segment III respectively; segment III with 12–19 and IV with 0–3 secondary rhinaria; processus terminalis 2.5–2.8× as long as base of antennal segment VI; Abdominal dorsum with segmental transverse sclerotic bands on 1st–8th tergites, besides pleural sclerites, which become confluent with the band on 8th tergite; hairs on dorsum fine, longest one on anterior tergites 0.130–0.146 mm long, shortest one 0.066–0.076 mm long, these being 5.0–6.0× and 2.5–3.0× as long as the basal diameter of antennal segment III respectively; longest hair on 7th, 0.172–0.178 mm long and on 8th tergite 0.146–0.149 mm long, these being 5.6–5.7× and 6.6–8.0× as long as the mentioned diameter. Siphunculi dark, 0.05–0.06× as long as the body, about 0.75× as long as second segment of hind tarsus, with distinct reticulation over apical 0.50 portion, rest with interconnected striae. Cauda pale, knobbed, with about 8 hairs. Legs with apical portion of fore femora and middle portions of tibiae variably pale, rest dark brown; hind tibiae with 5–9 pseudosensoria; longest hair on hind tibiae 0.100 mm long, 2.5–2.7× as long as the diameter at the middle of hind tibiae. Wing venation normal. Other characters as in apterae.

Colour: Dark in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1. 1.80	0.82	1.44	0.44	0.24	0.22	(0.10+0.28)	0.19	0.12	0.09
2. 1.85	0.82	1.54	0.44	0.24	0.21	(0.12+0.30)	0.18	0.14	0.10

(1, 2, K. D. Verma's Collections)

Sexual forms: [From Szelegiewicz, 1961.]

Apterous male: Body 1.83 mm long. Antennae 1.44 mm long, brown, segment III 0.44 mm long, with 30–35, segment IV 0.33 mm long, with 30–36, and segment V 0.22 mm long, with 15–16 secondary rhinaria; processus terminalis nearly twice as long as base of segment VI and little less than half the length of antennal segment III. Rostrum 0.57 mm long, reaches 2nd abdominal segment. Dorsum black, abdominal tergites 2nd–6th fused together. Siphunculi dark. Hind tibiae with 1–2 pseudosensoria. Genitalia weakly developed.

Colour: Body, antennae and legs black.

Alate male: Body 1.88–1.94 mm long. Head and thorax black. Antennae 1.31–1.36 mm long and brown, segment III 0.41–0.42 mm long and with 35–50, segment IV 0.19–0.23 mm long and with 18–26 and segment V 0.19 mm long and with 10–16 secondary rhinaria; processus terminalis 2.0–2.25 × as long as base of segment VI and 0.60 × as long as antennal segment III. Rostrum 0.57 mm long, reaches hind coxae. Abdominal tergites 1st–8th each with a transverse sclerotic band, those on 7th and 8th tergites, reaching marginal areas and appear more extensive. Hind tibiae with a few pseudosensoria.

Colour: Dark.

Oviparous female: Body 2.11–2.41 mm long. Head and pronotum brown. Antennae 1.13–1.43 mm long, segment III and base of segment IV pale, rest blackish; segment III 0.34–0.41 mm long, IV 0.19–0.24 mm long and V 0.16–0.21 mm long; processus terminalis 2.0–2.3 × as long as base of segment VI and 0.60–0.62 × as long as antennal segment III. Rostrum 0.62–0.67 mm long. Abdominal dorsum pale except marginal sclerites on 6th and 7th tergite and a transverse band on 8th tergite which are brown. Siphunculi short and pale. Cauda knobbed, pale. Hind tibiae swollen and with numerous pseudosensoria. First tarsal segment with 6, 6, 6 hairs.

Colour: Body light brown, antennae and legs black.

Nymphs: Early stage apterous nymph: Body pale; head brown, antennae dark on segment I and II, apices of IV and whole of V and VI, rest pale; processus terminalis little over twice as long as base of segment VI; longest hair on antennal segment III 0.066 mm long, 2.2 × as long as the basal diameter of the segment. Rostrum reaches beyond middle of abdomen, ultimate rostral segment 0.18 mm long, 1.3 × as long as the second segment of hind tarsus. Abdominal dorsum pale with many long, thick hairs with furcated apices, those on anterior tergites upto 0.093 mm long, on posterior tergites upto 0.103 mm long. Siphunculi pale and very short. Legs with stout femora which are brownish; tibiae dark at bases and apices, rest pale; tarsi dark.

Late stage alate nymph: Body pale; antennae with segments I and II, apices of V and whole of VI dark; longest hair on segment III 0.060 mm long, shortest one 0.023 mm long. Ultimate rostral segment brownish at apex, 0.17 mm long. Hairs on the dorsum of abdomen thick, mostly with furcated apices, on anterior tergites 0.100 mm long, on posterior tergites 0.160 mm long. Siphunculi pale. Legs little dark at knees, tarsi black, rest of the legs pale.

Measurements in mm:

	Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
				III	IV	V	VI			
1.	0.96	0.55	0.96	0.22	0.14	0.14	(0.09+0.20)	0.18	0.11	0.026
2.	1.79	0.96	1.14	0.33	0.19	0.18	(0.10+0.28)	0.19	0.12	0.065

(1, apterous nymph, 2, alate nymph, K. D. Verma's Collections)

Material examined: One apterous and two alate viviparous females, one apterous and one alate nymph, from *Populus alba*, Srinagar, Kashmir, INDIA, 5-5-1966, Coll. K. D. Verma; four apterous viviparous female, from *Populus alba*, Putney, ENGLAND, 1965, Coll. V F. Eastop; one apterous one alate viviparous female from *Populus tremula*, Istanbul, TURKEY, 18-6-1964, Coll. H. fanal-foglu [British Museum (Nat. Hist.) London, Collections]; one apterous and three alate viviparous females from *Populus*, Ghazrin, IRAN, 26-5-1966, Coll. v.d. Bosch, det. D. Hille Ris Lambers.

Discussion: This species with dark body and furcated dorsal hairs may easily be separated from the others. Although recorded only once in INDIA, it is likely to be found in other Poplar growing areas.

According to Szelegiewicz (1961) at least two subspecies of this species could be recognised viz. *C. populeti sensoriatus* Mimeur and *C. populeti jaxarti* Nevsky but Eastop and Hille Ris Lambers (1976) considered these subspecies as complete synonyms of *populeti*, besides *pseudotremulae* Ghulamullah which was described from AFGHANISTAN. Further, he has mentioned about an ant species, *Myrmica laevinodis* Nyl. which may be seen in association with *C. populeti*. Fundatrices as reported by him appear between end of April and June whereas sexuales appear between middle of September and end of October. It may be noted that both the above morphs are unknown in INDIA.

In recent years Szelegiewicz (1961) has given detailed description of all morphs of this species from POLAND and Higuchi (1972) has described the viviparous morphs from JAPAN; Szelegiewicz (op. cit.) has also shown its relationship with *C. nassonowi* Mordv. and east asian species, *C. coreanus* Okamoto and Takahashi and *C. chinensis* Takahashi.

Eastop (*in litt.*) has informed that *Chaitophorus pseudotremulae* Gulam Ullah 1943 originally described from AFGHANISTAN, is a member of *C. populeti* (Panzer) complex. As no material of Gulam Ullah's collection could be traced the identity of the species remains uncertain.

In EUROPE and SOUTHEAST ASIA, this species has been recorded from *Populus alba*, *P. adenopoda*, *P. balsamifera*, *P. nigra* var. *italica*, *P. tomentosa* and *P. tremula*.

Distribution.—INDIA, (Kashmir), JAPAN, KOREA, CHINA, TURKEY, IRAN, ISRAEL, EUROPE, MOROCCO, EGYPT.

Types.—Probably do not exist, according to British Museum (Nat. Hist.) London.

Chaitophorus populialbae (Boyer de Fonscolombe)

(Fig. 22, Pl. V, figs. 3, 4)

1841. *Aphis populialbae* Boyer, de Fonscolombe, *Ann. Soc. Ent. Fr.* **10**: 187
 1901. *Chaitophorus albus* Mordwilko, *Trudy russk. ent. obshd.* **33**: 410.
 1922. *Chaitophorus inconspicuous* Theobald, *Bull. Soc. Ent. Egypt.*, **7**: 61.
 1931. *Chaitophorus hickeliana* Mimeur, *Revue Path. Veg. Ent. Agric. Fr.* **18**: 201.
 1955. *Chaitophorus tremulinus* Mamontova, *Izd. An Ukrain SSR*, Kiev., p. 68.
 1971. *Chaitophorus populialbae*, David, Narayanan, Rajasingh, *Madras agric. J.*, **58**: 372.
 1974. *Chaitophorus albus*, Ghosh, A. K. *J. Bombay nat. Hist. Soc.*, **71**(2) 208.

Apterous viviparous female: Body pale, 1.10–1.3 mm long. Frons convex; hairs on frons, 0.073–0.100 mm long, longest hair may be up to 6.0× as long as the basal diameter of antennal segment III. Antennae pale, 0.50–0.60× as long as the body; flagellum gradually more distinctly imbricated apicad; hairs on flagellum blunt or acuminate at apices, longest one on segment III 0.03–0.04 mm long, shortest one 0.02–0.03 mm long, these being 2.0× and 1.2–1.6× as long as the basal diameter of the segment; processus terminalis 2.3–2.6 as long as base of segment VI and equal to or longer than antennal segment III. Rostrum reaches hind coxae, ultimate rostral segment long and slender, 1.2–1.4× as long as second segment of hind tarsus and bears 4 accessory hairs. Tergum pale nodulose on lateral and median areas of head and faintly so on prothorax, rest of thorax variably spiculose and reticulated. Abdominal dorsum faintly nodulose laterally on tergites 1st–6th, 7th and 8th tergites with spiculose imbrication; hairs on dorsum of abdomen acuminate or furcated at apices, longest one on anterior tergites 0.106–0.130 mm long, shortest one 0.060–0.070 mm long, these being 5.3–7.0× and 3.3–3.6× as long as the basal diameter of antennal segment III; longest hair on 7th tergite 0.115–0.130 mm long and those on 8th, 0.124–0.130 mm long, these being 6.0–7.6× and 6.6–7.6× as long as the mentioned diameter; 8th tergite with 7 hairs. Siphunculi pale, reticulated, 0.04× as long as the body, 0.07–0.08× as long as second segment

of hind tarsus. Cauda pale, distinctly knobbed and bears 6-7 hairs. Anal plate entire. Legs pale; hairs on tibiae fine, longest one on hind tibiae 0.076-0.083 mm long, 2.5-3.1 × as long as the diameter at the middle of hind tibiae. First tarsal segments with 5, 5, 5 hairs.

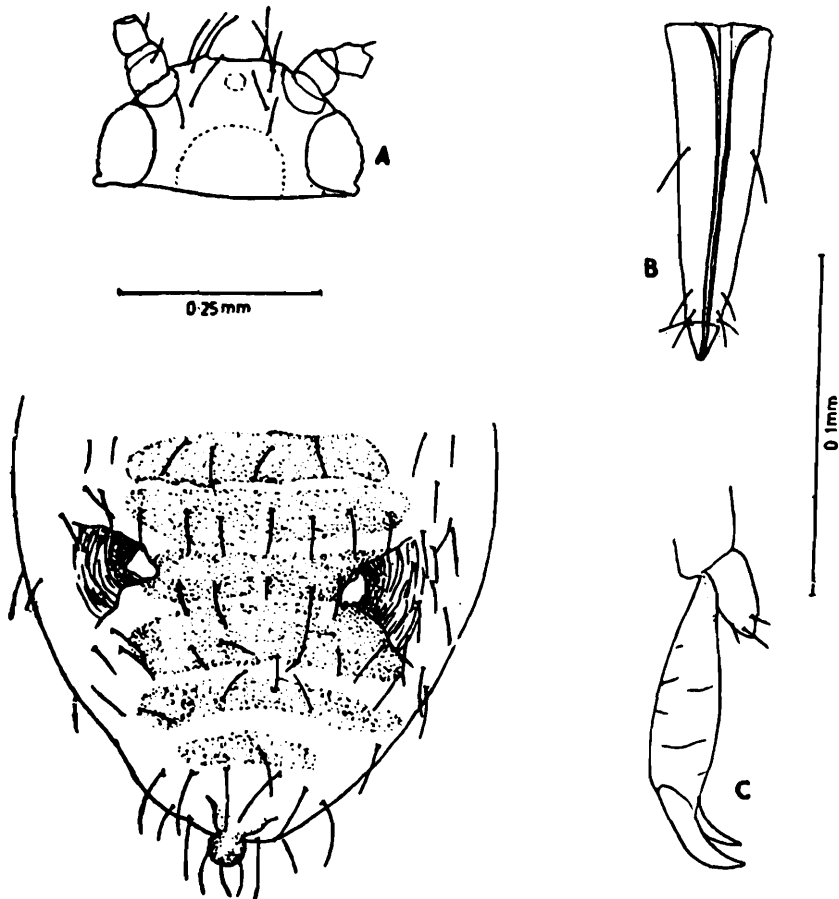


FIG. 22. *Chaitophorus populiabae* (B.d.F.): A. head, B. ultimate rostral segment C. second segment of hind tarsus, D. abdominal dorsum of alate viviparous ♀.

Colour: Yellowish white-with greenish dorsal flocks (Richards, 1972).

	Measurements in mm		
	1	2	3
Length	1.10	1.22	1.30
Width	0.65	0.67	0.75
Antenna	0.69	?	0.71
Antennal segments			
III	0.18	0.16	0.16
" IV	0.08	0.09	0.10
" V	0.08	0.08	0.09
" VI	(0.08+0.19)	(0.08+ ?)	(0.08+0.22)
urs.	0.10	0.10	0.10
ht. ₂	0.08	0.08	0.07
Siph.	?	?	0.06
Cauda	0.09	0.09	0.10

[1, 2, 3 British Museum (Nat. Hist.) London, Collections.]

Alate viviparous female: Body 1.44 mm (1.23–1.85) long. Head and thorax brown, hairs on frons fine, longest one 0.08 mm long, $4.1 \times$ as long as the basal diameter of antennal segment III. Antennae brown on segments I and II, pale brown on segment V and base of segment VI, rest pale; longest hair on antennal segment III 0.03 mm long, shortest one 0.01 mm long, these being $2.0 \times$ and $0.66 \times$ as long as the basal diameter of the segment; segment III with 9–10 (7–22), IV with 0–3 (0–5) and V with 0–1 round secondary rhinaria; processus terminalis $3.0\text{--}3.8 \times (2.3\text{--}3.2) \times$ as long as base of segment VI and subequal to or little longer than antennal segment III. Abdominal dorsum pale bearing segmental brown sclerotic bands on 3rd–8th tergites, those on 3rd–6th broader and may be nearly confluent; 7th and 8th tergites with similar bands, but the one on 8th much paler; sometimes sclerotic band hardly discernible; hairs on dorsum of abdomen fine, longest one on anterior tergites 0.07 mm long, shortest one 0.04 mm long, these being $3.3 \times$ and $2.0 \times$ as long as the basal diameter of antennal segment III; longest hair on 7th tergite 0.08 mm long and on 8th 0.10 mm long, these being $4.1 \times$ and $5.0 \times$ as long as the mentioned diameter, Siphunculi nearly pale, reticulated, $0.04\text{--}0.05 \times$ as long as the body. Cauda pale, knobbed bearing 7–8 hairs. Legs pale or pale brown; first tarsal segment bearing 5, 5, 5 hairs. Wing venation normal.

(* Figures in parenthesis, from Szelegiewicz, 1961.)

Colour: Head and thorax brown, abdomen yellowish with a dorsal patch (Richards, 1972).

		<i>Measurements in mm</i>	
		1	2
Length		1.44	1.41
Width		0.60	0.65
Antenna		0.96	1.10
Antennal segments	II	0.28	0.28
	„ IV	0.16	0.15
	„ V	0.10	0.14
	„ VI	(0.08+0.24)	(0.08+0.31)
urs.		0.12	0.11
ht. ₂		0.10	0.10
Siph.		0.06	0.07
Cauda		0.09	0.10

(1, H. Szelegiewicz's Collections, 2, S. K. David's Collections.)

Sexual forms: [From Szelegiewicz, (1961).]

Apterous male: Body 1.80–2.08 mm long. Head and thorax dark brown. Antennae long, 0.60–0.66 × as long as the body, segment III 0.35–0.43 mm long bearing 39–53 secondary rhinaria, segment IV 0.23–0.25 mm long, bearing 22–35 secondary rhinaria and segment V, 0.15–0.22 mm long, bearing 10–19 secondary rhinaria; base of segment VI 0.09–0.10 mm long and processus terminalis 0.24–0.30 mm long. Abdominal tergites 1st–8th each with a brown transverse band, those on last two tergites more extensive. Siphunculi, cauda and legs dark brown. Genitalia well developed. Otherwise as in apterous viviparous female.

Colour: Body and appendages dark, almost black.

Oviparous female: Body 1.99–2.40 mm long. Antennae 1.08–1.13 mm long, nearly half as long as the body; segment III and base of segment IV pale, rest of flagellum brown; segments III 0.34–0.38 mm long, IV 0.16–0.20 mm long, V 0.11–0.15 mm long and VI 0.08–0.09 + 0.26–0.29 mm long. Dorsum pale, except subgenital plate which is dark. Legs brown, hind tibiae considerably swollen, with many pseudosensoria.

Colour: Body yellowish, antennae and legs dark brown.

Nymphs: (Early stage, apterous); Body pale 0.82 mm long. Antennae 0.55 mm long, pale, five segmented; segments III 0.18 mm long, IV 0.08 mm long and V 0.06–0.19 mm long. Ultimate rostral segment, 0.10 mm long, reaches hind coxae and 1.25 × as long as second segment of hind tarsus. Abdominal dorsum pale bearing 2 spinal, 2 pleural and 4 marginal hairs per segment on anterior tergites, longest one 0.07 mm long and 4.5 × as long as basal diameter of antennal segment III; 7th and 8th tergite each with 4–5 hairs, longest one up to 5.0 × as long as mentioned diameter. Siphunculi slightly developed. Legs pale.

Material examined: Five apterous viviparous females and four nymphs, from white poplar, INDIA, VII. 1933, det. Takahashi [Slide No. B.M. 1937–58 from British Museum (Nat. Hist.) London, collections, labelled as *Chaitophorus hickeliana* Mim]. One alate viviparous female, from *Populus euphratica* pit galls on twig, Ghazighat, Multan, Punjab, INDIA, 6-5-1929, Coll. R. W. Mather, [Slide No. IBE 589 from British Museum (Nat. Hist.) London, collections]. One alate viviparous female, from *Solanum* sp. (Vagrant). Srinagar, INDIA, 1-6-1968, Coll. KN & SGR det. DHRL [Slide No. 696 from S. K. David's collection, Madras]. Three apterous viviparous females (fundatrices) from white poplar, Channel Is, 9-10-1971 coll. H. J. Banks, [Slide No. 695/71 from British Museum (Nat. Hist.) London, collections labelled as *Chaitophorus albus* (Mordv.)]; Three alate and 2 apterous viviparous females (Fundatrices) from *Populus alba*, Raleigh, N.C.U.S.A. 24-4-1964, Coll. and det. D.H.R.L./[Slide No. 270 from D. Hille Ris Lamber's

collections, Netherlands]. Two alate and three apterous viviparous females from *Populus alba*, Warszawa, Polonia Centre, Coll. & det. H. Szelegiewicz [Slide No. 792 from H. Szelegiewicz' collections, POLAND].

Discussion: This species is reported to infest white poplar and Aspen but have been recorded only in a few instances from Indian subcontinent and the material from pit gall of *P. euphratica* appeared so damaged that its identity could hardly be ascertained. Fundatrices as noted by Szelegiewicz (1961) are much larger in size [1.97–2.32 mm] of body and length of other parts also differ considerably from those of apterous on alate viviparous females; however, collections from INDIA did not contain any fundatrix, which in EUROPE is reported to appear towards end of month of April. Sexuales, which are again unknown from INDIA, are reported to appear in October. Szelegiewicz (op. cit.) has discussed relationship of this species with *Chaitophorus beuthani* (Borner) and *Chaitophorus caparae* (Mosley). Szelegiewicz (op. cit.) has also provided detailed description of all morphs from POLAND and Richards (1972) has given descriptions of apterous and alate viviparous morphs from CANADA.

Distribution.—HOLARCTIC; known from wide areas in continental EUROPE, CENTRAL ASIA, parts of NORTH AFRICA (Szelegiewicz 1961); perhaps widely distributed in CANADA wherever white poplars have been introduced; in this region known from Punjab and Kashmir.

Types.—Boyer de Fonscolombe has left no type.

***Chaitophorus manaliensis* Chakrabarti**

(Fig. 23, Pl. VI, figs. 1, 2)

1977. *Chaitophorus manaliensis*, Chakrabarti, *Oriental Ins.*, **11**(2): 211

Apterous viviparous female: Body 1.86–2.07 mm long, extremely pale. Dorsum of head spiculose, dorsal hairs on frons stiff with acute apices, 0.138–0.178 mm long, $5.0\text{--}7.1 \times (7.5)$ as long as the basal diameter of antennal segment III. Antennae pale, 6 segmented, $0.61\text{--}0.65 \times$ as long as the body; flagellum feebly imbricated, hairs on flagellum long and fine, longest one on segment III 0.100–0.109 mm long, shortest one 0.026–0.040 mm long, these being $3.7\text{--}4.1 \times$ and $1.0\text{--}1.5 \times$ as long as the basal diameter of antennal segment III; processus terminalis $3.6 \times (3.4\text{--}3.75) \times$ as long as base of segment VI, and nearly equal to the antennal segment III. Rostrum reaches mid coxae, ultimate rostral segment stout, somewhat obtuse, nearly equal to second segment of hind tarsus and bears 6(2) accessory hairs besides the preapicals. Abdominal dorsum pale, nodulose; hairs on the dorsum, of two types, longer and stouter and shorter and finer, longest one on

anterior abdominal tergites 0.184–0.198 mm long (0.173–0.215 mm. and shortest one 0.050 mm (0.05–0.060 mm) long, these being $7.1\text{--}7.5\times(6.5\text{--}7.7\times)$ and $2.0\times(2.3\text{--}2.6)\times$ as long as the basal diameter of antennal segment III, respectively; longest hair on 7th tergite 0.163–0.198 mm long, $6.2\text{--}7.5\times$ as long as the mentioned diameter and longest one on 8th tergite, 0.215 mm long and $8.1\times$ as long as the mentioned diameter. Siphunculi brownish; short, truncate, $0.04\times$ as long as the body, $0.6\times$ as long as second segment of hind tarsus, reticulated almost over 0.70–0.08 portion. Cauda distinctly constricted and knobbed, bearing about 8 hairs. Legs pale, hairs on femora and tibiae long and fine, longest one on hind tibiae 0.109–0.130 mm long, $2.5\text{--}2.8\times$ as long as the diameter at the middle of hind tibiae; first tarsal segment with 7, 7, 7 hairs.

(* Figures within parenthesis from original description.)

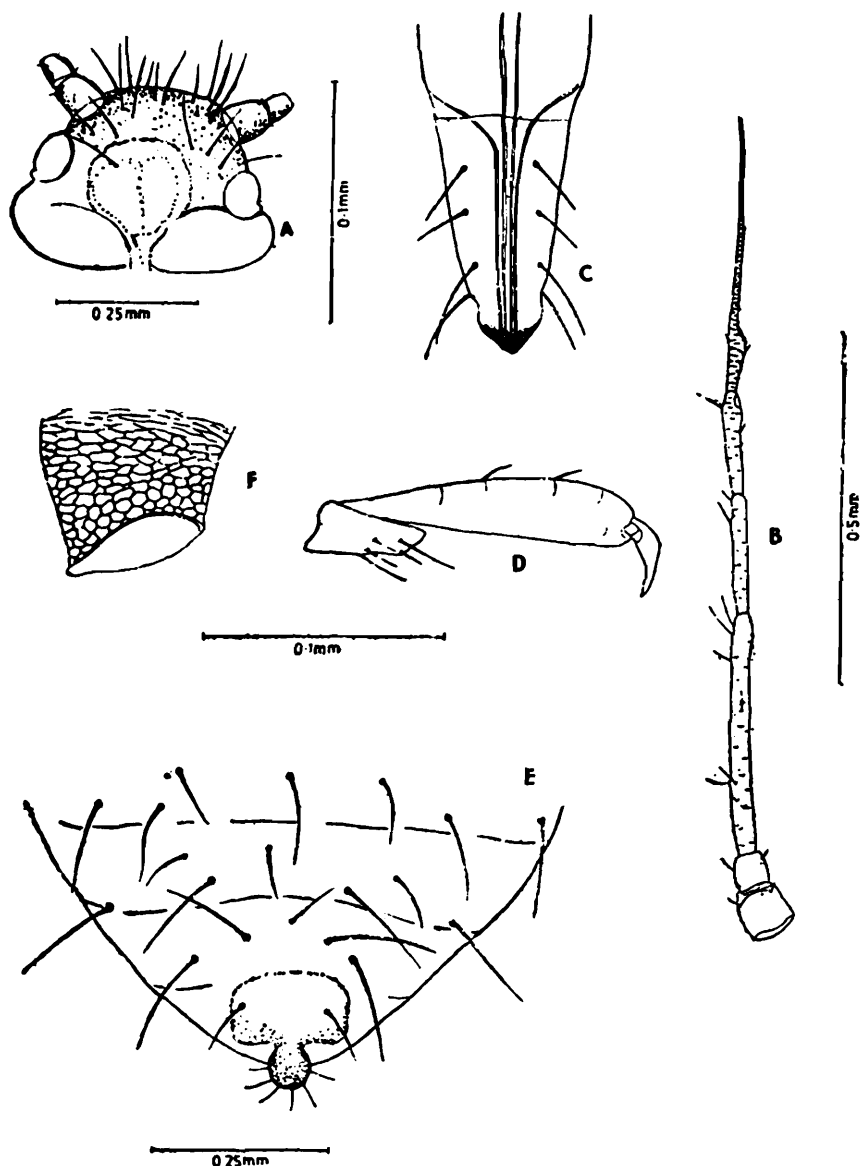


FIG. 23. *Chaitophorus manaliensis* Chakrabarti: A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. abdominal dorsum of apterous viviparous ♀, F. siphunculi.

Colour: Pale in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	2.07	1.14	1.28	0.37	0.18	0.15 (0.09+0.33)	0.11	0.13	0.08
2.	1.86	0.96	1.24	0.35	0.18	0.14 (0.09+0.33)	0.12	0.13	0.07

(Nos. 1-2, paratypes, S. Chakrabarti's Collections.)

Alate viviparous female: Not known.

Sexual forms: Not known.

Nymphs: Not known.

Material examined: Two apterous viviparous females from *Salix* sp., Manali, Uttar Pradesh, INDIA, 1-1-1973, Coll. S. Chakrabarti (Paratypes).

Discussion: This species is very closely related to *himalayensis* and *indicus* group of species but by its very long dorsal hairs and long processus terminalis it may be separated from the formers; arrangement of nodules, first tarsal chaetotaxy, large number of hairs on 8th tergite and cauda help to separate it from other species.

Distribution.—INDIA (Himachal Pradesh).

Types.—In the collections of S. Chakrabarti, Department of Zoology, University of Kalyani, West Bengal.

Chaitophorus sp.

(Fig. 24, Pl. VI, figs. 3, 4 & Pl. VII, figs. 1, 2)

1977. *Chaitophorus dorocola*, Chakrabarti, *Oriental Ins.*, **11**(2): 208.

Apterous viviparous female: Body 2.50 mm long, pale. Head pale, distinctly spinulose; hairs on frons with acute apices 0.130–0.152 mm long, up to 4.2 × as long as the basal diameter of antennal segment III. Antennae 0.45 × as long as the body, pale except at apices of segment V and base of antennal segment VI which are dusky; flagellum imbricated, segment III with 7–9, IV with 2–4, V with 2–3 and base of segment VI with 2 hairs, longest one on segment III 0.063 mm long, shortest one 0.026 mm long, these being 2.6 × and 1.7 × as long as the basal diameter of the segment; processus terminalis 2.6 × as long as base of segment VI and nearly equal to antennal segment III. Ultimate rostral segment stout, 1.1 × as long as second segment of hind tarsus and bears 4 accessory hairs. Abdominal dorsum pale, spinulose on

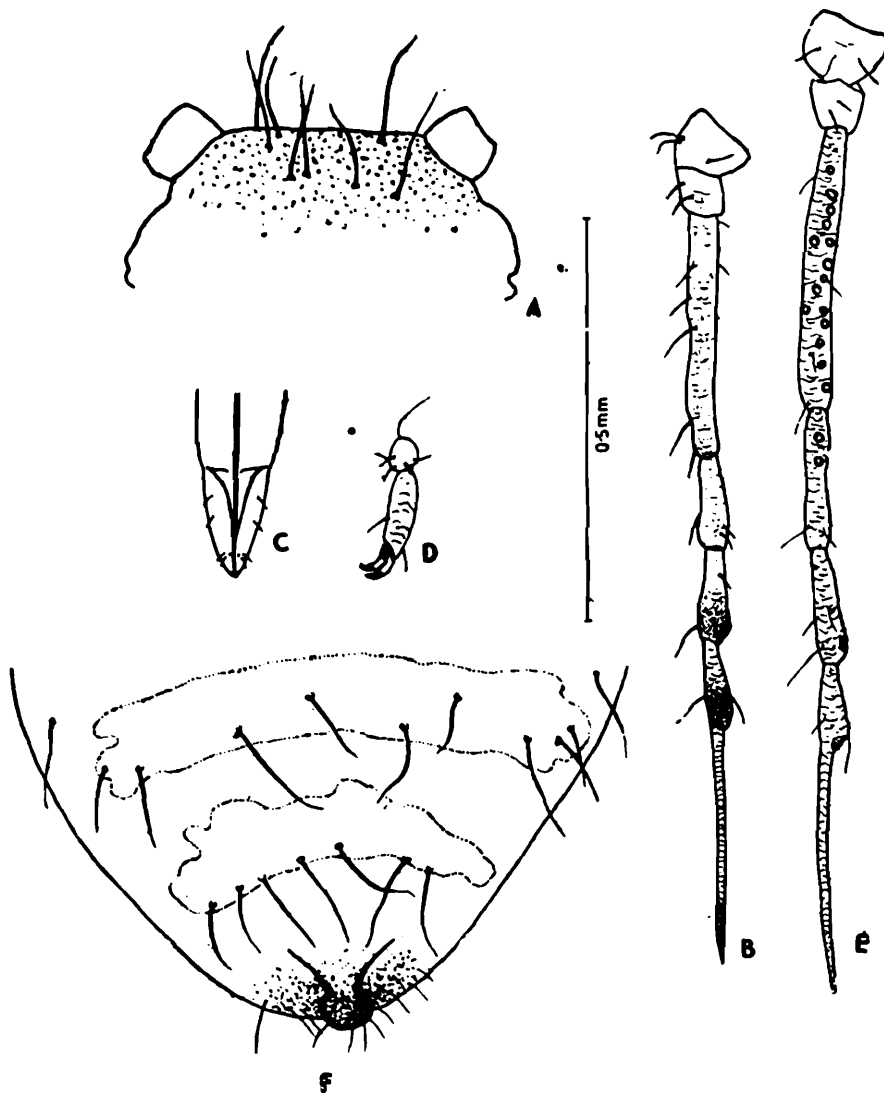


FIG. 24. *Chaitophorus* sp.: A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. antenna of alate viviparous ♀, F. abdominal dorsum of alate viviparous ♀.

spinopleural region; hairs on dorsum of abdomen mostly thick, with fine apices, longest one on anterior tergites 0.166 mm long, shortest one 0.05 mm long, these being $4.7 \times$ and $1.3 \times$ as long as the basal diameter of antennal segment III respectively, 8th tergite with 8 hairs, longest one being 0.205 mm long and $5.6 \times$ as long as the mentioned diameter. Siphunculi pale, $0.05 \times$ as long as the body and little over $0.60 \times$ as long as second segment of hind tarsus. Cauda knobbed, little dusky. Legs pale with many fine hairs, longest one on hind tibiae 0.100 mm long and $1.6 \times$ as long as the diameter at the middle of the tibiae.

Colour: Not known.

		<i>Measurements in mm</i>
		1
Length		2.50
Width		1.44
Antenna		1.13
Antennal segments	III	0.31
	„ IV	0.15
	„ V ..	0.12
	„ VI	(0.10+0.29)
urs.	..	0.15
ht. ₂		0.13
Siph.		0.08
Cauda	..	?

(Calcutta University Collections.)

Alate viviparous female: Body 2.41 mm long. Head dark, hairs on frons upto 0.130 mm long and $5.0 \times$ as long as the basal diameter of antennal segment III. Antennae pale, except at apices of segment V and base of segment VI which are dusky, $0.55 \times$ as long as the body; flagellum imbricated, segment III with 5–8 hairs, longest one 0.073 mm long and shortest one 0.04 mm long, these being $2.7 \times$ and $1.2 \times$ as long as the basal diameter of the segment, respectively; segment III with 15–16 secondary rhinaria distributed over entire length, segment IV with 0–2 similar rhinaria; processus terminalis $3.5 \times$ as long as base of segment VI and little shorter than antennal segment III. Rostrum stout, ultimate rostral segment $1.1 \times$ as long as second segment of hind tarsus and bears 4 accessory hairs. Abdominal dorsum pale, bearing paired marginal sclerites on 1st–6th tergites and broad spino pleural sclerotic bands on 3rd–8th tergites; on first two tergites some scattered sclerites present in spino-pleural region; hairs on dorsum of abdomen long and fine, longest one on anterior tergites 0.152 mm long, shortest one 0.050 mm long, these being $6.0 \times$ and $2.0 \times$ as long as the basal diameter of antennal segment III, respectively; longest hair on 7th tergite 0.130 mm long and on 8th, 0.156 mm long, these being $5.0 \times$ and $6.0 \times$ as long as the mentioned diameter; 8th tergite with 8 hairs. Siphunculi dark brown, reticulated over most part, $0.04 \times$ as long as the body, $0.66 \times$ as long as the second segment of hind tarsus. Cauda dusky, distinctly knobbed, with at least 6 hairs. Legs pale yellow, dusky at knees and tarsi. Hairs on tibiae fine, longest one on

hind tibiae 0.093 mm long, about $2.0 \times$ as long as the diameter at the middle of tibia. First tarsal segments with 7, 7, 7 hairs.

Colour: Not known in life.

		<i>Measurements in mm</i>
		1
Length	. . .	2.41
Width		1.17
Antenna	. . .	1.33
Antennal segments III	..	0.38
" IV	.	0.18
" V		0.16
" VI		(0.10+0.35)
urs. . .	. . .	0.15
ht. ₂ ..	. . .	0.14
Siph. .		0.10
Cauda	.	0.13

(Calcutta University Collections.)

Sexual forms: Not known.

Nymphs: Late stage alate nymph: Pale with apices of antennal segment V and base of VI brownish. Dorsal hairs mostly long, thick with acute apices, some thin and fine; 8th tergite with 8 hairs, longest one 0.138 mm long, $3.3 \times$ as long as the basal diameter of antennal segment III. Siphunculi dusky at apices, rest pale.

Material examined: Apterous viviparous female, one alate viviparous female and one alate nymph, from *Populus* Sp., Kalimpong, West Bengal, INDIA, 2-2-1971, Coll. M. R. Ghosh, det., F. W. Quednau, as *C. dorocola* Mats. (Calcutta University Collections.)

Discussion: The specimens identified as *dorocola* Mats., appear close to *dorocola* but differ in the ratio of ultimate rostral segment to second segment of hind tarsus, in the sensoriation of antennae of alatae and setal pattern of nymph. Material borrowed from D. Hille Ris Lambers, collected in JAPAN and identified as *dorocola* Mats., by R. Takahashi, showed the above differences but apterae of this species identified by H. Higuchi, JAPAN showed completely dark sclerotic dorsum which does not agree with the original short description as given by Matsumura (1919). It may be stated further that the species dealt with as *dorocola* Mats., by Higuchi (1972) is not that species and is being described as a

new species by D. Hille Ris Lambers and V. F. Eastop; material of this species was also borrowed from Higuchi but it appears to be a distinct species from the present one; the present species cannot, however, be identified specifically, till more specimens become available.

Distribution.—INDIA (Darjeeling district, West Bengal).

Genus **Periphyllus** van der Hoeven

1863. *Periphyllus* van der Hoeven, *Tijdschr. Ent.*, **6**: 1; Essig, and Abernathy, 1952, The aphid genus *Periphyllus*, Univ. California Press, 1; Eastop, 1966, *Aust. J. Zool.*, **14**: 523; Richards, 1972, *Mem. ent. Soc. Canada*, **87**: 71; Higuchi, 1972, *Insecta matsum.*, **35**: 93. Type species: *Periphyllus testudo* van der Hoeven = *Phyllophora testudinacea* Fernie.
1913. *Chaitophorinella* van der Goot, *Tijdschr. Ent.*, **56**: 112. Type species: *Phyllophora testudinatus* Thornton.
1930. *Chaitophorinus* Börner, *Arch. Klassif. phylogen. Ent.*, **1**(2): 126. Type species: *Chaetophorus lyropictus* Kessler.

Morphology: Frontal tubercles absent. Antennae 6 segmented, shorter than body, without secondary rhinaria in apterae, in alatae only segment III with secondary rhinaria; processus terminalis $1.5 \times$ to more than $6.0 \times$ as long as base of segment VI; hairs on flagellum long and fine, usually longer than basal diameter of antennal segment III. Head and prothorax never fused. Ultimate rostral segment usually shorter than second segment of hind tarsus and bears 1–7 accessory hairs. Abdominal tergites in apterae with or without pigmented patches, in alatae, transverse black bands usually present. Dorsal hairs long, fine, more than 10 per abdominal tergite. Siphunculi 0.04 – $0.10 \times$ as long as the body, with polygonal reticulation which may extend over their entire length. Cauda semicircular or weakly knobbed. Anal plate entire. Primary gonapophyses 4. Legs variably pigmented; apices of tibiae spinulose, more strongly so in alate; apical tibial hairs not differentiated from other tibial hairs; tarsi imbricated; first tarsal segments with 5–7 ventral hairs, without any dorsal hairs. Empodial hairs flattened. Wing venation normal.

Sexual forms unknown in many species. Oviparae are apterous with robust body variably pigmented and with swollen hind tibiae bearing pseudosensoria. Males may be apterous or alate, the latter with more secondary rhinaria on antennae than in alate viviparae. Descriptions of Sexual forms for a number of species have been provided by Essig & Abernathy (1952).

Embryos normal with paired, segmental, spinal, pleural and marginal hairs and indistinct siphunculi. Marginal hairs may be foliate in aestivating larvae.

Discussion: In the temperate region, according to Essig and Abernathy (1952) all the maple infesting species hibernate in egg stage, even in warmer limits of their distribution, but so far, no egg stage has been recorded for any of the *Periphyllus* species found in northern temperate region of Indian subcontinent. The occurrence of aestivating first instar larvae or dimorphs, during summer, as known elsewhere in temperate areas, has not been noted in this region. Dimorphs, however, could easily be recognised by the foliate marginal setae as found in many of the species.

Periphyllus is rather a small genus in which only 28 species were known till 1976.

Following the complicated life history of many members of the genus, Essig & Abernathy (op. cit.) have recognised 15 types of morphs among the normal generations of individuals, e.g. intermediate spring apterous and alate viviparous female, lamellate dimorph, dimolt, intermediate fall apterous and alate viviparous female, intermediate fall apterous viviparous+oviparous female, alate and apterous sexupara etc., but in the region under study many of these forms have not been recorded so far.

Biology: The genus is related to *Chaitophorus* on Salicaceae and has become mostly associated with *Acer* species. Some species are host-specific and holocyclic on one species of maple, whereas other species e.g. *Periphyllus testudinacea* (Ferne) is known to occur on at least 9 different host-plant species. Although most of the species are known from Aceraceae, a few have been recorded from plants of Sapindaceae and Hippocastanaceae. The species recorded in INDIA have been noted to occur between the months of July to May.

Distribution.—HOLOARTIC, ORIENTAL and AUSTRALIAN. As Essig & Abernathy (op. cit.) have indicated, the exact distribution range is not well known and it is probably much greater than the present records indicate; only extensive collections over northern limits of the areas where maples occur, could lead to a definite idea about the distribution.

In recent years, Essig & Abernathy (op. cit.) have given an extensive account of 10 species of the genus, Mammontova (1955) has provided account of Ukranian species, Tao (1963), of Chinese species, Richards (1972) of Canadian species, and Higuchi (1972), of Japanese species. Hille Ris Lambers (1966-67) has provided a key to the European species and Eastop (1966) has discussed about the Australian species of the genus. Chakrabarti (1977) has given a key to the Indian species.

Type species.—(*Periphyllus testude* van der Hoeven 1863) = *Phyllophora testudinacea* Ferne 1852) Location of type unknown according to Dr. V. F. Eastop, British Museum (Nat. Hist.), London.

Key to the species of Periphyllus

Apterous viviparous female:

1. First tarsal segment with 7, 7, 7 hairs; body large 2.6–3.5 mm long; hairs on frons 0.231–0.240 mm long; processus terminalis 1.33–1.63 × as long as base of segment VI and half as long as segment III; longest hair on base of segment VI 0.068–0.078 mm long, 1.5–2.4 × as long as basal diameter of antennal segment III; siphunculi 0.71–0.88 × as long as second segment of hind tarsus .. *P. aesculi* H.R.L.
- First tarsal segment with 5, 5, 5 hairs; processus terminalis at least 2.0 × as long as base of segment VI. 2
2. Body large, over 3.0 mm long; hairs on frons 0.230–0.260 mm long, longest hair on antennal segment III 0.178 mm long; processus terminalis 3.0 × as long as base of segment VI and 0.50 × as long as antennal segment III; siphunculi 1.3–1.4 × as long as second segment of hind tarsus. *P. californiensis* Shinji
- Body 1.5–2.2 mm long; hairs on frons 0.118–0.260 mm long, processus terminalis 0.60–1.0 × as long as antennal segment III 3
3. Siphunculi 1.1–1.3 × as long as second segment of hind tarsus; processus terminalis 2.2–2.3 × as long as base of segment VI and 0.60–0.74 × as long as antennal segment III; longest hair on base of segment VI 0.027–0.038 mm long, 1.1–1.2 × as long as the basal diameter of antennal segment III. *P. bengalensis* Ghosh & Ray-chaudhuri
- Siphunculi 0.70–0.80 × as long as second segment of hind tarsus; processus terminalis 3.5–3.7 × as long as base of segment VI and about equal to the antennal segment III; longest hair on base of segment VI, 0.100–0.150 mm long, 4.0–5.6 × as long as the basal diameter of antennal segment III. *P. vandenboschii* H.R.L.

Alate viviparous female:

1. First tarsal segments with 7, 7, 7 hairs. 2
First tarsal segments with 5, 5, 5 hairs. .. 3
2. Processus terminalis 1.43–1.77 × as long as base of segment VI; antennal segment III with 11–23 secondary rhinaria, segment IV without any secondary rhinaria; ultimate rostral segment with 6 accessory hairs; siphunculi reticulated over entire length; legs pale except near apices of tibiae. *P. aesculi* H.R.L.

Processus terminalis 3.5 × as long as base of segment VI; antennal segment III with 12–15 secondary rhinaria; ultimate rostral segment with 12 accessory hairs; siphunculi reticulated over distal 0.40 portion; legs pale with second segment of tarsi dusky.

Periphyllus villosi Chakrabarti

3. Hairs on flagellum minute, longest one segment III hardly 0.50 × as long as the basal diameter of the segment; segment III with 12–13 and IV with 3–5 secondary rhinaria; processus terminalis 2.0 × as long as base of segment VI; ultimate rostral segment bears a pair of accessory hairs; siphunculi reticulated over distal 0.65 portion, rest striated; legs uniformly pale brown.

P. pusillus Quednau & Chakrabarti

Hairs on flagellum long and fine, longest one on segment III more than 3.0 × as long as the basal diameter of the segment; segment III with more than 20 secondary rhinaria, processus terminalis 2.2–2.7 × as long as base of antennal segment VI; ultimate rostral segment bears 4–6 accessory hairs; siphunculi variably reticulated; legs variably pigmented.

4

4. Body at most 2.50 mm long; hairs on frons 0.125–0.180 mm long and on anterior tergites almost 0.187 mm long; ultimate rostral segment 0.80 × as long as second segment of hind tarsus and bears 6 accessory hairs; siphunculi reticulated over distal 0.65–0.75 portion; legs largely pale brown to dark brown

P. bengalensis Ghosh & Raychaudhuri

Body over 3.0 mm long; hairs on frons 0.220–0.260 mm long, and on anterior tergites 0.225–0.276 mm long.

5

5. Flagellum uniformly pale brown; segment III with 30–40 secondary rhinaria, segment IV without any secondary rhinaria; ultimate rostral segment 0.66 × as long as second segment of hind tarsus; siphunculi dark brown, reticulated over distal 0.75 portion; hind legs pale yellow except apical 0.66 portion of femora and apical 0.50 portion of tibiae, which are brown.....

P. californiensis Shinji

Flagellum dark except at bases of segment III which are pale; segment III with 35–41 secondary rhinaria and IV with 5–8 similar ones; ultimate rostral segment 0.75–0.80 × as long as second segment of hind tarsus; siphunculi dark, reticulated over distal 0.66 portion; hind legs black except at basal 0.30 portion of femora which are pale.....

P. himalayensis Chakrabarti

Periphyllus aesculi Hille Ris Lambers

(Fig. 25, Pl. VII, figs. 3, 4)

1933. *Periphyllus aesculi* Hille Ris Lambers, *Stylops*, **2**: 200.1969. *Periphyllus aesculi*, Verma, *Sci. & Cult.*, **35**: 29.1972. *Periphyllus aesculi*, Chakrabarti, Ghosh, A. K., & Raychaudhuri
Oriental Ins., **6**(3): 395.

Apterous viviparous female: Body elongated oval 2.59–3.47 mm long with 1.22–1.75 mm as maximum width. Head brownish on frons, with long fine hairs, up to 0.231–0.240 mm long, which may be 4.6–6.1 × as long as the basal diameter of antennal segment III. Antennae 6 segmented, 0.53–0.73 × as long as body; segment I, apices of segment III and IV, apical 0.33 portion of segment V and whole of segments VI dark, rest pale; flagellum imbricated

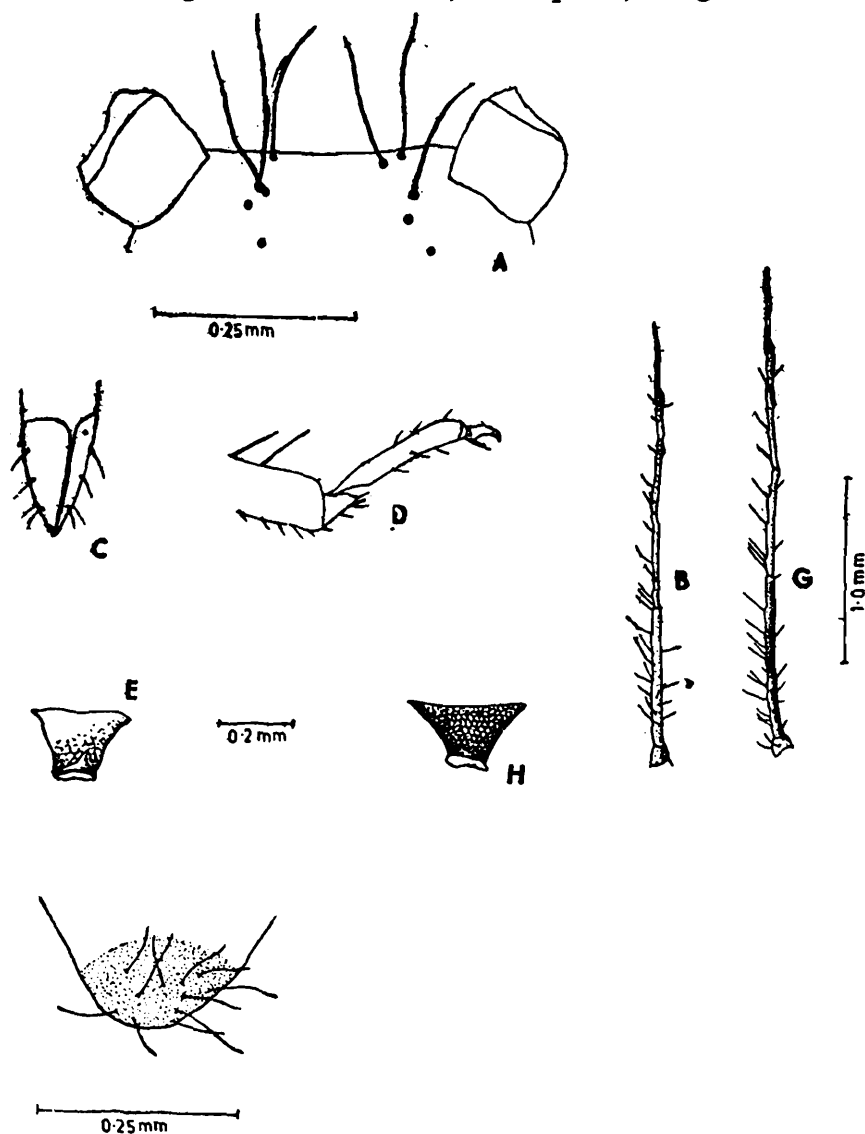


FIG. 25. *Periphyllus aesculi* H.R.L.: A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. siphunculus, F. cauda, G. antenna of alate viviparous female, H. siphunculus of alate viviparous

from distal half of segment III; hairs on flagellum fine, longest ones on segment III 0.195–0.200 mm long, 3.5–4.6 × as long as the basal diameter of the segment, shortest one 0.100–0.115 mm long and upto 2.0 × as long as mentioned diameter; base of segment VI with 3 hairs, 0.060–0.068 mm, 0.068–0.078 mm, 0.037–0.046 mm long, respectively from base to apex, longest one being 1.5–2.4 × as long as the mentioned diameter; processus terminalis 1.33–1.63 × as long as base of segment VI and less than half the length of antennal segment III. Rostrum reaches beyond mid coxae, ultimate rostral segment stout, 0.76–0.84 × as long as second segment of hind tarsus and bears 6 accessory hairs. Abdominal dorsum pale with paired, segmental, spinal and marginal sclerites, besides some hair bearing sclerites in spinal & pleural areas on tergites 1–7, these being confluent on 8th tergite and appears as a transverse band; hairs on the dorsum of abdomen long, fine, longest ones 0.250–0.275 mm long, shortest one up to 0.180 mm long, these being 4.3–6.3 × and 3.0–3.2 × as long as the basal diameter of antennal segment III, respectively, those on tergites 7 and 8 similar to the long hairs on anterior tergites. Siphunculi short, truncate, dark brown 0.04–0.05 × as long as the body, 0.71–0.88 × as long as second segment of hind tarsus, reticulated on distal half and with thick apical flange. Cauda semioval with many long fine hairs. Legs pale brown with apices of femora and tibiae and whole of tarsi slightly darker, hairs on femora and tibiae long and fine; apices of tibiae with minute spinules; first tarsal segments with 7, 7, 7 hairs.

Colour: Brownish in life with black spots on dorsum.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Cauda
			III	IV	V	VI			
1. 3.48	1.72	2.07	0.64	0.44	0.33	(0.15+0.24)	0.15	0.17	0.14

(S. Chakrabarti's Collections)

Alate viviparous female: Body 2.26–3.42 mm long. Hairs on frons 0.163–0.205 mm long, 4.0–5.4 × as long as the basal diameter of antennal segment III. Antennae 0.71–0.74 × as long as the body, with segment I, basal 0.75 portion of segment II, apices of segment III–V, and base of segment VI and processus terminalis dark, rest pale; hairs on flagellum fine, longest one on segment III 0.169–0.180 mm long, 3.4–4.4 × as long as the basal diameter of the segment; base of segment VI with 3 hairs, 0.037–0.046 mm, 0.037–0.075 mm, 0.028–0.056 mm long, respectively from base to apex, longest one being 1.3–2.25 × as long as the mentioned diameter; segment III with 11–23 secondary rhinaria; processus

terminalis $1.43-1.77 \times$ as long as base of segment VI. Ultimate rostral segment with 6-8 accessory hairs. Abdominal dorsum pale, with paired marginal and band like spino-pleural sclerites on tergites 1-6, these being confluent on 7th and 8th tergites; hairs on dorsum long, longest one on anterior tergites $0.215-0.220$ mm long, $6.0-6.5 \times$ as long as the basal diameter of antennal segment III. Siphunculi $0.05-0.06 \times$ as long as the body, $0.75-0.90 \times$ as long as second segment of hind tarsus, reticulated over their entire lengths. Legs pale except $0.15-0.17$ portion of hind tibiae which are brown. Wing venation normal.

Colour: Dark brown in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Cauda
			III	IV	V	VI			
1.	3.24	1.38	2.20	0.69	0.47	0.35 (0.19+0.27)	0.16	0.17	0.14

(S. Chakrabarti's Collections)

Sexual forms: Not known.

Nymphs: Alate nymphs conform with adult alatae in most of morphological characters but siphunculi showed hardly or no reticulation.

Material examined: Many apterous and alate viviparous females, from *Aesculus indica*, Nainital, Uttar Pradesh, INDIA, 7-4-1970, Almora, Uttar Pradesh, INDIA, 8-4-1970, 9-4-1970, Ranikhet, Uttar Pradesh, INDIA, 12-4-1970, Coll. S. Chakrabarti; [S. Chakrabarti's collections, Dept. of Zoology, University of Kalyani, India]. 4 alate nymphs, Forest Research Inst., Dehradun collections [without any data].

Discussion: Hille Ris Lambers (1933) while describing the present species from alatae, mentioned that it differs from others in having processus terminalis $2.0 \times$ as long as base of segment VI and $0.50 \times$ as long as antennal segment III, and siphunculi being shorter than base of antennal segment VI. The large collection examined, while agreeing with last two of the above mentioned characters, showed that the processus terminalis may even be considerably less ($1.33-1.63 \times$ in apterae, $1.43-1.77 \times$ in alatae) than twice the base of segment VI.

The insects are reported to infest undersurface of young leaves of the host plant, i.e. *Aesculus indica*. No ants were observed in association.

Distribution.—INDIA, (Kashmir and Uttar Pradesh).

Types.—In the collections of British Museum (Nat. Hist.) London and D. Hille Ris Lambers, Bennekom, THE NETHERLANDS.

Periphyllus bengalensis Ghosh & Raychaudhuri

(Fig. 26, Pl. VIII, figs. 1, 2)

1972. *Periphyllus bengalensis* Ghosh, A. K. and Raychaudhuri, *Proc. zool. Soc., Calcutta*, **25**: 29.

Apterous viviparous female: Body pyriform 1.8–2.2 mm long. Head faintly dusky; dorsal hairs thick, 0.118–0.150 mm long and with acute apices, these being 4.2–5.5 × as long as the basal diameter of antennal segment III. Antennae 6 segmented, 0.74–0.76 × as long as the body, flagellum nearly smooth and pale on basal 0.50–0.75 portion of segment III, rest dusky and gradually more distinctly imbricated apicad; hairs on the flagellum longer on inner margin, these being 0.078–0.125 mm long, those on outer margin 0.025–0.040 mm long; longest one on segment III up to

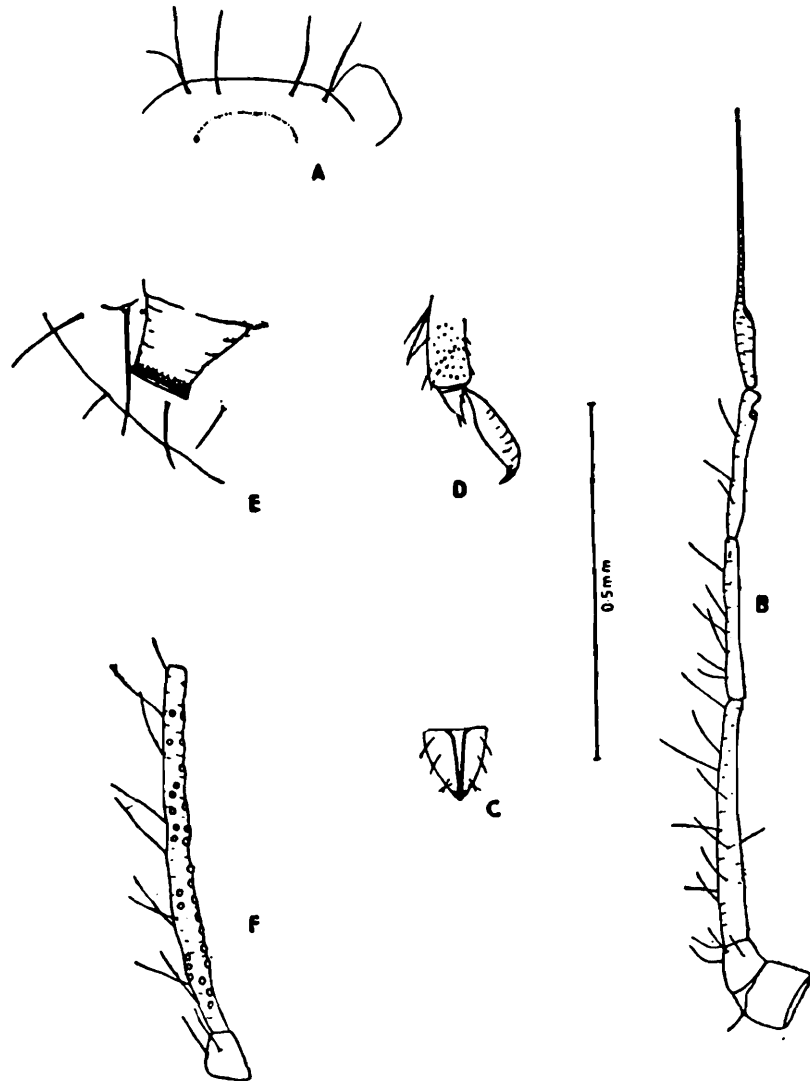


FIG. 26. *Periphyllus bengalensis* Ghosh & Raychaudhuri: A. head, B. antenna. C. ultimate rostral segment, D. second segment of hind tarsus, E. siphunculus F. antenna of alate viviparous ♀.

4.0 × as long as the basal diameter of the segment, and shortest one 0.90 × as long as the mentioned diameter; base of segment VI with 2 hairs, longest one 0.027–0.038 mm long, 1.1–1.2 × as long as basal diameter of segment III and 4.0 × as long as basal diameter of segment VI; processus terminalis 2.2–2.3 × as long as base of segment VI and 0.60–0.74 × as long as antennal segment III. Rostrum reaches mid coxae, ultimate rostral segment stout, 0.75–0.85 × as long as second segment of hind tarsus and bears 6 accessory hairs. Abdominal dorsum pale with hair-bearing paired, segmental, spinal and marginal sclerites on tergites 1–7, besides smaller sclerites bearing hair in pleural region; hairs on the dorsum of abdomen mostly long, conspicuous, with acute apices, these being 0.128–0.178 mm long and 4.5–7.0 × as long as the basal diameter of antennal segment III; a few shorter hairs, 0.046–0.068 mm long and may be twice as long as the mentioned diameter; 8th tergite with a broad hair-bearing transverse sclerotic band. Siphunculi dark brown, 0.07–0.08 × as long as the body, and 1.1–1.3 × as long as second segment of hind tarsus, with 2–3 rows of apical reticulation, rest nearly smooth but striate at margins. Cauda shorter than wide. Legs dusky only on apical 0.25–0.50 portions of tibiae, more so on hind tibiae and whole of tarsi, rest pale; hairs on legs long and fine, those on hind tibiae 4.0–5.0 × as long as the diameter at the middle of hind tibiae; fore and mid tibiae finely spinulose near apices but hind tibiae with conspicuous spinules extending over apical 0.35 portion. First tarsal segments with 5, 5, 5 hairs.

Colour: Yellowish in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	1.85	1.86	1.45	0.39	0.22	0.22 (0.13+0.29)	0.11	0.12	0.14
2.	1.93	1.03	1.52	0.41	0.25	0.23 (0.14+0.32)	0.10	0.12	0.14
3.	2.20	1.10	1.62	0.45	0.30	0.24 (0.12+0.28)	0.10	0.12	0.16

(1, Holotype, 2–3, paratypes, Calcutta University Collections.)

Alate viviparous female: Body 2.0–2.50 mm long, Head dark brown; dorsal cephalic hairs 0.125–0.180 mm long, 5.5–7.5 × as long as the basal diameter of antennal segment III. Antennae pale on basal segments; flagellum concolourous with the head; base of segment III smooth, rest gradually more distinctly imbricated apicad; hairs, on flagellum arranged as in apterae, longest one on segment III, 4.2–5.0 × as long as the basal diameter of the segment, shortest one equal to the mentioned diameter; segment III

with 28–36 secondary rhinaria distributed over entire length, segment IV with 2–6 similar rhinaria mostly restricted on basal 0.30 portion, sometimes a single one may be placed apically; processus terminalis 2.5–2.7 × as long as base of segment VI and 0.65–0.71 × as long as antennal segment III. Abdominal dorsum with rows of segmental sclerites on spinal and pleural areas which often become confluent and form sclerotic bands on spinopleural region on 1st–8th tergites; marginal sclerites always remain separate; hairs on dorsum of abdomen similar to those in apterae but long ones upto 0.187 mm long and 8.5 × as long as the basal diameter of antennal segment III; 8th tergite with 8 long hairs, of which spinal ones are often 0.160–0.180 mm long. Siphunculi dark brown, 0.06–0.07 × as long as the body, 0.09–1.0 × as long as its basal width which is twice the width before apical flange, with 7–9 rows of distinct reticulations on apical 0.65–0.75 portion. Cauda slightly dusky. Legs pale brown to dark brown, except on basal segments and whole of fore-femora and basal 0.33 portion of mid and hind femora, which are pale; all tibiae variably but more distinctly spinulose than in apterae; on fore and mid tibiae spinulosity restricted on basal 0.10–0.20 portion and on hind tibiae spinulosity extends upto apical 0.45 portion. Wing venation normal.

Colour: Yellowish in life with dark patches.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph
			III	IV	V	VI			
1. 2.0	0.90	1.72	0.52	0.30	0.29	(0.13+0.34)	0.10	0.12	0.14
2. 2.5	1.10	1.91	0.61	0.35	0.28	(0.14+0.39)	0.10	0.13	0.18
3. 2.5	1.13	1.93	0.65	0.36	0.29	(0.14+0.33)	0.10	0.13	0.16

(1, 2, 3 paratypes, Calcutta University Collections)

Sexual forms: Not known.

Nymphs: Embryos and nymphs are all long haired. Apterous nymphs pale in colour with head, apices of antennal segments, siphunculi and tarsi of legs dusky; numerous long fine hairs occur on antennae, body and legs. Alate nymphs similar but with paired large brown, spinal and marginal hair-bearing sclerites and small pleural sclerites each bearing a single hair on dorsum of abdomen.

Material examined: Apterous viviparous female, from *Acer* sp., Kurseong, West Bengal, INDIA, 1-5-1970, Coll. *S. D. Chakrabarti* (Holotype); 6 apterae, 6 alatae and nymphs with collection data as above (Paratypes).

Discussion: This species recently described from Darjeeling district, could be separated by pale knees, short processus terminalis, ratio of ultimate rostral segment to second segment of hind tarsus, 5 hairs on first tarsal segment etc., from the related species.

The species infests lower surface of older leaves of host plants. No ant was seen in association.

Distribution.—INDIA (Darjeeling district, West Bengal).

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

***Periphyllus californiensis* Shinji**

(Figs. 27, 28, Pl. VIII, figs. 3, 4)

1917. *Periphyllus californiensis* Shinji, *Ent. News*, **28**: 61.

1971. *Periphyllus testudinacea*, David, Narayanan and Rajasingh, *Madras agric. J.*, **58**: 374.

1971. *Periphyllus* sp., Ghosh, A. K., Ghosh, M. R. and Raychaudhuri, *Oriental Ins.*, **5**(3): 330.

Apterous viviparous female: Body 3.04 mm long, light yellow in colour. Frons with many long fine hairs, 0.230–0.260 mm long, longest one $4.4 \times$ as long as the basal diameter of antennal segment III. Antenna nearly $0.58 \times$ as long as the body; flagellum pale upto basal 0.80 portion of segment III, rest dark brown, feebly imbricated; hairs on flagellum fine, longest one on segment III 0.178 mm long, shortest one 0.093 mm long, these being $3.0 \times$ and $1.5 \times$ as long as basal diameter of antennal segment III, respectively; base of segment VI with two hairs, longest one 0.053 mm long, $2.3 \times$ as long as the basal diameter of the segment and nearly equal to the basal diameter of antennal segment; processus terminalis $3.0 \times$ as long as base of segment VI and $0.50 \times$ as long as segment III. Ultimate rostral segment stout, $0.80 \times$ as long as the second segment of hind tarsus and bears 4 long accessory hairs. Abdominal dorsum pale, bearing numerous long fine hairs, longest one on anterior tergites 0.292 mm long, shortest one 0.146 mm long, these being $5.0 \times$ and $2.5 \times$ as long as the basal diameter of antennal segment III, respectively; longest hair on 7th tergite 0.326 mm long, and on 8th tergite 0.332 mm long, these being $5.5 \times$ and $6.0 \times$ as long as the mentioned diameter. Siphunculi stout, pale on basal half, rest brownish, $0.07 \times$ as long as the body with apical 0.25 reticulated, rest with faintly spiculate imbrications. Cauda semioval with many fine hairs. Legs pale yellow to brown, with apices of tibiae and whole of tarsi black; tibiae spinulose at apices, more distinctly so on hind tibiae; hairs on tibiae fine,

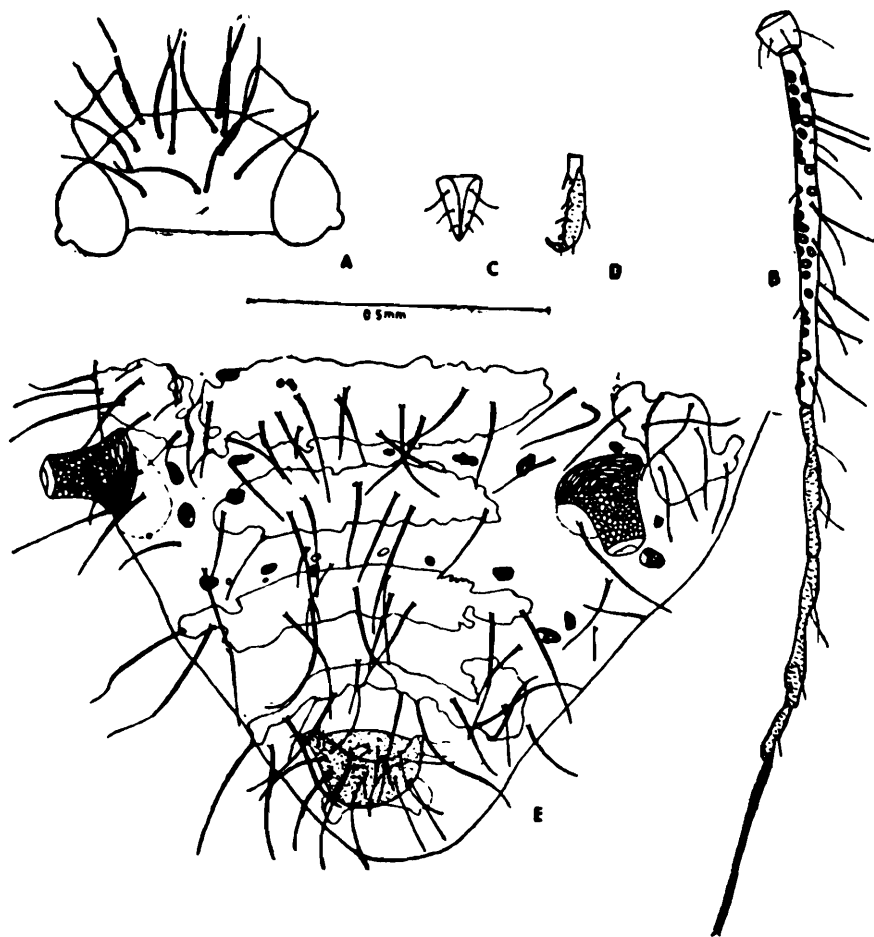


FIG. 27. *Periphyllus californiensis* Shinji, A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. abdominal dorsum (all of alate viviparous ♀).

longest one on hind tibiae 0.260 mm long and $2.6 \times$ as long as the diameter at middle of hind tibiae. First tarsal segment with 5, 5, 5 hairs.

Colour: Not known in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1. 3.04	1.79	1.74	0.62	0.28	0.23	(0.10+0.30)	0.13	0.16	0.22

(Calcutta University Collections, Slide No. PLK 246)

Alate viviparous female: Body 3.26 mm long. Head dark with long fine hairs on frons and vertex, longest one 0.22 mm long, nearly $6.0 \times$ as long as the basal diameter of antennal segment III. Antennae dark brown on basal two segments rest uniformly pale brown, nearly $0.60 \times$ as long as the body; flagellum feebly imbricated on segment III, rest distinctly imbricated; hairs on the

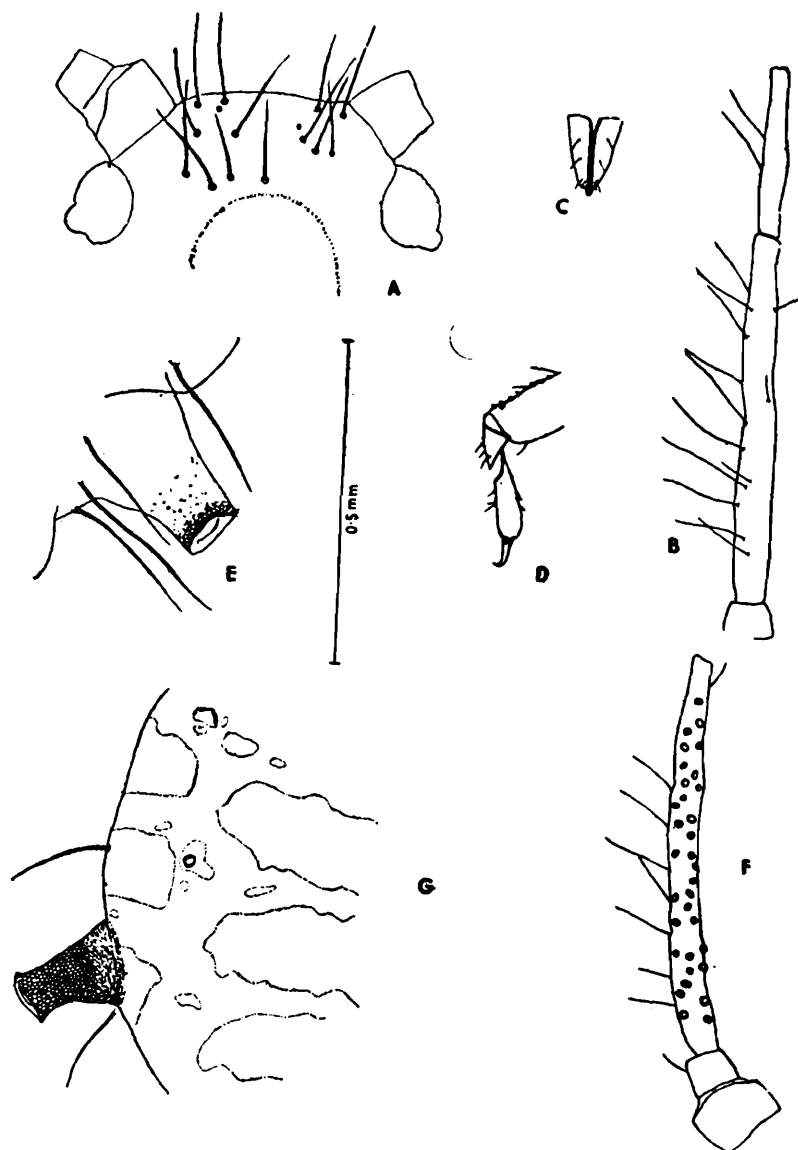


FIG. 28. *Periphyllus californiensis* Shinji: A. head, B. antenna, C. ultimate rostral segment, D. second segment of hind tarsus, E. Siphunculus, F. antennal segment III of alate viviparous ♀, G. siphunculus of alate viviparous ♀.

flagellum fine, longest one on segment III, 0.17 mm long, $4.0 \times$ as long as the basal diameter of the segment, shortest one 0.03 mm long and at most $0.70 \times$ as long as the mentioned diameter; base of segment VI with a fine hair, 0.06 mm long, $1.4 \times$ as long as the basal diameter of antennal segment III and $3.6 \times$ as long as the basal diameter of the segment; segment III with 30–34 secondary rhinaria distributed over entire length, segment IV without any secondary rhinaria; processus terminalis nearly $2.3 \times$ as long as base of segment VI and $0.46 \times$ as long as antennal segment III. Rostrum stout, ultimate rostral segment $0.66 \times$ as long as second segment of hind tarsus. Abdominal dorsum pale, bearing paired, brown, marginal sclerites and broad transverse spinopleural bands.

on 1st-7th tergites, besides some scattered scleroites in intersegmental areas; 8th tergite with a narrow transverse band; hairs on dorsum of abdomen long and fine, longest one on anterior tergites 0.255 mm long, shortest one 0.76 mm long, these being $6.1 \times$ and $2.0 \times$ as long as the basal diameter of antennal segment III, respectively; 8th tergite with 12 hairs, longest one 0.276 mm long and $6.6 \times$ as long as the mentioned diameter. Siphunculi dark brown, reticulated over distal 0.75 portion, about $0.05 \times$ as long as the body. Cauda semioval with many fine hairs. Forelegs pale, except at apices of tibiae and whole of tarsi which are brownish; mid-legs brownish on distal 0.80 portion of femora, very bases and apices of tibiae and whole of tarsi, rest pale; hind legs similarly pigmented as mid-legs except tibiae which are dark brownish on distal 0.40 portion; hairs on legs long and fine, longest one on hind tibiae 0.276 mm long, $3.3 \times$ as long as diameter at the middle of hind tibiae; apices of tibiae spinulose, more densely and widely so, over hind tibiae; first tarsal segments with 5, 5, 5 hairs.

Colour: Not known.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1. 3.27	1.24	1.90	0.69	0.29	0.30	(0.14+0.32)	0.10	0.15	0.17

(S. K. David's Collections)

Sexual forms: Not known.

Nymphs: Not known.

Material examined: One apterous viviparous female, one alate nymph from *Acer* sp., Darjeeling, West Bengal, INDIA, 3-4-1969, Coll. M. R. Ghosh, [Calcutta University Collections]. One alate viviparous female from *Acer oblongum*, Darjeeling, West Bengal, INDIA, 14-5-1969 Coll. S. G. Narayanan [S. K. David collections, No. 944].

Discussions: *Periphyllus californiensis* Shinji is apparently an old world species having its origin in CHINA and JAPAN (Essig & Abernathy, 1952). It is known from at least 5 different species of *Acer* in AUSTRALIA; it is also known from ENGLAND and HOLLAND in EUROPE and CANADA and U.S.A. in NORTH AMERICA.

Essig and Abernathy (op. cit.) has provided detailed description of all morphs including sexuales of the species. The present material appears to be a distinct subspecies.

Distribution.—In the region the species is only known from hilly areas of Darjeeling district of West Bengal. The nominate species is known from CHINA, JAPAN, ENGLAND, HOLLAND, U.S.A., CANADA and AUSTRALIA.

Periphyllus himalayensis Chakrabarti

(Figs. 29 & 30)

1977. *Periphyllus himalayensis* Chakrabarti, *Oriental Ins.*, **11**(2): 216

Alate viviparous female: Body 3.1–3.5 mm long (2.92 mm), Head dark with long fine hairs, longest one 0.220–0.260 mm long, (0.109–0.205 mm) 4.3–5.3 × as long as the basal diameter of antennal segment III. Antennae dark except flagellum feebly imbricated on segment III, more distinctly so from segment IV onward; hairs on flagellum fine, longest one on segment III 0.163–0.198 mm long, 3.3–4.0 × as long as the basal diameter of the

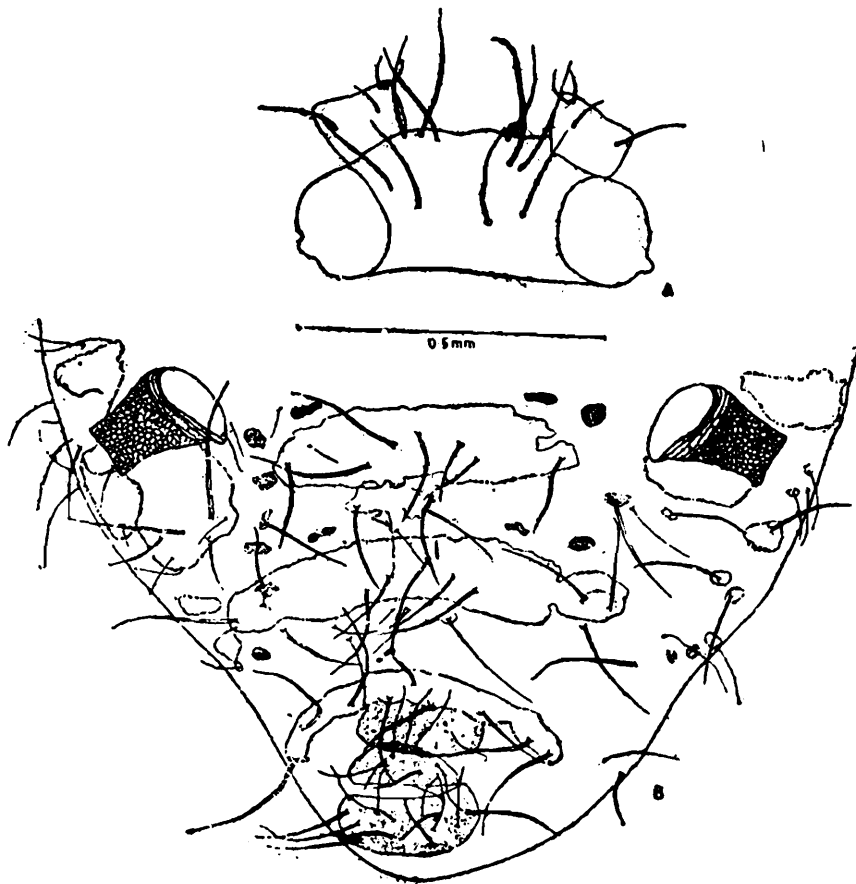


FIG. 29. *Periphyllus himalayensis* Chakrabarti: A. head, B. abdominal dorsum of alate viviparous ♀.

segment, shortest one 0.046–0.066 mm long, 0.95–1.2 × as long as the mentioned diameter; longest hair at base of segment VI 0.053–0.065 mm long, 1.0–1.1 × as long as the basal diameter of the antennal segment III and 3.0 × as long as the basal diameter of the segment; segment III with 35–41 (36–47) small secondary rhinaria distributed over the entire length, segment IV with 5–8 (–9) similar ones mostly restricted to basal half of the segment;

processus terminalis $2.5-2.6 \times$ as long as base of segment VI and $0.56-0.60 \times$ as long as antennal segment III. Rostrum stout, ultimate rostral segment $0.75-0.80 \times$ as long as second segment of hind tarsus and bears 4(2) accessory hairs. Thorax dark black. Abdominal dorsum pale with paired segmental dark brown marginal sclerites and transverse spinopleural bands on tergites 1st-7th, besides some dark scattered sclerites in the intersegmental areas; 8th tergite with a narrow transverse band; hairs on dorsum of abdomen fine, longest one on anterior tergites $0.260-0.276$ mm long, $5.3-5.6 \times (3.5-4.5) \times$ as long as the basal diameter of antennal segment III, shortest one $0.100-0.130$ mm long, and $2.5-3.0 \times$ as long as the mentioned diameter, respectively; 8th tergite with 8-10 hairs, longest one being $0.230-0.300$ mm long, $5.0-6.0 \times$ as long as the basal diameter of antennal segment III. Siphunculi

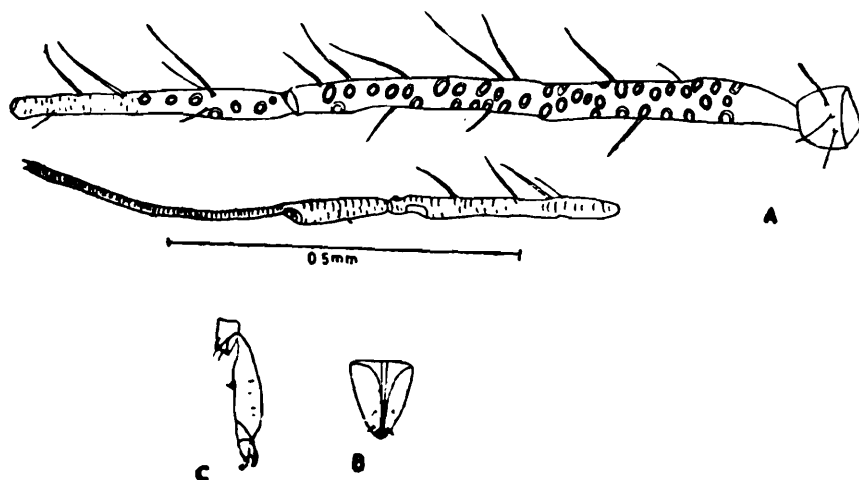


FIG. 30. *Periphyllus himalayensis* Chakrabarti: A. antenna, B. ultimate rostral segment, C. second segment of hind tarsus (all of alate viviparous ♀).

dark brown, $0.05-0.06 \times$ as long as the body, $1.1-1.2 \times$ as long as second segment of hind tarsus, reticulated over apical $0.66(0.80)$ portion. Cauda semioval with many long fine hairs. Legs with coxae and bases of femora very pale; forelegs with femora almost pale except at apices which are brownish as also the tibiae and tarsi; mid legs dark brown to black on apical 0.66 portion of femora, whole of tibiae and tarsi; hind legs dark brown to black on apical $0.70-0.80$ portion of femora as also the tibiae but tarsi paler than tibiae; hairs on legs long and fine; longest one on hind tibiae $0.230-0.300$ mm long, $3.4-3.8 \times$ as long as the diameter at the middle of hind tibiae; apices of tibiae with distinct spinules, more so on hind tibiae; first tarsal segments with 5, 5, 5 (7, 7, 7) hairs. Wing venation normal, with pterostigma dark.

Colour: Not known, appears to be light, on abdomen with dark bands.

(Figures within parenthesis, from original description.)

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	3.06	1.24	2.13	0.67	0.30	0.33 (0.14+0.38)	0.12	0.15	0.19
2.	3.56	1.38	2.48	0.75	0.44	0.38 (0.16+0.44)	0.12	0.16	0.19

(1, Calcutta University Collections, 2, S. Chakrabarti's Collections)

Sexual forms: Not known.

Nymphs: No early stage nymph or larva was available for study. Late stage alate nymph shows similar characteristics viz. long dorsal hairs, usual pigmentation of the flagellum, stout ultimate rostral segment and stout legs with spinulose dark apices of tibiae as in the adult alatae.

Chakrabarti (1977) has described 1st instar larvae in which pleural hairs are absent and antennal segment III shows 3 hairs.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	3.36	1.53	2.10	0.75	0.37	0.30 (0.15+0.36)	0.11	0.15	?

(Calcutta University Collections)

Material examined: One alate viviparous female, from *Acer* sp., Simla, Himachal Pradesh, INDIA, 30.xii.1972, Coll. & det. S. Chakrabarti, (Paratype); one alate viviparous female and one nymph from? *Acer* sp., Kurseong, West Bengal, India, 1.xi.1970, Coll. S. D. Chakrabarti No. 309, from Calcutta University Collections.

Discussions: This species, known only from the alatae, shows closest relationship with the himalayan subspecies of *P. californiensis* but the dark flagellum and hind legs and occurrence of secondary rhinaria on segment IV helps to separate it from the former; from *bengalensis* Ghosh and Raychaudhuri, it may be separated by large size besides above characters.

Distribution.—INDIA; (Himachal Pradesh, and Darjeeling district, West Bengal).

Types.—In the collections of S. Chakrabarti, Department of Zoology, University of Kalyani, West Bengal.

***Periphyllus pusillus* Quednau and Chakrabarti**

(Fig. 31, Pl. IX, figs. 1, 2)

1975. *Periphyllus clarius*, Chakrabarti and Raychaudhuri, *Oriental Ins.*, 9: 209,

1976. *Periphyllus pusillus*, Quednau and Chakrabarti, *Can. Ent.*, **108**(5): 461.

1977. *Periphyllus pusillus*, Chakrabarti, *Oriental Ins.*, **11**(2):217.

Alate viviparous female: Body elongate 2.01 mm (1.93 mm) long. Head with 3 pairs of long hairs on frons arising from strong sockets, longest one 0.112 mm long, about $5.6 \times$ as long as the basal diameter of antennal segment III. Antennae six segmented, nearly $0.50 \times$ as long as the body, dark brown on segments I and II, rest of flagellum pale brown and slender; hairs on flagellum extremely sparse and minute, longest one on segment III, 0.01 mm long, hardly $0.50 \times$ as long as the basal diameter of the segment; base of segment VI apparently without any hair; segment III with 12–13 (8–18) small secondary rhinaria distributed irregularly over entire length; segment IV with 3–5 similar rhinaria; processus terminalis $2.0 \times$ as long as base of segment VI and $0.54 \times$ as long as antennal segment III. Eyes large. Rostrum slender, ultimate rostral segment $0.75 \times$ as long as second segment of hind tarsus

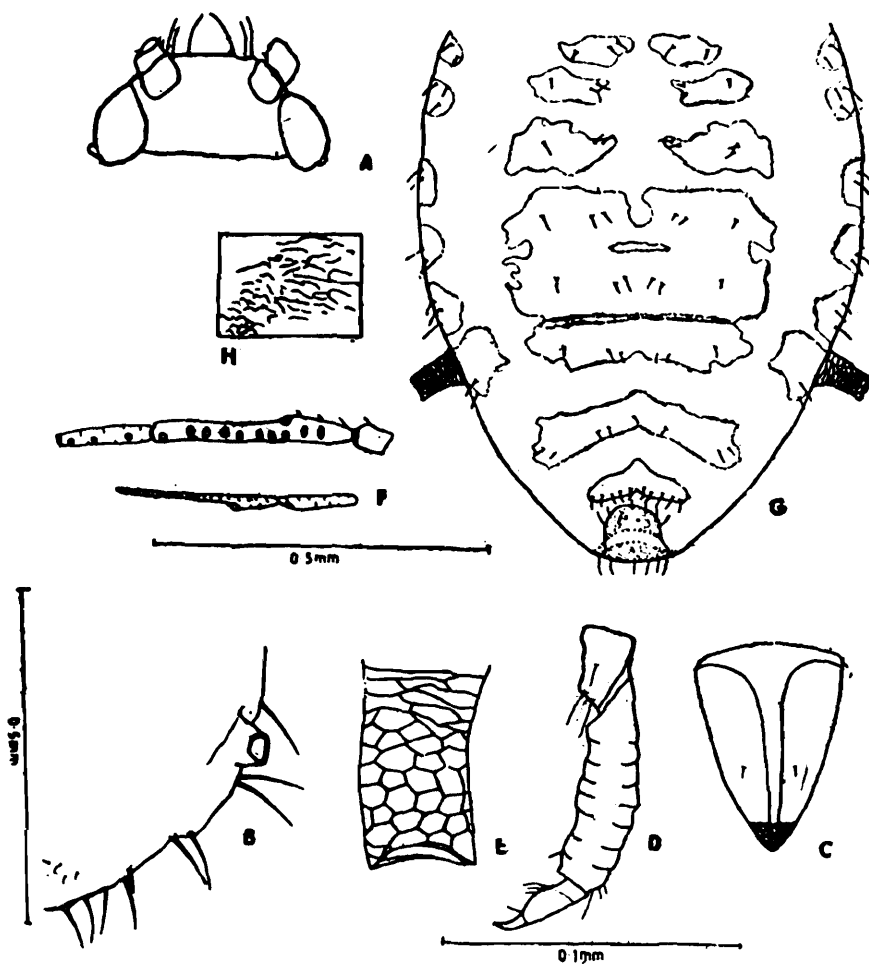


FIG. 31. *Periphyllus pusillus* Quednau & Chakrabarti: A. head, B. dorsal hairs, C. ultimate rostral segment, D. second segment of hind tarsus, E. siphunculus, F. antenna, G. abdomen, H. sculpture on dorsum (all of alate viviparous ♀).

and bears a pair of accessory hairs. Abdominal dorsum pale, bearing paired spinopleural sclerites on 1st–3rd tergites, those on 4th–6th being confluent, appear like a broad brown dorsal patch; 7th and 8th tergite each with a spinopleural sclerotic band; marginal sclerites on anterior tergites paler than those on the spinopleural areas; hairs on the dorsum of abdomen sparse, 5–6 per segment on spinopleural region and 2–3 on each marginal sclerites on 1st–6th tergites; 7th tergite with a pair of marginal hairs on each side besides 2 spinopleural hairs; longest hair on anterior tergites 0.066 mm long and $3.3 \times$ as long as the basal diameter of antennal segment III, shortest one 0.033 mm long and $1.6 \times$ as long as the mentioned diameter; 8th tergite with a single marginal hair on each side besides 10 hairs arranged in a row in spinopleural region, of which the longest one 0.063 mm long and $3.2 \times$ as long as the mentioned diameter. Siphunculi slender, almost colourous with dorsal sclerites, $0.05 \times$ as long as the body, reticulated over distal 0.65 portion, rest striated. Cauda distinctly semioval, $0.70 \times$ as long as the siphunculi and bears 9 fine hairs. Legs almost uniformly pale brown and slender; hairs on legs fine, longest one on hind tibiae 0.060 mm long and $2.0 \times$ as long as the diameter at the middle of the hind tibiae; apices of tibiae spinulose, more so on hind tibiae; first tarsal segments with 5, 5, 5 hairs. Wing venation normal.

Colour: Not known.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	2.01	0.69	1.05	0.37	0.16	0.14 (0.10+0.20)	0.9	0.12	0.10

(S. Chakrabarti's Collections)

Apterous viviparous female: Not known.

Nymphs: Alate nymphs: Body pale; antennae 6 segmented; frontal hairs long; paired segmental marginal hairs present in all thoracic and abdominal tergites 1st–5th, other dorsal hairs being hardly discernible; longest marginal hair on anterior tergites 0.163 mm long and $5.5 \times$ as long as the basal diameter of antennal segment III; 6th and 7th tergites each with 2 pairs of marginal hairs and 8th tergite with 8–9 hairs arranged in a row, longest one 0.100 mm long and $3.3 \times$ as long as the basal diameter of antennal segment III. Siphunculi pale, truncate, with a thick apical flange and without any reticulation. Legs pale; spinulosity at apices of tibiae hardly discernible.

Embryo, as reported by Quednau and Chakrabarti (1976) shows normal Chaetotaxy of body and antennae; anterior pair of

lateral setae on thoracic tergites shorter than posterior pair; dorsal setae appear blunt and serrated; pleural setae absent except a single pair on mesonotum.

Colour: Pale in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	1.54	0.52	0.72	0.22	0.09	0.10 (0.06+0.16)	0.08	0.09	0.06

(S. Chakrabarti's Collections)

Material examined: One alate viviparous female and 3 alate nymphs (Paratypes) from *Acer villosum*, Almora, Uttar Pradesh, INDIA, 15.x.1970, Coll. S. Chakrabarti, det. F. W. Quednau.

Discussion: This endemic species differs from all other *Periphyllus* species known from the area in having very short hairs on flagellum & dorsum of abdomen; body size, occurrence of secondary rhinaria in both antennal segments III and IV, short processus terminalis, only a pair of accessory hairs on ultimate rostral segment, and first tarsal segments with 5 hairs etc., further helps to distinguish this species.

Distribution.—INDIA, (Uttar Pradesh).

Types.—In the collections of S. Chakrabarti, Department of Zoology, University of Kalyani, West Bengal, INDIA.

***Periphyllus vandenboschi* Hille Ris Lambers**

(Fig. 32, Pl. IX, fig. 3)

1966. *Periphyllus vandenboschi*, Hille Ris Lambers, *Tijdschr. Ent.*, **109**: 217

1969. *Periphyllus vandenboschi*, David, Narayanan and Rajasingh, *Bull. Ent.* **10**(2): 158.

1972. *Periphyllus vandenboschi*, (misidentification) Chakrabarti, Ghosh, A. K. and Raychaudhuri, *Curr. Sci.*, **41**(2): 71.

Apterous viviparous female: Body pale, 1.52–1.79 mm, (1.35–2.00 mm) long. Head with long fine hairs with acute apices, 4.5–5.5 × as long as the basal diameter of antennal segment III. Antennae 6 segmented, 0.75–0.80 × as long as the body, pale except segments I and II, apices of segment V, base of segment VI and apical half of processus terminalis which are dusky to dark; hairs on the flagellum long and fine, longest one on segment III 0.13–0.15 mm long and 4.5–5.6 × as long as the basal diameter of the segment, shortest one 1.0–2.0 × as long as the mentioned diameter; base of segment VI with 2 hairs, longest one 0.10–0.15 mm long, 7.5–8.0 × as long as the basal diameter of the segment,

shortest one 0.06–0.07(0.09) mm long; processus terminalis 3.5–3.7 × (4.0) as long as base of segment VI and about as long as segment III. Rostrum reaches hind coxae, ultimate rostral segment obtuse and stout, 0.84–0.90 × as long as second segment of hind tarsus and bears 4–5(7) accessory hairs besides the preapicals. Dorsum of thorax and abdomen completely pale, with many long fine hairs, longest one on anterior abdominal tergites 0.16–0.20 mm long, 5.5–7.0 × as long as basal diameter of antennal segment III, shortest ones 0.04–0.07 mm long, 1.5–2.4 × as long as the mentioned diameter; longest hair on 8th tergite 0.19–0.20 mm long and 6.4–7.0 × as long as the mentioned diameter. Siphunculi dark black, 0.70–0.80 × as long as second segment of hind tarsus, almost always with minimum width at the middle, which is 1.2–1.5 × as long as width at middle of hind tibiae, and with 1–2 rows of apical reticulation just before the wide flange. Cauda, pale, semioval, usually as long as siphunculi, without any basal constriction and

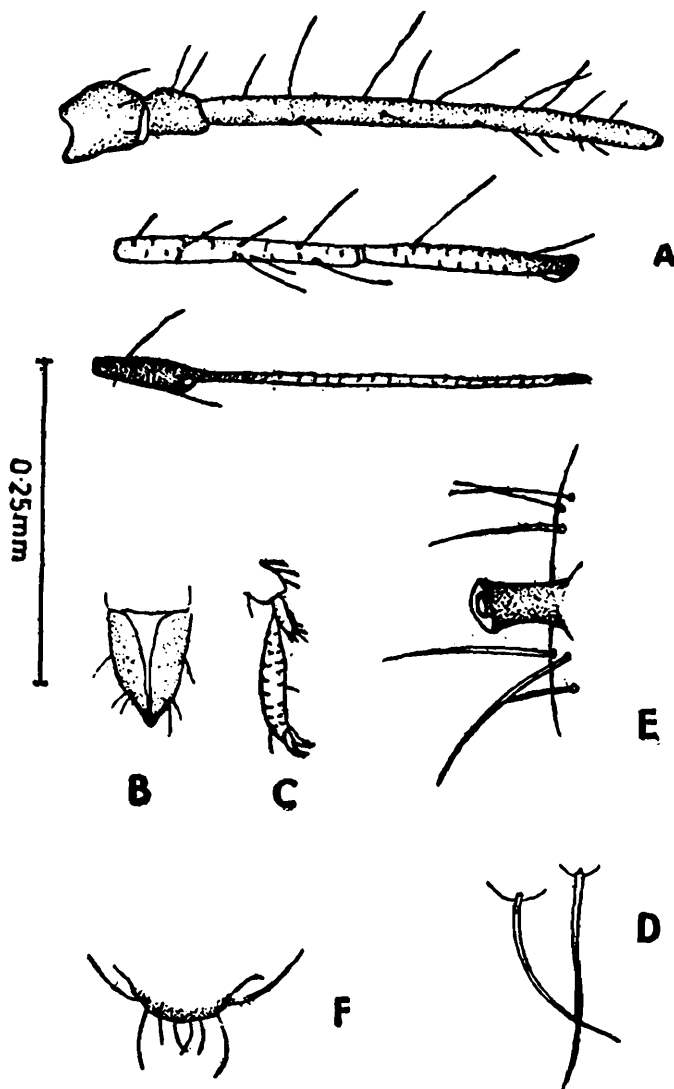


FIG. 32. *Periphyllus vandenboschi* H.R.L.: A. antenna, B. ultimate rostral segment, C. second segment of hind tarsus, D. dorsal hairs, E. siphunculus, F. cauda.

bearing at least 10–12 hairs. Legs pale, tarsi somewhat dusky; first tarsal segments with 5, 5, 5 hairs.

Colour: Light green or pale with dark siphunculi.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.	
			III	IV	V	VI				
1.	1.79	0.82	1.40	0.39	0.24	0.18	(0.09+0.35)	0.10	0.12	0.10
2.	1.72	0.89	1.40	0.38	0.24	0.19	(0.09+0.35)	0.10	0.12	0.08
3.	1.66	0.82	1.20	0.34	0.22	0.18	(0.09+ ?)	0.11	0.12	0.07
4.	1.58	0.75	1.27	0.34	0.22	0.15	(0.09+0.34)	0.10	0.12	0.07
5.	1.52	0.69	1.24	0.30	0.20	0.15	(0.09+0.33)	0.10	0.12	0.07

(1–5, D. Hille Ris Lambers's Collections)

Sexual forms: Not known.

Nymphs: 1st instar: Antennae 4 segmented, 0.80 × as long as body, processus terminalis 4.0 × as long as base of segment IV which is dusky. Ultimate rostral segment with 2 pair of subapicals. Abdominal dorsum with double row of long and fine, spinal and marginal hairs. Siphunculi dark with a black rim. Cauda with 2 long hairs; subanal plate with 4 hairs.

Material examined: Six apterous viviparous females and 2 larvae (first instar) (Paratypes), from *Acer* sp., Murree, West PAKISTAN, 4.vii.1964, Coll. *v.d. Bosch*, det. D Hille Ris Lambers.

Discussion: This species, according to Hille Ris Lambers (1966) comes close to *P. obscurus* Mammantova from *Acer campestre* but differs in having pale body, less reticulated siphunculi and 5 hairs on first tarsal segment.

This species has been recorded from petioles of leaves of *Acer* sp., heavily attended by ants.

Distribution.—INDIA, (Himachal Pradesh), PAKISTAN (Murree).

* *Types*.—In the collections of D. Hille Ris Lambers, Bennekom, THE NETHERLANDS.

***Periphyllus villosi* Chakrabarti**

(Figs. 33–37, Pl. IX, fig. 4)

1972. *Periphyllus vandenboschi*, Chakrabarti, Ghosh, A. K. and Raychaudhuri, *Curr. Sci.*, **41**: 71.

1975. *Periphyllus viridis*, Chakrabarti and Raychaudhuri, *Oriental Ins.*, **9**(2):209.

1977. *Periphyllus villosi* Chakrabarti, *Oriental Ins.*, **11**(2): 209.

Alate viviparous female: Body pale, 3.48 mm long. Head dull brown, hairs on frons and vertex long and fine, longest one 0.203 mm long, $4.0 \times$ as long as the basal diameter of antennal segment III. Antennae pale yellow except at apices of segment IV and V and base of segment VI which are dusky, slightly longer than the body; flagellum nearly smooth upto apices of segment IV, rest gradually becoming more distinctly imbricated apicad; hairs on flagellum long and fine, longest one on segment III, 0.255 mm long, shortest one 0.117 mm long, these being $5.0 \times$ and $2.2 \times$ as long as the basal diameter of the segment; base of segment VI with 2 fine hairs, 0.177 mm–0.203 mm long, longest one up to $2.8 \times$ as long as the mentioned diameter and $6.0\text{--}7.0 \times$ as long as the basal diameter of the segment; segment III with 12–15 round to oval secondary rhinaria, distributed over basal 0.40 portion; processus terminalis $3.5 \times$ as long as base of segment VI and $0.70 \times$ as long as

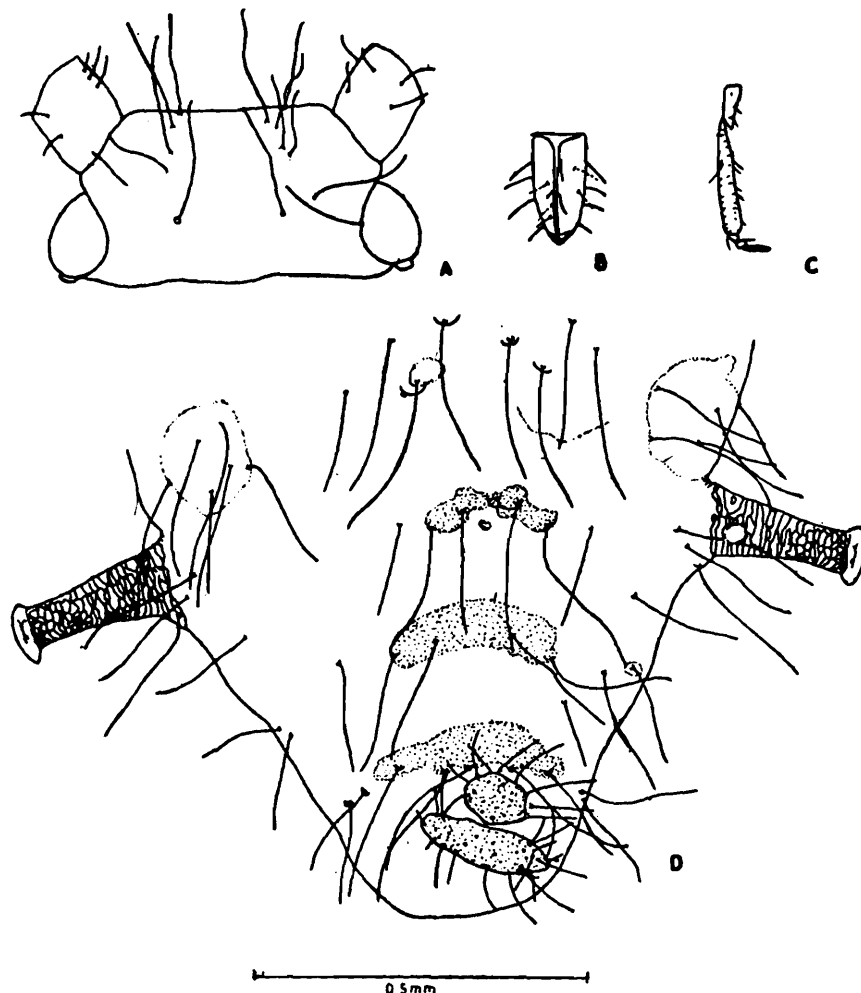


FIG. 33. *Periphyllus villosi* Chakrabarti: A. head, B. ultimate rostral segment, C. second segment of hind tarsus, D. abdominal dorsum (all of alate viviparous ♀).

antennal segment III. Rostrum reaches mid coxae (?); ultimate rostral segment stout, $0.90 \times$ as long as second segment of hind tarsus and bears 11 accessory hairs. Abdominal dorsum pale,

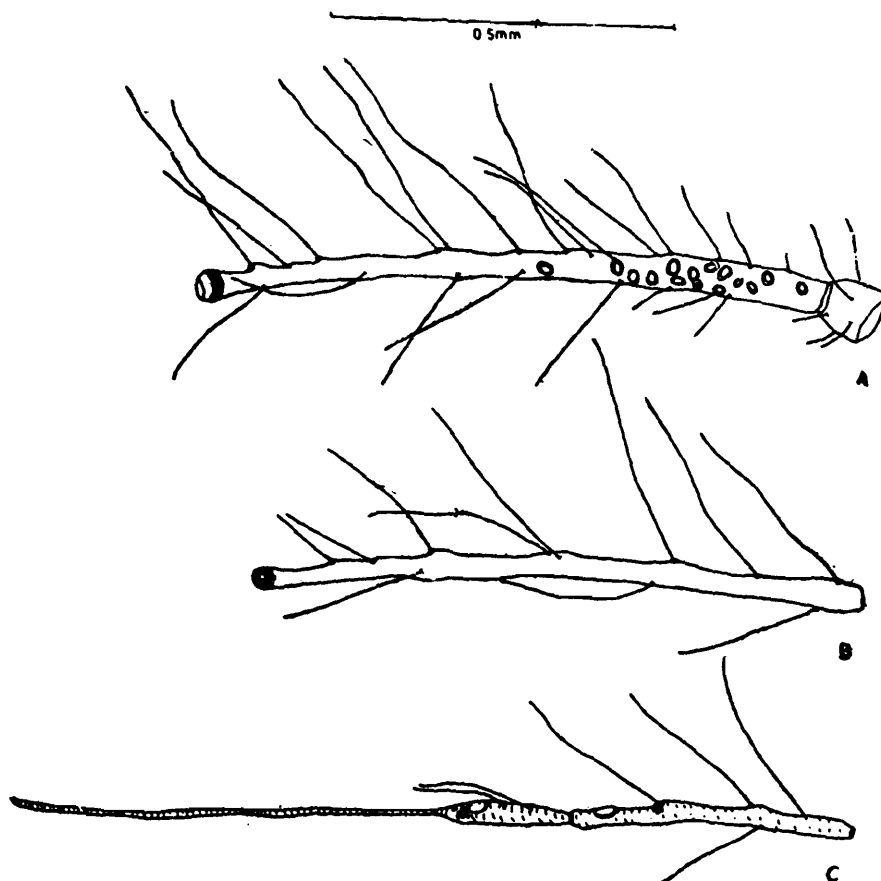


FIG. 34. *Periphyllus villsoi* Chakrabarti: A, B, C. antenna of alate viviparous ♀.

bearing paired marginal sclerites on 1st-5th tergites besides hair bearing spinal sclerites, those on 6th-8th tergites being fused together and form a faint sclerotic band in the region; longest hair on anterior tergites 0.290 mm long, shortest one 0.138 mm long, these being 5.5 × and 2.5 × as long as the basal diameter of antennal segment III, respectively; 8th tergite with 8 fine hairs, longest one equal to the longest hair on anterior tergites. Siphunculi brownish, 0.04 × as long as the body, 1.2 × as long as second segment of hind tarsus and reticulated over distal 0.40 portion. Cauda pale, knobbed, with 8 hairs. Legs pale with second segments of tarsi little dusky; hairs on tibiae fine, longest one on hind tibiae 0.414 mm long and 7.5 × as long as the diameter at the middle of hind tibiae. First tarsal segments with 7, 7, 7 hairs.

Colour: Not known.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.9	3.48	1.10	3.72	1.07	1.03	0.48 (0.19+0.75)	0.19	0.22	0.26

(S. Chakrabarti's Collections)

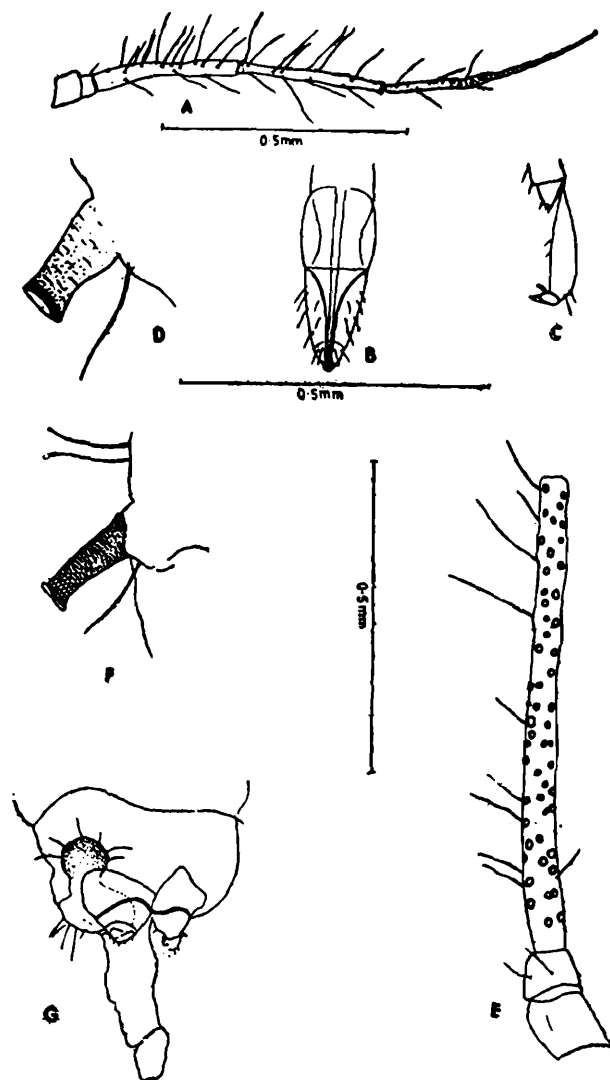


FIG. 35. *Periphyllus villosi* Chakrabarti: A. antenna, B. ultimate rostral segment, C. second segment of hind tarsus, D. siphunculus of apterous viviparous ♀, E. antennal segment III, F. siphunculus, G. genitalia of ♂

Apterous oviparous female: (immature): Body pale, nearly 4.00 mm long. Head pale brown with many long fine hairs. Antennae $0.88(-1.04) \times$ as long as the body; longest hair on segment III, 0.367 mm long, nearly $7.0 \times (6.8-7.5) \times$ as long as the basal diameter of the segment; longest hair at the base of segment VI 0.203 mm long, nearly $4.0 \times$ as long as the mentioned diameter; processus terminalis $3.8 \times (-5.3) \times$ as long as the base of segment VI and $0.60 \times$ as long as antennal segment III. Ultimate rostral segment $0.92 \times$ as long as the second segment of hind tarsus and bears 11 fine hairs. Abdominal dorsum pale, with faint marginal sclerites and some spinal hair-bearing sclerites, the latter on 8th tergite being fused together; hairs on the dorsum of abdomen long and fine, longest one on anterior tergites 0.354 mm long, and $6.5 \times (-7.5 \times)$ as long as the basal diameter of antennal segment III; 8th tergite with 10 hairs, longest one 0.380 mm long and

7.0 × as long as the mentioned diameter. Siphunculi brown, reticulated over distal 0.25 portion. Cauda semioval. Hind tibiae swollen bearing 40 or more (73) pseudosensoria.

[* Figures in parenthesis from description as given by Chakrabarti (1977).]

Colour: Perhaps pale in life.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1. 4.0	1.42	3.31	1.12	0.88	0.44	(0.18+0.69)	0.19	0.21	0.27

(S. Chakrabarti's Collections)

Alate male: Body elongate, 3.00 mm long. Head dark brown, hairs on frons up to 0.203 mm long, 4.2 × as long as the basal diameter of antennal segment III. Antennae dark brown, 1.1 × as long as the body; longest hair on segment III 0.231 mm long and shortest hair 0.115 mm long, these being 4.0 × and 2.0 ×

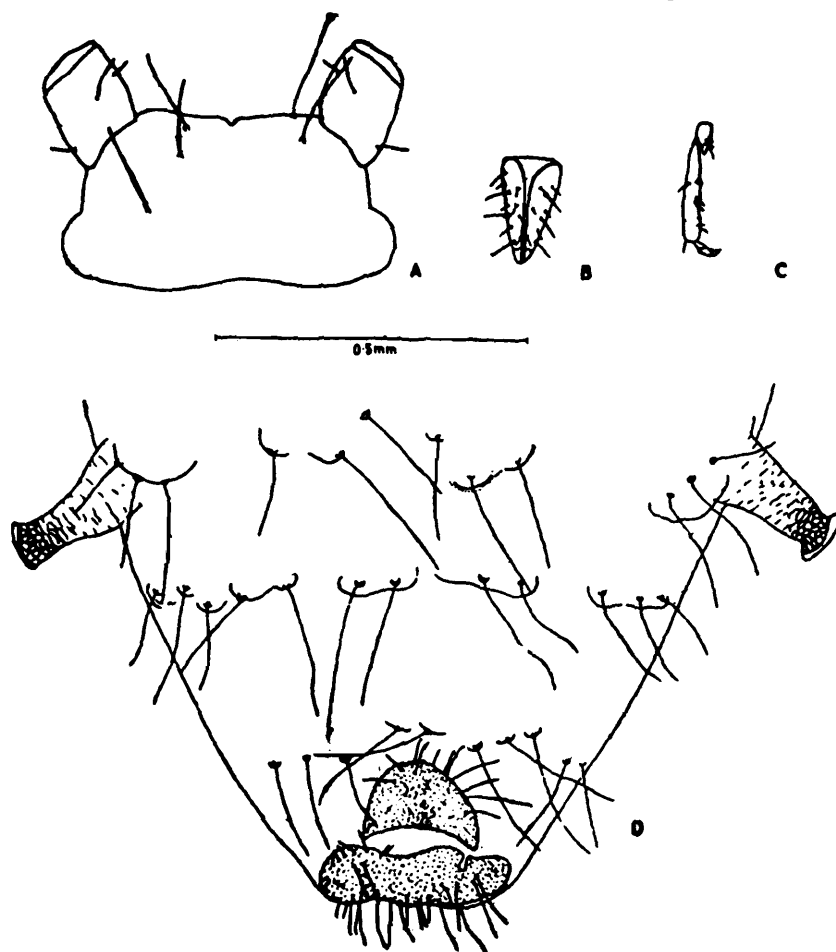


FIG. 36. *Periphyllus villosi* Chakrabarti: A. head, B. ultimate rostral segment, C. second segment of hind tarsus, D. abdominal dorsum of apterous oviparous ♀.

as long as the basal diameter of the segment; longest hair at the base of segment VI 0.163 mm long and nearly $9.0 \times$ as long as the basal diameter of the segment; segment III with more than 100 secondary rhinaria distributed over entire length, segment IV with 46 to 52 similar rhinaria, and segment V with 6–8 similar rhinaria; processus terminalis $3.5 \times$ as long as base of segment VI and $0.70 \times$ as long as segment III. Ultimate rostral segment nearly $0.80 \times$ as long as second segment of hind tarsus and bears 10 accessory hairs. Abdominal dorsum pale with paired dark marginal sclerites on 1st–6th tergites, which become nearly confluent with segmental transverse band; 7th and 8th tergites each with a transverse sclerotic band; hairs on dorsum of abdomen fine, longest one on anterior tergites 0.248 mm long and shortest one 0.130 mm long, these being $4.4 \times$ and $2.3 \times$ as long as the basal diameter of antennal segment III; longest hair on 7th tergite 0.205 mm long and on 8th tergite 0.225 mm long, these being $3.6 \times$ and $4.0 \times$ as long as the mentioned diameter, respectively. Siphunculi brownish, reticulated on apical 0.30 portion, $0.07 \times$ as long as the body. Cauda brownish, sclerotic. Claspers distinct, sclerotic. Legs with femora pale yellow, tibiae and tarsi darker; tibial hairs fine, longest hair on hind tibiae, 0.341 mm long, up to $6.0 \times$ as long as the diameter at the middle of hind tibiae; spinulosity at apices of tibiae hardly discernible.

Colour: Not known.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs.	ht. ₂	Siph.
			III	IV	V	VI			
1.	3.00	0.82	3.41	0.96	0.96	0.48 (0.20+0.69)	0.16	0.20	0.22

(S. Chakrabarti's Collections.)

Material examined: One alate viviparous female, 1 alate male, and 2 apterous oviparous females (immature) from *Acer villosum*, Kathalia, Almora, Uttar Pradesh, INDIA, 15.x.1970, Coll. S. Chakrabarti, det. F. W. Quednau.

Discussion: This species was originally recorded as *vandenboschi* H.R.L., from which it could easily be separated by the numbers of accessory hairs on ultimate rostral segment, and subsequently identified as *viridis* (Matsumura) by F. W. Quednau (S. Chakrabarti, *in litt.*). However, the specimens differ from the description of *viridis* as given by Higuchi (1972) in having much larger number of accessory hairs on the last rostral segment in all morphs, besides in the nature of hairs on base of segment VI etc.; comparison with the material collected from *Acer mono* in JAPAN, identified as *viridis* by late R. Takahashi, and borrowed from D. Hille Ris

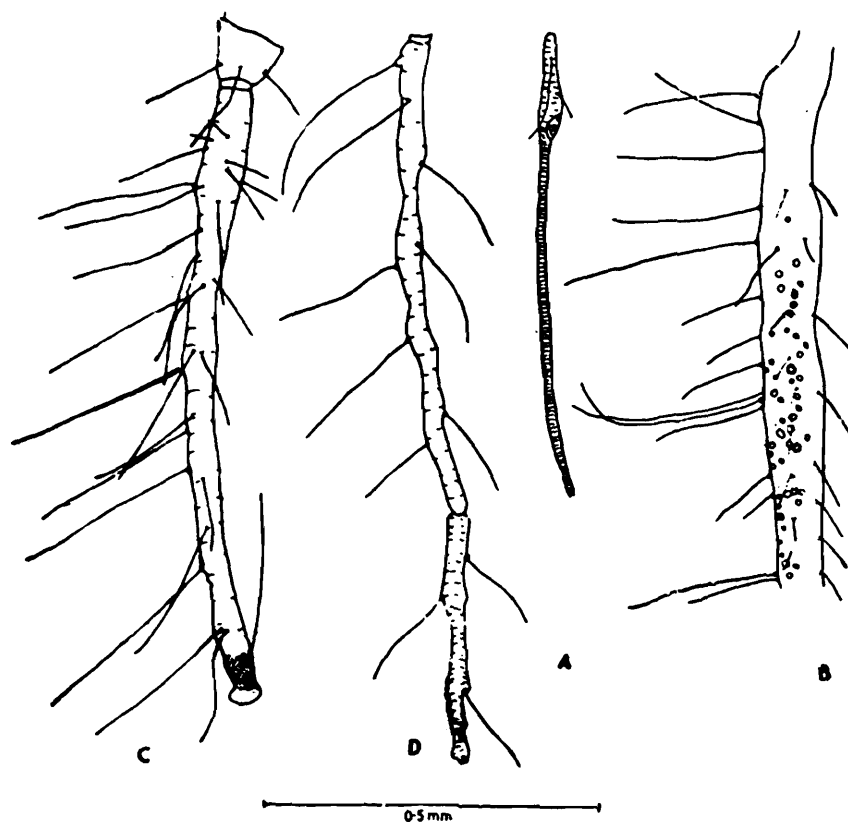


FIG. 37. *Periphyllus villosi* Chakrabarti: A, C, D. antennae, B. hind tibia of apterous viviparous ♀.

Lamber's collections and additional material of alatae viviparae obtained from H. Higuchi, JAPAN, also showed that the present species is not *viridis* (Mats.). As it is impossible to co-relate little known viviparae and oviparae produced in autumn with early summer apterae from which nearly all species have been described, and as embryos and first instar larvae were not available, the species has not been named, awaiting further material. Subsequently, Chakrabarti (1977) has described it as *villosi*.

Distribution.—INDIA (Uttar Pradesh).

Types.—In the collection of S. Chakrabarti, Dept. of Zoology, University of Kalyani, West Bengal.

Genus *Trichaitophorus* Takahashi 1937

1937. *Trichaitophorus* Takahashi, *Annotones zool. jap.*, **16**: 17; Tao, 1963, *Sc. Yb., Taiwan Mus.*, **6**: 52; Hille Ris Lambers, and Basu, A. N., 1966, *Ent. Ber. Amst.*, **26**: 29; Higuchi, 1972 *Insecta matsum.*, **35**: 98. Type species: *Trichaitophorus aceris* Takahashi.

Morphology: Body depressed, of medium size (1.0–2.5 mm. Head fused with prothorax; frons slightly convex, frontal tubercles absent, laterad with distinct, long and thick hair-bearing tubercles,

Antennae 5–6 segmented, shorter than body, without secondary rhinaria in apterae; processus terminalis longer than base of last segment (1.4–2.3×); primary rhinaria without any cilia; hairs on flagellum shorter than basal diameter of antennal segment III and with blunt apices. Eyes small with distinct ocular tubercles. Ultimate rostral segment shorter than second segment of hind tarsus and bears 0–3 accessory hairs. Dorsum membranous, rugose or corrugated over entire surface or marginally more conspicuous. Abdominal tergites 1st–7th or 2nd–7th completely fused. Dorsal hairs, spinally & pleurally, thin and blunt, but marginally long and thick, arising from strong sockets, lanceolate or backwardly directed, with acute or blunt apices; marginal hairs usually arranged one on each side, per segment, but may be double on prothorax and posterior abdominal tergites; 8th tergite with 6–9 hairs. Siphunculi short, truncate, shorter than wide, corrugated or striate but without any reticulation. Cauda wider than long with 8–11 hairs. Anal plate entire. Rudimentary gonapophyses 4. Legs with long or short blunt hairs on basal half of tibiae, apical tibial hairs not differentiated; first tarsal segment with 3–5 ventral hairs and without dorsal hairs. Empodial hairs somewhat flattened.

Sexual forms and alate viviparae have not been recorded so far for any of the species known under the genus.

Embryos unknown in all species except in *recurvispinosus* H.R.L. and Basu, where they show long marginal & cephalic hairs and small eyes with more than 3 facets.

Discussion: A small genus of only three species, *Trichaitophorus* is restricted to ORIENTAL region and has drawn very little attention so far. Hille Ris Lambers and Basu (1966) pointed out that although in the structure of body, marginal hairs and fused head and pronotum etc., it comes near *Thelaxes* Westwood, but number of gonapophyses, multicorneal nature of eyes and flattened empodial hair, suggest its relationship to *Chaitophorus* and *Periphyllus* group of genera. *Trichaitophorus albus* Takahashi 1961 was transferred to *Nippochaitophorus* by H.R.L. and Basu (op. cit.) but Higuchi has designated this species as genotype for his genus *Yamatochaitophorus* Higuchi, which differs from *Trichaitophorus* in the number of marginal setae and shape & length of dorsal setae.

Biology: Of three species, two e.g. *aceris* Takahashi and *koyaensis* Takahashi are known to occur on Aceraceae, and the endemic Indian species is recorded from *Actinidia callosa*.

Key to the species of Trichaitophorus

Apterous viviparous female:

1. Body less than 1.5 mm long; antennae 5 segmented, processus terminalis little shorter

than or equal to base of last antennal segment; marginal hairs lanceolate.

T. aceris Takahashi

Body 2.38-2.48 mm long; antennae 6 segmented; processus terminalis little less than twice to $2.4 \times$ as long as base of antennal segment VI; marginal hairs thick and depressed, never lanceolate.

T. recurvispinosus H.R.L. and Basu

Trichaitophorus aceris Takahashi

(Figs. 38, 39, Pl. X, figs. 1, 2, 3)

1937. *Trichaitophorus aceris* Takahashi, *Annotones. zool. Jap.*, **16**: 17.

1963. *Trichaitophorus aceris*, Tao, *Sci., Yb., Taiwan Mus.*, **6**: 53.

Apterous viviparous female: Body pale 1.14 mm long. Front convex, bearing at least 3 pairs of adpressed hairs, arising from tuberculate bases, longest one about 0.05 mm long, $2.6 \times$ as long as the basal diameter of antennal segment III. Antennae pale, usually 5 segmented (4 segmented in the material examined) hardly $0.30 \times$ as long as the body; hairs on flagellum sparse and minute, longest one on segment III $0.33 \times$ as long as the basal

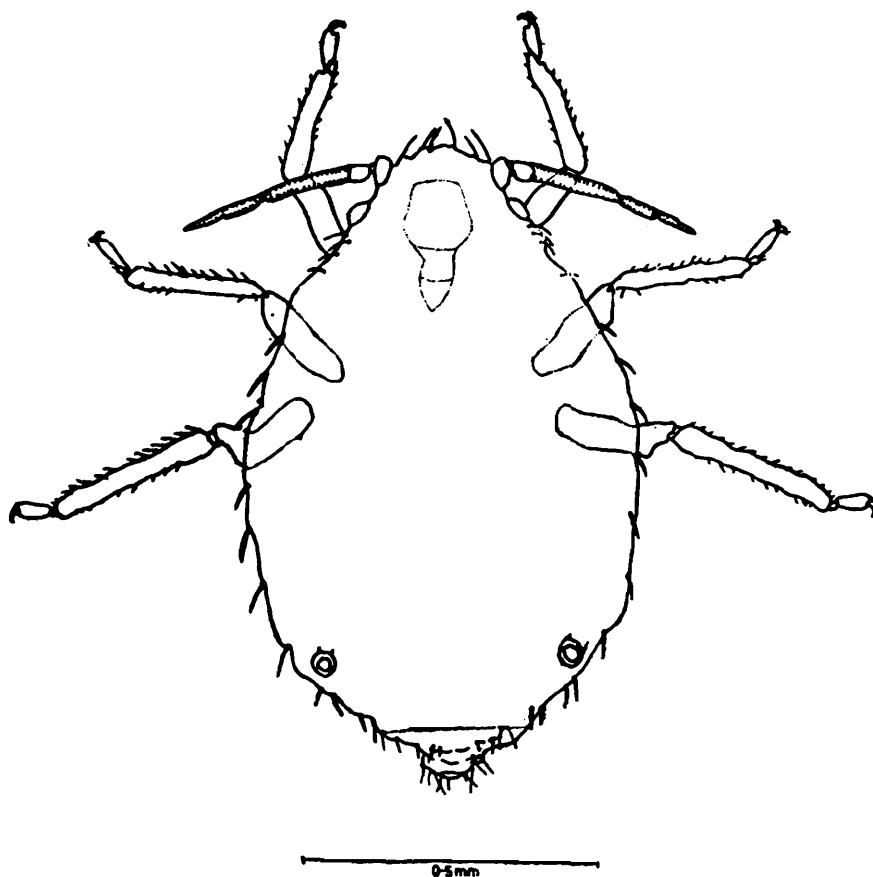


FIG. 38. *Trichaitophorus aceris* Takahashi, apterous viviparous ♀.

diameter of the segment; processus terminalis little shorter than or equal to base of last antennal segment and half as long as antennal segment III. Eyes pale and small. Rostrum reaches prothorax, ultimate rostral segment stout, $0.80\times$ as long as second segment of hind tarsus and bears a pair of accessory hairs. Tergum pale, membranous, marginally corrugated; pronotum with more than one pair of marginal hairs on each side but other thoracic tergites and abdominal tergites 1st–5th, each with one pair of hair per segment which are distinctly lanceolate; abdominal tergite 6th and 7th each with a pair of hairs on each side placed in tandon; longest marginal hair on anterior tergites 0.10–0.11 mm long, more than

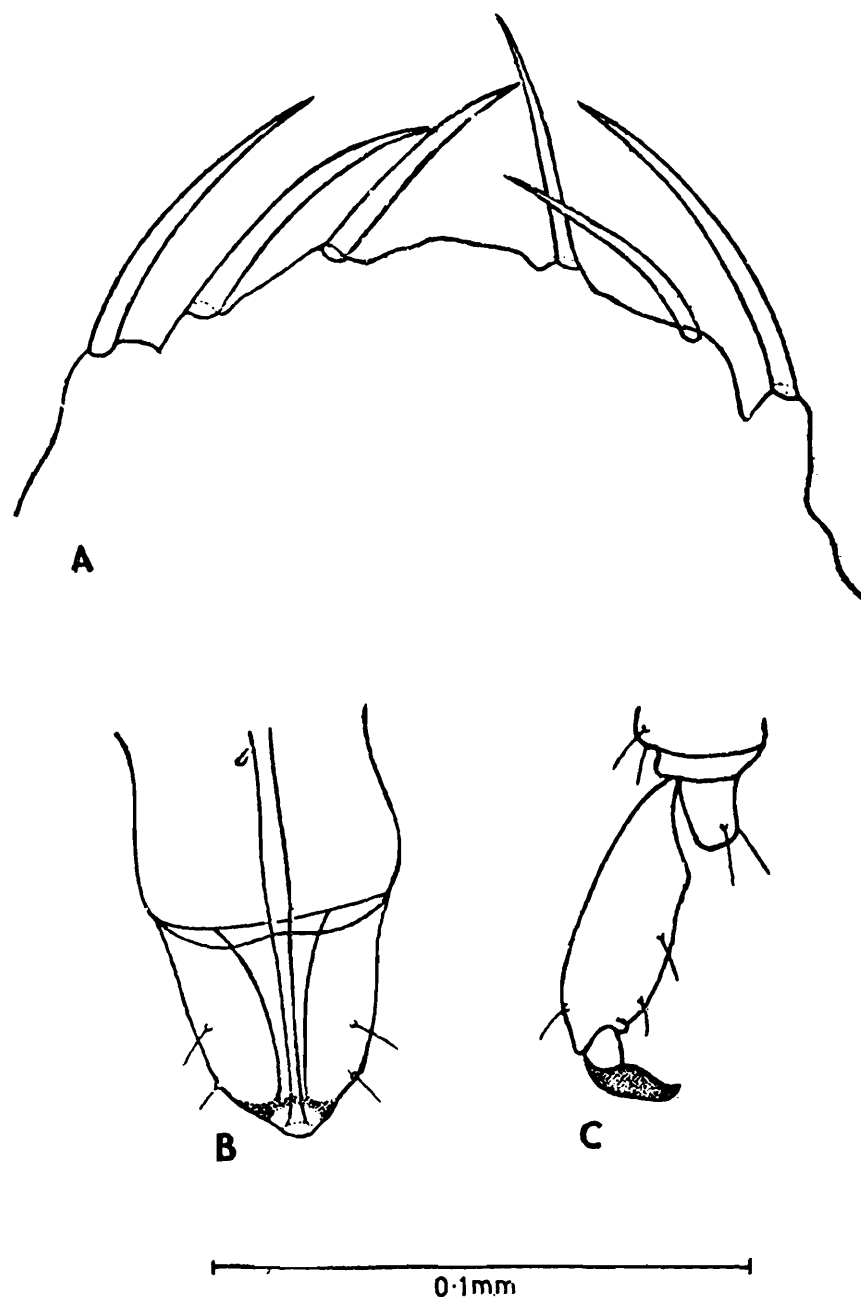


FIG. 39. *Trichaitophorus aceris* Takahashi: A. head, B. ultimate rostral segment, C. second segment of hind tarsus,

5.0 × as long as basal diameter of antennal segment III; other dorsal hairs minute & sparse; 8th tergite with 10 stout hairs with acute apices, arising from tuberculate bases, longest one 0.07 mm long and about 3.3 × as long as the mentioned diameter. Siphunculi, short, truncate, corrugated. Cauda pale, 0.66 × as long as their width, bearing 11–13 hairs. Anal plate entire and rounded. Legs pale, femora and tibiae smooth; hairs on femora sparse, mostly 0.02 mm long, on tibiae 0.03 mm long, stout with acute apices; first tarsal segments with 3, 3, 3 hairs.

Colour: Pale in life.

Measurements in mm:

	Length	Width	Antenna	Antennal segments		urs.	ht. ₂	Siph.	Cauda
				III	IV				
1.	1.14	0.65	0.35	0.15	(0.97+0.07)	0.05	0.07	0.05	0.04

(S. K. David's Collections.)

Alate viviparous female: Not known.

Nymphs: Not known.

Material examined: Two apterous viviparous female (one damaged) from *Acer pictum*, Rahla, Punjab, 22.viii.1969, Coll. S. S. Sekhon, det. D. Hille Ris Lambers. (S. K. David's Collections, Madras).

Discussion: The species with small pale body, 5 segmented antennae, minute spinal and pleural hairs, and lanceolate marginal hairs, is easy to distinguish from the related ones; this species is more closely related to Japanese species *koyaensis* (Takahashi) than to endemic *recurvispinosus* Hille Ris Lambers and Basu, but the former shows a distinctly and uniformly sculptured dorsum as figured in Higuchi (1972). So far it is known only from two species of *Acer* viz. *rubescens* in TAIWAN and *pictum* in INDIA.

Distribution.—INDIA (Punjab), TAIWAN.

Types.—Probably in the collections of Agricultural Research Institute, Taipei, TAIWAN.

***Trichaitophorus recurvispinosus* Hille Ris Lambers
and Basu**

(Fig. 40, Pl. XI, fig. 1)

1966. *Trichaitophorus recurvispinosus* Hille Ris Lambers, and Basu, A. N.,
Ent. Ber. Amst., 26: 29,

Apterous viviparous female: Body pale, 2.38 mm (2.38–2.48) long. Head and pronotum fused, front slightly convex bearing at least 4–6 stout hairs, 0.10–0.14 mm long, arising from tuberculate bases. Antennae pale, 6 segmented, less than half the length of body, and without any secondary rhinaria, bearing a very few minute hairs, longest one on segment III, $0.22 \times$ as long as the basal diameter of the segment; processus terminalis little less than twice to $2.4 \times$ as long as the base of segment VI. Rostrum reaches prothorax, ultimate rostral segment $0.66\text{--}0.75 \times$ as long as second segment of hind tarsus and bears 2–3 accessory hairs. Abdominal segments 1st–7th fused, tergum membranous; long, stout hairs arising from tuberculate bases, present marginally on thoracic and abdominal segments, one pair per segment on 1st–5th, but 2 pairs each on segment 6th and 7th; these may be 0.14–

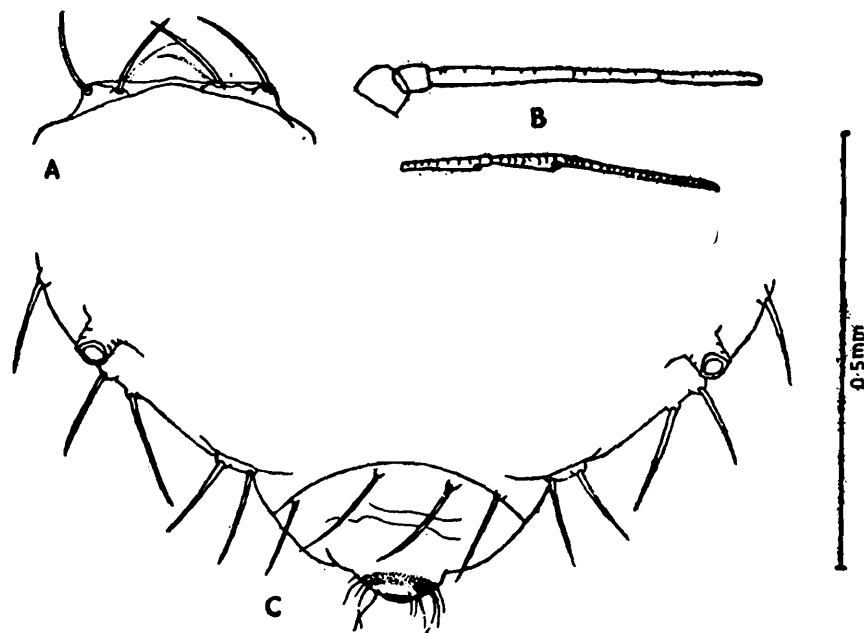


FIG. 40. *Trichaitopharus recurvispinosus* H.R.L., & Basu: A. head, B. antenna, C. abdominal dorsum.

0.16 mm long and $5.5\text{--}6.0 \times$ as long as the basal diameter of antennal segment III; 8th tergite with 4 hairs, (sometimes 6) 0.16 mm long and 2 short hairs, 0.065 mm long; other dorsal hairs very short & blunt; ventral hairs long and fine and at most twice as long as the basal diameter of antennal segment III. Siphunculi pale, truncate, corrugated at base, nearly as long as their basal width. Cauda, pale, $0.50 \times$ as long as its width, basally constricted and bearing 11 (8) hairs of which 4 are conspicuously longer than others. Anal plate entire, rounded; rudimentary gonapophyses 4. Legs pale, femora and tibiae smooth, bearing very short hairs, (0.001–0.002) mm but the ones on apical half of tibiae 0.04–0.05 mm long and stouter. First tarsal segments with 5, 5, 5 hairs. (3–5 hairs with 3 on hind tarsi, H.R.L.).

Colour: Pale with tips of antennae and legs brown.

		<i>Measurements in mm</i>
		1
Length	..	2.38
Width		1.38
Antenna	..	1.08
Antennal segments III	.	0.31
" IV		0.14
" V		0.14
" VI		(0.10+0.24)
urs.		0.08
ht. ₂		0.12
Siph.		0.07
Cauda		0.06

(D. Hille Ris Lambers's Collections.)

Alate viviparous female: Not known.

Sexual forms: Not known.

Nymphs: Eyes with more than 3 facets, small; chaetotaxy same as in adults.

Material examined: One apterous viviparous female, (Co-type) from *Elaeocarpus sikkimensis*, Darjeeling, INDIA, 9.iv.1957, leg. A. N. Basu det. D. Hille Ris Lambers.

Discussion: Hille Ris Lambers and Basu (1966) while describing the species, has shown its relation with other two species of the genus and distinguished this species by minute pronotal hairs and minute hairs on basal half of the tibiae, besides 6 segmented antennae and longer processus terminalis etc. This species appears to be restricted to only some areas of Darjeeling district in West Bengal as it has never been collected during a five year extensive survey in other areas of the district or in Assam, Meghalaya region.

Distribution.—INDIA (Darjeeling, West Bengal).

Types.—In the collections of D. Hille Ris Lambers, Bennekom, THE NETHERLANDS

Genus **Sipha** Passerini

1860. *Sipha* Passerini *Gli afidi* Parma, 29; Baker, 1920, *Bull. U.S. Dept., Agric.*, **826**: 35; Palmer, 1952, *Thomas Say Foundation*, **5**: 103; Richards, 1972, *Mem. ent. Soc., Canada.*, **87**: 98; Szelegiewicz, 1974, *Fragm. Faun.*, **10**: 307. Type species: *Aphis glyceriae* Kaltenbach,

Morphology: Body usually flat. Frons convex, head and prothorax separate. Antennae 5 segmented, much shorter than the body, without secondary rhinaria in apterae, with few rounded secondary rhinaria on antennal segment III of alatae; processus terminalis shorter than or more than twice as long as base of segment V. Rostrum short, usually reaching at most mid-coxae; ultimate rostral segment short and blunt without any or usually with 2 accessory hairs. Dorsum without any sculpturing or with numerous spicules, colourless or with small sclerotic patches. Dorsal hairs usually thick, somewhat spine like. Siphunculi short, truncate, not longer than broad, without any reticulation. Cauda knobbed or arc-shaped (in sub-genus *Rungisia*, Mim.) bearing few to 10–12 hairs. Anal plate entire, sometime concealed under terminal segment of abdomen. Legs variably pigmented, first tarsal segments with 4–5 ventral hairs. Forewings with media once branched, hind wings with both obliques.

Sexual forms not known in many species. Oviparae are usually apterous and bear pseudosensoria on swollen hind tibiae. Males are alatae with secondary rhinaria on both antennal segments III and IV.

First instar nymphs usually with 6 hairs per segment on abdominal tergites 1st–6th; 7th tergite with 4 hairs and 8th with 2 hairs.

Discussion: The genus belongs to a group of genera e.g. *Atheroides* Hal., *Chaetosiphella*, H.R.L., *Caricosipha* Börner, *Laingia* Theobald, which according to some aphid taxonomists should form a subfamily Atheroidinae or at least a tribe Atherodini, or Siphini, under Chaitophorinae. Most of these genera have five segmented antennae, flattened body and poriform or very short siphunculi besides thick dorsal hairs. *Rungisia* Mim., has been considered as a separate genus by many taxonomists, but as it differs from *Sipha* Passerini only in having arc-shaped cauda and smooth tergum as opposed to constricted cauda in *Sipha*, it has been considered as a subgenus following Martelli (1950). *Chaetosiphella* H.R.L. is also very close to *Sipha* differing only in the presence of poriform siphunculi. The genera under Siphini are mostly restricted to Graminae and Cyperaceae and till 1968 only 35 species were known from the world (Eastop and van Emden, 1972), of which nearly half the members belong to *Sipha* s.l.

Biology: The species of this genus live holocyclic life on plants of Graminae and Cyperaceae and are reported to live on leaves of Grasses in wet places. In the region under study only one species is known from Northwestern India.

Distribution.—Mainly PALAEARCTIC in distribution, some species e.g. *Sipha* (*R*) *maydis* Pass, is now known to occur over wide areas of EUROPE, EGYPT, SOUTH AFRICA, and INDIA,

Shaponsnikov (1964) has given an extensive key to the species occurring in USSR, and Szelegiewicz (1974) has dealt with the species from POLAND. Palmer (1952) and Richards (1972) have given keys and descriptions of species found in NORTH AMERICA.

Type species.—*Aphis glyceriae* Kaltenbach.

***Sipha* (*Rungsia*) *maydis* (Passerini)**

(Fig. 41, Pl. XI, fig. 2)

1860. *Sipha maydis* Passerini, *Gli., Afidi*, Parma, 38.
 1874. *Sipha graminis* Kaltenbach, *Die Pflazenf. a.d. kasse d. Ins.*, 756.
 1933. *Rungsia graminis* Mimeur, *Bull. Soc. Scien. Nat. Maroc.*, **13**: 104.
 1904. *Sipha maydis v. avenae*, Del. Guercio, *Redia*, **2**: 144.
 1950. *Sipha* (*Rungsia*) *maydis*, Martelli, *Redia*, **35**: 272.
 1957. *Sipha brunnea* Nevsky, *Trud. vsesoyuz ent. obsnch*, Moscow, **43**: 43.
 1969. *Sipha maydis*, Bindra and Sekhon, *Bull. Ent.*, **10**(2): 157.
 1973. *Sipha* (*Rungsiella*) *maydis*, Kumar, *Oriental Ins.*, **7**(1): 14.

Apterous viviparous female: Body dark, 1.40–1.56 mm long. Frontal tubercle undeveloped; hairs on disc long, stiff and conspicuous. Antennae 5 segmented, pale except on basal two segments which are darker, little more or little less than half the length of body, without any secondary rhinaria; flagellum imbricated; hairs on flagellum stiff, longest one on segment III 0.050–0.070 mm long, 2.5–3.0 × as long as the basal diameter of the segment, shortest one upto 0.013 mm long, 0.55 × as long as the mentioned diameter; processus terminalis, 1.4–1.7 × as long as the base of segment V and 0.6–0.7 × as long as antennal segment III. Rostrum reaches mesothorax, ultimate rostral segment 0.07–0.09 mm long, 0.7 × as long as second segment of hind tarsus. Abdominal dorsum dark brown; dorsal hairs long, thick, with acute apices, longest one on anterior tergites 0.097–0.117 mm long, 4.3–6.0 × as long as basal diameter of antennal segment III, the shorter ones 0.050–0.066 mm long, up to 3.0 × as long as the mentioned diameter; hairs on 7th and 8th tergites 0.115–0.120 mm long, up to 5.0–5.5 × as long as the mentioned diameter. Siphunculi short, dark, truncate, at most equal to antennal segment I. Cauda arc-shaped, anal plate entire. Legs pale, smooth, hairs on tibiae fine and acute, longest one on hind tibiae 1.5 × as long as the diameter at the middle of tibiae. First tarsal segments with 5, 5, 5 hairs.

Colour: Dark in life.

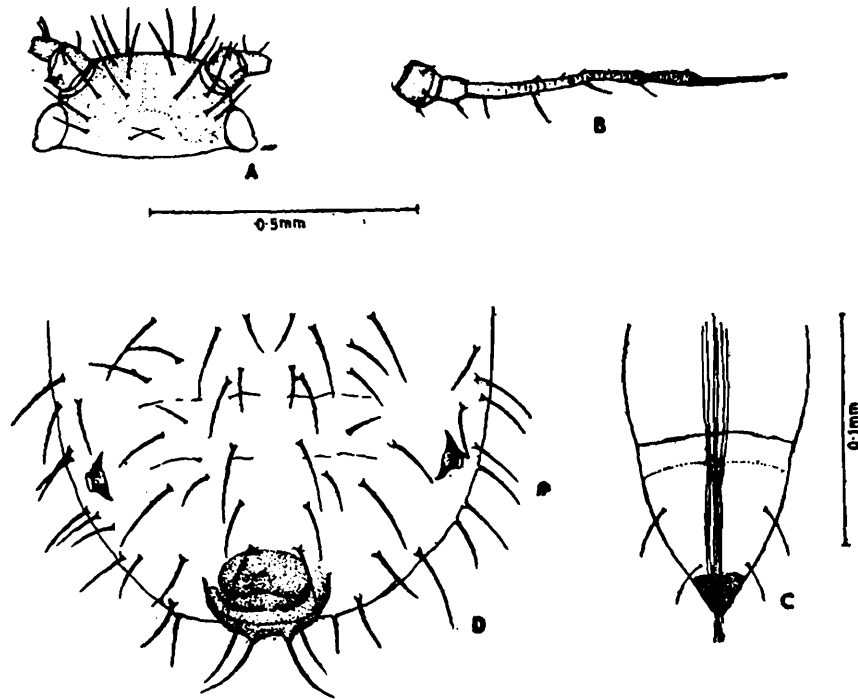


FIG. 41. *Sipha (R.) maydis* (Pass.); A. head, B. antenna, C. ultimate rostral segment, D. abdominal dorsum.

Measurements in mm:

	Length	Width	Antenna	Antennal segments			urs.	ht. ₂	Siph.
				III	IV	V			
1.	1.56	0.94	0.80	0.26	0.10	(0.09+0.16)	0.09	0.13	0.04
2.	1.40	0.68	0.56	0.18	0.08	(0.08+0.12)	0.07	?	?
3.	1.40	?	0.63	0.21	0.07	(0.09+0.14)	0.08	0.11	0.05

(No. 1, L.K. Ghosh's Collections; 2 and 3, S. K. David's Collections.)

Alate viviparous female: [Not recorded in India. The following description has been based on material received from other areas] Body dark, sclerotic, 1.52–2.01 mm long. Head black, with thick dorsal hairs on frons and vertex, 0.050–0.113 mm long, 4.0–9.0 \times as long as the basal diameter of antennal segment III. Antennae 5 segmented, little longer than half the length of body, variably brown to dark brown with segment I almost concolourous with head; longest hair on segment III 0.033–0.053 mm long and shortest hair 0.016–0.033 mm long, these being 2.5–4.0 \times and 1.2–2.5 \times as long as the basal diameter of the segment; segment III with 4–7 small round secondary rhinaria, segment IV with 0–1 similar rhinaria; processus terminalis 1.7–1.8 \times as long as base of segment VI. Thoracic tergum dark black. Abdominal dorsum dark, scleritic with a solid patch on 3rd–7th tergites; 1st and 2nd tergite, each with a transverse spino-pleural sclerotic band, areas between

them being almost colourless; paired marginal sclerites present in all tergites but those on 4th–7th tergites fused with the spinopleural patch and the one on 8th tergite fused with broad transverse sclerotic band; hairs on the dorsum of abdomen thick, almost spiny, longest one on anterior tergites 0.050–0.070 mm long, shortest one 0.026–0.036 mm long, these being 4.0–5.2 × and 2.0–2.7 × as long as the basal diameter of antennal segment III, respectively; longest hairs on 7th tergite upto 0.083–0.124 mm long and on 8th 0.130–0.198 mm long, these being 6.1–9.5 × and 10.0–15.0 × as long as the mentioned diameter, respectively; 8th tergite with 5–7 hairs. Siphunculi short, dark, truncate. Cauda short, dark, semioval. Legs with femora, apices of tibiae and second segments of tarsi, brown to dark brown, rest paler; tibiae with fine hairs, longest one on hind tibiae 0.050–0.073 mm long, 1.5–2.0 × as long as the diameter at the middle of the hind tibiae. Forewings with media twice branched, hind wings with both obliques, sometimes the latter appear very pale.

Colour: Not known.

Measurements in mm:

Length	Width	Antenna	Antennal segments			urs.	ht. ₂	Siph.
			III	IV	V			
1. 2.01	0.99	1.07	0.38	0.19	(0.14+0.24)	0.16	—	0.04
2. 1.52	0.69	0.89	0.38	0.12	(0.10+0.18)	0.14	0.09	0.03

[1, British Museum (Nat. Hist.) Collections; 2. D. Hille Ris Lambers's Collections.]

Sexual forms: No sexual form has been recorded from India. Tutay & Remaudiere (1964) have given short descriptions of male and oviparous females from material collected in TURKEY, as follows:

Male: Body elongate. Tergum sclerotic, pigmented. Antennae entirely pigmented, except segment II and bases of segment III which are paler; segment III with 45–50 small circular secondary rhinaria, segment IV with 8–16 similar ones.

Oviparous female: Similar to apterae viviparae; hind tibiae with apical 0.20 portion pale, rest dark, swollen and with 80–100 small pseudosensoria.

Nymphs: Apterous nymph: Body 0.96 mm long. Head brown sclerotic; antennae 5 segmented 0.44 mm long. Dorsal hairs long, conspicuous, mostly arising from dark sclerotic bases, spinal ones on abdominal dorsum 0.078–0.091 mm long; abdominal tergites 1st–6th with 6 longitudinal rows of dark sclerites. Siphunculi brown, truncate. 8th tergite with 4 hairs.

Material examined: Apterous viviparous female from *Stellaria media*, Simla, Himachal Pradesh, INDIA, 7.i.1970 leg. *L. K. Ghosh*; [L. K. Ghosh's collections, Z. S. I.] Four apterous viviparous females from Wild Grass, Bhuti, Punjab, INDIA, 22.vii.1968, coll. *S. S. Sekhon*, det. D.H.R.L. [S. K. David's collections, Madras]; Four apterous viviparous female, from *Archenatherum elatius*, Kew Survey, England, 26.viii.1962, leg. *V. F. Eastop* (VFE 9247), one alate viviparous female, 8.vi.1963; other data same as above (VFE 9455) [British Museum (Nat. Hist.), London, collections]; Six apterous and 3 alate viviparous females and 2 nymphs from *Avena sterius*, Beirut, LEBANON, 1.iv.1973, leg. *Talhauk* det. D. Hille Ris Lambers. [D. Hille Ris Lambers's collections, Netherlands].

Discussion: Mimeur (1933) erected the genus *Rungisia* with *graminis* Mimeur as the type. Martelli (1950) while presenting a detailed description of *maydis* Passerini considered *graminis* Mim., as a synonym of *maydis* Pass., and used *Rungisia* Mim., as a subgenus of *Sipha* Pass.

This species, so far recorded from Grasses in Northwest India, is known to occur on cereals and other Graminae in Europe and North and South AFRICA, one of the most common host being *Bromus*.

Distribution.—INDIA (Himachal Pradesh); EGYPT. SOUTH AFRICA. TURKEY. EUROPE.

Types.—Location of types unknown according to British Museum (Nat. Hist.) London.

HOST PLANTS OF *Chaitophorinae* RECORDED IN THE REGION

Acer spp.

Periphyllus bengalensis

Periphyllus himalayensis

Periphyllus vandenboschii

Acer oblongum

Periphyllus californensis

Acer pictum

Trichaitophorus aceris

Acer villosum

Periphyllus pusillus

Periphyllus villosi

Aesculus indica

Periphyllus aesculi

- Eleocarpus sikkimensis*
Trichitophorus recurvispinosus
- Populus* spp.
Chaitophorus indicus
Chaitophorus sp.
- Populus alba*
Chaitophorus populeti
- Populus ciliata*
Chaitophorus kapuri
- Populus euphratica*
Chaitophorus populialbae
- Salix* spp.
Chaitophorus himalayensis
Chaitophorus nigrinus
Chaitophorus nainitalensis
- Salix acmophylla*
Chaitophorus pakistanicus
- Salix babylonica*
Chaitophorus niger
- Stellaria media*
Sipha (Rungia) maydis

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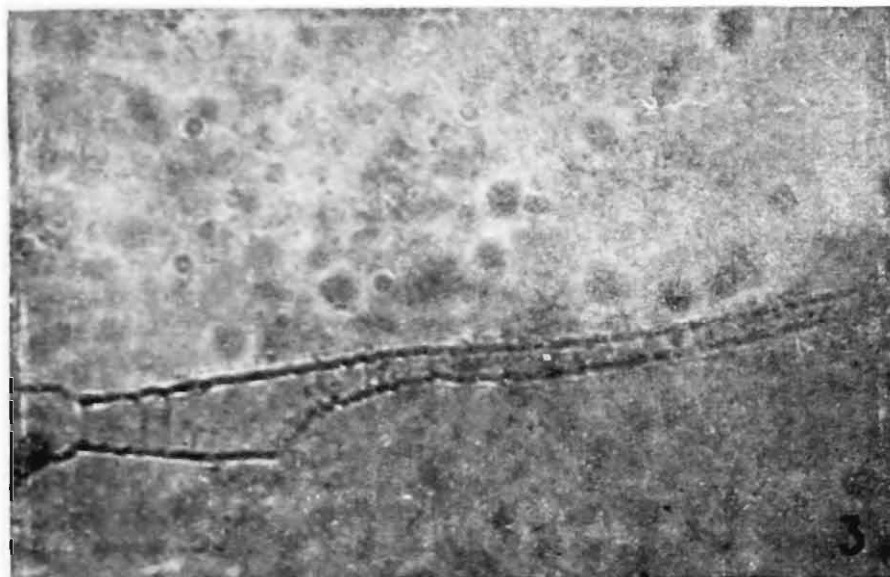


PLATE I. *Chaitophorus himalayensis* (Das): figs 1 & 2. apterous viviparous
♀, ×52, ×66, 3. last antennal segment ×300.

PLATE II

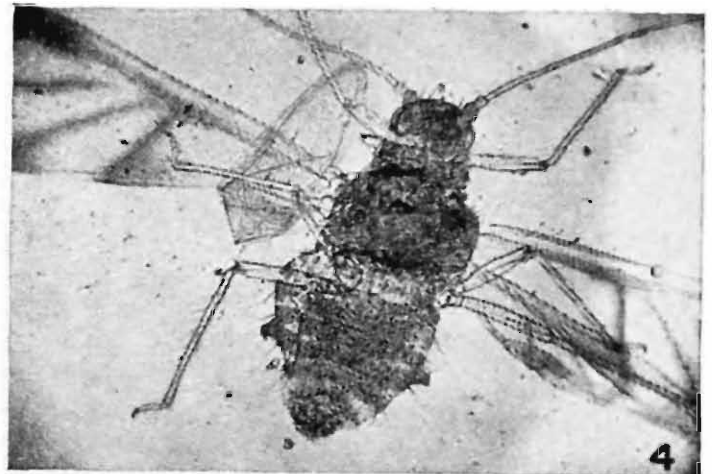
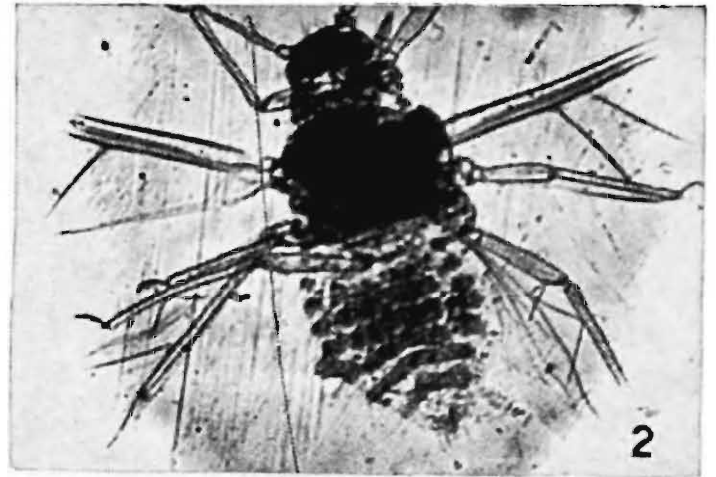


PLATE II. *Chaitophorus indicus* Ghosh et. al.: figs. 1. apterous viviparous ♀, ×24, 2. alate viviparous ♀; *Chaitophorus kapuri* H.R.L., ×24, figs. 3. apterous viviparous ♀, ×30, 4. alate viviparous ♀, ×27.

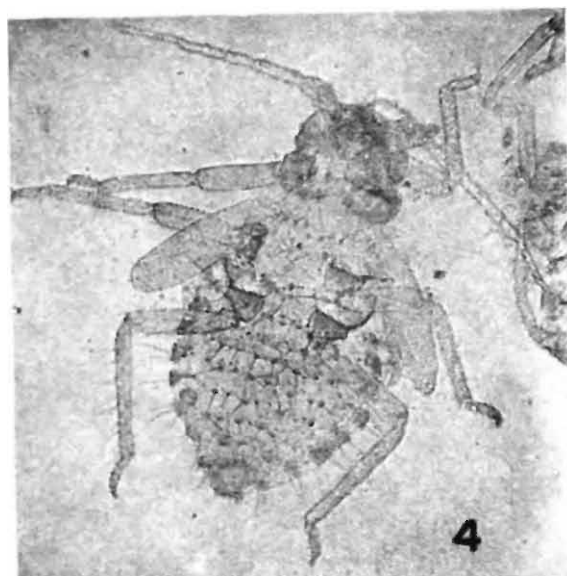
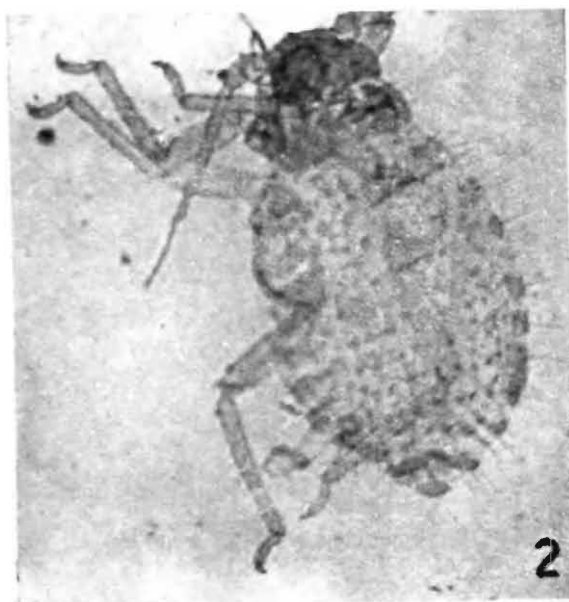


PLATE III. *Chaitophorus salijaponicus niger* Mordvilko: figs. 1. apterous viviparous ♀, ×27, 2. nymph ×112; *Chaitophorus nigrinus* H.R.L.: figs. 3. apterous viviparous ♀, ×27, 4. nymph, ×27.

PLATE IV

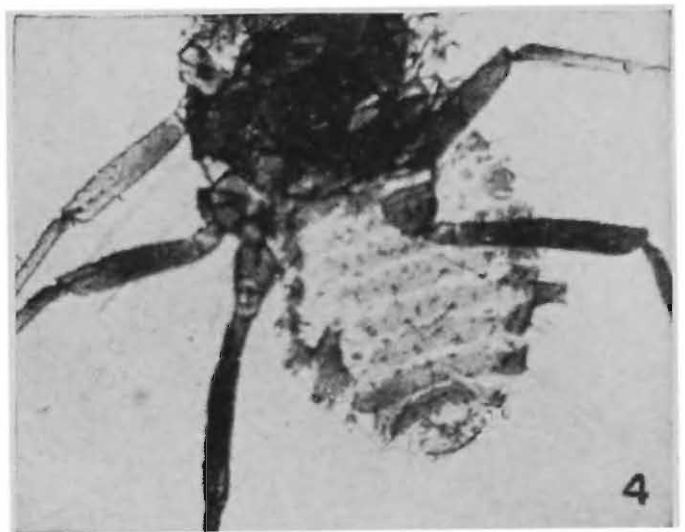
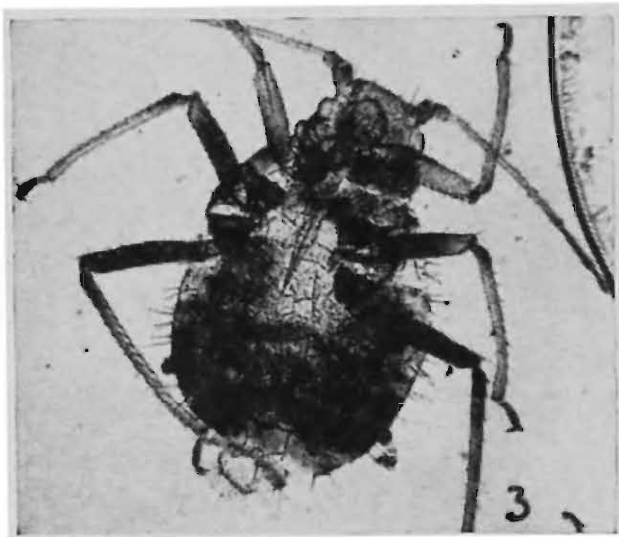


PLATE IV. *Chaitophorus pakistanicus* H.R.L.: figs. 1, 2. apterous viviparous ♀, ×66; *Chaitophorus populeti* (Panzer): figs. 3. apterous viviparous ♀, ×24; 4. alate viviparous ♀, ×40.

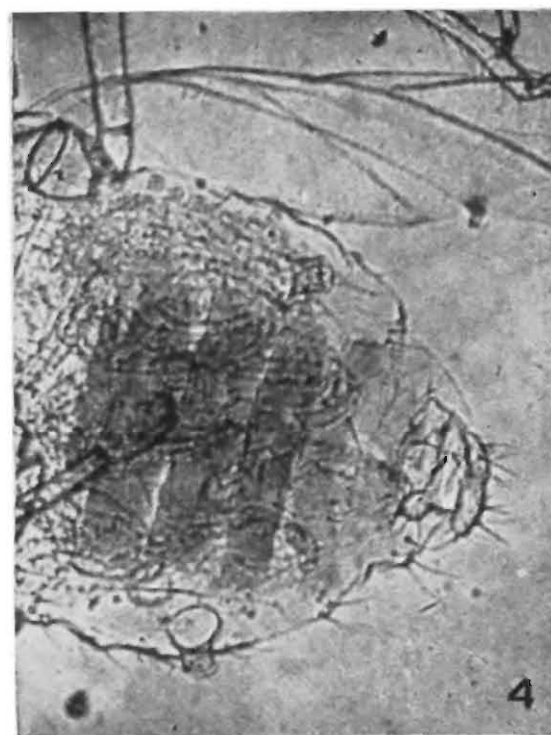


PLATE V *Chaitophorus populeti* (Panzer): figs. 1, 2. nymphs, $\times 27$, $\times 24$;
Chaitophorus populiabiae (B.d.F.): figs. 3. apterous viviparous ♀, $\times 60$,
 4. abdomen of alate viviparous ♀, $\times 66$.

PLATE VI

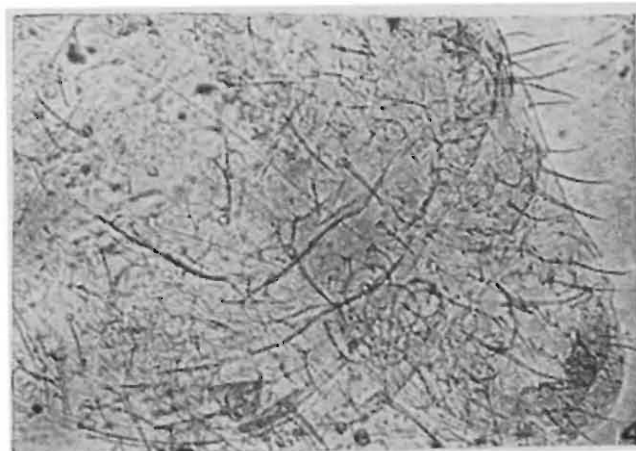
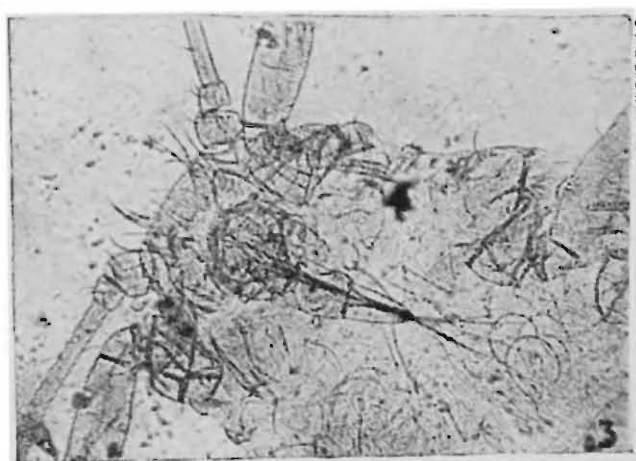
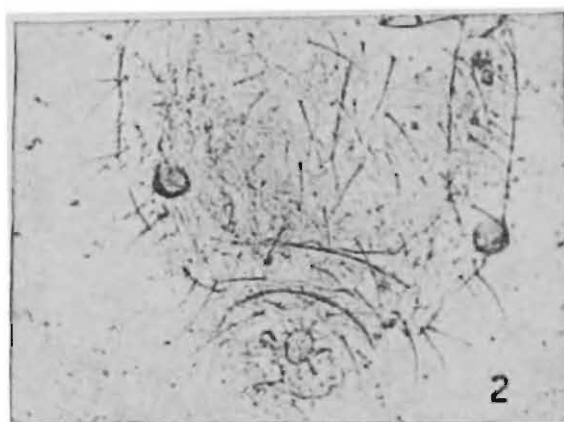


PLATE VI. *Chaitophorus manaliensis* Chakrabarti: figs. 1, 2. apterous viviparous ♀, $\times 54$, $\times 50$; *Chaitophorus* sp.: figs. 3, 4. apterous viviparous ♀, $\times 54$.

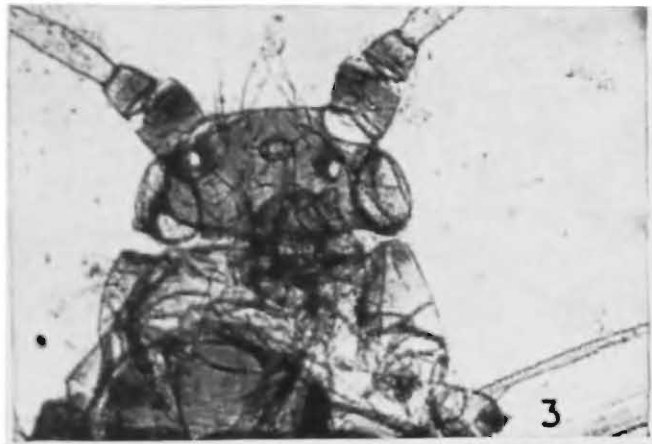
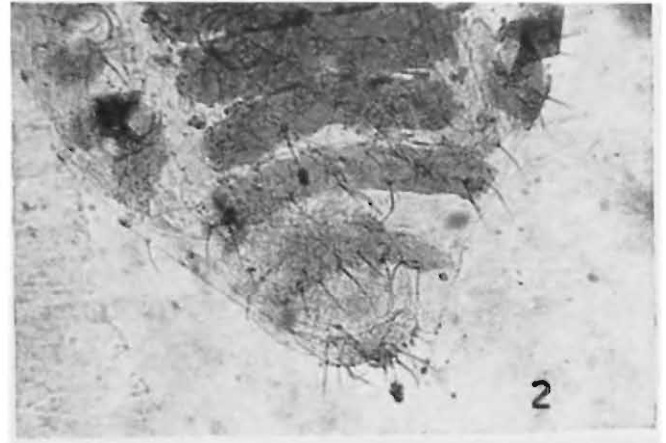


PLATE VII. *Chaitophorus* sp.: figs. 1, 2. alate viviparous ♀, ×54; *Periphyllus aesculi* H.R.L.: figs. 4, 3. alate viviparous ♀, ×54.

PLATE VIII

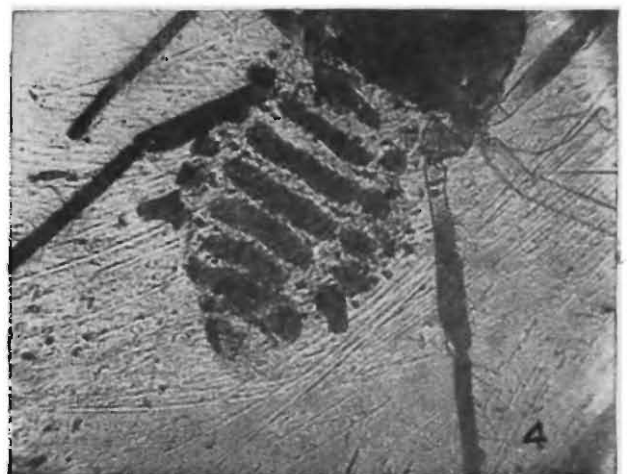
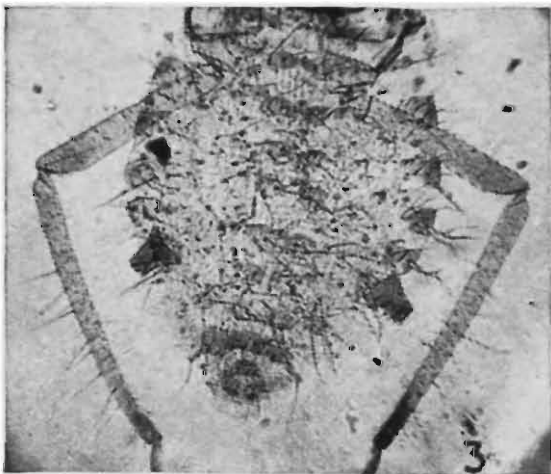
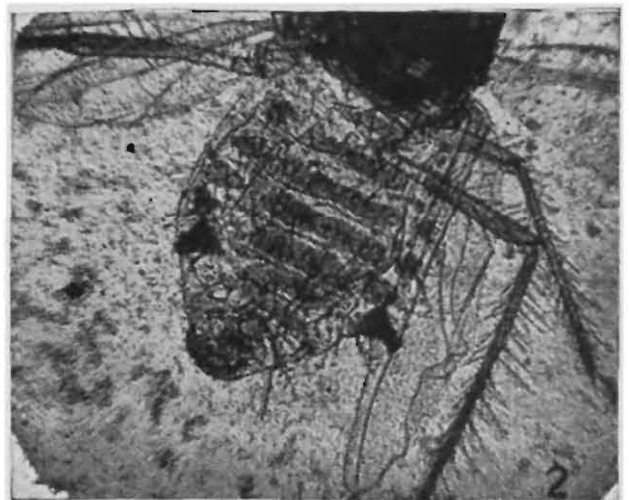
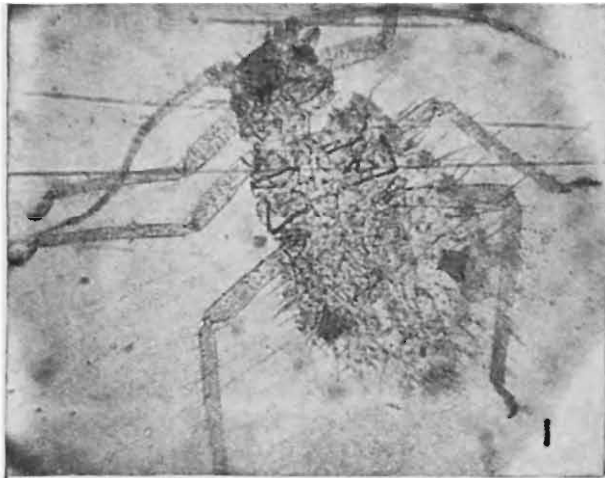


PLATE VIII. *Periphyllus bengalensis* Ghosh & Raychaudhuri, figs. 1. apterous viviparous ♀, ×20; 2. alate viviparous ♀, ×30; *Periphyllus californiensis darjeelingensis* David and Narayanan; figs. 3. alatoid ♀, ×20; 4. alate viviparous ♀, ×24.

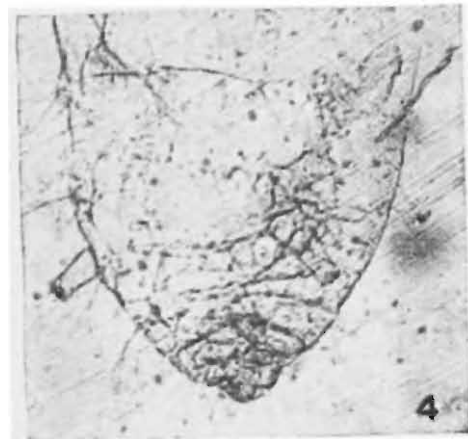
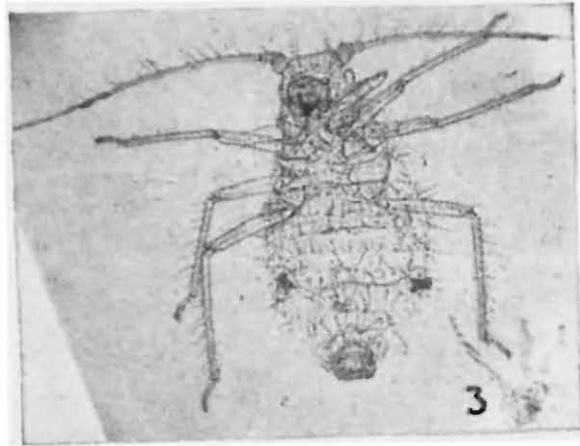
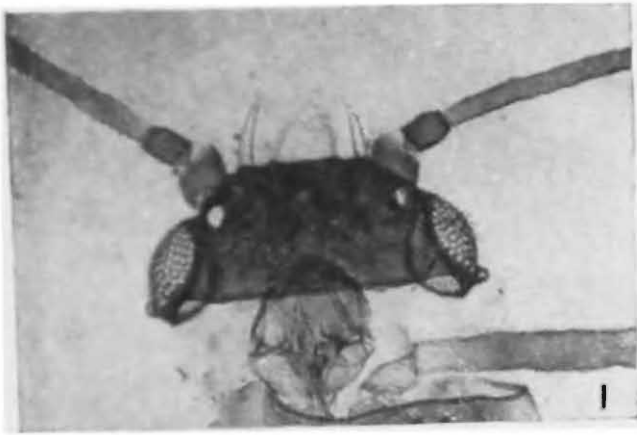


PLATE IX. *Periphyllus pusillus* Quednau and Chakrabarti: figs. 1, 2. alate viviparous ♀, ×105; *Periphyllus vandenboschi* H.R.L.: figs. 3. apterous viviparous ♀, ×24; *Periphyllus* sp.: fig. 4. abdomen of apterous viviparous ♀, ×20.

PLATE X

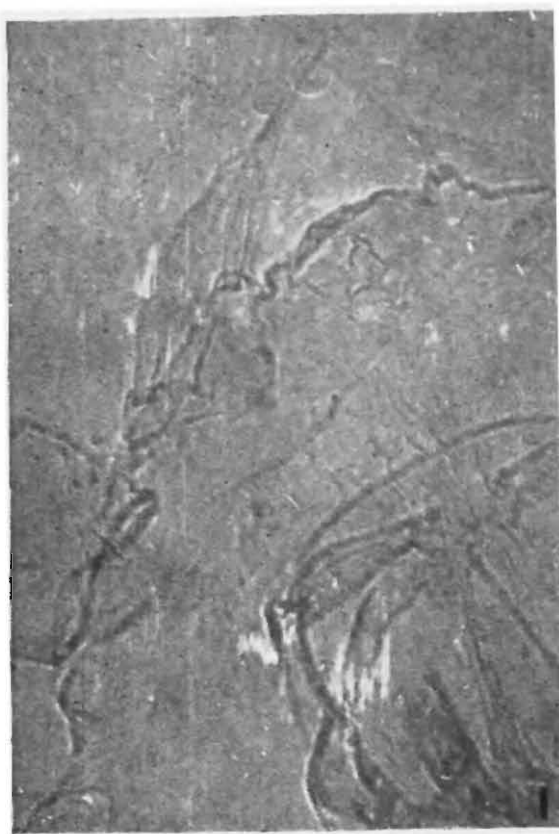


PLATE X. *Trichaitophorus aceris* Takahashi: figs. 1. frontal hairs, $\times 500$;
2. head, $\times 120$; 3. abdomen of apterous viviparous ♀, $\times 105$.



PLATE XI. *Trichaitophorus recurvispinosus* H.R.L. and Basu: fig. 1. apterous viviparous ♀ (Part), $\times 27$; *Sipha (Rungia) maydis* (Passerini): fig. 2. apterous viviparous ♀, $\times 35$.



Born in 1938 at Rourkella, Orissa, India, Dr. A. K. Ghosh had his education at the University of Calcutta and University of Wisconsin, Madison, U.S.A. He also started his research on Indian Aphidoidea first at the University of Calcutta in 1958 and continued the same till he left for U.S.A. in 1965 to work on a project on long-range dispersal of aphids vectors of plant viruses, with a Fulbright Grant for higher studies, at University of Wisconsin. On his return he resumed his work at the University of Calcutta in 1968 and subsequently at Zoological Survey of India from 1972. He has so far more than 135 research publications to his credit including 'Aphids of Economic Importance in India' (1974) 'Fauna of India : Aphidoidea' part 1, General Introduction and subfamily Chaitophorinae (1980), part 2. Subfamily Lachninae (1982), Aphid parasitoids of India and adjacent countries with P. Stary (1983), besides contributing to the multi-authored volume on 'Aphids of North East India and Bhutan' Edited by D. N. Raychaudhuri (1980). His current interests includes 'Biosystematics of Aphidoidea and their natural enemies' and 'Aphid-galls and Gall-aphids'. A member of several scientific societies, Dr. Ghosh is also associated with a number of Universities in Eastern India and has been acting as a visiting Guest Lecturer in the University of Calcutta.