OCCASIONAL PAPER NO 127

Records of the Zoological Survey of India

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K. R. Rao

Zoological Survey of India

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Studies on a Small Collection of Leafhoppers (Homoptera Cicadellidae) from Khasi Hills, Meghalaya

By

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सत्यमेव जयते

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I. Introduction

Leafhoppers are members of the family Cicadellidae (Auchenorrhyncha : Homoptera) and constitute the largest family in the order Hemiptera. They range from minute, brilliantly coloured typhlocybines to large, robust eurymelines and cicadellines. Leafhoppers are considered closest to treehoppers (Membracidae) from which they differ in having spines on their rather angulate hind tibiae and in the pronotum not extending over the abdomen.

Leafhoppers feed on leaves, shoots and stems of a variety of vegetation; a few are restricted to feeding on roots, Douglas (1875). The members of Eurymelinae (Evans 1947), Macropsinae, some Ledrinae (Chatterjee, 1934) and Agalliinae are actively attended by ants. Several species are oligophagous or polyphagous. Adults often feed on plants different from those preferred for oviposition (De Long, 1971).

In recent years leafhoppers have been gaining importance as pests of economically important plants often causing direct damage by desapping them and reducing their vigour; a few of them are also known to inject toxins causing local destruction of tissues. The most important damage caused by leafhoppers to crops is, however, by acting as vectors of several plant pathogens. Nielson (1979) listed 128 species of Cicadellidae as vectors of plant pathogens in the World. A knowledge of their distribution and their correct identity is of vital importance since each plant virus or Mycoplasma-like-organism is often transmitted by a specific vector.

The increasing interest on leafhoppers is evidenced by the number of species added to the family every year. Viraktamath (1983) estimated that fifty per cent (5600 species) of known species were discovered during 1956-62 and stressed the importance of making intensive surveys in Africa, Asia and South America. Hamilton (1984) estimated that 15000 species of leafhoppers were described so far from all over the world but considered that, 15000 species more were yet to be described thus making a conservative estimate of 30000 world species of leafhoppers.

Though the leafhopper fauna of the American continent and other western parts of the world are well known, studies on Oriental leafhoppers,

especially of the Indian subcontinent are very much limited. The only pioneering work from the Indian subcontinent is that of Distant (1908, 1916, 1918). Distant's work, however, is outdated as many new characters are employed now in determining the species. Though Pruthi (1903, 1934b, 1936) revised some of Distant's genera and species, his identifications have sometimes been proved erroneous. Other notable works from India are Ramakrishnan and Menon (1971, 1972a, 1972b, 1973, 1974), Datta (1972, 1973), Datta and Dhar (1984), Sohi and Dworakowska (1984) and Viraktamath (1976a, 1976b, 1979a, 1979b, 1980a, 1980b, 1981, 1982, 1983).

The present study consists of a taxonomic treatment of nine subfamilies of Cicadellidae encountered in Khasi Hills, Meghalaya. Linnavuori (1975) in his revision of the Ethiopean species of Hecalini, treated Hecalini as a tribe of the subfamily Deltocephalinae which is upheld by Oman (1985). It is treated here as a distinct subfamily because of distinctive flattened body and elongate head which is usually foliaceous. Nielson (1985) also treated as a separate subfamily.

The study of leafhoppers from Khasi Hills was taken up with a view to enumerate the genera and species of cicadellidae occurring in the area, to describe new taxa discovered during the study to construct keys to subfamilies, genera and species of the area for idetification and to bring out zoogeographical relations between the cicadellid fauna of Khasi Hills and rest of the country and Oriental Region.

The persent work deals with the study of 2145 specimens of leafhoppers belonging to 42 species. It includes one new genus, 12 new species, three new combinations and one new synonymy which have been described elsewhere (Rao, 1989). However a brief description for each of them is given here for ready reference.

Earlier to this work, only four species were known from the group of subfamilies studied in this work. It is therefore evident that the cicadellid fauna of Khasi Hills is very poorly known. The present study is an attempt to fill this lacuna and all the species dealt here are new records to Khasi Hills. Keys to the identification of subfamilies, genera and species have been provided. Zoogeographical relations between the leafhopper fauna of Khasi Hills and the rest of the country and the Oriental Region have been discussed. The distribution of leafhoppers in Khasi Hills compared to other regions of the world is shown in Table No. 1.

TABLE 1

Table showing the distribution of leafhoppers of the subfamilies from different regions

Subfamily	From Indian Subcontinent No. of Genera	No. of species	No. of species recorded from N.E. India	From Khasi Hills alone	S.E. Asia Pacific Fauna No. Genn.	No. of spp.	World Fauna No. of spp.
					*	*	*
Aphrodinae	6	22	1	1	2	2	119
Evacanthinae	8	13	2	—	1	2	57
Nirvaninae	11	27	—	—	19	53	75
Coelidiinae	7	53	7	1	8	214	432
Penthimiinae	8	38	3	—	29	85	109
Acostemminae	1	1	—	—	1	1	19
Drabescinae	6	16	—	—	6	29	34
Hecalinae	6	26	2	—	—	—	—
Deltocephalinae	64	165	7	2	83	275	3104

*After Knight (1983)

Economic importance of leafhoppers

Leafhoppers are considered insects of economic importance as many of them attack and suck sap from crops, trees and foliage and some species transmit phytopathogenic agents. Oman (1949) reported on the species of *Erythroneura* attacking ears, eyes and nose of workers in vineyards and apple orchards. Ghauri (1983) reported on the nuisance caused to the residents of Ascension island when huge swarms of *Balclutha paurilla* Lindberg, appeared before dawn and blocked sunlight in May 1976 and of the millions of these insects which got trapped in ceiling light fixtures of many houses at the time of dispersal. Distant (1908) reported on the formation of huge swarms of *Nephotettix* in Calcutta towards the end of October after the rains, dashing against the lights in houses and public streets. "Green flies" as they are popularly called, are found in heaps, during this period, in public streets as well as in houses causing much annoyance.

It has been estimated by Harris (1983) that 130 known leafhopper vector species and sub-species covering 10 subfamilies and 58 genera transmit about 71 disease agents (about 33 viruses, 31 mycoplasma-like organisms (MLO), 3 spiroplasmas and 4 rickettsia-like organisms. Harris (1983) also lists 20 genera and 34 species of leafhoppers as responsible for transmitting 33 viruses.

Ling *et al.* (1983) in a review of insect-vectors of rice and mycoplasma-like organisms associated with diseases of rice dealt in detail the virus-vector-interactions and transmission mechanisms. Oman (1949) listed leafhopper vectors and the viruses they carry. Bindra *et al.* (1973) listed cicadellid vectors of plant pathogens from India. Sohi (1977) reported on pests of different plants in North-western India.

Viraktamath (1983) provided a comprehensive key to all the economically important species of cicadellidat in India covering 25 species in 17 genera. Sohi (1983) provided a key for the identification of important typhlocybine leafhoppers of cotton and rice from India and Oriental Region covering 24 species in 9 genera.

Leafhoppers cause damage to the plants by (1) sucking plant-sap, (2) injecting toxins while sucking, (3) by laying eggs and cover the leaf surface and (4) as vectors by transmitting viruses and mycoplasma-like organisms. In Table 2 are listed important leafhoppers in India which are reported to cause damage to the plants in several ways.

TABLE 2

Vectors	*Phytopathogens transmitted*
Hishimonus phycitis (Distant)	MLO's causing of little leaf brinjal
Orosius albicinctus Distant	MLO's causing Phyllody of seasame Phyllody of gram Potato purple top
Nephotettix virescens (Distant)	Rice tungro virus Rice yellow dwarf MLO
Nephotettix nigropictus (Stål)	Rice tungro virus Rice yellow dwarf MLO
Recilia dorsalis (de Motschulsky)	Rice stunt, MLO and virus Orange leaf disease of Rice
Cicadulina chinai Ghauri ***Cicadulina bipunctella*** (Matsumura)	Ragi strak virus and ragi mottle streak virus
Calodia kirkaldyi Nielson (=Coelidia indica Auct)	Sandal spike MLO
Moonia albimaculate Distant	Sandal spike MLO (Suspected)
Alebroides nigroscutellatus (Distant)	Purple top roll of potato, witch's broom of potato

Pests of economic importance

Amritodus atkinsoni (Lethierry) ***Amritodus brevistylus*** Viraktamath ***Idioscopus clypealis*** (Lethierry) ***Idioscopus nagpurensis*** (Pruthi) ***Idioscopus niveosparsus*** (Lethierry) ***Amrasca splendens*** Ghauri	Mango
Empoascanara indica (Datta) ***Empoascanara maculifrons*** (de Motschulsky) ***Cicadulina bipunctella*** (Matsumura) ***Cicadulina chinai*** Ghauri	On seedling of rice, wheat and ragi Rice
Cofana spectra (Distant) ***Cofana unimaculata*** (Signoret) ***Empoascanara alami*** (Ahmed) ***Empoascanara truncata*** (Ahmed)	Rice

Table 2 (*Contd.*)

Vectors	*Phytopathogens transmitted*
Thaia subrufa Motschulsky *Thaia oryzivora* Ghauri *Thai assamensis* (Mahmood)	Seedling of rice
Amrasca biguttula biguttula (Ishida)	Cotton, bhendi, sunflower, castor
Empoasca motti Pruthi	Pulses
Empoasca kerri Pruthi *Empoasca terminalis* Dist.	Groundnut
Empoasca signata Haupt	Castor
Yamotettix sexnotatus (Izzard)	Sugarcane
Zygina manalicnsis Sawai Singh	Maize and wheat

II. PHYSIOGRAPHY OF KHASI HILLS

Khasi Hills is one of the three districts of Meghalaya, a small state in the North-eastern India, the other two being Garo Hills and Jaintia Hills. This area is little explored by any agency for any faunal investigation and there exists a big lacuna in our knowledge on the fauna of leafhoppers. The area is however zoogeographically important, because its fauna along with that of Assam, Burma, Thailand and Malaya is peculiar and bears a basic affinity with the fauna occurring in the hills of South India and Sri Lanka. Khasi Hills are seen to rise gradually from the plains of Assam in the north but abruptly in the south, Rao (1974). The highest point is the Shillong peak (1966 m). According to geological records Shillong plateau was formed out of the eastern most tip of the Peninsular India during the process of mountain formation Zimba (1977). The Leitkar peak and Shillong peak are parallel to each other.

The south-west monsoon and the north-east monsoon control the climate of Khasi Hills. During March and April the climate is usually warm and may be called spring. The maximum temperature is reached during May and this period may be termed as summer, the maximum temperature recorded at Shillong so far being 26°C. The rainy season lasts from the third week of May to middle of October and thereafter it gradually peters out. The maximum rainfall occurs at Cherranpunji and Mawsynram platforms (12,000 mm), the former with the distinction of having the highest record of rainfall till recently in the whole world. The rainfall is

highest in the central Meghalaya i.e., in Khasi Hills whereas it is less in eastern Meghalaya i.e., Jaintia Hills and scanty in Western Meghalaya i.e., Garo Hills. Shillong, the capital, alone has an annual average rainfall of 2500-3000 mm. The winter season is from November to February. During this period the temperature goes down to 2°C or 1°C in the hills.

The type of vegetation in Khasi Hills is a mixture of the temperate and tropical. The tropical evergreen forests are seen upto an altitude of 900 m and include evergreen or semi-evergreen forests, deciduous forests and grass lands. The evergreen forests include tall trees, palms, epiphytes and ferns. The deciduous type includes the sal forests with *Shorea robusta* dominating and are found on the northern lower slopes. The grass lands are restricted to the tops of flat hills. The temperate vegetation occurs at elevations from 1300 to 2500 m in the Shillong plateau. The pitcher plant, *Nepenthes khasiana* is one endemic insectivorous plant which is found in Khasi Hills. "Jhuming" a kind of primitive practice of burning forests before planting, is still followed here. The kind of shifting cultivation for the past many generations has drastically changed the forest ecosystem of Maghalaya and secondary vegetation mainly bamboos, has come up to take its place.

III. MATERIAL AND METHODS

1. *Collection procedures* :

Being invariably associated with plants, leafhoppers were collected by making sweeps on vegetation by a sweep-net. They were then aspirated from the net and killed in a cyanide bottle and transferred to butter paper packets after recording the relevant data. They were later mounted on paper tips and appropriately labelled for further study.

The places visited by the author for the collection of leafhoppers are Sonapahar, Mairang, Nongklah, Maurapat Mawsynram, Jakriem, Satmowe-don, Balat, Ranikor, Puksora. No agency had previously explored the above areas for any zoological collections. Other areas of collection included Nongpoh, Cherrapunjee, Maphlong, Sohryongkham, Shillong, Umran (Maps 1 and 2). Leafhopper collections present in the Eastern Regional Station, Shillong were also made use of.

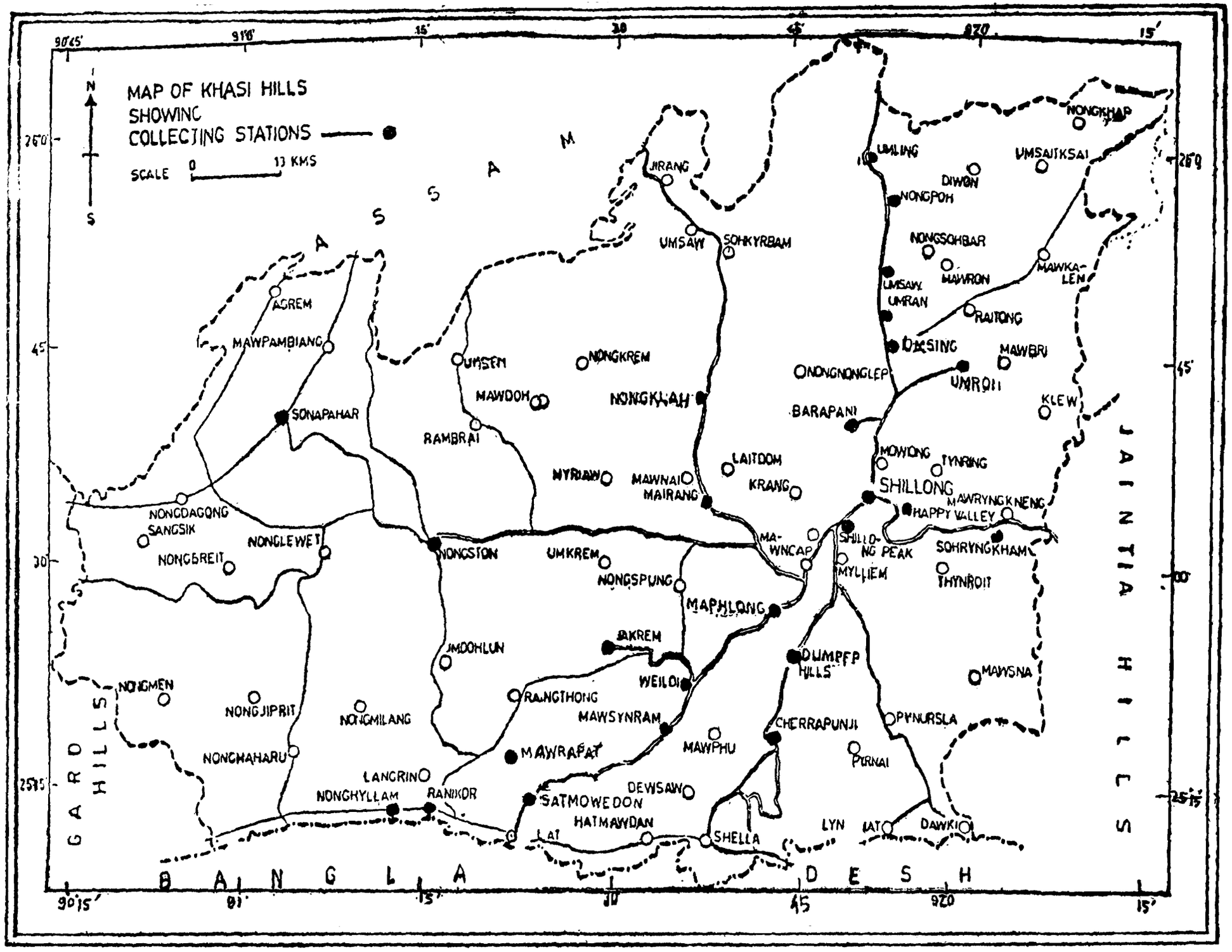
All the collections were made during summer and post monsoon months. The study period ranged from 1974-1985.

2. *Processing of material* :

For study of the male genitalia, the procedure described by Oman (1949) was followed. The entire abdomen was separated by a minute pin and macerated in 10% caustic potash and allowed to remain in it overnight or for twenty four hours depending upon the degree of sclerotization of specimen. Dissection of the genitalia was made in glycerine using mounted microneedles. Holding the abdomen in position, the connection between male plates, the connective and the dorsal apodeme and the tenth segment was severed. Thereafter, the whole of internal male genitalia i.e., aedeagus, styles and connective were drawn out of the genital capsule. After study and drawing the genital structures were replaced within the empty abdomen which was then stored in a microvial containing a drop of glycerine at the bottom. The pin bearing the specimen was then thrust diagonally through the plastic stopper of the microvial so that the glycerine remained at the bottom of the vial.

The following meristic characters were considered necessary for identification of leafhoppers: 1. Median length of head; 2. Width of head, interocular width and width across the eyes; 3. Median length of pronotum; 4. Width of pronotum at its widest place; 5. Length of scutellum; 6. Width of scutellum; 7. Total length from tip of head to the tip of folded tegmina.

The abbreviations used in this work are as follows: A-appendix; Aac-ante-apical cell; Ac-apical cell; Adp-aedeagal process; Ads-aedeagal spine; Aed-aedeagus; Aeds-aedeagal shaft; Apd-apodeme; App-apophysis; As-anal style; At-anal tube; Brc-brachial cell; Bt-basitarsus; Ca-carina; Cl-clavus; Clp-clypellus; Cls-claval suture; Clv-claval vein; Cm-commissural margin; Con-connective; Cona-connective arm; Cons-connective shaft; Cor-corium Dc-discal cell; F-femur; Fc-frontoclypeus; G-gena; Gd-gonoduct; Gp-gonopore; H-hamulus; Hfs-hind femoral setae; Ib-inner branch of I sector; J-jugum; L-lorum; Lfs-lateral facial suture; Lm-lateral margin; Lp-lamellatt process of apodeme; Mc-marginal comb of spines; Mdp-multi-digitate process; Mm-mesial margin; Mp-male plate; Mpp-male plate process; O-ocellus; Ob-outer branch of I sector; Ooa-ocellocular area; Ov-ovipositor; P-pronotum; Par-paramere (paraphysis); Prl-pre-apical lobe; Py-pygofer; Pyh-pygofer hook/s; Pyp-pygofer process; Pys-pygofer spine/s; Sc-scutellum; St-style; Sv-submarginal vein; V-vertex; Vl-valve; Vpa-ventral process of aedeagus; Vps-ventral process of shaft; I sr-first sector; II sr-second sector; VII s-seventh sternum; X sg-tenth segment; XI Sg-eleventh segment; 1, 2, 3, 4-apical cells numbered.


MAP OF KHASI HILLS
SHOWING
COLLECTING STATIONS
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S
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BANGLADESH
GARO HILLS
JAINTIA HILLS
JIRANG
UMSAW
SOHKYRBAM
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NONGKHAR
DIWON
UMSAITKSAI
NONGPOH
NONGSOHBAR
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BARAPANI
MOWLONG
TYNRING
SHILLONG
MAWRYNGKNENG
HAPPY VALLEY
SHILLO-NG PEAK
SOHRYNGKHAM
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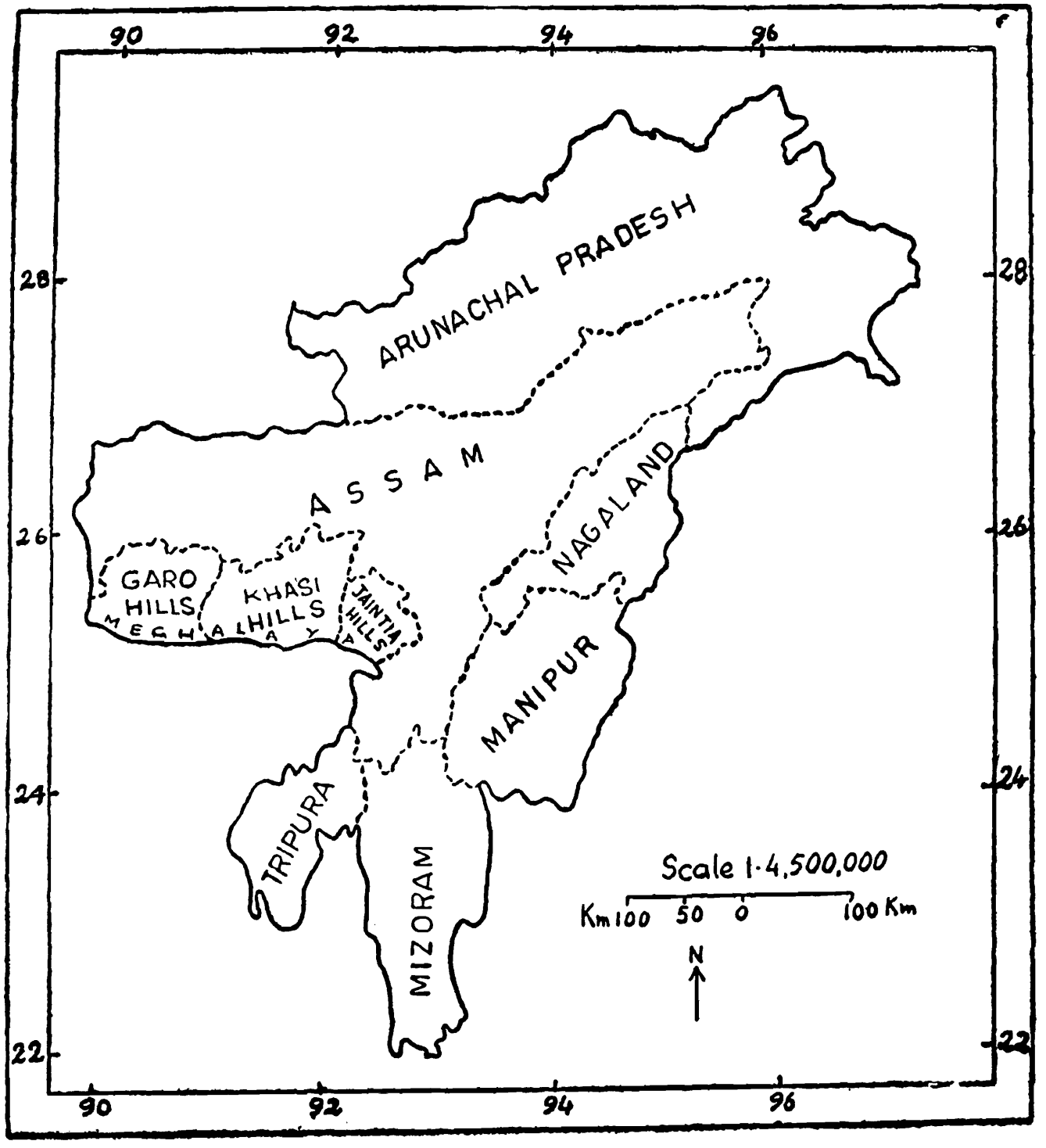
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IV. TERMINOLOGY OF PRINCIPAL PARTS OF TAXONOMIC IMPORTANCE

The principal morphology of a typical leafhopper is illustrated in *Cicadula compressa* Rao (Text fig. 1 & 2) and variatioss are depicted in the illustrations of other species. The description of various parts of leafhoppers followed here is based on Evans (1946, 1947), Oman (1949), Young (1952, 1968), Davies (1975), Barnett (1977a) and Cwikla and Freytag (1983).

Head : It is variable in size and shape. The length and width of head and its relative size compared to that of pronotum are diagnostic characters of some importance.

Face : (Text fig. 1, b) : It is divided into frontoclypeus (Text fig. 1, Fc) (clypeus and postclypeus of Young and Barnett) and clypellus (Clp). The lora (L) (mandibular plates of Snodgrass) may or may not extend upto clypellus.

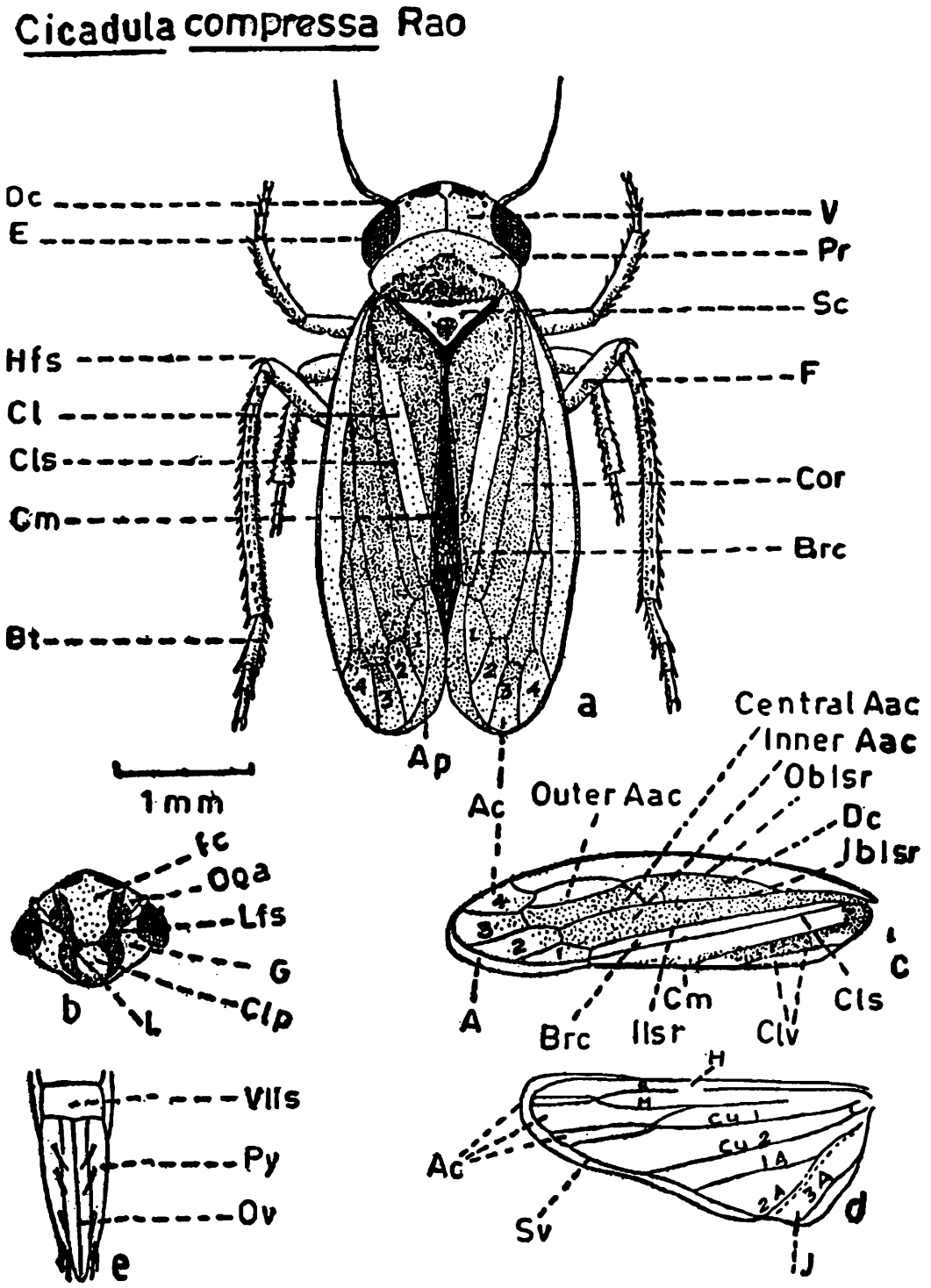
Ocelli : Ocelli (Text fig. 1, Oc) occupy different positions on the head and serve as useful characters for subfamily classification.

Pronotum : (Text fig. 1, a, Pr) : Lateral margins of pronotum, whether keeled or rounded and the nature of the surface of pronotum are useful characters. The pre-episternum may be concealed or exposed.

Wings : (Text fig. 1, c & d) : Leafhoppers may be macropterous, brachypterous or sub-brachypterous as seen in Deltocephalinae. The venation followed here is after Oman (1949) and Young (1952) asd Barnett (1977a). Two principal sectors of veins are met with, the first sector corresponding to the R of Barnett before it branches. The veins are usually distinct but may be evanescent as in *Nirvana* (Text fig. 8) except for the apical ones. In the hind wings the number of apical cells (Ac) the submarginal vein (Sv) provide useful diagnostic characters.

Legs : The hind legs of leafhoppers provide a number of useful characters as shown by (Davies, 1975). The arrangement of setae on the posterior femora (Text fig. 2, Hfs) is denoted by a formula (Ribaut, 1952).

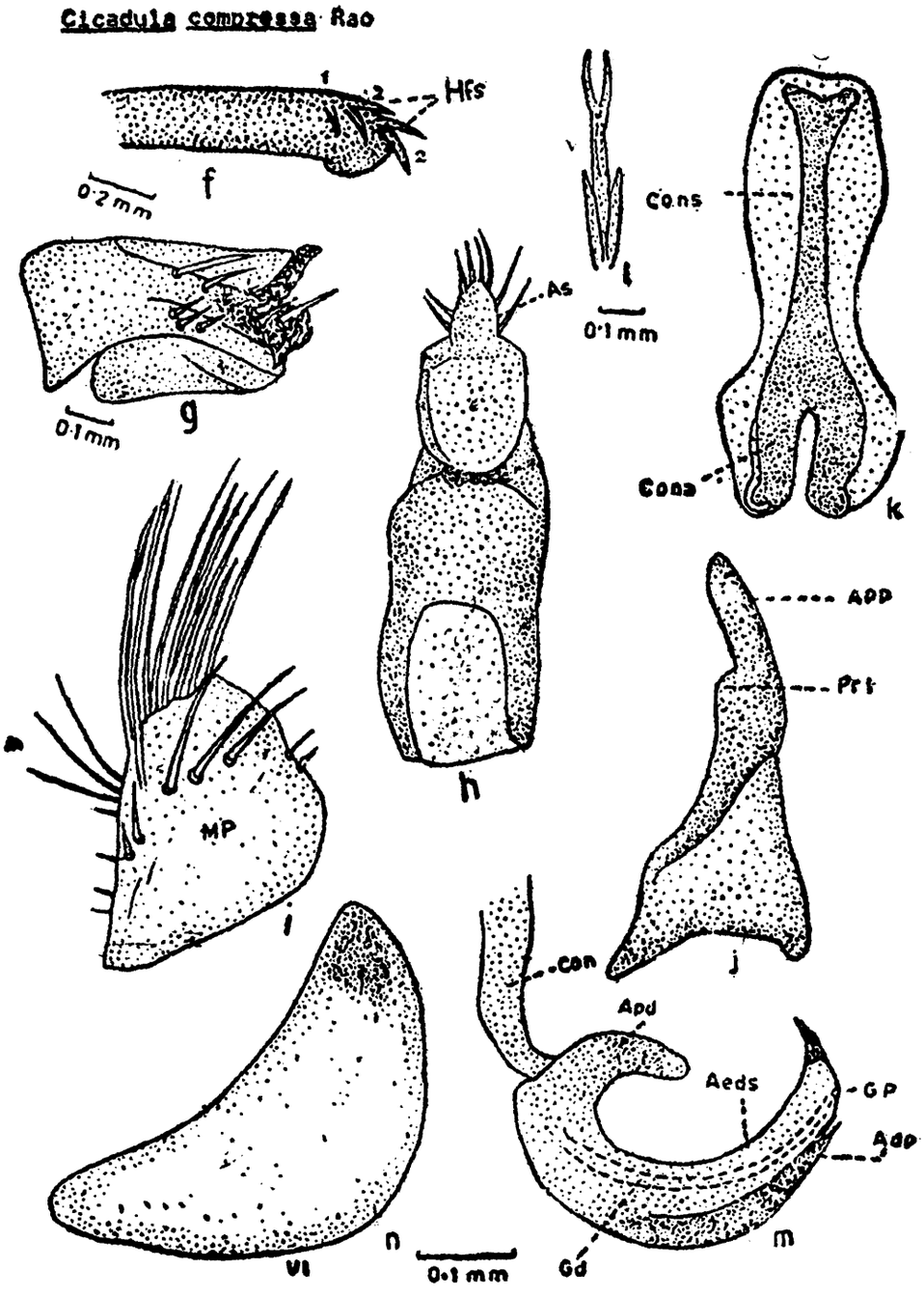
Male genitalia : (Text fig. 2) : The ninth abdominal segment is usually deeply incised dorsally and appears to consist of two lateral lobes called pygofers (Text fig. 2, g). Each pygofer may have appendages of various kinds. The pygofer may have a caudodorsal process, having apical serrated margins or it may have articulated membranous caudal lobe as in



Text fig. 1. *Cicadula compressa* Rao a-Habitus. .dorsal view; b-Face. .ventral view; c-Forewing. .dorsal view; d-Hind wing. .dorsal view; e-Female genitalia .ventral view

Cicadula compressa or its caudal and ventral processes may be hook-like. Ventral aspect of genital capsule is the value and a pair of subgenital plates articulate with it caudally.

Ventrally the genital capsule is differentiated into valve and plates. Male plate for instance, may have a process, or they may have narrow serrations or they may be frequently short, exceeded by styles.



Text fig. 2. *Cicadula compressa* Rao f-Hind femora. .lateral view; g-Pygofer. . lateral view; h-Anal tube. .dorsal view; i-Male plate. .ventral view; j-Style. .dorsal view; k-Connective. .dorsal view; l-Aedeagus. .dorsal view; m-Aedeagus. .lateral view; n-Valve. .ventral view

The inner parts of male genitalia are the aedeagus, the connective and the paired styles (Text fig. 2, j, k & l). Styles articulate mesally with the connective which in turn articulates with the aedeagus.

Connective : This assumes a variety of shapes which are useful in the recognition of tribes and genera in Deltocephalinae. Aedeagus and connective may be either freely articulated or fused. The connective takes different species. It may be like a racket or loop as in *Aconurella solana* (Text fig. 30, g).

Aedeagus : The aedeagus usually articulates by its subterminal portion with the connective, but the articulation may be terminal, dorsal or much more basal. The shaft is usually straight but may be curved as in *Cicadula compressa* (Text fig. 2, m). Aedeagus usually has one gonopore but sometimes is provided with two gonopores.

The gonopore may be apical as in *Glossocratus* (Text fig. 18, h) or may be subapical as in *Cicadula* (Text fig. 2, m). The processes of aedeagus are varied. The aedeagus is strongly curved with a pair of caudal and apical processes as in *Cicadula* (Text fig. 2, m). In *Evacanthus* the dorsal apodeme has lamellate processes (Text fig. (6, h, Lp). In *Glossocratus* (Text fig. 18, g, h) the aedeagus has dorsal and apical processes. Sometimes aedeagus is with asymmetrical processes.

Accessory genital structures, paraphyses (Barnett, 1977a) occurring between the apex of connective and base of aedeagus are also useful in determination of species especially in *Scaphoideus* (Text fig. 36, g, Par).

Female genitalia : The shape of the female seventh sternum and the ovipositor (Text fig. 1, e) extending beyond pygofer or not provide useful characters. The same is followed in this work.

V. CLASSIFICATION OF SUBFAMILIES

It is rather unfortunate that no proper key has been devised for separating all the known subfamilies of cicadellidae. The first attempt over made to divide the family into various subfamilies was that of Evans (1947) who proposed 17 subfamilies. Other workers proposed different methods of primary subfamily divisions (Oman, 1949, Borror *et al*. 1976, Ribaut, 1952, Hamilton, 1983). Oman (1949) treated Nearctic leafhoppers under a single family. Metcalf (1962-1958) elevated the leafhopper family Cicadellidae to the superfamily Cicadelloidea and assigned 17 families to it. Knight

(1983) treated 24 subfamilies from from South-east Asia and Nielson (1985) recognised 50 subfamilies and the same arrangement is followed in this work. Knight and Nielson (1986) also listed nominal subfamilies and tribes of the Cicadellidae. A key is now prepared here to separate 25 subfamilies occurring in India based on Borror *et al.* (1976).

VI. KEY TO SUBFAMILIES OF CICADELLIDAE OCCURRING IN INDIA

1. Entire body covered with hairs or scales, lateral margins of abdominal terga not covered by forewings. Forewing held flat, largely or partly overlapping; appendix wide, corrugated extending around apex as costal margin ... Hylicinae

——Body rarely covered by hairs, never by scales, if covered, hairs are short, very sparse; macropterous forms with entire abdomen covered by forewings which are usually gabled, appendix not as above ... 2

2. Forewings without cross-veins proximal to apical series; longitudinal veins indistinct basally; apex of hind basitarsus sharply pointed; small, slender, fragile leafhoppers ... Typhlocybinae

——Forewings with cross-veins proximal to apical series; longitudinal veins distinct at base; apex of hind basistarsus truncate ... 3

3. Ocelli on face, below fore margin of head; male valve and pygofer fused; genital plates narrow basally (in some Krisninae the ocelli appear to be on fore margin of head) ... 4

——Ocelli on crown or fore margin of head; valve usually more or less triangular, often articulated with pygofer, genital plates usually triangular ... 11

4. Lateral margin of pronotum moderately long, carinate; ledge or carina above antennal pit, transverse or nearly so ... 5

——Lateral margins of pronotum short and not carinate; ledge above antennal pit, if present oblique ... 6

5. Hind wing with submarginal vein extending to jugum; large robust leafhoppers	...	Krisninae
——Hind wing with submarginal vein not extending to jugum	...	7
6. Forewings with large appendix with overlapping apices; lateral facial sutures extending beyond antennal pits to or near ocelli	...	Idiocerinae
——Forewings without or with a very narrow appendix and not overlapping caudally, lateral facial sutures terminating at antennal pits	...	8
7. Male plates fused not concealed by eighth sternum; antennal pit shallow; placed nearer to anterior margin of eye	...	Acostemminae*
——Male plates separate, concealed by eighth sternum for the most part; antennal pit deep placed nearer to posterior margin of eye	...	Iassinae
8. Hindwings always present, with three closed apical cells, distance betwetn ocelli equal to or usually greater than twice the distance from ocellus to eye	...	Macropsinae
——Hindwings wherever present with four closed apical cells, distance between ocelli not over twice the distance from ocellus to eye	...	9
9. Face with carinate frontal sutures above antennal pits	...	Megopthalminae
——Face without such carinate	...	10
10. Pronotum extending foward beyond anterior margin of eye, very short, entirely black, heavily sclerotized leafhoppers	...	Nioniinae
——Not as above, may be black	...	Agalliinae
11. Crown narrow, little or no wider than eye in dorsal view; frontoclypeus narrow and parallel sided	...	Coelidiinae*
——Crown much broader than eye, clypeus usually wider above	...	12
12. Ocelli on crown, if submarginal, frontoclypeus not medially carinate	...	13
——Ocelli on margin anterior to eye, if submarginal, frontoclypeus with median carina	...	16

13. Lateral facial sutures extending over margin and well on to crown, almost reaching ocelli which are large and remote from eye; lateral margins of pronotum rounded with a weak keel, head not produced	...	Cicadellinae
——Lateral facial sutures not or briefly extending on to crown, head often produced forward and often laminate	...	14
14. Antennae very long, ocelli lateral in position, dorsal to marginal carina, pronotum with only traces of a longitudinal keel, flattened delicate forms	...	Nirvaninae*
——Antennae short, ocelli more central in position, lateral margin of pronotum widely and sharply keeled	...	15
15. Hind tibiae with short, fine widely spaced setae usually behind well developed serrations, genae below eyes sinuate, exposing pro-episterna; ocelli nearer to hind margin of head than to front margin; large elongate forms	...	Ledrinae
——Hind tibial spines normal, large and densely packed, pro-episterna concealed by genae, ocelli nearer to anterior margin of crown; forewing with large appendix	...	Penthimiinae*
16. Entire pro-episterna exposed, entire body with circular pits, forewings coriaceous; hind wings reduced or absent	...	Ulopinae
——Pro-episterna largely concealed; other characters variable	...	17
17. Ocelli in impressed, lateral areas, isolated both above and below by keels or ridges, frontoclypeus with a median carina	...	18
——Ocelli not in impressed areas, if with keels both above and below lateral areas not isolated	...	19
18. Pronotum extended backward to cover entire mesoscutum; head, pronotum and atleast basal $^1/_3$ of forewing heavily pitted	...	Signoretiinae
——Pronotum normal, exposing mesoscutum; head, pronotum and basal part of forewing not usually pitted	...	Evacanthinae*

19. Ocelli situated on a narrow marginal rim which separates the crown from the face of the head, antennal ledges prominent	...	20
——Not as above	...	21
20. Forewings overlapping apically with raised spots on the veins	...	Drabescinae*
——Forewings not overlapping, without raised spots on the veins	...	Selenocephalinae
21. Frontoclypeus extending laterally over base of antennae, thus forming a relatively deep inconspicuous antennal pit, small species with head rounded, eyes small, clypeus ovate, antennae near margin of eye	...	Xestocephalinae
——Frontoclypeus not extending laterally over base of antenna to form an antennal pit, species variable but not with above combination of characters	...	22
22. Submarginal vein extending around jugum and receiving 3A; large leafhoppers with pronotum extending forward to crown medially	...	Tartessinae
——Submarginal vein not extending around jugum; pronotum not as above	...	23
23. Ocello-ocular area with a distinct transverse ledge above antennal pit; face broad, relatively flat	...	Aphrodinae*
——Ocello-ocular area not produced into a distinct ledge or carina above antennal pit, face variable	...	24
24. Margin of gena below eye strongly sinuate or incised, dorsoventrally flattened, crown flat, strongly produced, anterior margin acute or foliaceous, lateral margins of pronotum carinate and usually as long as or longer than the short diameter of eye in dorsal view	...	Hecalinae*
——Margin of gena not incised or strongly sinuate, if sinuate or incised, head not produced and body not dorsoventrally flattened; lateral margins of pronotum not carinate or very feebly so	...	Deltocephalinae*

*indicates subfamilies treated in this work.

VII. LIST OF GENERA AND SPECIES INCLUDING CHECK LIST OF LEAFHOPPERS FROM KHASI HILLS (MEGHALAYA)

Family CICADELLIDAE Latreille, 1825

Subfamily 1 APHRODINAE Haupt, 1927

I Genus **Stroggylocephalus** Flor, 1861

Stroggylocephalus indicus Rao, 1989

II Genus **Gurawa** Distant, 1908

Gurawa vexillum Distant, 1908

Subfamily 2 EVACANTHINAE Crumb, 1911

III Genus **Evacanthus** Le Peletier and Serville, 1825

Evacanthus repexus (Distant), 1908

Evacanthus extremus (Walker), 1851

IV Genus **Onukia** Matsumura, 1912

Onukia connexia (Distant), 1918

V Genus **Dussana**, 1908

Dussana quaerenda Distant, 1908

Subfamily 3 CICADELLINAE Latreille, 1825

VI Genus **Atkinsoniella** Distant, 1908

***Atkinsoniella maculata* Distant, 1908

***Atkinsoniella gregalis* (Distant, 1908)

***Atkinsoniella sulphurata* (Distant, 1908)

VII Genus **Bothrogonia** Melichar, 1926

***Bothrogonia ferruginea* (Fabricius, 1787)

VIII Genus **Anatkina**

***Anatkina assamensis* (Distant, 1880)

Subfamily 4 NIRVANINAE Baker, 1923

IX Genus **Chudania** Distant, 1908

Chudania delecta Distant, 1908

X Genus **Nirvana** Kirkaldy, 1900

Nirvana shillongensis Rao, 1989

Nirvana pallida Melichar, 1903

Subfamily 5 IDIOCERINAE Baker, 1915

XI Genus **Idioscopus** Baker, 1915

***Idioscopus shillongensis* Viraktamath, 1976

Subfamily 6 COELIDIINAE Dohrn, 1859

XII Genus **Taharana** Nielson, 1982

Taharana khasiensis Rao, 1989

Subfamily 7 TASSINAE Amyot and Serville, 1843

XIII Genus **Trocandella** Pruthi, 1930

***Trocandella shillongensis* Pruthi, 1930

Subfamily 8 PENTHIMIINAE Kirschbaum, 1868

XIV Genus **Penthimia** Germar, 1821

Penthimia melanocephala Melichar, 1963

Subfamily 9 ACOSTEMMINAE Evans, 1972

XV Genus **Acostemma** Signoret,, 1860

Acostemma walkeri (Kirkaldy, 1901)

Subfamily 10 DRABESCINAE Ishihara, 1953

XVI Genus **Drabescus** Stål, 1870

Drabescus shillongensis Rao, 1989

Subfamily 11 HECALINAE Distant, 1908

XVII Genus **Hecalus** Stål, 1864

Hecalus porrectus (Walker, 1858)

Hecalus arcuatus (de Motschulsky, 1854)

XVIII Genus **Glossocratus** Fieber, 1866

Glossocratus sp.

Subfamily 12 DELTOCEPHALINAE Fiber, 1869

Tribe OPSIINI Emeljanov, 1962

XIX Genus **Hishimonus** Ishihara, 1953

Hishimonus sonapaharensis Rao, 1989

Tribe MACROSTELINI Kirkaldy, 1906

XX Genus **Macrosteles** Fieber, 1866

Macrosteles picturatus Rao, 1989

Macrosteles brevis Rao, 1989

XXI Genus **Balclutha** Kirkaldy, 1900

Balclutha versicolorides Ghauri, 1971

Balclutha saltuella (Kirschbaum), 1868

Tribe DELTOCEPHALINI Dallas, 1870

XXII Genus **Recilia** Edwards, 1866

Recilia dorsalis (de Motschulsky, 1859)

Recilia prabha (Pruthi, 1930)

Recilia indica Rao, 1989

Recilia maculata (Pruthi, 1930)

Recilia intermedia (Melichar, 1903)

XXIII Genus **Paramesodes** Ishihara, 1952

Paramesodes montanus Rao, 1989

Tribe DORATURINI Ribaut, 1952

XXIV Genus **Aconurella** Ribaut, 1948

***Aconurella montana* (Distant, 1908)

Aconurella solona Ghauri, 1978

Tribe FIEBERIELLINI Wagner 1951

XXV Genus **Phlogotettix** Ribaut, 1942

Phlogotettix indicus Rao, 1989

Tribe STIRELLINI Emeljanov, 1966

XXVI Genus **Doratulina** Melichar, 1903

Doratulina jacosa Melichar, 1903

Doratulina indra (Distant, 1908)

Doratulina rubrolineata (Distant, 1908)

Doratulina solitaris (Melichar, 1903)

Tribe SCAPHOIDEINI Oman, 1943

XXVII Genus **Scaphoideus** Uhler, 1889

Scaphoideus assamensis Distant, 1918

Scaphoideus coloratus Rao, 1989

Tribe EUSCELINI Naude, 1926

XXVIII Genus **Exitianus** Ball, 1929

Exitianus indicus (Distant, 1908)

Exitianus coronotus (Distant, 1918)

XXIX Genus **Nephotettix** Matsumura, 1902

Nephotettix nigropictus (Stål, 1870)

Nephotettix virescens (Distant, 1908)

Nephotettix malayanus Ishihara & Kawase, 1968

XXX Genus **Cicadula** Zetterstedt, 1840

Cicadula compressa Rao, 1989

Tribe JASSARGINI Emeljanov, 1962

XXXI Genus **Khasiana** Rao, 1989

Khasiana prima Rao, 1989

VIII. SYSTEMATIC TREATMENT OF TAXA

1. Subfamily : APHRODINAE

The subfamily Aphrodinae includes small, usually brownish to yellow leafhoppers. Ocelli situated on the margins of vertex. Antennal pits shallow. Frontoclypeus large and well developed. Lateral facial sutures

**Species not represented in the present work.

distinct. Aedeagus symmetrical. The tribe Aphrodini includes leafhoppers which are flattened and exhibit brown to yellow colour markings. They have complete ventation and often resemble some members of Ledrinae.

Pruthi (1930) synonymised *Kartwa* with *Chiasmus* Mulsant and Ray. Sawai Singh (1969) added two more species to the genus *Chiasmus* from Himachal Pradesh.

Evans (1947) included the genera *Gurawa* and *Stroggylocephalus* Flor under the tribe Aphrodini which arrangement is followed here.

The Aphrodini are reported from all the principal geographical regions and are known to feed on grasses.

Out of the seven genera known from India *viz.*, *Baileyus* Pruthi, *Stroggylocephalus* Flor, *Chaismus* Mulsant & Roy, *Gurawa* Distant, *Postumus* Distant, *Leofa* Distant and *Prasutagus* Distant, only *Stroggylocephalus* and *Gurawa* are dealt here. The genus *Stroggylocephalus* has been recorded for the first time from the Oriental region in this study.

Key to the genera included in this study

1. Pronotum twice the length of vertex; pygofers with pincer-like process; aedeagus with a pair of pre-apical process ... *Stroggylocephalus* Flor

——Pronotum as long as or shorter than vertex; pygofer without a pincer-like process; aedeagus simple ... *Gurawa* Pruthi

Genus **Stroggylocephalus** Flor, 1861

Stroggylocephalus Flor, 1861, *Arch. Naturk. Liv. Est.-u.* Kurlands, **4**(2) : 357.
Type species : *Stroggylocephalus agrestis* Fallén

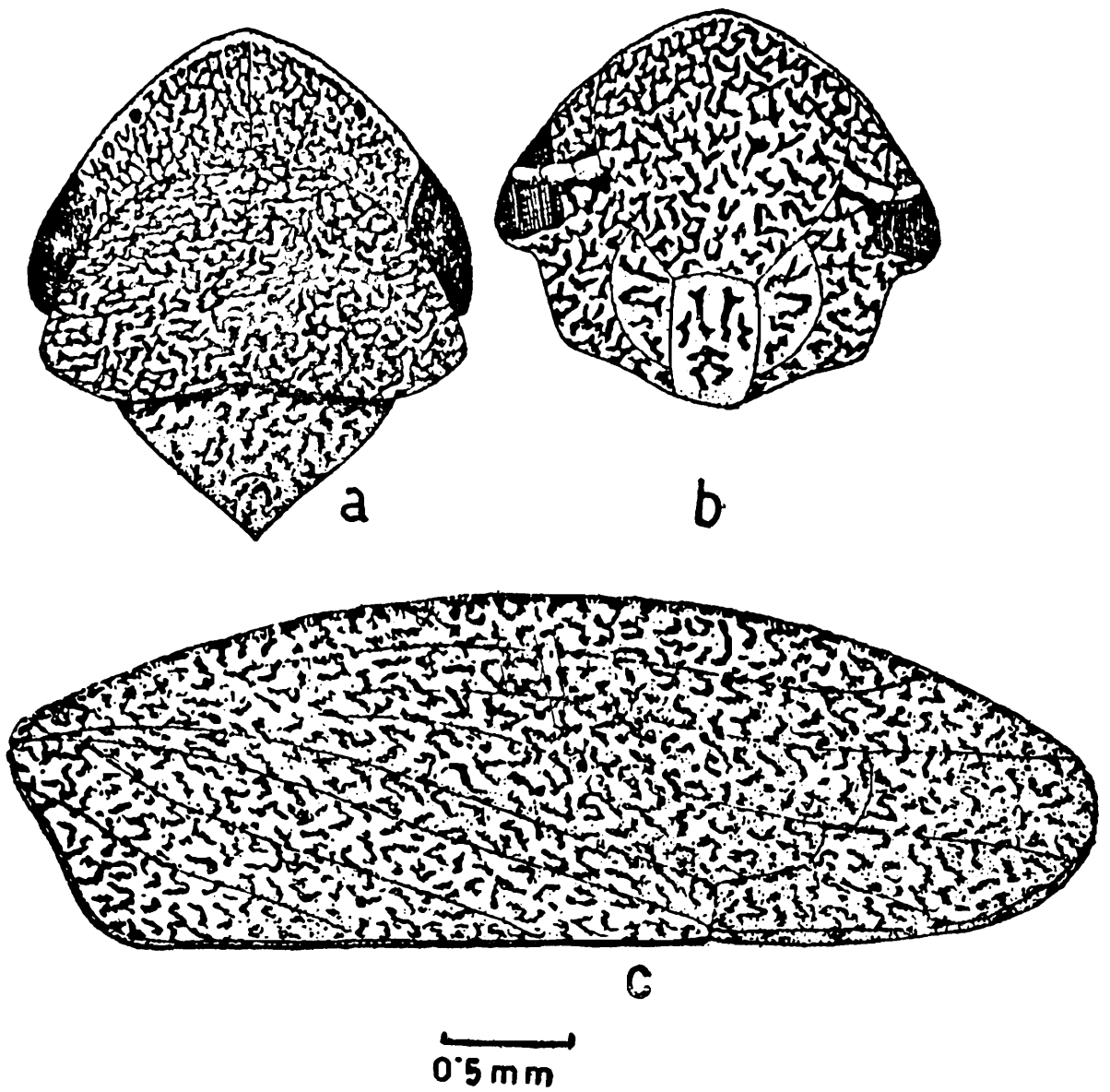
Stroggylocephalus indicus Rao

(Text fig. 3, a-c)

Stroggylocephalus indicus Rao, 1989, *Hexapoda*, **1** (1) : 59, fig. 1-7.

Diagnosis : Vertex, pronotum and scutellum molted all over with with irregular markings. Fore wings with four apical cells and with brown markings all over. Aedeagus with pre-apical process reaching the middle of shaft. Male 6.65 mm long and 1.98 mm wide.

Distribution : Balat, Khasi Hills, Meghalaya.



Text fig 3. *Stroggylocephalus indicus* Rao a-Head and thorax. .dorsal view; b-Face ventral view; c-Fore wing. .dorsal view

Genus **Gurawa** Distant, 1908

Gurawa Distant, 1908, *Fauna Brit. India*, Rhynchota, **4** : 262. Type species : *Gurawa vexillum* Distant.

Gurawa : Pruthi, 1930, 1934, *Mem. Indian Mus.* **11** (1) & (2) : 29 & 76; Evans, 1947, *Trans. R. Ent. Soc. Lond.*, **98** : 149; Hamilton, 1975, *Can. Ent.*, **107** : 1009.

Diagnosis : Vertex sub-triangular, broad and depressed; ocelli on lateral margins. Face long, narrow, transversely impressed at base, and more than

twice as long as clypellus. Pronotum shorter than vertex. Scutellum medially depressed, apex acute. Posterior tibia thickly spinulose. Fore wing broad, surpassing abdominal apex with five apical and three ante-apical cells ; claval veins curved.

Four species are so far knows under this genus. One of them is reported from Flores and out of the remaining three present is India, only one species *G. vexillum* Distant is represented in the collection.

Gurawa vexillum Distant

Gurawa vexillum Distant, 1908, *Fauna Brit. India*, Rhynchota, **4** : 263 ; Pruthi, 1934, *Mem. Indian Mus.*, **11** (2) : 77 ; Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 149.

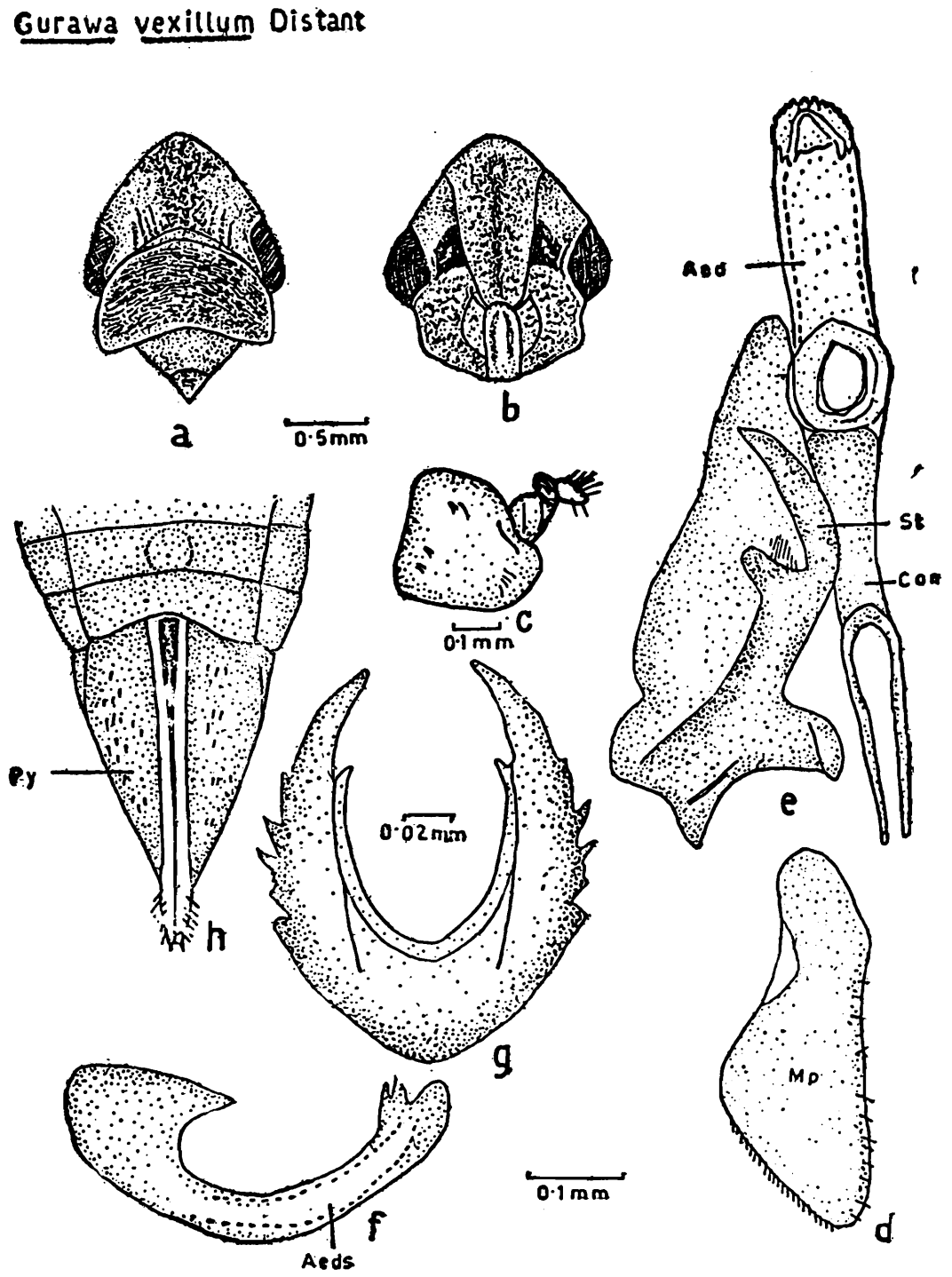
Dull ochraceous. Vertex subacute, foliaceous into a broad median longitudinal black stripe and a pair of black dots near base, (dots sometimes obsolete) ; ocelli on lateral margins midway between eye and apex. Face greyish, longer than broad with irregular, small, black spots ; clypeus long, narrow with a shallow depression at base and apex ; clypellus rectangular ; lora not reaching apex. Pronotum shorter than vertex, with transverse black fasciae on anterior margin. Scutellum with a black spot near each basal angle, sometimes obsolete. Forewing with five apical and three ante-apical cells.

Male genitalia : Pygofer almost triangular with a cleft at the anterior end which is broadened at the caudal end. Male plate narrow at the base and broadened at the caudal end with minute setae at the lateral margins. Style long, narrow, broad at base and curved laterally at apex ; pre-apical process blunt with minute setae. Connective U-shaped. Aedeagus strongly curved with a pair of short and pointed apical hooks with lateral margins deeply serrated.

Female genitalia : Pygofers long with minute setae ; hind margins of seventh sternum concave ; ovipositor stout, projecting beyond the posterior extremity of abdomen.

Measurements : Male 3.9 to 3.90 mm long and 1.15 to 1.37 wide ; female 3.63 mm long and 1.15 mm wide.

Specimens examined: India : Meghalaya : Shillong, 2 ♂♂, 9.ix. 1975, M. S. Jyrwa, Coll.; Cherrapunji, 1 ♀ , 15.i.1978, K. R. Rao, Coll.



Text fig. 4. *Gurawa vexillum* Distant a-Head and thorax. .dorsal view; b-Face. ventral view; c-Pygofer. .dorsal view; d-Male plate. ventral view; e-Aedeagus, Connective, Style and Plate. .dorsal view; f-Aedeagus... lateral view; g-Apex of aedeagus. .dorsal view; h-Fefale genitalia... ventral view

Distribution : This is reported from Eastern Himalayas and South India.

Remarks : This species resembles *Gurawa minorcephala* Pruthi from which it can be distinguished by the shorter pronotum and the serrated process of the aedeagus.

2. Subfamily : EVACANTHINAE

Robust leafhoppers, black or brown suffused with yellow, their size measuring from 4.5 mm to 9 mm. Frontoclypeus with a distinct median carina. Ocelli situated near the anterior margin of vertex, at times in depressions. Pronotum with lateral margins either parallel or converging anteriorly. Hind femoral spinulation 2+1+1 in most of the species. Pygofers large and usually with processes. Style short.

Evacanthinae are distributed in the Oriental and Holarctic regions. Usually cylindrical, in shape and resembling Cicadellinae.

The following genera are known from India : *Evacanthus* Le Peletier and Serville, *Bundera* Distant, *Mainda* Distant, *Cunedda* Distant, *Dussana* Distant, *Onukia* Matsumura (=*Apphia* Distant).

Four species belonging to three genera, *viz.*, *Evacanthus*, *Dussana* and *Onukia* are represented in the present collections.

Key to the genera of Evacanthinae of Khasi Hills

1.	Median carina of vertex raised, vertex about 1.5 times as long as wide between eyes ...	*Dussana* Distant
——	Median carina of vertex not raised. Vertex either as long as or shorter than width between eyes ...	2
2.	Male pygorer without a ventral process; disc or vertex longitudinally rugose; clypeus lateroanteriorly strongly convex; hind femoral spinulation 2+1+ 1 ...	*Onukia* Matsumura
——	Male pygofer with a ventral process; disc of vertex smooth, not rugose; clypeus rather flat; hind femoral spinulation 2+0+0 ...	*Evacanthus* Le Peletier and Serville

Genus **Evacanthus** Le Peletier & Serville, 1825

Evacanthus Le Peletier and Serville, 1825, *Encycl. Method.*, **10** : 612. Type species : *Cicada interrupta* Linnaeus.

Euacanthus : Burmeister, 1835, *Handb. Ent.* **2** : 116 (invalid emendation of *Evacanthus* Le Peletier & Serville) ; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 227.

Evacanthus : Van Duzee, 1917, *Tech Bull. Calif. agric. Exp. Sm. ent.*, **2** : 607 (=*Eucanthus Burn.* 1835 ; =*Eucanthus* (Sic) van Duzee, 1894 ; =*Evacantha* provancher, 1889) ; Ribaut, 1952, *Faune Fr.*, **57** : 350; Ishihara, 1979, *Trans. shikoku. ent. Soc.*, **14** : 99.

Oman (1949) has provided a detailed description of the genus.

Key to the Indian species of Evacanthus

Le Poletier & Serville

1. Face black	...	2
——Face ochraceous, sometimes a black spot on upper part of the face	...	3
2. Pronotum black with extreme lateral and posterior margins ochraceous; shaft of aedeagus longer than the lamellate process on dorsal apodeme	...	*repexus* Distant
——Pronotum with anterior half black and posterior half ochraceous	...	*bellus* Distant
3. Pronotum black, basal margins broadly testaceous, the apex of face with a minute black spot	...	*militaris* Distant
——Pronotum ochraceous, with a broad central fascia and two black spots which sometimes occupy the whole of the lateral areas; shaft of the aedeagus as long as the laminate procss of dorsal apodeme	...	*extremus* Distant

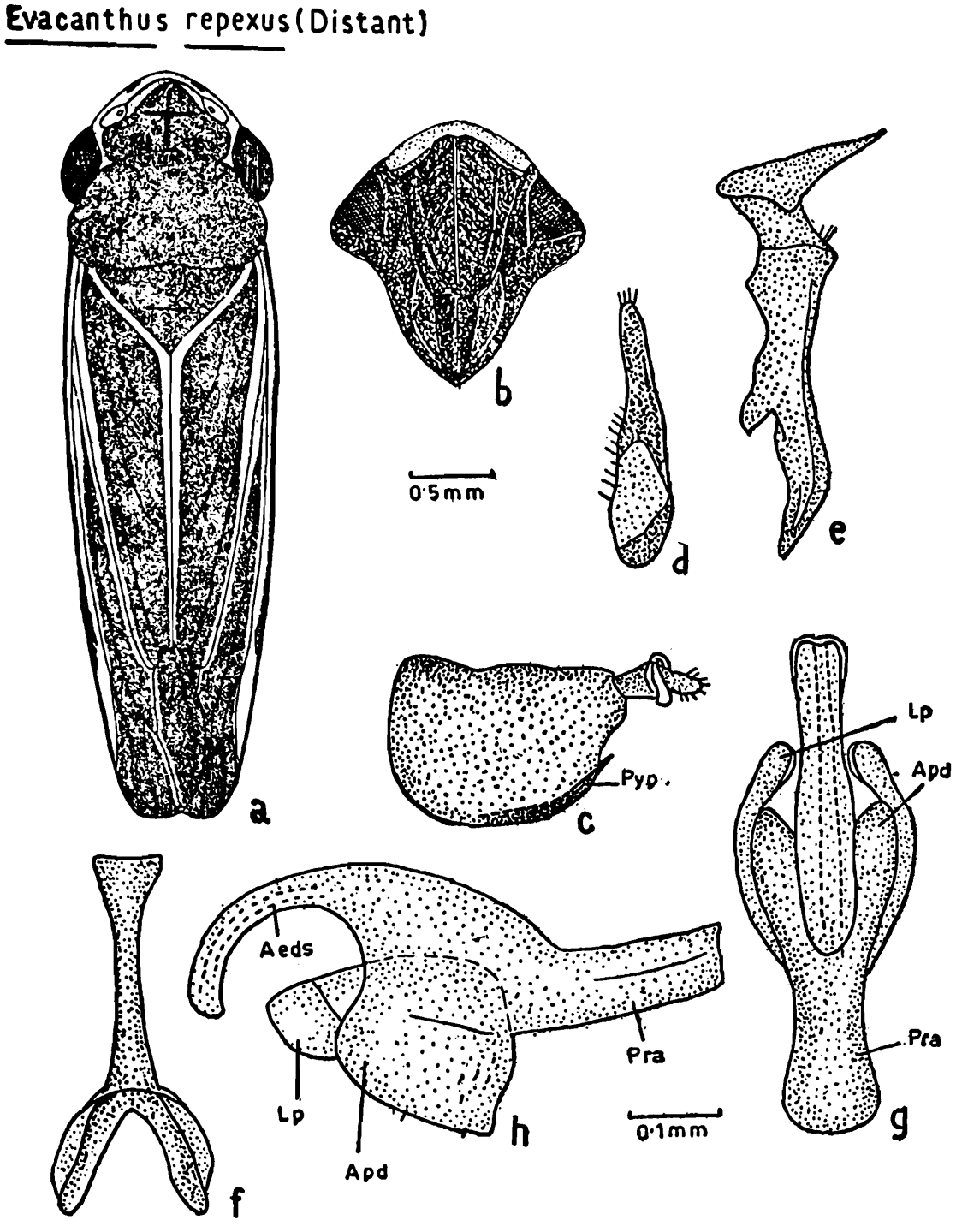
Evacanthus repexus (Distant)

(Text fig. 5, a-h)

Euacanthus repexus Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 228 ; 1918, *Ibid.* **7** : 11 ; Mathur, 1953, *Hemiptera, Indian Forest Leaft.*, **121** (3) : 167; Datta, 1973, *Zool. Anz.*, **190** (3/4) : 215.

Evacanthus repexus : Metcalf, 1963, *Evacanthidae*, General *Catalogue of the Homoptera*, **6** (6) : 43 ; Ishihara, 1979, *Trans. Shikoku, ent. Soc.*, **14** : 99.

Vertex wholly piceous with anterior and posterior margins ochraceous, an elevated spot sometimes present on either side of median carina. Face



Text fig. 5. *Evacanthus repexus* (Distant) a-Habitus...dorsal; b-Face...ventral view; c-Pygofer...lateral view; d-Male plate...ventral view; e-Style...dorsal view; f-Connective...dorsal view; g-Aedeagus...dorsal view; h-Aedeagus ...lateral view

black, frontoclypeus carinate. Pronotum black and finely transversely striate, the lateral and posterior margins normally ochraceous. Scutellum black;

pronotum and scutellum finely pubescent. Forewing piceous, the costal, inner, and claval margins ochraceous, apical cells four in number and appendix well developed.

Male genitalia : Pygofers with a ventral process not reaching the apex of posterior margin. Male plate long, narrow and with concentration of setae on lateral and apical margins. Style long apophyses foot-like Connective Y-shaped. Aedeagus with a well developed dorsal apodeme, pre-atrium long and cylindrical, lamellate process of dorsal apodeme not reaching shaft of aedeagus, shaft curved and simple.

Female genitalia : Pygofer long; seventh sternum concave at the posterior margin, ovipositor long, narrow, projecting beyond posterior margin of abdomen.

Measurements : Male 5.11 to 5.5 mm long and 1.32 to 1.48 mm wide. Female 5.61 to 6.87 mm long and 1.48 to 1.70 mm wide.

Specimens examined : India : Meghalaya : Shillong, 1 ♂, 24.xi.1977, K. R. Rao, Coll.; 1 ♀, 25.xi.1977, K. R. Rao, Coll.; 2 ♂♂, 2 ♀♀ Mawsynram, 5.xii.1977, K. R. Rao, Coll.; 2 ♀♀, Mawsynram, 8.xii.1977, K. R. Rao, Coll.

Distribution : Northern India.

Remarks : In the male genitalia figured by Datta (1973), the pygofer process is shown as arising from the lateral side, while it actually arises from the ventral side.

This species resembles *E. bellus* Distant in having black face but differs in having the pronotum entirely black.

Evacanthus extremus (Walker)

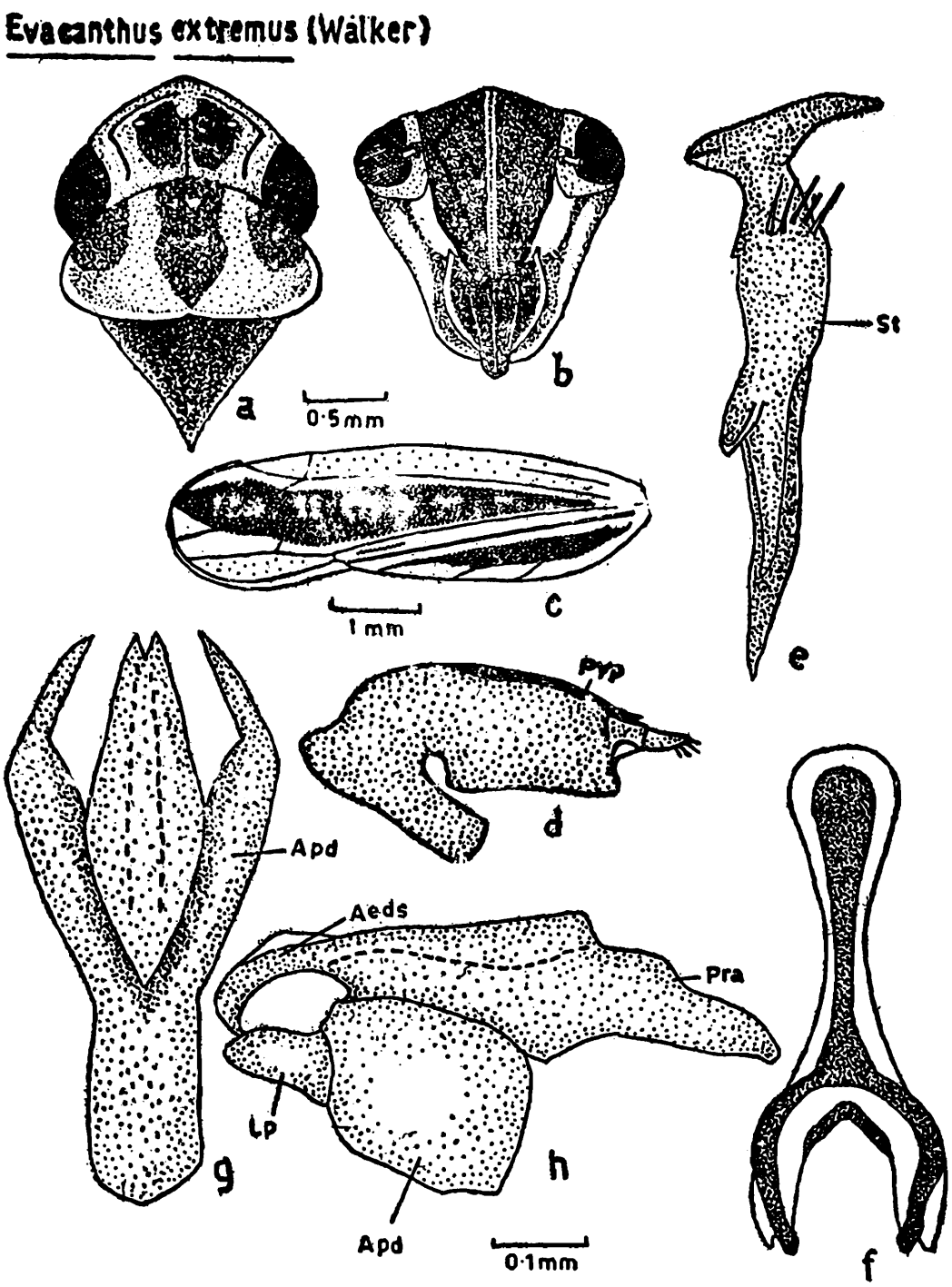
(Text fig. 6, a–h)

Tettigonia extremus Walker, 1851, *List Hom. ins. Br. Mus.*, **3** : 76.

Euacanthus extremus (*Walker*) : Distant, 1908, *Fauna Br. India, Rhynchota*, **4** : 227.

Evacanthus extremus : *Metcalf*, 1963, *Evacanthidae, General Catalogue of the Homoptera*, **6**(6) : 25.

Ochraceous. Vertex with a large black fascia on the disc, lateral and basal areas ochraceous, carinate medially and foveate on either side of carination. Face ochraceous, lorae narrow. Pronotum with a broad central



Text fig. 6. *Evacanthus extremus* (Walker) a-Head and thorax...dorsal view; b-Face ...ventral view; c-Forewing...dorsal view; d-Pygofer...lateral view; e-Style...dorsal view; f-Connective...dorsal view; g-Aedeagus...dorsal view; h-Aedeagus...lateral view

fascia and two black spots which sometimes occupy whole of lateral surface. Scutellum black. Tegmina with four apical cells and well developed appendix.

Male genitalia : Pygofer with ventral process extending beyond posterior margin. Style long, with a blunt preapical process on the lateral side. Connective Y-shaped, the arms widely separated. Aedeagus long, with well developed dorsal apodeme and preatrium, shaft curved, ending in two points; laminate process of dorsal apodeme as long as the shaft.

Measurements : Male 5.99 mm long and 1.43mm wide across eyes.

Specimens examined : India : Meghalaya : Shillong 1 ♂, 3.xi.1977, K. R. Rao, Coll.

Distribution : Distributed in Northern India and Fukien (China).

Remarks : *E. extremus* resembles *E. militaris* in general appearance especially the face being ochraceous, but differs from it and other species of *Evacanthus* in having a black lateral spots on pronotum. Laminate process of the dorsal apodeme in *E. extremus* is as long as the shaft.

Genus **Onukia** Matsumura, 1912

Onukia Matsumura, 1912, *Annot. Zool. Jap.*, **44**; Type species : *Onukia anukii Matsumura.*

Onukia connexia (Distant)

(Text fig. 7, a-c)

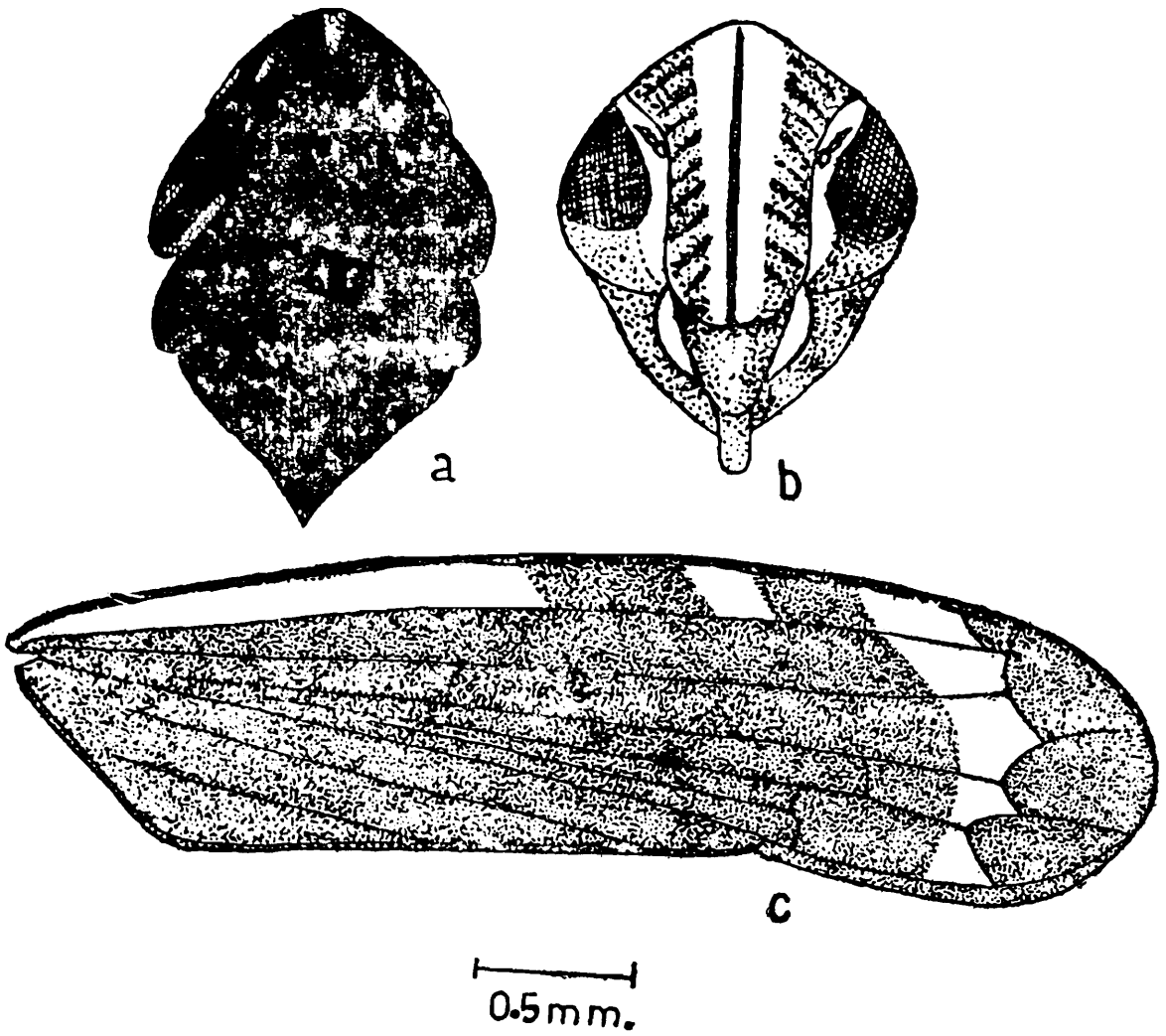
Platyretus connexus Distant, 1918, *Fauna Br. India*, Rhynchota, **7** : 37.
Onukia connexia : Rao, 1989, *Hexapoda*, **1** (1) : 60, fig. 8-13.

Diagnosis : Dark piceous species Frontoclypeus latero-anteriorly convex medially carinate. Male plate broad with numerous macrosetae towards mesial side. Connective Y-shaped with spatulate arms; aedeagus with two pairs of subapical processes. The species *connexia* has been combined with *Onukia* because of conical vertex, convex nature of frontoclypeus and aedeagal processes.

Male 5.17 mm long and 1.15 mm wide.

Distribution : Eastern Himalayas; Bengal (Metcalf, 1967).

Onunkia connexia (Distant)



Text fig. 7. *Onukia connexia* (Distant) a-Head and thorax...dorsal view; b-Face... ventral view; c-Forewing...dorsal view

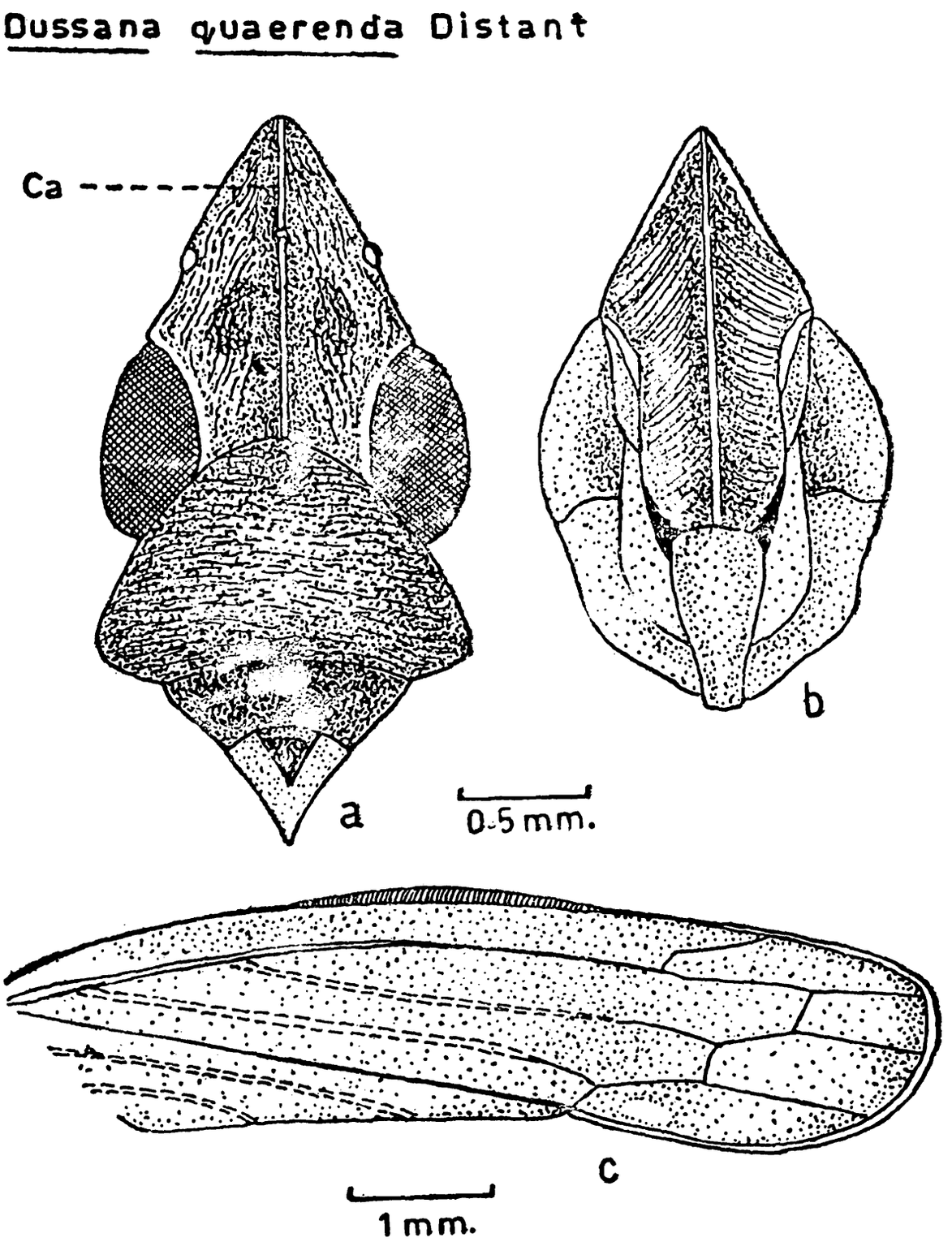
Genus **Dussana** Distant, 1908

Dussana Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 322. Type species : *Dussana quaerenda* Distant; Pruthi, 1934, *Mem. Indian Mus.*, **11** (2) : 85; Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 154.

Diagnosis : Vertex subtriangular, median carina lamellately raised, ocelli below the margins anteriorly and closer to eyes than to apex. Genae sinuate, frontoclypeus much longer than clypellus. Forewing extending beyond the apex of abdomen. Posterior tibiae finely spinulose.

Dussana quaerenda Distant

(Text fig. 8, a-c)



Text fig. 8. Dussana *quaerenda* Distant a-Head and thorax...dorsal view; b-Face... ventral view; c-Forewing...dorsal view

Vertex subtriangular, medially carinate apex a little reflexed upwards and moderately foveate on either side of carination. Ocelli below lateral ridged margins and situated closer to eyes than to apex. Face longer than broad, piceous with oblique rows of furrows; frontoclypeus more than three times median length of clypellus, lora long, narrow, not reaching apex of clypellus; genae sinuate; face finely punctuate. Pronotum piceous, narrowed anteriorly and broadened posteriorly. Scutellum triangular, basally piceous, and ochraceous at apex. Eyes fuscous brown. Hind femoral spinulation, 2+1+1. Fore wing dark brown, costal margin pale ochraceous and disc minutely punctate; apical cells four in number.

Measurements : Female 7.11 mm long 1.37 mm wide.

Specimens examined : India : Meghalaya : Ranikor 1 ♀ , 9.xiii.1977, K. R. Rao, Coll.

Host : Collected from vegetation having *Gnophatum butea alb.* Lin.

Distribution : This species is so far known from Sri Lanka and Southern India only.

Remarks : Apart from the present species Genus *Dussana* has only one more species which occurs in Fukien (China). It is *Dussana sinensis Jacobi*, 1944.

3. Subfamily : NIRVANINAE

Nirvaninae are flattened leafhoppers ranging from 6 to 9 mm in size. They are of yellow, white or orange colours, sometimes with red or dark markings. They have long antennae and the ledges are usually prominent. The ocelli are situated on the crown of the head. Tegminal venation obscure, some like *Omaranus* Distant, exhibit sexual dimorphism.

The subfamily is distributed throughout the Oriental Region, Afrotropical, Australian and Neptropical areas. Wesley (1980) reviewed the Nirvaninae of the Indian sub-continent.

The following genera are known from India : *Balbillus* Distant, *Kana* Distant, *Nirvana* Kirkaldy, *Mohunia* Distant, *Omaranus* Distant, *Ophiuchus* Distant, *Chudania* Distant and *Sophonia* Walker. Out of these only two genera, *Chudania* and *Nirvana* are represented in the material under study. Viraktamath and Wesley (1989) revised Indian Nirvaninae.

Key to the genera occurring in Khasi Hills

1. Predominantly black; dorsal apodeme of aedeagus poorly developed, aedeagus with a pair of comb-like processes ... *Chudania* Distant

——Predominantly yellow or stramineous; dorsal apodeme of aedeagus well developed; with processes not comb-like ... *Nirvana* Kirkaldy

Chudania and *Nirvana* have venation very similar to that of Typhlocybinae. They differ from Typhlocybinae in having dorsoventrally flattened bodies, ocelli on disc of vertex near margin of compound eyes and a blunt hind basitarsus.

Genus **Chudania** Distant, 1908

Chudania Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 268. Type species : *Chudania delecta* Distant; Pruthi, 1934, *Mem. Indian Mus.*, **11** (2) : 78; Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 177.

Diagnosis : Vertex about as long as wide between eyes; ocelli situated sublaterally in front of eyes which project behind the anterior margins of pronotum. Face centrally carinate on basal half, and somewhat globose. Pronotum convex at the anterior margin and concavely sinuate at the posterior margin. Forewing broad, extending beyond the apex of abdomen. Posterior tibiae thickly and finely spinulose. Male pygofors sclerotised; connective Y-shaped, aedeagus with a pair of comb-like processes laterally.

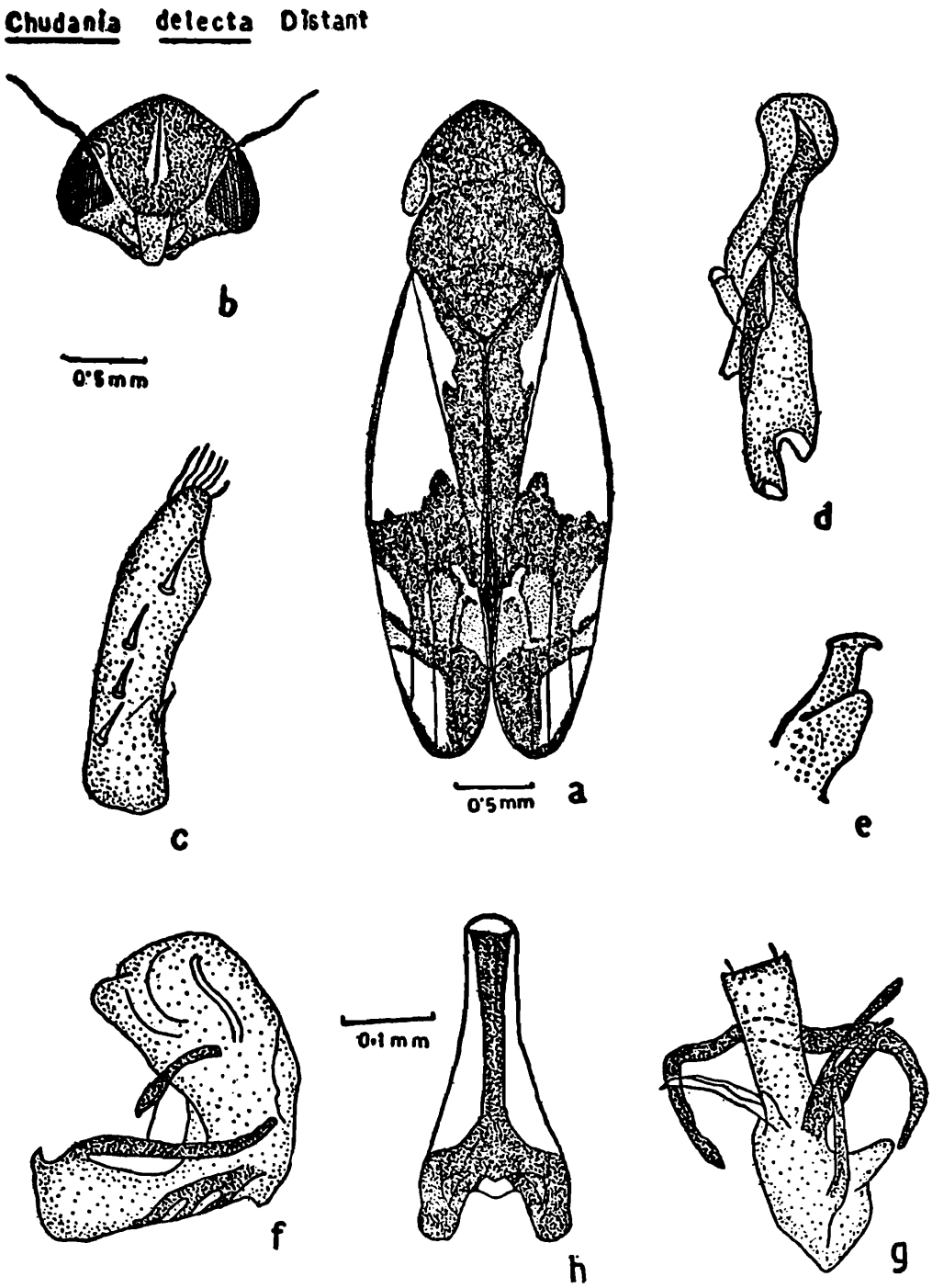
Chudania is represented by three species, one each from India, Africa and Fukien. *Chudania delecta* Dist. is reported here. Other species are *C. exposita* (Fukien, China), *C. africana* Heller (Cameroon, Africa).

Chudania delecta Distant

(Text fig. 9, a-h)

Chudania delecta Distant, 1908, *Fauna Br. India, Rhynchota*, **4** : 268; 1918, *Ibid.*, **7** : 29; Pruthi, 1934, *Mem. Indian, Mus.*, **11** (2) : 78; Jacobi, 1944, *Munchen Ent. Geselt. Mitt.*, **34** : 52; Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 17.

Diagnosis : Predominantly blackish; head, pronotum and scutellum completely black. Vertex about as long as wide between eyes; margins slightly reflexed. Ocelli sublateral, situated close to eyes. Eyes and ocelli castaneous. Face with its basal half black and finely punctate; clypellus, lora and genae ochraceous; basal half of frontoclypeus medially carinate; lora long, not reaching the apex of clypellus. Forewing marked with black, as in figure. Legs yellow; hind femoral spinulation 2+1+1.



Text fig. 9. *Chudania delecta* Distant a-Habitus...dorsal view; b-Face...ventral view; c-Male plate...ventral view; d-Style...dorsal view; e-Style apex...dorsal view; f-Aedeagus...lateral view; g-Aedeagus...dorsal view; h-Connective...dorsal view

Male genitalia : Pygofer rounded and highly sclerotised with a ventral club-like process. Tenth segment long and sclerotised. Male plate with an oblique row and numerous marginal hair-like setae. Style spanner-shapped

with a long base. Connective Y-shaped with a long stem. Aedeagus strongly bent at the middle, basal half sclerotised, the apical half membraneous and divided caudally; a pair of antero-dorsally directed long processes arise from point, where aedeagus articulates ventrally with the connective; a pair of three to four digitate processes arise laterally at the point where the shaft is bent and another pair of simple ventrally directed processes at about the mid-ventral point of the membraneous part of the aedeagus.

Measurements : Male 5.55 mm long and 1.2 mm wide.

Specimens examined : India : Meghalaya : Mairang 1 ♂, 2.xii.1977, K. R. Rao, Coll.

Host : Collected by sweeping on plants having *Fragaria nilgiriensis* Schl.

Remarks : *Chudania delecta* is known from Kurseong and Bengal. It is also reported from Fukien by Jacobi (1944).

Genus **Nirvana** Kirkaldy, 1900

Nirvana Kirkaldy, 1900, Entomologist, **33** : 292; Type species : *Nirvana pseudommatos* Kirkaldy; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 281; 1918, *Ibid.*, **7** : 33; Pruthi, 1934, *Indian Forest Rec. ent. ser.*, **19** (4) : 17; Evans, 1947, *Trans. R. ent. Soc.* **98** : 177; Ishihara, 1953, *Matsuyama agr. Coll. Sci. Rep.*, **11** : 19.

Diagnosis : Yellowish white or pale ochraceous, vertex nearly twice as long as pronotum; apex subangular. Ocelli situated on lateral margins of vertex, closer to the eyes. Antennae simple, long. Frontoclypeus slightly concave. Scutellum about as long as pronotum. Tegmina with veins evanescent except for apical ones.

At present 10 species of *Nirvana* are known from the world. They are *N. adelaideae* Evans, *N. babai* Ishihara, *N. insignis* Distant, *N. koreana* Matsumura, *N. orientalis* Matsumura, *N. pallida* Melichar, *N. philippinensis* Baker, *N. placida* Stål, *N. pseudommatos* Kirkaldy and *N. suturalis* Melichar.

Two species are reported from Khasi Hills *viz.*, *Nirvana pallida* Melichar and *Nirvana shillongensis* Rao.

Key to the species of Nirvana from Khasi Hills

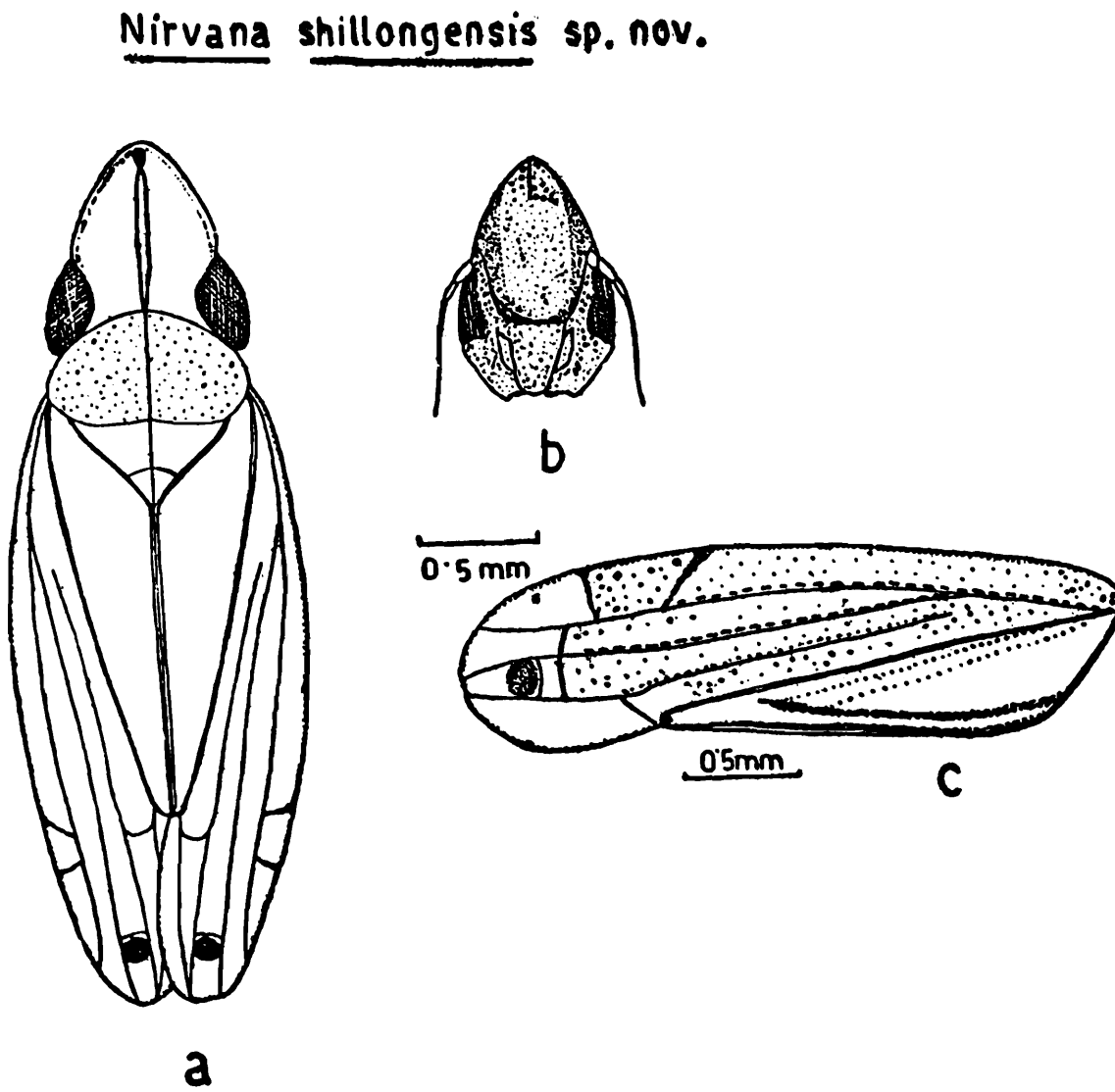
1. Vertex with a black spot, from which two longitudinal lines arise and unite at the base of vertex, ventral process of pygofer curved dorsally; aedeagus with a pair of subapical caudally directed divergent processes ... *Nirvana shillongensis* Rao

——Vertex without black spot, but with a median white line from base to tip ... *pallida* Melichar

Nirvana shillongensis Rao

(Text fig. 10, a-c)

Nirvana shillongensis Rao, 1989, *Hexapoda*, 1 (1) : 62, fig. 14-19.



Text fig. 10. *Nirvana shillongensis* Rao a-Habitus...dorsal view ; b-Face...ventral view ; c-Forewing...dorsal view

Diagnosis : Vertex long more than than one and half a times the median length of prosotum ; dorsal apodeme, aedeagus with short spines, shaft curved anteriorly,, ventral process of pygofer accuminate.

Male 4.08 mm long and 0.92 mm wide.

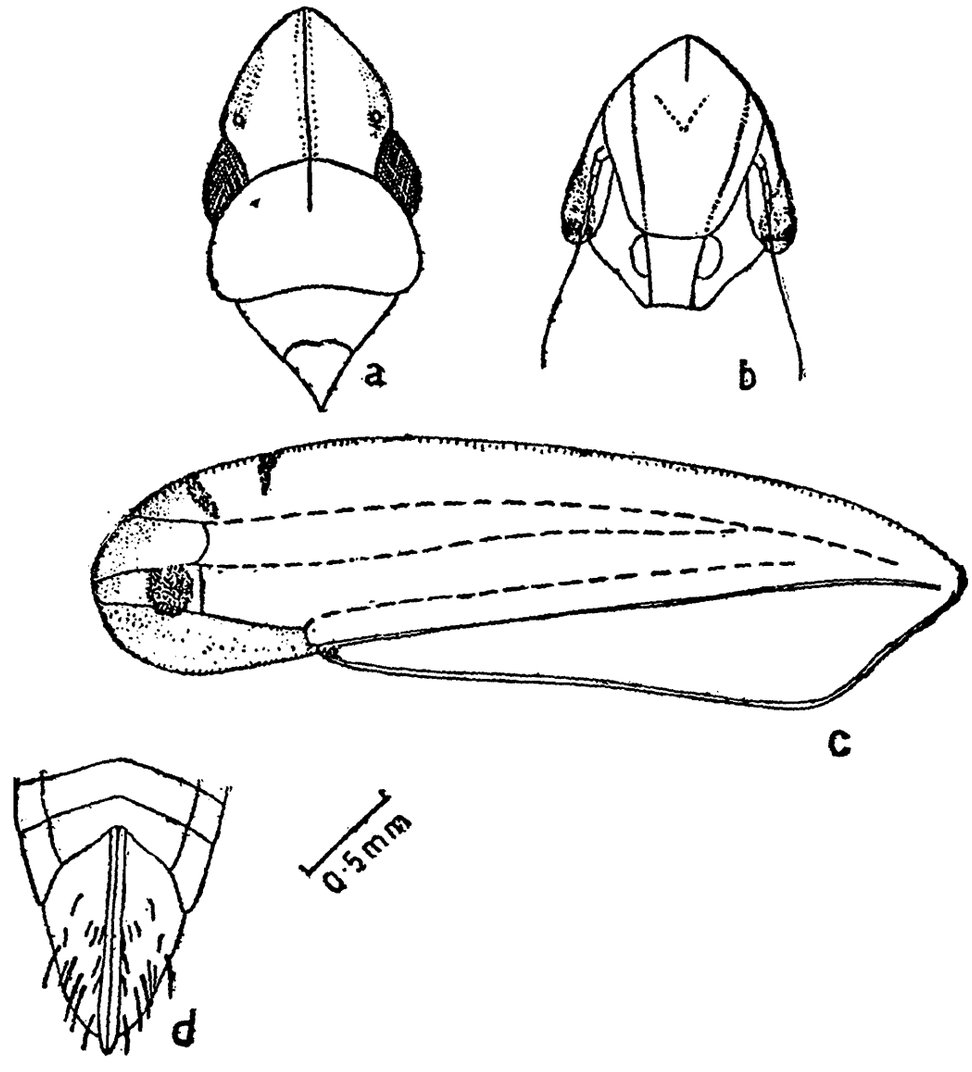
Distribution : Moirang, Meghalaya.

Nirvana pallida Melichar

(Text fig. 11, a-d)

Nirvana pallida Melichar, 1903, *Homopteren Fauna Von Ceylon*, 166 ; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 284; Pruthi, 1934, *Indian Forest Rec. ent. ser.*, **19** (4) : 17; Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 176; Ishihara, 1953, *Matsuyama agric. Coll. Sci. Rpt.*, **11** : 19; Mathur, 1953, *Hemiptera, Indian Forest Leaft.*, **121** (3) : 164.

Nirvana pallida Melichar



Text fig. 11. *Nirvanna pállida* Melichar a-Head and thorax...dorsal view; b-Face... ventral view; c-Forewing...dorsal view; d-Female genitalia...ventral view

Vertex pale ochraceous, less than twice as long as length of pronotum; a pale white line running from its apex to the base. In some, it extends to the pronotum medially upto one-third of its length. An orange yellow streak present on each lateral side of vertex. Face pale ochraceous, frontoclypeus with faint transverse striations, medially carinate from basal one-third, thrice the length of clypellus medially. Pronotum with a distinct well impressed oblique line in anterior margin. Scutellum whitish. Forewing with a brownish dot in median apical cell, two large marginal oblique brownish stripes on the costal margin beyond middle. Abdomen pale ochraceous beneath.

Female genitalia : Pygofers long and convex; hind margins of seventh sternum concave.

Measurements : Female 4.12 to 5.4 mm long and 0.88 to 1 mm wide.

Specimens examined : India : Meghalaya : Sonapahar, 4 ♀♀, 20.xi. 1977, K. R. Rao, Coll.

Distribution : This is well distributed in the Oriental Region especially in the Indo-Malayan and Indo-China Regions. In India, it is known from Calcutta. Box (1953) reported it also from Madras.

Remarks : This species superficially resembles *kana decora* Melichar in having yellowish longitudinal stripes along the lateral sides of vertex, but can be distinguished by the distinct longitudinal vein on fore wing and by the bright yellow stripes on it. In the case of *decora*, the longitudinal veins are obscure and the stripes on the hind wing are brownish.

4. Subfamily : COELIDIINAE

Leafhoppers ranging from 5 to 9 mm in length usually brownish or blackish. Head always narrower than pronotum; frontoclypeus long, narrow and parallel-sided; lateral facial sutures extending to ocelli; genae very broad, completely covering the episternum and meeting clypellus as a broad plate; fore wings usually broad apically, costal margins of wings expanded basally in macropterous forms, appendix well developed.

Coelidiinae is well represented in all the principal geographical regions of the world, and particularly abundant in the Oriental and Neotropical Regions.

Nielson while revising the subfamily, Coelidiinae of the World, included nine tribes namely, Tinobregmini, Sandersellini, Tharrini, Teruliini, Hikagriini, Youngolidini, Gabitini, and Coelidiini in it. He synonymised several genera of Distant with the genus *Thagria* and also transferred several Indian species of *Jassus* into *Thagria*.

The following genera are reported from India : *Thagria* (Synonyms : *Sabima* Distant, *Dharmma* (Distant), *Guliga* Distant, *Mukwana* Distant and *Soortana* (Distant), *Placidius* Distant, *Coelidia* Germar, *Aeternus* Distant, *Taharana* Nielson.

A single genus viz., *Taharana* Nielson occurs in Khasi Hills. Primarily being an Oriental genus and well distributed in South East Asia, it is being reported from India for the first time.

Genus **Taharana** Nielson, 1982

Taharana Nielson, 1982, *Pacif. Ins. Monogr.*, **38** : 50; Type species : *Coelidia sparsa* Stål.

The genus *Taharana* has been reported from the following countries : Burma, Thailand, Vietnam, Singapore, Malaysia, Indonesia, Cambodea, China, Philippines and Laos and ose species ranges into Ethiopian Region also (Nielson 1982).

Taharana khasiensis Rao

(Text fig. 12, a-b)

Taharana khasiensis Rao, 1989, *Hexapoda*, **1** (1) : 64, fig. 20-27.

Diagnosis : Vertex with a central fine carination; face longer than broad. Fore wing with pre apical cells, appendix well developed. Male plate with serrations on meso and latero caudal angles.

Distribution : Satmowedon, Khasi Hills, Meghalaya.

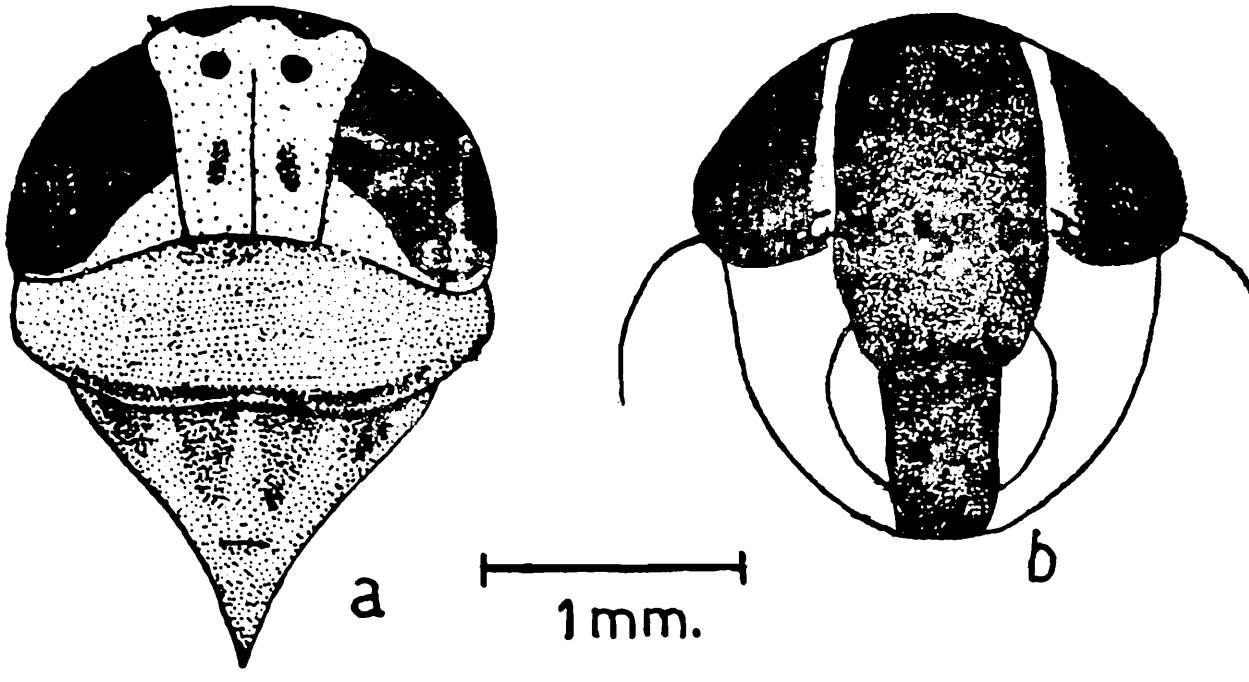
5. Subfamily : Penthimiinae

Oman (1949) and Evans (1972) have enumerated the diagnostic characters of the subfamily.

Linnavuori (1977) gave a detailed description of the subfamily.

Body short and depressed, of black, dull red or brownish colouration with yellow, orange or green markings. Head, thorax asd abdomen and be pitted and bear microsetae. Face usually wider than long. Ocelli

Taharana khasiensis Rao



Text fig. 12. *Taharana khasiensis* Rao a-Head and thorax...dorsal view; b-Face... ventral view

situated adjacent to the lateral facial sutures or may be placed ventrally or dorsally, rarely marginal. Lateral facial sutures terminate at antennal pits or extend beyond the anterior margin of head. Macropterous, forewing broad and appendix wide. Hind femora with five macrosetae, hind tibiae curved with an armature of strong spines. Male pygofers without processes and often bilobed. Styles short. Connective Y-shaped. Male plate broad. basally.

Evans (1971) suggested that the genus *Magnentius* Pruthi, which he had formerly included in the subfamily Macropsinae should be transferred to Penthimiinae. Linnavuori (1978) placed *Magnentius* in the subfamily Nioniinae under a new tribe Magnentiini.

Penthimiinae are universally distributed in all principal geographical regions, especially in the Oriental region. They are also well represented in Afrotropical, Australian and Holarctic regions.

They inhabit both trees and shrubs. In Africa they are abundant in rain forests and Savannah (Knight 1983). *Penthimia theae* Matsumara feeds on tea in Formosa.

The following genera are known from India *viz.*, *Penthimia* Germar, *Haranga* Distant, *Tambilia* Distant, *Malichus* Distant, *Vulturnus* Kirkaldy. *Neodartus* Melichar and *Uzelina* Melichar. Out of the seven genera only the genus *Penthimia* has been collected from Khasi Hills.

Genus **Penthimia** Germar, 1821

Penthimia Germar, 1821, *Mag. Ent.*, **4** : 46; Type species : *Cicada nigra* Geoze; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 2 1; Merino, 1936, *Philip. J. Sci.*, **61** : 343; Chatterjee, 1939, *Indian J. ent.*, **1** : 18; Evans, 1947, *Trans. R. ent. Soc.*, **98** : 211; Ribaut, 1952, *Faune Fr.* **57** : 355; Ishihara, 1953, *Matsuyama agric. Coll. Sci. Rep*, **11** : 5; Linnavuori, 1977, *Etudes, Cont. afr.*, **4** : 10.

Diagnosis : Oman (1949) has redefined genus *Penthimia*. The genus *Penthimia is* represented by 17 species in India out of which *Penthimia melanocephala* de Motschulsky alone is being reported from Khasi Hills.

Penthimia melanocephala de Motschulsky

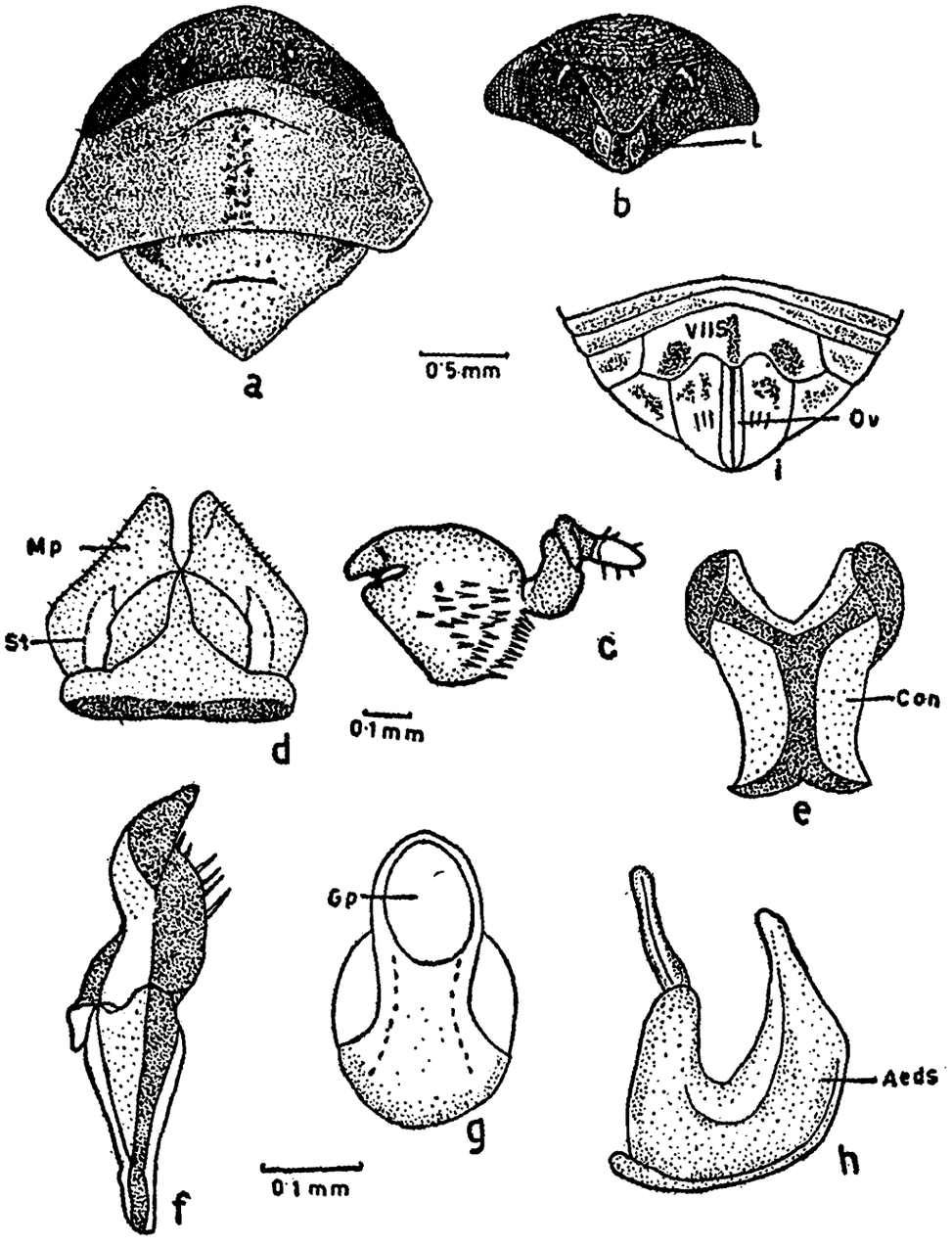
(Text fig. 13, a-i)

Penthimia melanocephala de Motschulsky, 1863, *Bull. Soc. Nat. Moscou*, **36** : 95; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 241; 1918, *Ibid.*, **7** : 11; Pruthi, 1934, *Indian Forest Rec.* (*Ent. Ser.*) **19** (4) : 13.

Vertex piceous, shorter than pronotum, anterior half convex, strongly striate transversely, posterior half flat, minutely punctate, ocelli on disc situated nearer to eyes than to each other. Face piceous, frontoclypeus strongly reflexed anteriorly and transversely striate; anterior area with an arched greyish furrow. Scutellum triangular, castaneous, basal angles with a short brown spot at each side, transversely impressed with a piceous arch on disc, apical area finely transversely wrinkled. Forewing castaneous, inner claval margins upto the apex of scutellum and claval suture dark piceous, forewing with pale white round spots, apex with a pale oblique whitish fascia, appendix broad and well marked on the inner margin. Femora generally black, apices of femora and tibiae ochraceous.

Male genitalia : Pygofer broad, ventral margin truncate, postero-dorsal margin with numerous setae, valve triangular. Male plate broad at base, narrowed towards apex. Style long, narrowly produced anteriorly,

Penthimia melanocephala Melichar



Text fig. 13. *Penthimia melanocephala* Melichar a-Head and thorax...dorsal view; b-Face...ventral view; c-Pygofer...lateral view; d-Valve and Male plate ...ventral view; e-Connective...dorsal view; f-Style...dorsal view; g-Aedeagus...dorsal view; h-Aedeagus...ventral view; i-Female genitalia ...ventral view

pre-apical lobe poorly developed, apophysis short, apex curved laterad Connective Y-shaped, arms widely separated. Aedeagus short, shaft short and curved, gonopore broad, subapical.

Female genitalia Seventh sternum posteriorly produced, lateral margins sinuate; pygofers broad, piceous anteriorly.

Measurements: Male 4.6 mm long and 1.68 mm wide. Female 4.76 mm long and 1.69 mm wide.

Specimens examined: Indit : Meghalaya : Shillong : 1 ♂, 1 ♀, 6.xi. 1981, C. A. Viraktamath, Coll.

Distribution: India, Burma and Sri Lanka. Within Indian limits, it is restricted to Southern India i.e. Nandidrug, Madras and Coorg.

Remarks: *Penthimia melanocephala* resembles *P. compacta* Walker in the shape of head, pronotum and scutellum but can be distinguished from it by the castaneous colouration of the body. In *P. melanocephala* the apex of forewing is provided with a pale oblique whitish fascia and the entire forewing is covered with pale whitish round shadings. In *P. compacta* however, apex of forewing is hyaline and veins are covered with fuscous spots.

6. Subfamily : ACOSTEMMINAE

Linnavuori & Quartau (1975) characterised the subfamily in detail. Appanna and Dover (1932) and Pruthi (1934a) discussed the economic aspect of the species *Acostemma walkeri* Kirkaldy, the only species of the subfamily occurring in the Indian subcontinent

Genus **Acostemma** Signoret, 1860

Acostemma Signoret, 1860, *Homopteres Soc. Ent. de France Ann.*, 8 (3) : 204; Type-species : *Acostemma marginalis* Signoret.

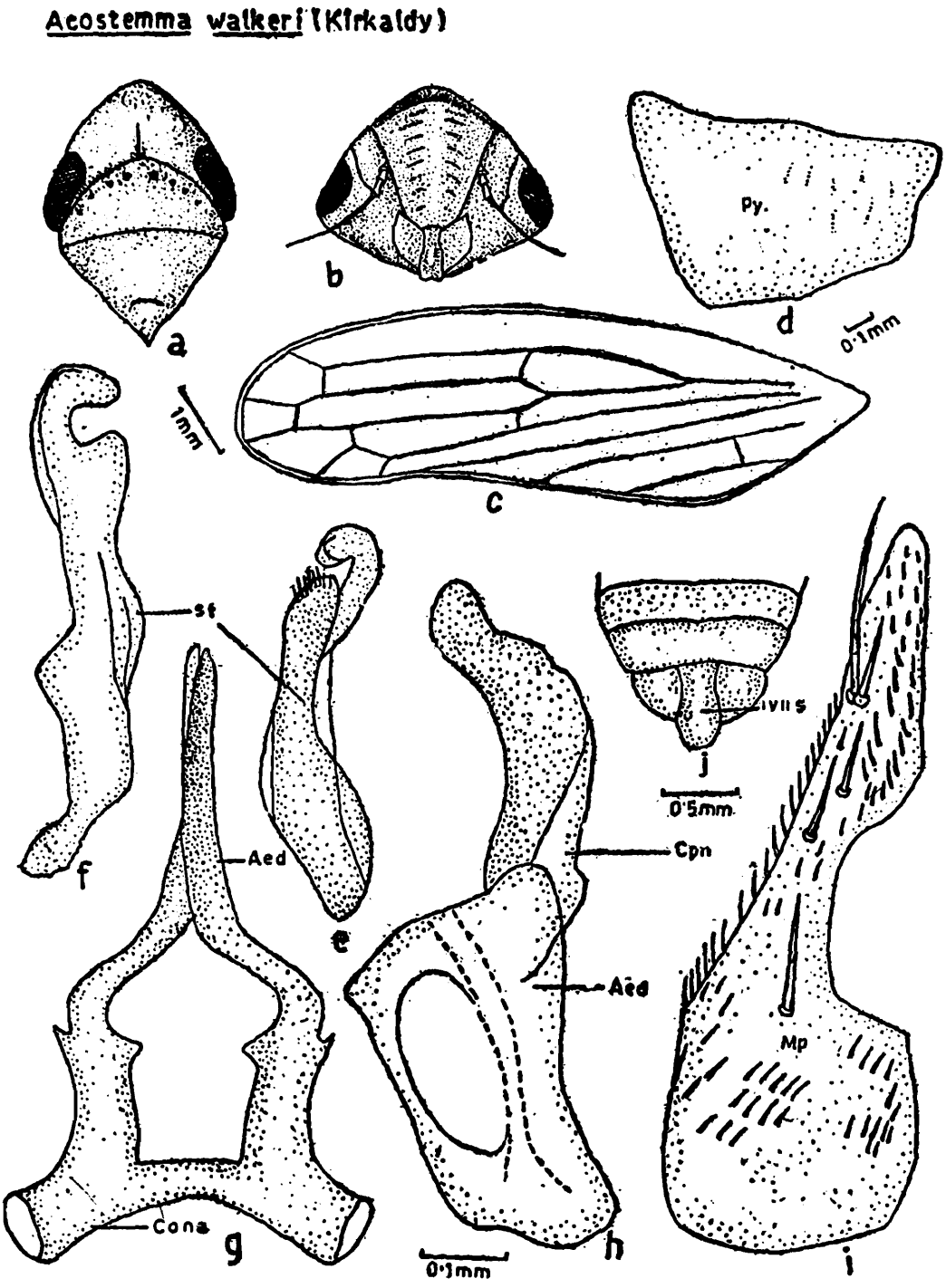
Acropona : Melichar, 1903, *Hom. Fauna Ceylon,* 68; Type species : *Gypona prasina* Walker; Distant, 1908, *Fauna Br. India,* Rhynchota, 4 : 300.

Acostemma : Evans, 1954, *Mem. Inst. Sci. Madagascar,* (E) 4 : 116 (=*Acropona* Melichar).

Diagnosis: Linnvuori and Quartau (1975) characterised the genus in detail.

Acostemma walkeri (Kirkaldy)

(Text fig. 14, a-j)



Text fig. 14. *Acostemma walkeri* (Kirkaldy) a-Head and thorax...dorsal view; b-Face ...ventral view; c-Forewing...dorsal view; d-Pygofer...lateral view; e-Style...lateral view; f-Style...dorsal view; g-Aedeagus and Connective ...dorsal view; h-Aedeagus and Connective...lateral view; i-Male plate of one side...ventral view; j-Female genitalia...ventral view

Gypona prasina Walker, 1858, *List. Hom. Br. Mus. suppl.*, 258.

Titia (?) *walkeri* Kirkaldy, 1900, *Entomologist*, **33** : 294, *nom. nov. pro Gypona prasina* Walker, 1858, not *Gypona prasina* Burmestier, 1839.

Eogypona walkeri Kirkaldy, 1901, *Entomologist*, **34** : 39 (=*Gypona* (?) walkeri Kirkaldy, =*Gypona prasina* Walker not Burmestier.

Acropona prasina : *Distant*, 1908, *Fauna Br. India, Rhynchota* **4** : 300 (=*Gypona prasina* Walker, =*Acropona* (?) *walkeri* Kirkaldy.

Acropona walkeri : China, 1926, *Ann. Mag. nat. Hist.*, **17** (9) 349, 350 (=*Gypona prasina* Walker not Burmestier, *Gypona walkeri* Kirkaldy, =*Acropona prasina Melichar*; Appana and Dover, 1932, *Indian Inst. Sci. jour.*, **6** : 13; Pruthi, 1934, *Indian forest Rec.*, **19** : 18; Mathur, 1953, *Indian Forest Leaft*, **121** (3) : 160.

Acostemma walkeri : Metcalf, 1966, Iassidae, *General Catalogue of the Homoptera*, VI, 15 : 196.

Female : Pale ochraceous or virescent. Vertex subtriangular with the anterior margins ridged and with a central impressed line from base to half the distance. Ocelli on the front border of the vertex close to eyes. Face ochraceous, smooth; frontoclypeus convex; clypellus narrow at base and broader at apex; lora large, broad but not reaching apex of clypellus; genae sinuate; lateral facial sutures extending to ocelli. Pronotum about one and half times the length of vertex. Scutellum large, a little more than twice the length of vertex and impressed transversely before apical area. Legs ochraceous, posterior tibiae slightly curved. Forewing with four apical cells and a cross vein between the claval veins. Posterior tibial spinulation 2+1+1.

Female genitalia : Seventh sternum large, posterior margin produced slightly towards the ovipositor; ovipositor long, stout and slightly projecting beyond posterior extremity of the abdomen.

Male : Above virescent and beneath pale virescent. Eyes and a thin streak along the anterior margin of vertex purplish red. Vertex faintly and longitudinally striate. Pronotum finely punctate and transversely striate. Posterior femoral spinulation 2+1+1. All other characters same as in the female.

Male genitalia : Pygofer large, posterior margin notched, connective broadly Y-shaped with the arms united posteriorly. Male plate long, united basally and free at the apical end. Style long, the basal portion spanner-shaped, posterior end membraneous. Aedeagus long, tubular in dorsal aspect.

Measurements : Male 8.85 mm long and 2.64 mm wide. Female 7.92 mm long and 2.42 mm wide.

Specimens examined : India : Meghalaya : Shillong : 1 ♀ , 22.ix.1976, K. R. Rao, Coll. ; Karnataka : Bangalore : 1 ♂, 4.ii 1983, C. A. Viraktamath, Coll.

Remarks : One male specimen collected and donated by Dr. Viraktamath from Bangalore has been made use of for studying male genitalia. The female is from Khasi Hills.

Distribution : This species is distributed in Sri Lanka, India, Mahe islands and Seychelles islands.

7. Subfamily : DRABESCINAE

Robust, broad and flattened species. Vertex three times broader between eyes than long; ocell placed in fossae on cephalic margins. Elytra with an appendix, two closed ante-apical cells. Anterior tibiae above sulcate. Male plates with broad base, style well developed, apophysis distinct; connective short Y-shaped; aedeagus symmetrical, gonopore subapical; pygofer sclerotised with or without appendage.

Genus **Drabescus** Stål, 1870

Drabescus Stål, 1870, *Ofvers. K. sevenska ventensk Akad.* Forth., 27 : 738; Type-species : *Bythoscopus remotus* Walker ; Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 304 ; Pruthi, 1930, *Mem. Indian Mus.*, **11** : 36 ; Merino, 1936, *Philipp. J. Sci.*, **61** : 366 ; Ishihara, 1953, *Matsuyama agr. coll. Sci., Rep.*, **11** : 23 ; Mathur, 1953, *Hemiptera, Indian Forest Leaft.*, **121** (3) : 161 ; Linnavuori, 1960, *Acta ent. fenn.*, 150 : 144 ; Evans, 1972, *Pacif. Insects,* **14** (1) : 196.

Diagnosis : Linnavuori (1960) redescribed the genus. The genus is distributed in Japan, Oriental Region and Afrotropical Regions. In India, the genus is so far represented by seven species. A new species was described from Khasi Hills (Rao, 1989).

Drabescus shillongensis Rao

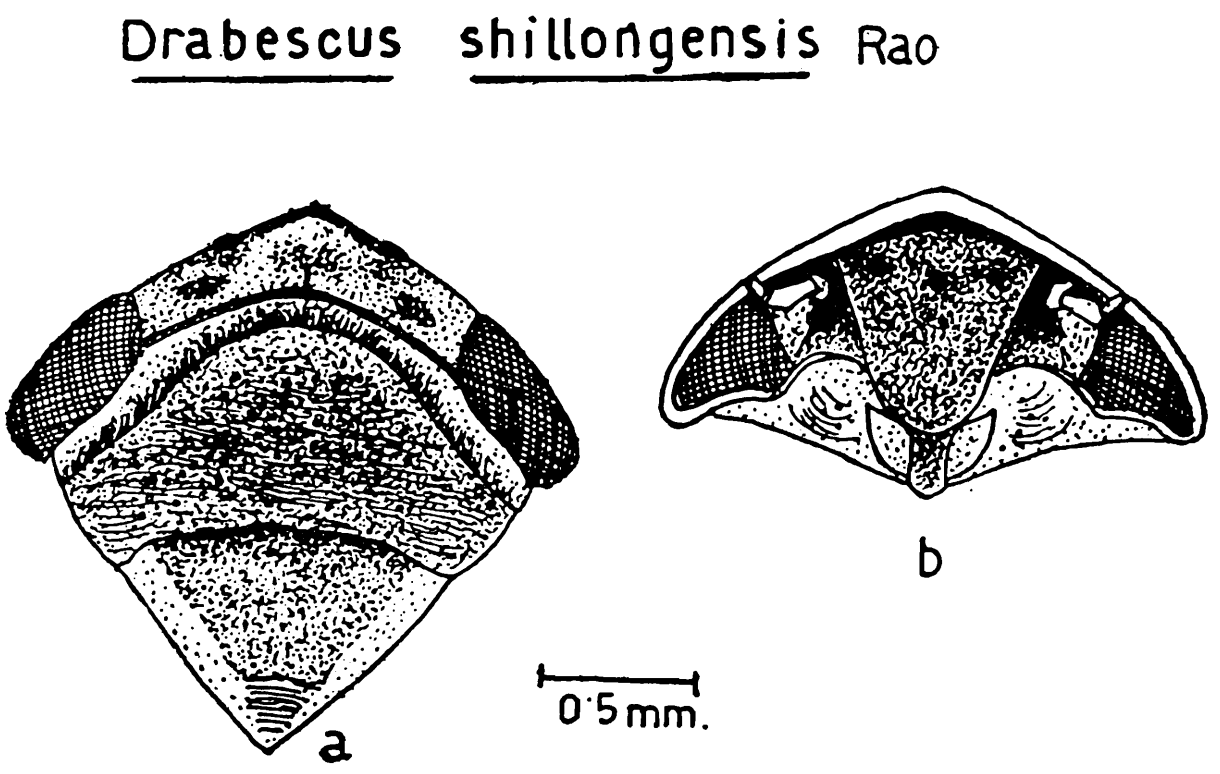
(Text fig. 15, a-b)

Drabescus shillongensis Rao, 1989, *Hexapoda,* **1** (1) : 65, fig. 28-34.

Diagnosis : Vertex more than three times as broad as long. Fore wing with a pale broad stripe across before the apex of clavus, veins with white dots.

Male 7.2 mm long and 2.6 mm wide.

Distribution : Shillong, Meghalaya.



Text fig. 15. *Drabescus shillongensis* Rao a-Head and thorax...dorsal view; b-Face... ventral view

8. Subfamily : HECALINAE

Brownish or greenish, often with orange markings and usually distinctly flattened dorsoventrally. Vertex flat, strongly produced with anterior margin acute or foliaceous. Ocelli located on the antero-lateral margins or on the crown near margiin. Genae uually sinuate at the margins. Lateral margins of the head usually carinate. Some species exhibit strong sexual dimorphism. Pygofers highly setose or bare they may be hooked, rounded or subacutely pointed posteriorly. Valve triangular. Male plates are of various shapes and possess setae. Connective Y-shaped. Aedeagus usually with processes of various shapes, the shaft may be tubular, dorsoventrally flattened or laterally compressed ; gonopore apical or subapic

Though most often grasses constituted host-plants, a few species have been reported from Casuarina and Melaleuca. The subfamily is reported from Casuarina and Melaleuca. The subfamily is reported from all the principal geographical regions of the world.

The following genera are known from India *viz.*, *Hecalus* Stål, *Glossocratus* Fieber. A key to separate them has been provided by Morrison (1973).

Key to the genera included in the present study

1. Hind femoral spinulation 2+2+1+1+1; female ovipositor not extending beyond pygofer; male pygofer, with 2-3 rows of short, stout setae on posterior margin ... *Glossocratus* Fieber

——Hind femoral spinulation 2+2+1; female ovipositor extending beyond pygofer, male pygofer without stout short setae on posterior morgin ... *Hecalus* Stål

Genus **Hecalus** Stål, 1864

Hecalus Stål, 1864, *Ann. Soc. ent. Fr.*, **4** (4) : 65, Type species : *Hecalus paykulli* Stål.

Parabolocratus Fiber, 1866, *verh. Zool. bot. Ges. Wien.*, **16** : 502; Type species : *Parabolocratus glaucescens* Fieber

Thomsoniella Signoret, 1880, *Ann. Soc. ent. Fr.*, **10** (5) : 52. Type species : *Columbanus misranus* Distant

Linnavuorriella Evans, 1966, *Mem. Aust. Mus.*, **12** : 134; Type species : *Linnavuoriella arcuatus* (de Motschulsky)

Hecalus : Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 273; Merino, 1936, *Philip. J. Sci.*, **61** : 313; *Evans*, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 141; Mathur, 1953, *Hemiptera, Indian Forest Leaft.*, **121** (3) : 158; *Ishihara*, 1953, *Matsuyama agri. Coll. Sci. Rep.*, **11** : 35; *Morrison*, 1973, *Facif. Insects*, **15** (3-4); Anufriev, 1978, *Trudy. ent. Obschch.*, **60** : 51.

Diagnosis : Vertex sub-angularly acute, body oblong, elongated and depressed. Eyes small or moderate. Ocelli on margins, next to eyes. Pronotum transverse, very obtusely rounded at apex. Forewing rounded at apex. Hind femoral setal spinulation 2+2+1. Posterior half of male pygofer bears setae. Aedeagus with terminal processes. Female ovipositor extending beyond pygofers. Seventh sternum with or without median projection or notches.

Hecalus is represented in India by five species while two species are reported from Khasi Hills. *Varta moshiensis* Rao is synonymised with *Hecalus arcuatus* (de Motsch.)

Key to the species of Hecalus Stål occurring in Khasi Hills

1. Concentric parabolic fasciae on head and thorax; aedeagus with two pairs of processes	...	arcuatus (de Motschulsky)
——Longitudinal orange fasciae on head, pronotum and scutellum; aedeagus with a single pair of process	...	porrectus((*Walker*)

Hecalus porrectus (Walker)

(Text fig. 16, a-g)

Acocephalus porrectus Walker, 1858, *List. Hom. Br. Mus. Suppl.*, : 362.

Thomsoniella porrecta : Melichar, 1903, *Hom. Fauna Ceylon,* 171. (=*Acocephalus porrectus* Walker) ; Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 278. (*Acocephalus porrectus* Walker)

Parabolocratus porrectus : Distant, 1918, *Fauna Br. India* Rhynchota, 7 : 31 (=*Thomsoniella porrecta* Walker)

Hecalus porrectus : Morrison, 1973, *Pacif. Insects,* **15** (3-4) : 421 (=*Parabolocratus porrectus* Walker : *Thomsonieila albomaculata* Distant) ; Rao, 1973, *zool. Anz.*, **191** (1/2) : 93-94 ; 1980, *Rec. Zool. Surv. India,* **76** : 192 ; 1981, *Ibid.*, **78** : 2 (=*Hecalus albomaculatus* Distant)

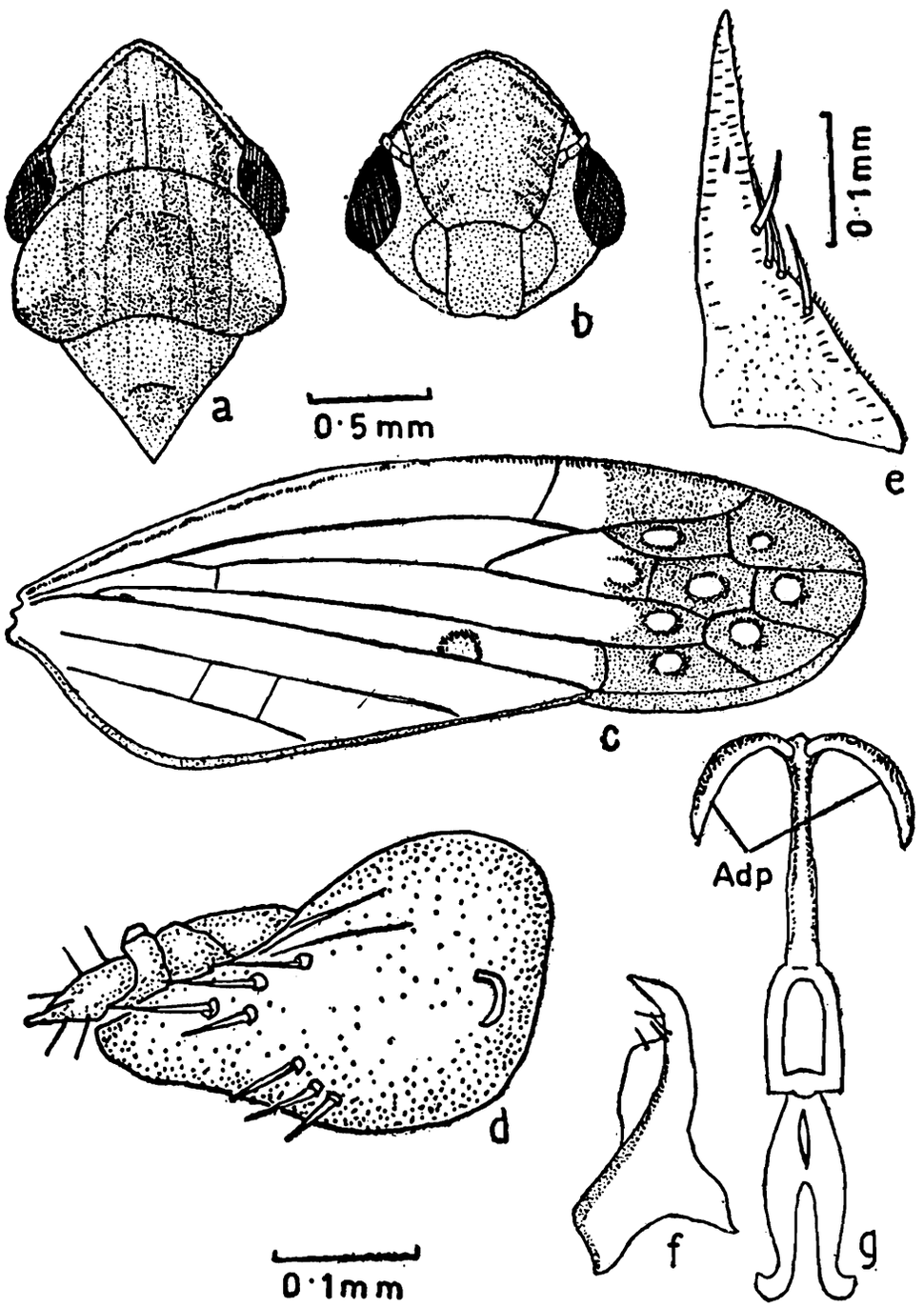
This species is well described by Morrison (1973) and hence only a brief description is given below. Pale ochraceous or greenish ochraceous species. Longitudinal orange fasciae—four on vertex, six on pronotum and three or four on scutellum. Apex of fore wing with white round spots in male and female without spots. Aedeagus with a pair of apical processes directed laterad.

Measurements : Male 4.34 to 5.22 mm long and 1.26 to 1.37 mm wide. Female 5.94 to 6.05 mm long and 1.43 to 1.54 mm wide.

Host : *Oryza sativa*

Specimens examined : India : Meghalaya : Shillong, Fruit Garden, 3 ♂♂, 6 ♀♀ , 29.vii.1977, M. S. Jyrwa, Coll. ; Umroi, 5 ♂♂ 6 ♀♀ 20.xii.

Hecalus porrectus (Walker)



Text fig. 16. *Hecalus porrectus* (Walker) a-Head and thorax...dorsal view; b-Face... ventral view; c-Forewing...dorsal view; d-Pygofer...lateral view; e-Male plate...ventral view; f-Style...dorsal view; g-Aedeagus and Connective... dorsal view

1977, Jyrwa, Coll.; Nongstoin, 11 ♂♂, 5 ♀♀, 27.xi.1977, K. R. Rao, Coll.; Sonapahar, 10 ♂♂, 9 ♀♀, 26.xi.1977, K. R. Rao, Coll.; Sohryngkham, 10 ♂♂, 18 ♀♀, 13.i.1978, K. R. Rao, Coll.; Shillong, Malki forest, 12 ♂♂, 15 ♀♀, 21.ix.1977, M. S. Jyrwa, Coll.

Distribution : The species is well distributed in Sri Lanka, India, Burma, Maldive Islands, Java, Formosa, karakatau, sunda islands, Sambawa and Australia.

Remarks : *Hecalus porrectus* closely resembles *Hecalus arcuatus* (de Motschulsky) in having sanguineous fasciae on the vertex and the body, but differs from it in having straight sanguineous fasciae to the vertex and and pronotum and obsolete fasciae to the tegmen. In case of *Hecalus arcuatus* the fasciae are arcuate in shape and those on the fore wing are distinct. Aedeagal shaft is with a pair of apical processes, where as *arcuatus* has two pairs of apical processes.

Hecalus arcuatus (de Motschulsky)

(Text fig. 17, a-c)

Acocephalus arcuatus de Motschulsky, 1859, *Etud. Ent.*, **8** : 15.
Hecalus arcuatus (de Motschulsky) : Rao, 1989, *Hexapoda*, **1** (1) : 66, fig. 35-40.

Varta moshiensis Rao is synonymised with *Hecalus arcuatus* (de Motschulsky) by Rao (1989) along with detailed description of the species. Here only a brief account of the species is given.

Diagnosis : Head and thorax with concentric parabolic fasciae. Pygofers large; apophysis broad and attached to the style mid laterally; connective Y-shaped; the arms distinct; aedeagus with two pairs of processes

Males 5.06 to 5.77 mm long and 1.43 to 1.65 mm wide. Female 5.99 to 6.6 mm long and 1.54 to 1.65 mm wide.

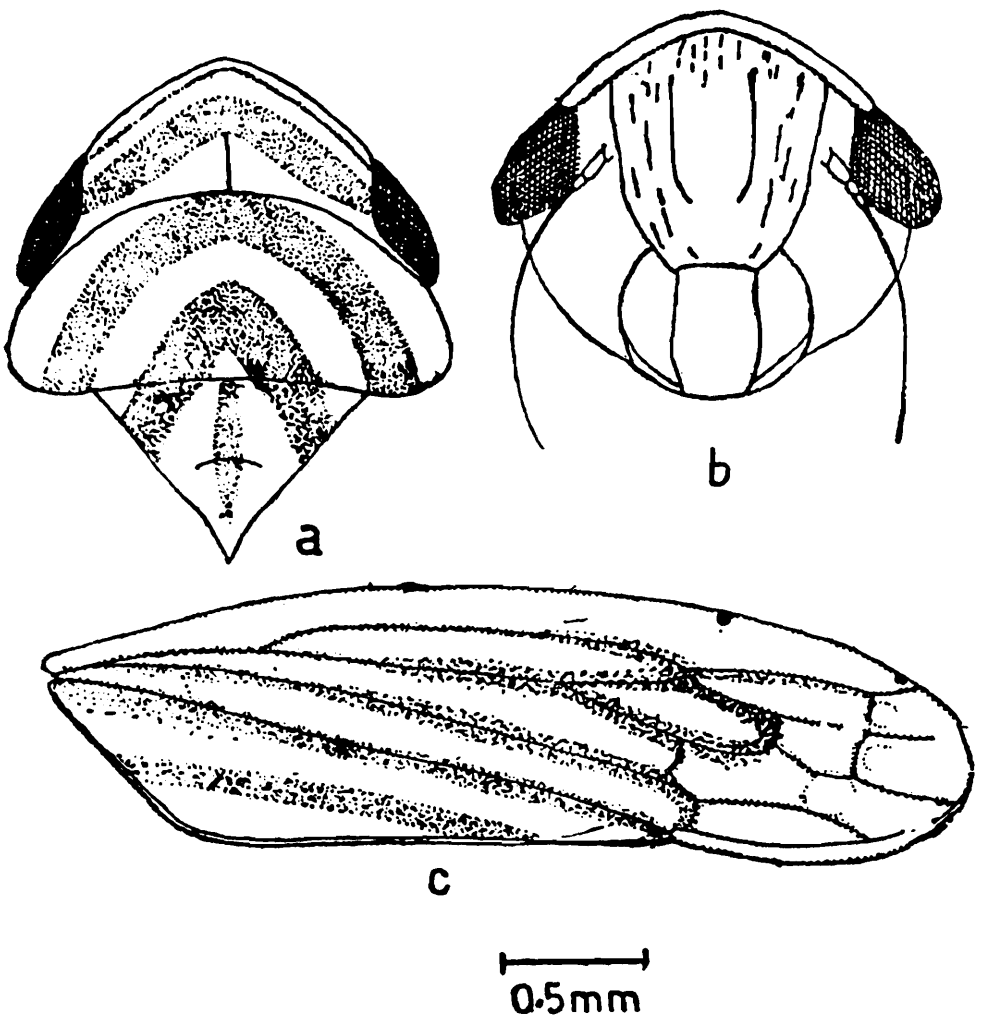
Distribution : Southern Asia, Queensland.

Genus **Glossocratus** Fieber, 1866

Glossocratus Fieber, 1866, *Verh. Zool. bot Ges. Wien.*, **16** : 502; Type species : *Glossocratus foveolatus* Fieber

Hecalus : Distant, 1908, *Fauna, Br. India, Rhynchota*, **4** : 273 (=*Glossocratus*); Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 141 (=*Glossocratus*); Oman, 1949, *Mem. ent. Soc. Wash.*, **3** : 32 (=*Glossocratus*); Ishihara, 1953, *Matsuyama agri. Coll. Sci. Rep.*, **11** : 32 (=*Glossocratus*).

Glossocratus Fieber : Morrison, 1973, *Pacif. Insects*, **15** (3-4).



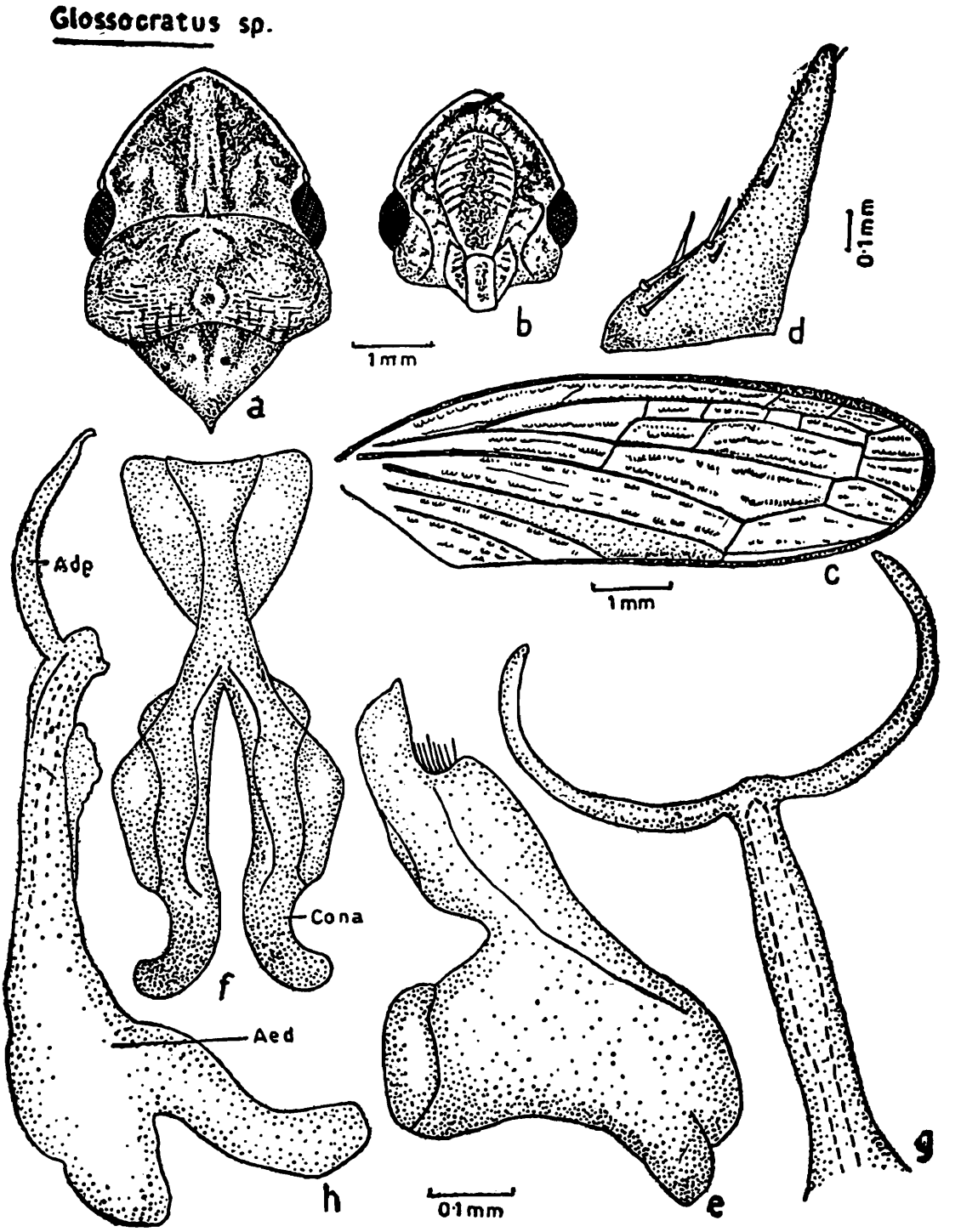
Text fig. 17. *Hecalus arcuatus* (de Motschulsky) a-Head and thorax...dorsal view; b-Face...ventral view; c-Forewing...dorsal view

Diagnosis : Vertx with lateral margins recurved. Ocelli nearer to eyes than to each other. Hind femoral spinulation 2+2+1+1+1. Pygofers with 2-3 rows of short, stout setae on the posterior margin. Aedeagus with two pairs of terminal processes. Female ovipositor not extending beyond pygofers.

Glossocratus sp.

(Text fig. 18, a-h)

Vertex a little shorter than distance between eyes, narrowed to apex, lateral margins slightly recurved and with two central rows of piceous spots, a piceous spot at the basal margin in the centre. Ocelli lateral, nearer to



Text fig. 18. *Glossocratus* sp. a-Head and thorax. .dorsal view ; b-Face. .ventral view ; c-Forewing. .dorsal view ; d-Male plate. .ventral view ; e-Style. dorsal view ; f-Connective. .dorsal view ; g-Aedeagus. .dorsal view ; h-Aedeagus. .lateral view.

the eyes.. Pronotum brownish orchaceous with minute piceous spots, the latter well concentrated at the disc and the lateral and posterior margin sinuate. Scutellum as long as pronotum, with castaneous spots at the disc,

a piceous spot on lateral margin and apex with ferrugineous spots. Scutellum indistinctly punctate. Forewing brownish ochraceous with nigroferrugineous markings in the cells, veins reddish, apical cells four, outer anteapical cell with two cross veins. Face at the anterior and lateral striations of fronto-clypeus darkly speckled with minute reddish brown spots; lora, clypellus and genae with piceous to reddish brown spots; lora not reaching apex of clypellus; clypellus and lora with minute setae white in colour. Posterior tibial spinulation 2+2+1+1+1.

Male genitalia : Pygofers heavily setose in apical half. Male plate broad at base, more or less triangular with a few marginal setae. Style with the apophysis finger-like with pre-apical lobe well developed. Connective Y-shaped. Aedeagus with a short dorsal apodeme and with a bulbous base, shaft with two dorsal lamellate more or less triangular processes about one-fourth of its length; a pair of apical processes of the shaft laterally curved with a basal tooth; gonopore apical.

Measurements : Male 8.47 mm long and 2.42 mm wide.

Specimens examined : Meghalaya : Shillong, 1 ♂, 3.xi. 1976, K. R. Rao, Coll.

Remarks : The species dealt with here is the one already studied and recognised as a new species from Karnataka by Mr. B. V Ramakrishna of the University of Agricultural Sciences, Bangalore. However, his results are yet to be published.

9. Subfamily : DELTOCEPHALINAE

Form variable but never too long or depressed; macropterous, brachypterous, or subbrachypterous. Head sometimes strongly produced but never foliaceous. Ocelli on anterior margin of head mostly near eyes. Lateral facial sutures extending to ocelli. Ocellocular area not forming a ledge above antennal pits. Lateral margins of pronotum short and not strongly carinate.

Male valve triangular or semicircular. Plates mostly triangular. Styles with curved apophyses and more or less fused with posterior lateral angles of plates.

This is the largest subfamily of leafhoppers consisting of 3000 species and has a universal distribution. This subfamily also harbours the largest number of economically important genera and species; 77 out of 130 known

vector species of plant pathogens belong to this subfamily (Viraktamath 1983).

Key to the tribes and genera of Deltocephalinae found in Khasi Hills

1. Aedeagal shaft and gonopores paired (tribe Opsiini) ; aedeagus with atrium not extending ventrad of shaft ... *Hishimonus* Ishihara

——Aedeagal shaft and gonopore single, not paired ... 2

2. Forewing venation with four or more recurved cross veins; pygofer with dense tufts of long setae (tribe Scaphoideini) ... *Scaphoideus* Uhler

——Forewing venation without recurved crossveins; pygofer either densely or sparsely setose ...

3. Male style with poorly developed apophysis for articulation with connective; branches of connective greatly divergent laterally, lying as a flat arc or on a straight line (tribe Fieberiellini) male pygofer with numerous long hair-like setae; vertex with median large black spot ... *Phlogotettix* Ribaut

——Male style with well developed apophysis; branches of connective diverge at an acute angle or parallel to each other or parallel or linear ... 4

4. Male connective forked with divergent or parallel branches never converging apically ... 5

——Male connective loop-like or racket-like with apices of branches close together or meeting ... 9

5. Two ante-apical cells on forewing; genital plate usually with long apical appendage (tribe Macrostelini). ... 6

——Three ante-apical cells on forewing; plate usually without long apical appendage (tribe Euscelini) ... 7

6. Head without markings; basal segment of hind tarsus distinctly sulcate; head usually very short; aedeagus without processes ... *Balclutha* Kirkaldy

——Head with black markings; basal segment of hind tarsus not sulcate basally; head longer medially than next to eyes; aedeagus with processes ... *Macrosteles* Fieber

7. Male plate short, exceeded by style with numerous long, filamentous setae in addition to usual spine-like setae ... *Cicadula* Zetterstedt

——Male plate normal not exceeded by style, with usual spine-like setae only; ... 8

8. Green species with black markings; apical areas of forewing black; aedeagus with a series of spines on its mesial area ... *Nephotettix* Matsumura

——Brown species with black markings; apical area of forewing not black; aedeagus without spines ... *Exitianus* Ball

9. Male connective linear, fused with aedeagus (tribe Deltocephalini) ... 10

——Male connective and aedeagus articulated ... 12

10. Male pygofer with long dorsal processes; vertex with a transverse black band between eyes ... *Paramesodes* Ishihara

——Male pygofer without dorsal long processes; vertex without a transverse black band but may be marked with marginal and often connected black spots ... 11

11. Gonopore on dorsum of aedeagal shaft very poorly delineated; shaft ending in a spine-like process ... *Recilia* Edwards

——Gonopore at apex of aedeagal shaft and clearly delineated; extreme apex of aedeagus notched ... *Deltocephalus* Burmeister

12. Forewing with pale spots on brown or black background ... *Paralimnus* Matsumura

——Forewing without such spots ... 13

13. Male plate with an elongated process; pygofer with a caudal articulated lobe (tribe Jassargini) ... *Khasiana* Rao

——Male plate simple, pygofer entire not with articulated lobe ... 14

14. Male pygofer with marginal black comb of short, stout spines; aedeagus not very long (tribe Doraturini) ... *Aconurella* Ribaut

——Male pygofer without a comb; aedeagus very long and tubular (tribe Stirellini) ... *Doratulina* Melichar

Tribe OPSIINI Emeljanov

Macropterous. Vertex often wide, transverse. Eyes with or without grooves on inner margin facing the scapes of the antennae. Space between eyes and frontoclypeus wide even when frontoclypeus is narrow; pronotum with lateral carina. Pygofers spinose, plates triangular with marginal stout setae often with terminal membranous appendages; aedeagus paired with two gonopores. Emeljanov (1962) while establishing the tribe recognised three subtribes namely Opsiina, Circuliferina and Achaetina. Of these the first two tribes occur in India. However *Hishimonus* of Opsiina was found to occur in Khasi Hills.

Genus **Hishimonus** Ishihara, 1953

Hishimonus Ishihara, 1953, *Matsuyama agric. Coll. Sci. Rep.*, **11** : 38; Type Species : *Thamnotettix sellata* Uhler; Knight, 1970, *Suom hyont. Aikak.*, **36** : 125; 1973, *Ibid.*, **39** : 153; Ishihara, 1972, *Trans. Shikoku ent. Soc.*, **11** : 84; Hamilton, 1975, *Can. Ent.* **107** : 493.

Diagnosis : Knight (1970) redefined *Hishimonous.*

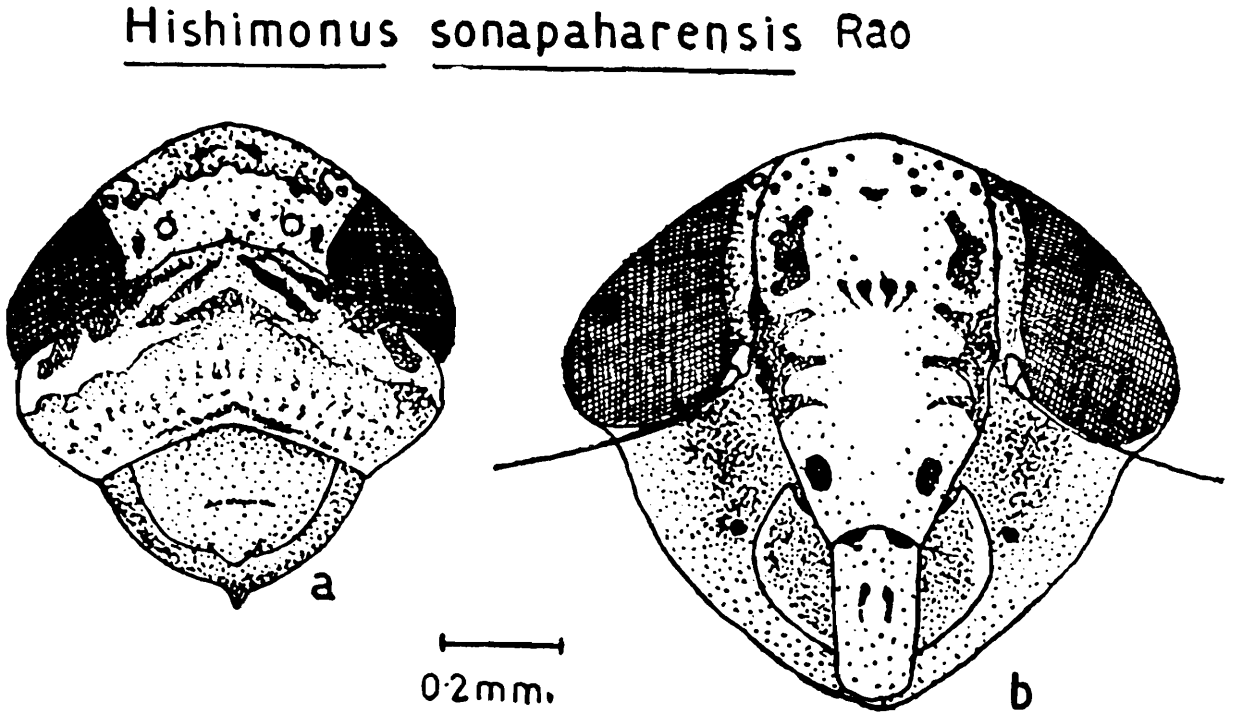
Sawai Singh (1971) suppressed *Hishimonus* and *Hishimonoides* in favour of *Cestius*. Knight (1973) after studying the female Holotype of *Cestius versicolor* recorded their separate status and concluded that "similarity between *Cestius* and *Hishimonus* group of genera (*Hishimonus Hishimonoides, Litura* and *Naevus*), lies in the male genitalia only and that externally the two groups are quite distinct" Ishihara (1972) considered *Hishimonus* a valid genus. In India the genus is represented by four species *viz.*, *H. phycitis* (Sohi), *H. viraktamathi* Knight and *H. bengalnesis* (Distant). None of these is represented in the collections from Khasi Hills but a fifth One *H. sonapaharensis* Rao is reported here.

From the agricultural point of view, *H. phycitis* (Distant) transmits the pathogens of "the little leaf of egg plant", while *H. indicus* (Sohi) and *H. viraktamathi* Knight attack species of *Terminalia* in North and South India, respectively. *H. disciguta* (Walker) is a serious pest of mulberry in Japan.

Hishimonus sonapaharensis Rao

(Text fig. 19, a-b)

Hishimonus sonapaharensis Rao, 1989, *Hexapoda,* 1 (1) 67, fig. 41-45.



Text fig. 19. *Hishimonus sonapaharensis* Rao a. Head and thorax. .dorsal view; b. Face. .ventral view.

Diagnosis : Vertex with a dark brown transverse fascia at the anterior margin and disc. Pronotum more than one and half times the length of vertex, brownish ochraceous. Scutellum shorter than pronotum. Male plate without any process and with a series of stout sete along the lateral margins aedeagus with short cylindrical shafts and apices with curved hooks directed anteriorly.

Male 2.86 mm long and 1.1 mm wide.

Distribution : Sonapahar, Meghalaya.

Tribe MACROSTELINI Kirkaldy

Clypeus not constricted basally, genae not expanded, least width of genae near clypellus less than the least width of ocellocular area below ocellus. Ocelli near eyes. Macropterous species. Forewing with only two anto-apical cells, the outer ante-apical cell being absent; style robust, pre-apical lobe well developed, connective Y-shaped, aedeagus with well developed dorsal apodome.

The genera belonging to this tribe have been collected from the Khasi Hills *viz.*, *Macrosteles* Fieber, *Balclutha* Kirkaldy.

Genus **Macrosteles** Fieber, 1866

Macrosteles Fieber, 1866, *Verh. Zool. bot. Ges. Wien.*, **16** : 504; Type-species : *Cicada sexnotata Fullén*, 1896; Beirne, 1982, *Can. Ent.* **84** 208; 1956, *Ibid., Suppl.*, **2** : 65; Moore & Rose, 1957, *Ann. ent. Soc. Am.* 109, 115; Anufriev, 1958, *Zool. Zh.*, **47** : 555; Nielson, 1968, *Tech. Bull. U.S. Dep. Agric.*, 1382, 165; Le Quesne, 1969, *Handb. Ident. Br. Insects*, **2** (2b) : 133; De Long, 1970, *Ohio J. Sci.*, **70** : 114; Ishihara, 1983, *Proc. Int. Symp. On Leafhoppers and Plant hoppers economic importance*, London, C.I.E. 459; Viraktamath, 1983. *Ibid.*, 490.

Diagnosis : Oman (1949) has redefined the genus.

Macrosteles is represented hitherto in India by two species viz., *M. sexnotatus* (*Fallén*) and *M. indrina* (Pruthi) Two new species in the genus have been described elsewhere.

Macrosteles picturatus Rao

(Text fig. 20, a-f)

Macrosteles picturatus Rao, *Hexapoda*, **1** (1) : 69, fig. 46-53.

Diagnosis : Vertex with two black spots and two transverse bands. Pygofer lobes squarish; aedeagus with ventrally curved processes which cross each other. Males 2.54. to 2.99 mm and 0.64 to 0. 84 mm wide. Females 3.36 to 3.8 mm long and 0.85 to 0. 98 mm wide.

Distribution : Sohoryngkham, Meghalaya

Macrosteles brevis Rao

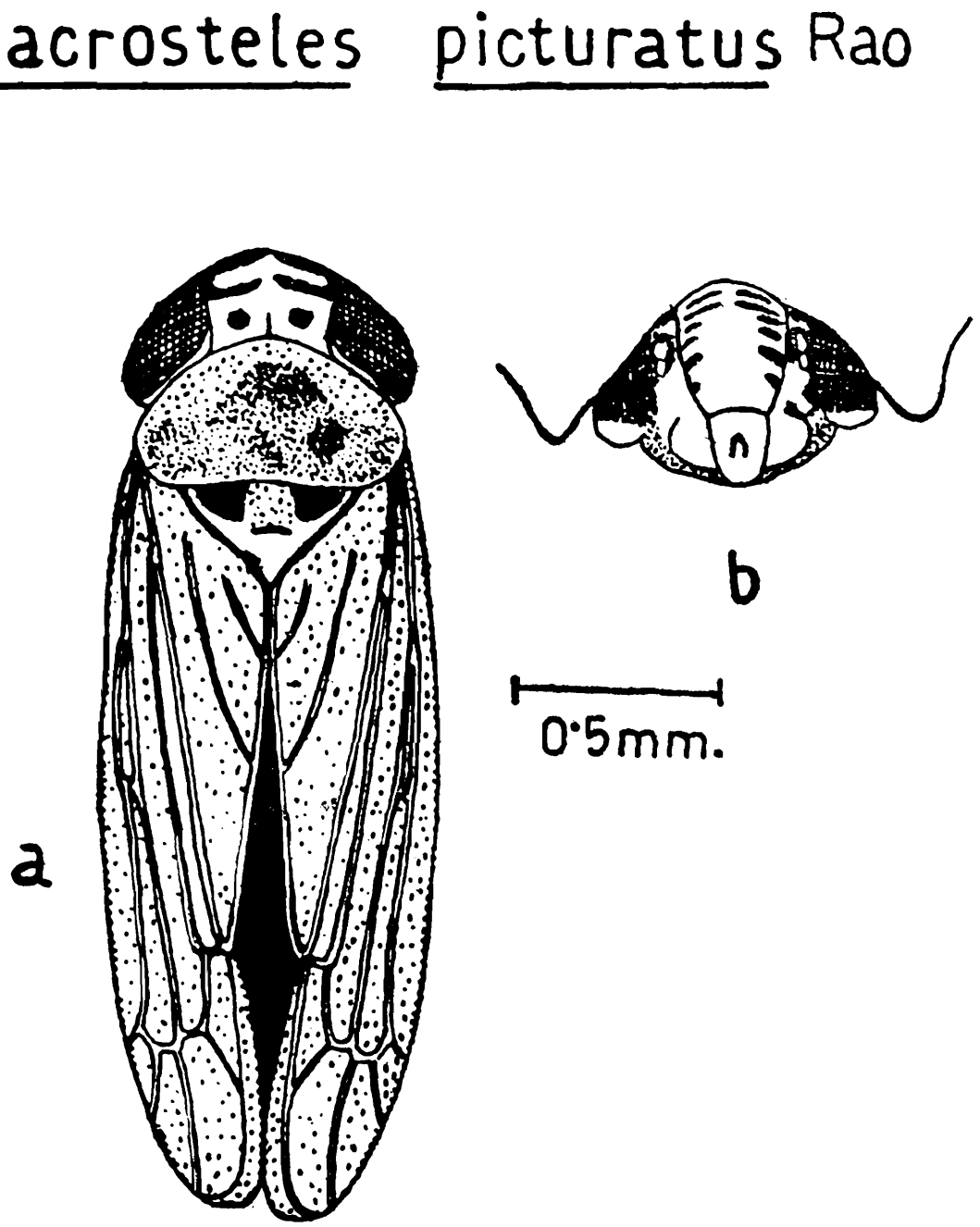
(Text fig. 21, a^1, a^2, b^1, b^2)

Macrosteles brevis Rao, 1989, *Hexapoda*, **1** (1) : 70, fig. 54-61.

Vertex with forceps-shaped or J-shaped black markings and without transverse bands. Pygofer with lobe rounded caudally; aedeagus with anteriorly curved processes which do not cross each other.

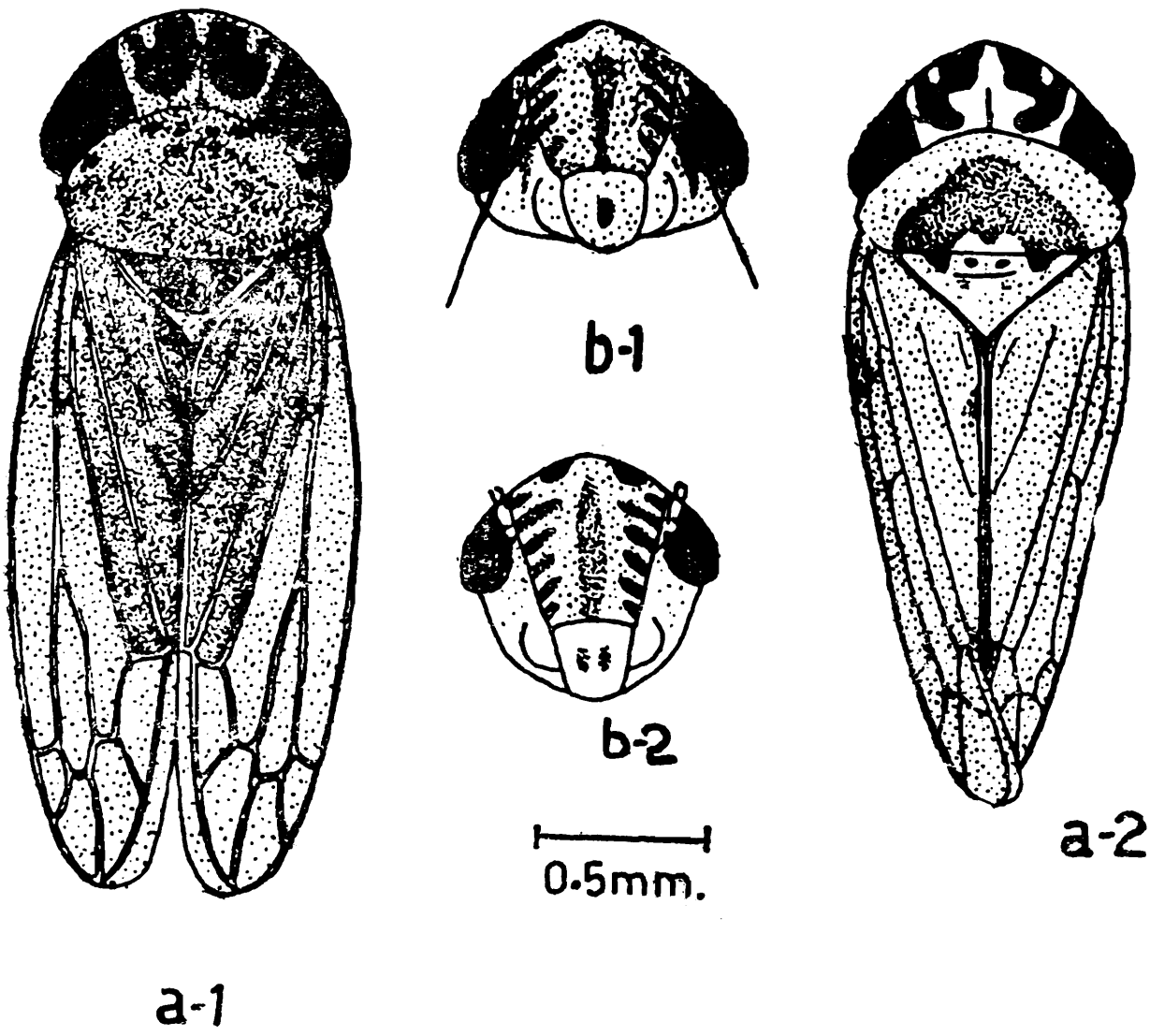
Male 2.68 mm to 3.24 mm long and 0.77 to 0.86 mm wide Female 3.36 to 3.43 mm long.

Distribution : Ranikor, Balat, Meghalaya.



Text fig. 20. *Macrosteles picturatus* Rao a. Habitus. .dorsal view; b. Face. .ventral view; c. Fore wing. .ventral view.

Macrosteles brevis Rao



Text fig. 21, *Macrosteles brevis* Rao a-1 & a-2. Habitus of two forms. .dorsal view; b-1 & b-2. Faces of a-1 & a-2. .ventral view; c. Fore wing. .dorsal view

Genus **Balclutha** Kirkaldy, 1900

Gnathodus Fieber, 1866 not Pander, 1866, *Verh. Zool.-bot. Ges. Wien.*, **16** : 505; Type-species : *Cicada punctatus* Thunberg

Balclutha Kirkaldy, 1900, *Entomologist*, **33** : 243, *Nom. nov. proc. Gnathodus* Fieber, 1866 not *Gnathodus* Pander, 1856, Type-species : *Cicadula punctatus* Thunberg

Eugnathodus Baker, 1903, *Invert. Pacificia*, Type-species : *Gnathodus abdominalis* Van Duzee.

Anomiana Distant, 1918, *Fauna Br. India, Rhynchota,* **7** : 109; Type-species : *Anomiana longula* Distant

Balclutha : Pruthi, 1930, *Mem. Indian Mus.,* **11** : 48; Evans, 1947, *Trans. R. ent. Soc. Lond.,* **98** : 248 (=*Gnathodus* Fieber; *Anomiana* Distant, *Nesosteles* Kirkaldy eror) ; Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 368; Ribaut, 1952, *Faune Fr.,* **63** : 40; Ishihara, 1953, *Matsuyama Agric. Coll. Sci. Rep.,* **11** : 36; Ghauri, 1963, *Ann. Mag. nat. Hist.,* **13** (6) : 562; Blocker, 1967, *Proc. U.S. natn. Mus.,* **122**, No. 3581 : 4-7. Sharma & Badan, 1985, *Entomotaxonomia,* **7** (2) : 149-156; Knight, 1987, *J. Nat. Hist.,* **21** : 1173.

Diagnosis : Slender, relatively small leafhoppers. Head slightly narrower than pronotum. Elytra long, appendix well developed. Spinulation of hind tibia 2 +2+1. Colour dull green to stramineous.

Male plates broad basally and ending in slender somewhat membraneous process distally, macrosetae uniseriate. Style with finger-shaped apophysis. Connective Y-shaped. Aedeagus simple, recurved and acuminate, gonopore subapical.

The distribution of the genus is world-wide. Because of their polyphagous grass feeding nature, these leafhoppers have been easily transported by commerce and have attained a wide distribution Knight (1987) provided a check list of species of *Balclutha* from the world, and redescribed several species. He provided a key to the males of Pacific species.

Key to species of Balclutha from the Khasi Hills

1. Aedeagal shaft more than 3x longer than basal bulbous area; head, pronotum, scutellum and cells of forewing marked with dark brown ... *versicolorides* Ghauri

——Aedeagal shaft not more than 2x as long as basal bulbous area; head, pronotum and scutellum not as above ... *saltuella* (Kirschbaum)

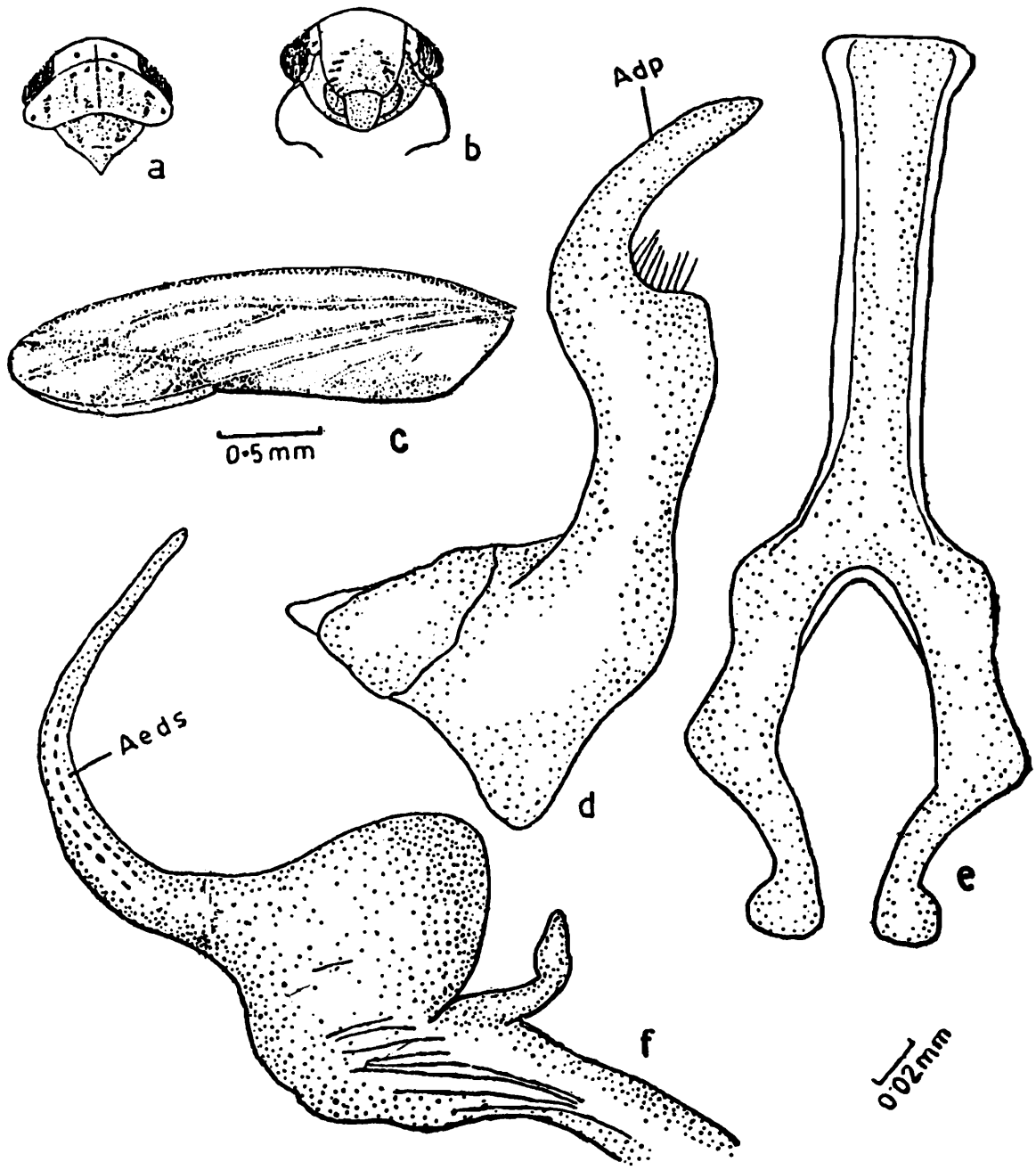
Balclutha versicoloroides Ghauri

(Text fig. 22, a-f)

Balclutha versicoloroides Ghauri, 1971, *Bull. ent. Res.,* **61** : 117.

Vertex pale ochraceous with two brownish spots on either side of the brownish median line. Face ochraceous, clypeus with pale brownish transverse striations, clypellus long with lateral margins parallel; lora small,

Balclutha versicoloroides Ghauri



Text fig. 22. *Balclutha versicoloroides* Ghauri a-Head and thorax. .dorsal view, b-Face ventral view; c-Forewing. .dorsal view; d-Style. .dorsal view; e-Connective. .dorsal view; f-Aedeagus. .lateral view.

not reaching the apex of clypellus. Pronotum more than twice the length of vertex with five linear sanguineous fasciae, the central one being narrowest, anterior margin of pronotum with a series of small brownish spots, posterior sinuate. Scutellum brightly ochraceous, with a large transvese patch

on each basal angle, a central thin longitudinal fascia and lateral margins at the apex of scutellum all-sanguineous. Forewing pale brownish with inner margins of some apical and ante-apical areas dark brownish.

Male genitalia : Connective Y-shaped, arms short, well separated from each other. Style with a well developed pre-apical lobe and having long setae, apophyses long deeply curved. Aedeagus with a well developed dorsal apodeme, shaft slender, tubular, long and curved.

Measurements : Male 2.74 mm long and 0.8 mm wide.

Host : Collected from weeds having chiefly *chromolaena odoratum* (Linn.)

Specimens examined : India : Meghalaya : Mairang, 1 ♂, 1.xii.1977, K. R. Rao, Coll.

Distribution : This species was originally described by Ghauri from specimens from Simla and not reported from anywhere else

Remarks : The single male specimen available differs from typical *B. versicoloroides* as it has slightly shorter aedeagus and in the absence of clouded pattern of colouration on vertex. But it agrees well with other characters. It is presumed that variations observed are within the range of variation expected in this species.

Balclutha saltuella (Kirschbaum)

(Text fig. 23, a-h)

Jassus saltuellus Kirschbaum, 1868, *Massau, ver. f. Naturk. Jehrb.* **21-22** : 86

Gnathodus angustus Puton, 1866, *Catalog. Hemp. psyllides fauna palearctic, 3e Ed.* 81 ; Then, 1901, *Naturw. Ver. f. Stelemark nitt.*, 37 : 265.

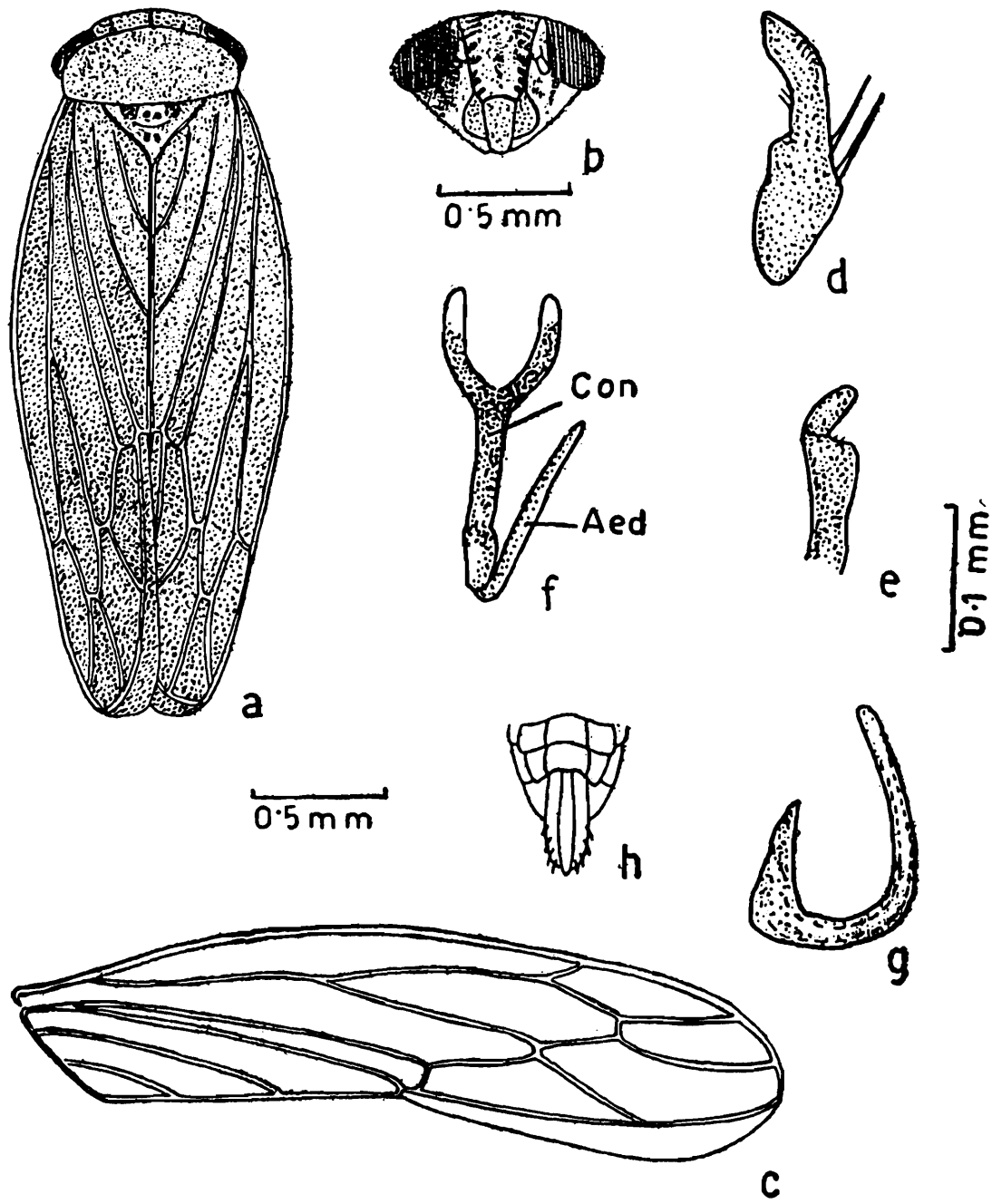
Balclutha saltuella : (Oshanin) 1906, *Lieferung, Mus. Zool. St. Petersburg Ann.*, **11** : 186 (=*Jassus* (*Thamnotettix*) *saltuellus* Kirschbaum, =*Gnathodus angustus* Then) ; Ribaut 1952, *Faune Fr.*, **63** : 67 ; Hamilton, 1983, *Can. Ent.* **115** : 489.Knight 1987, *J. Nat. Hist.*, 21 : 1182

Measurements Male 2.03 to 2.08 mm long and 0.77 to 0.79 wide.

Host : Collected by sweeping on *Digitaria pedicellaris* Prain.

Specimens examined : India : Meghalaya : Shillong : Elephant Falls, 1 ♂, 2 ♀♀ , 6.x.1977, K. R. Rao, Coll. ; Mairange, 3 ♂ 5 ♀♀ , 1.xii.1977, K. R. Rao, Coll. ; Jakriem, 2 ♂♂ 8 ♀♀ , 4.xii.1977, K. R. Rao, Coll. ;

Balclutha saltuella (Kirschbaum)



Text fig. 23. *Balclutha saltuella* (Kirschbaum) a?Habitus. .dorsal view; b-Face. . ventral view; c-Forewing. .dorsal view; d-Male plate. .ventral view; e-Style, apex. .dorsal view; f-Connective and Aedeagus. .dorsal view; g-Aedeagus. .lateral view; h-Female genitalia. .ventral view.

Mawsynram, 2 ♂♂, 6 ♀♀, 5.xii.1977, K. R. Rao, Coll; Bala, 2 ♀♀ 9.xii.1977, K. R. Rao, Coll.

Distribution : It is well well distributed in Europe, Egypt and India.

Remarks : This species resembles *B. nicolasi* (Leth.) in the general shape of the male genitalia but can be distinguished from it by aedeagus having a well developed dorsal apodeme and the shaft having only one curvature instead of two.

Tribe DELTOCEPHALINI Dallas

Oman (1948) and Linnavuori (1960) defined this tribe in detail.

Under the tribe Deltocephalini four genera from the Khasi Hills are studied viz., *Recilia* Edwards, *Paralimnus* Matsumura and *Paramesodes* Ishlihara.

Genus **Recilia** Edwards, 1866

Recilia Edwards, 1922, *Entomologist's mon. Mag.*, **58** : 204 ; Type-species : *Jassus coronifer* Marshall

Inazuma Ishihara, 1953, *Matsuyama agric. Coll. Sci. Rep.*, **11** : 15 & 48 ; Type species : *Deltocephalus dorsalis de* Motschulsky

Recilia : Kramer, 1962, *Proc. biol. Soc. Wash.*, **75** : 259 ; Nielson, 1968, *Tech. Bull. U.S. Dep. Agric.* **1332** : 315 ; Ghauri, 1980, *Reichenbachia*, **18** (25) : 166..

Diagnosis : Vertex obtuse, ocelli on anterolateral margin. Scutellum triangular broader than long ; forewing longer in males of some species. Male plate triangular with stout setae on lateral side ; connective Y or U-shaped and arms approximated. Aedeagus and connective fused, shaft long and pointed at tip, gonopore dorsal.

The genus is well distributed in the Palearctic, Ethiopian and Oriental Regions. The genus *Recilia* differs from *Deltocephalus* in the gonopore being dorsal and ill-defined, whereas in the latter the gonopore is well-defined and apical in position. The arms of the connective in *Recilia* are approximated while they are divergent anteriorly in *Deltocephalus*.

In India *Recilia* is so far represented by three species viz., *R. dorsalis* (de Motschulsky), *R. prabha* (*Pruthi*) and *R. veinatus* (Pruthi). Five species are now reported from the Khasi Hills viz., *R. dorsalis, R. prabha, R. indica Rao R. maculata* (Pruthi) and *R. intermedia* (*Melichar*).

Recilia *dorsalis* (de Motschulsky) is the only species of the genus so far known as a vector of virus disease of paddy (Nielson, 1979).

Key to the species of Recilia found in the Khasi Hills

1. Forewing with a zigzag brown stripe	...	*dorsalis* (de Motschulsky)
——Forewing either entirely brown or without zigzag brown stripe	...	2
2. Vertex with distinct large black spots	...	3
——Vertex without spots; if present, small, ill-defined, pale brownish	...	*intermedia* (Melichar)
3. Vertex with 4-5 brown to dark submarginal spots, pronotum with four longitudinal brown stripes, aedeagus tubular, gonopore short, dorsal subapical	...	*indica* Rao
——Vertex with either three large or a single large black spot; pronotum without longitudinal stripes; aedeagus boat-shaped, gonopore large, not well marked	...	4
4. Vertex with three well defined apots; pronotum yellow, scutellum with basal black triangle	...	*maculata* (Pruthi), Rao
——Vertex with single large black spot interrupted by three small ochraceous areas; pronotum and scutellum dark brown	...	*prabha* (Pruthi)

Recilia dorsalis (de Motschulsky)

(Text fig. 24, a-h)

Deltocephalus dorsalis de Motschulsky, 1859, *Etude, Ent.*, **8** : 114.

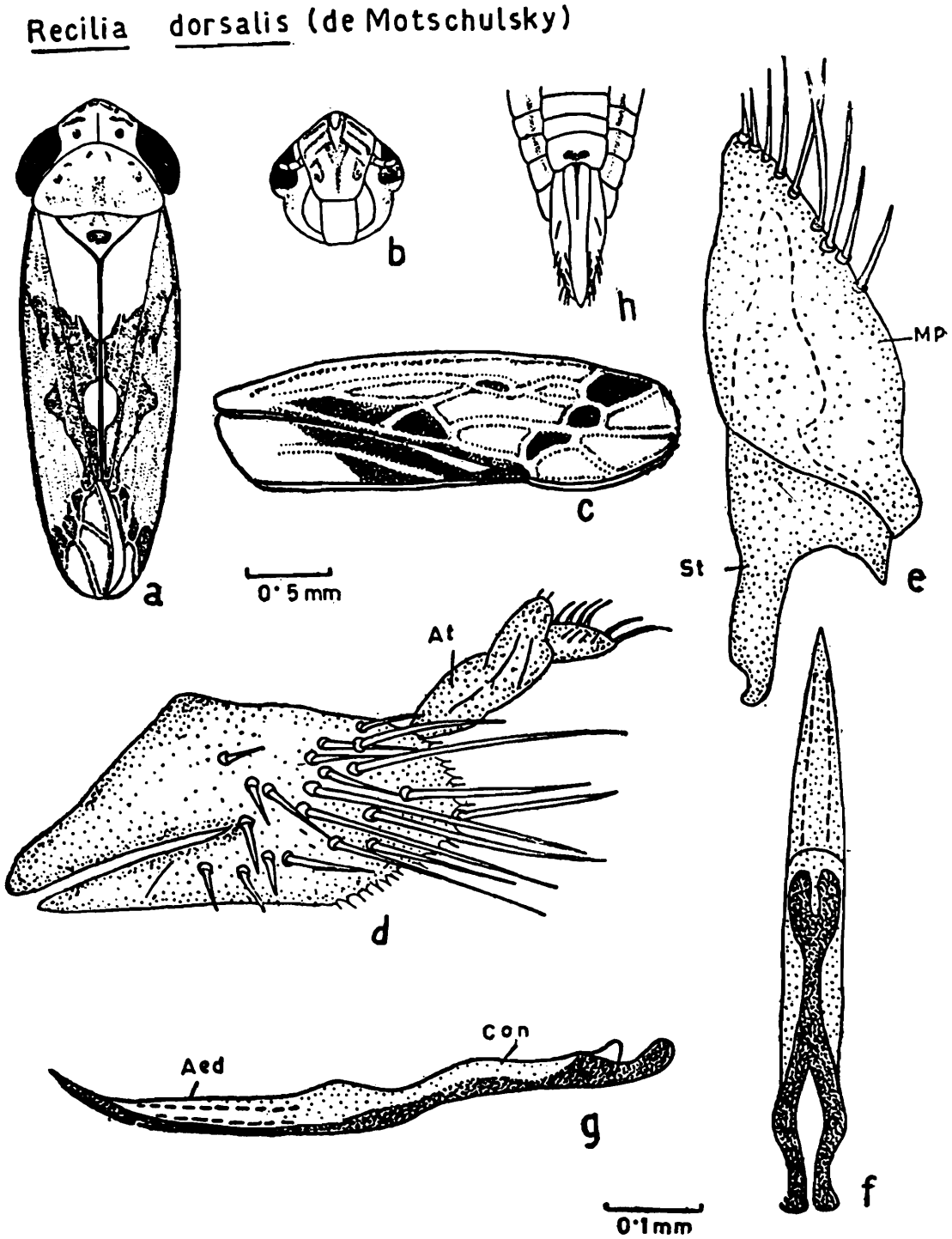
Deltocephalus fulguralis Matsumura, 1902, *Termeszetr. Fuz.*, **2** : 391.

Deltocephalus dorsalis : Distant, 1908, *Fauna Br. India*, Rhynchcta, **4** : 380 (=*Deltocephalus fulguralis Matsumura*) : Pruthi, 1934, *Indian Forest Rec. Ent. Ser.*, **19** (4) : 1-30.

Inazuma dorsalis Ishihara, 1953, *Matsuyyama agric. Coll. Sci. Rep.*, **11** : 48 (=*Deltocephalus dorsalis* de Motschulsky)

Recilia dorsalis : *Nielson*, 1968, *Tech. Bull. U.S. Dept. Agric.*, **1382** : 315 (=*Inazuma dorsalis* Ishihara) ; Viraktamath, 1983, *Proc. 1st International Symp. Leafhoppers and planthoppers of economic importance, London*, C.I.E., 497.

Vertex ochraceous with a short pale brownish fascia and two short submarginal fasciae; two pale obscure brown spots between eyes; (sometimes)



Text fig. 24. *Recilia dorsalis* (de Motschulsky) a-Habitus. .dorsal view; b-Face. ventral view; c-Forewing. .dorsal view; d-Pygofer. .lateral view; e?Male plate and Style. .ventral view; f-Aedeagus and Connective. .dorsal view; g-Aedeagus and Connective. .lateral view; h-Female genitalia. .ventral

vertex either with two longitudinal short pale brownish streaks at apex or two semicircular pale spots and two brownish spots between eyes. Ocelli placed on lateral margins, nearer to eyes than to apex. Face broader than

long, ochraceous; lora short, convex, not reaching apex of clypellus; frontoclypeus marked with or without lateral brownish striations. Pronotum ochraceous with irregular markings. Scutellum small, as long as vertex with obscure pale patches at basal angles and a small brown streak on each lateral margin. Forewing with zigzag markings, a brownish longitudinal band arising from antero-lateral part traversing claval suture upto clavus and then diagonally crossing to costal margin from the apex of clavus, a central pale spot enclosed on claval sutures where forewings meet.

Male genitalia: Pygofer large, caudal margin minutely dentate, large setae arising from mid-dorsal region, caudoventral region oblique. Male plates large, narrowed to the apical end with large stout setae at lateral margins. Connective Y-shaped, arms fused, Style large, the inner limb (mesal) with a small curve at apex turned mesiad, pre-apical lobe small, apophysis long, narrow at apex. Aedeagus long, fused with the connective, shaft long, dagger-like.

Female genitalia: Seventh sternum short, posterior margin truncate, pygofers long, narrow, with stout setae at posterior margins; ovipositor long, reaching posterior extremity of abdomen.

Measurements: Male 3.07 to 3.32 mm long and 0.86 to 0.92 mm wide. Female 3.35 to 3.52 mm long and 0.88 to 0.98 mm wide.

Host: Collected from *Oryza sativa*

Specimens examined: India : Meghalaya : Balat, 2 ♂♂, 6 ♀♀ 8.xii.1977, K. R. Rao, Coll.; Shillong : Nogthumai, 1 ♂, 4 ♀♀, 10.xii.1977, K. R. Rao, Coll.

Distribution: This species is distributed in India, Sri Lanka, Borneo, Formosa, China and Japan.

Remarks: It can be easily distinguished from other species of the genus by the zigzag brown stripe on the forewing.

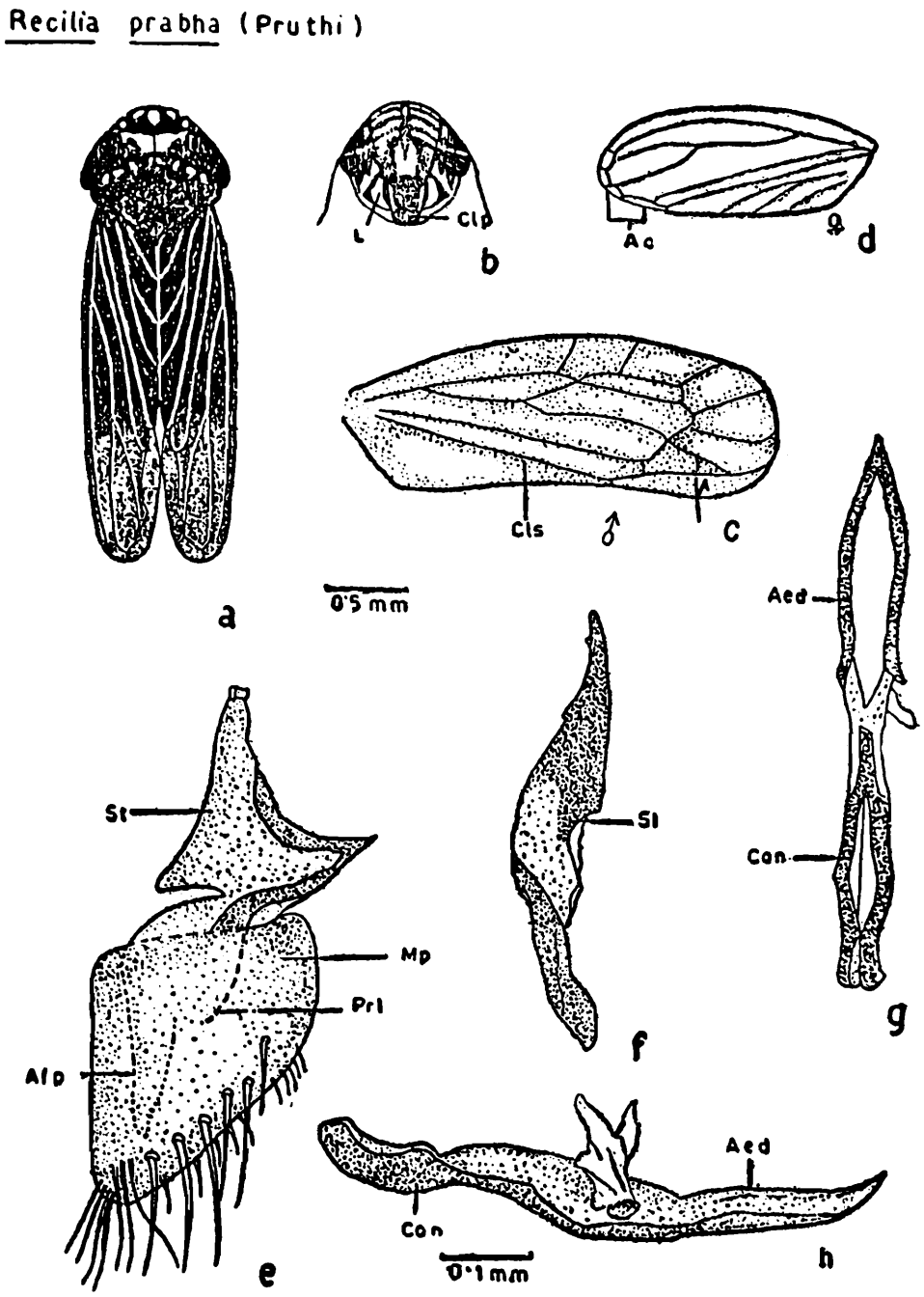
Ling *et al.* (1983) listed four viruses of plant diseases transmitted by this vector, viz., Dwarf, Gall Dwarf, Orange leaf and Tungro Virus. Harris (1983) also reported on the transmission of Tungro virus by this species. Viraktamath (1983) included this in the illustrated key for separating the economically important leafhoppers.

Recilia prabha (Pruthi)

(Text fig. 25, a-h)

Thamnotettix prabha Pruthi, 1930, *Mem. Indian Mus.*, **11** : 62; Datta, 1972, *Zool. Anz.*, **189** (1-2) : 199.

Recilia prabha : Ghauri, 1980, *Reichenbachia*, **18** (25) : 166 (=*Thamnotettix prabha* Pruthi)



Text fig. 25. *Recilia prabha* (Pruthi) a-Habitus. .dorsal view; b-Face. .ventral view; c-Forewing. (male) .dorsal view; d-Forewing (female) .dorsal view; e-Male plate and Style. .ventral view; f-Style. .lateral view; g-Aedeagus and Connective. .dorsal view; h-Aedeagus and Connective. .lateral view

Vertex anteriorly obtuse, anterior margin piceous, interrupted by three pale ochraceous spots, posterior margin of vertex pale ochraceous. Face broader than long, a small spot at base of frontoclypeus, posterior margins and lateral transverse striae fuscous, sometimes frontoclypeus with a pale median fascia; clypellus broad at base and narrowed to apex with a rectangular black patch on the disc; lora convex and dark fuscus. Pronotum dark fuscous, anterior margin rounded, posterior margin nearly truncate, anterior margin with a few pale ochraceous markings. Scutellum broader than long, fuscous, with lateral margins ochraceous. Forewing dark brown, long, narrow, reaching the posterior extremity of abdomen, appendix short; forewing in females short, broad, with apical cells small and not reaching the posterior extremity of abdomen. Legs ochraceous, posterior femoral spinulatioon, 2+1+1.

Male genitalia: Male plate triangular, with hair-like marginal setae and stout submarginal setae on lateral margin. Connective V-shaped with the arms fused and also fused with aedeagus. Style flattened anteriorly, internal claw short, the pre-apical lobe well developd, apophysis short, apex nearyl pointed, better discernible in lateral aspect. Aedeagus fused with connective, shaft boat-shaped, apical spine-like process short and straight.

Female genitalia: Seventh stenum short, postrior margin concave, ovipositor long, slender, not extendig to posterior extremity of abdomen.

Measurements: Male 2.51 to 2.83 mm long, and 0.83 to 0.86 mm wide. Female 2.84 to 3.08 mm long and 0.86 to 1 mm wide.

Host: Collected from vegetation containing chiefly *Paspalum distidum* Linn. and *Osbeckia crinita* Benth.

Specimens examined: India : Meghalaya : Shillong, Nongthumai, 2 ♂♂, 3 ♀♀, 9.viii.1975, M. S. Jyrwa, Coll.; Shillong, Happy valley, 1 ♀, 23.viii.1976, M. S. Jyrwa, Coll.; Shillong, Golf links, 3 ♂♂, 5 ♀♀, 6.ix.1976, M. S. Jyrwa, Coll.; Upper Shillong, 2 ♂♂, 4 ♀♀, 30.iv.1977, K. R. Rao, Coll.; Shillong, Motinagar, 1 ♀, 20.v.1978, P. B. Thapa, Coll.; Shillong, Fruit Garden, 1 ♂, 1 ♀, 11.viii.1977, K. R. Rao, Coll.; Shillong, Fruit Garden, 2 ♂♂, 3 ♀♀, 8.viii. 1983, M. S. Jyrwa, Coll.

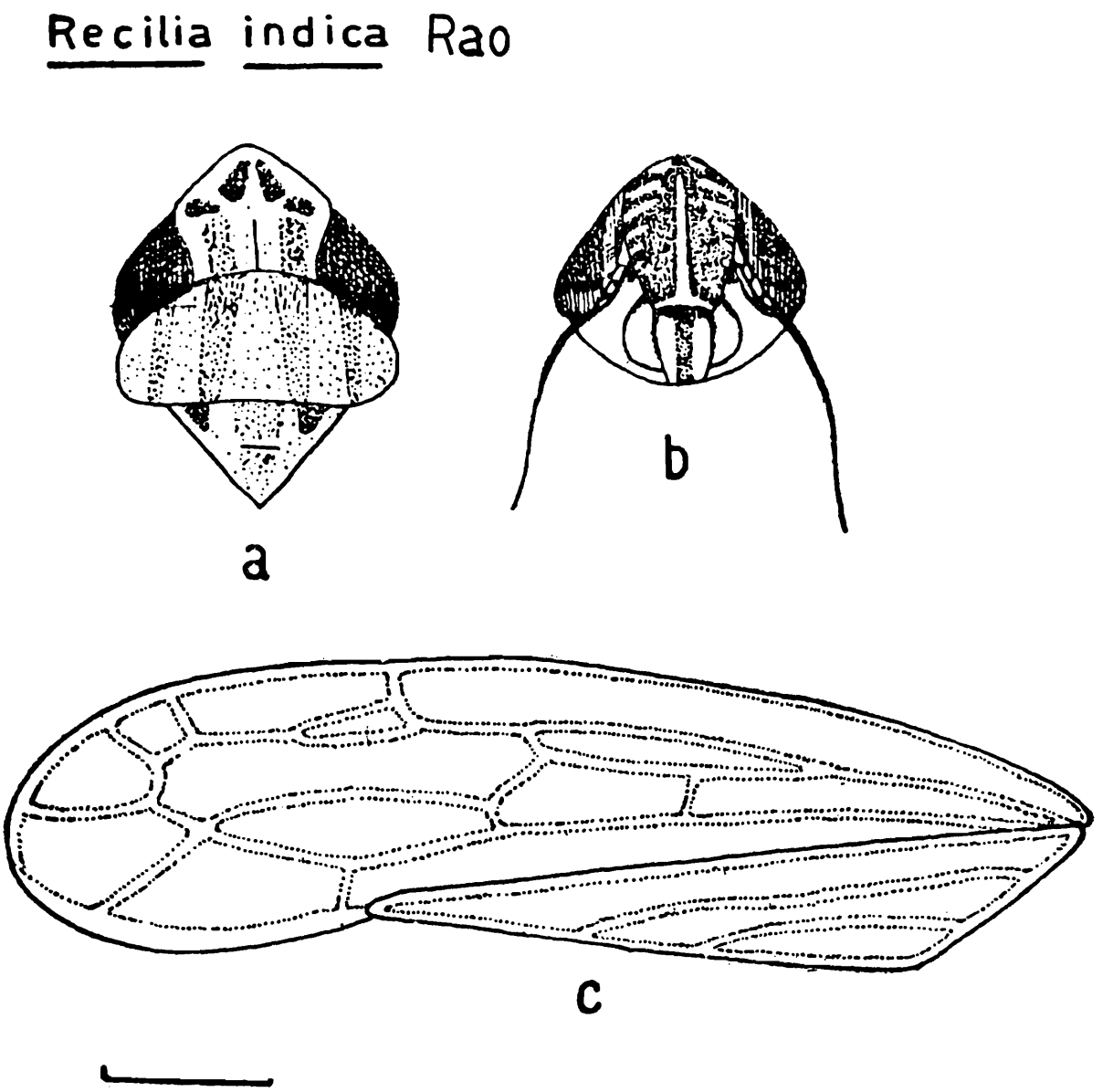
Distribution: This species is known to occur only from Dumpeep, Khasi Hills.

Remarks: This species closely resembles *R. maculata* (Pruthi) in the general shape of male genitalia especially in the boat-shapped aedeagal shaft. But it can be distinguished from *maculata* by colouration and by the aedeagal shaft having the apical process short and straight, whereas in *maculata* the aedeagal shaft is characterised by a strongly curved apical hook. In addition to this, the colouration of vertex also serves to distinguish the two species.

Recilia indica Rao

(Text fig. 26, a-c)

Recilia indica Rao, 1989, *Hexapoda*, **1** (1) : 72, fig. 62-64.



Text fig. 26. *Recilia indica* Rao a. Head and thorax. .dorsal vitw; b. Face. .ventral view; c. Fore wing. .dorsal view

Diagnosis : Vertex with 4-5 brown to dark submarginal spots, pronotum with four longitudinal brown stripes. Scutellum ochraceous, broader than long with three ochraceous bands. Fore wing with four apical and three anteapical cells. Style broad basally, apophysis finger like with a ventral tooth near apical one third. Aedeagus tubular, shaft slightly curved dorsally near apex at it caudal margin, terminated by an elongated acuminate spine.

Male 3.75 mm long, 1.03 mm wide, females 3.4 to 3.45 mm long and 0.9 to 0.95 mm wide.

Distribution : Nongstoin, Meghalaya.

Recilia maculata (Pruthi)

(Text fig. 27, a-d)

Cicadula maculatus Pruthi, 1930, *Mem. Indian Mus.*, **11** : 80-81.

Recilia maculata (Pruthi) : Rao, 1989, *Hexapoda*, **1** (1) : 65-66.

Diagnosis : Vertex with a small piceous spot at apex and two large piceous round spots below it. Scutellum ochraceous with a piceous spot at each basal angle. Fore wing with four apical cells. Connective and aedeagus fused, aedeagal shaft boat-shaped.

The species *maculata* is taken from *Cicadula* and combined with *Recilia* because of aedeagal shaft is long and pointed at tip where as in *Cicadula* it is strongly curved dorso-anteriorly.

Male 2.8 to 3.36 mm long and 0.89 to 95 mm wide.

Female 3.05 to 3.36 mm long and 0.95 to 1.03 mm wide.

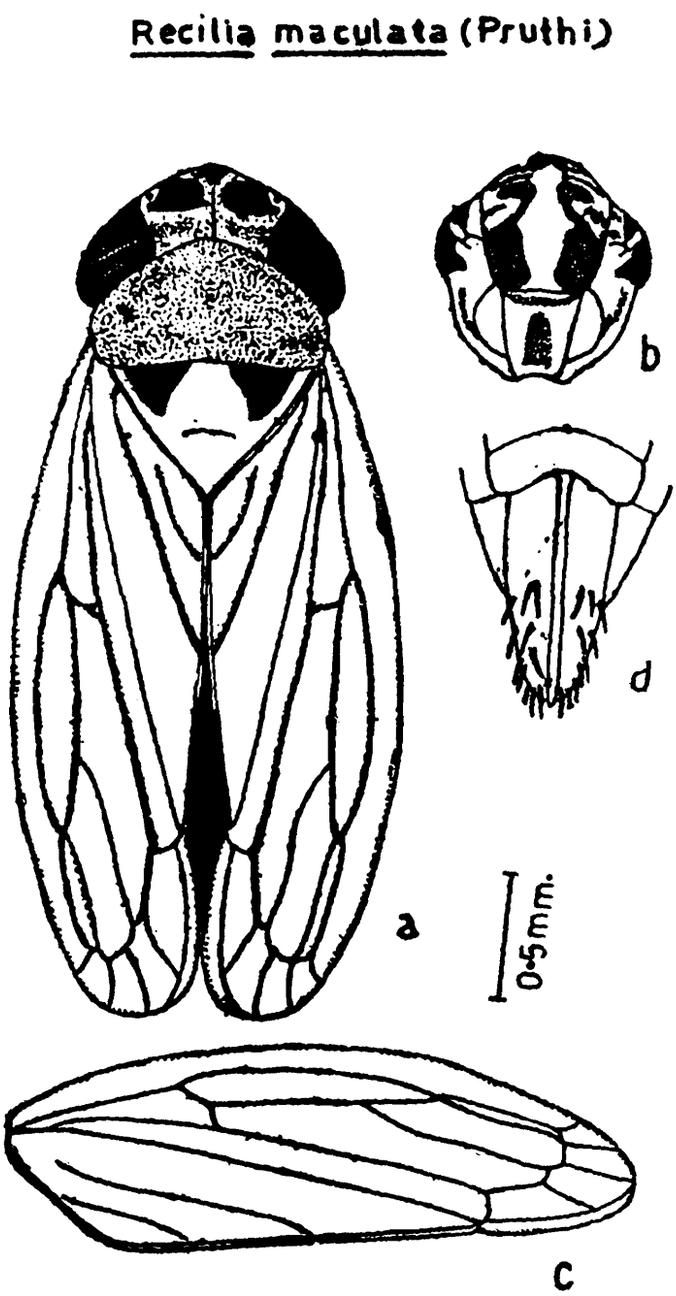
Distribution : This species is so far recorded from Sikkim and Bengal.

Recilia intermedia (Melichar)

(Text fig. 28, a-c)

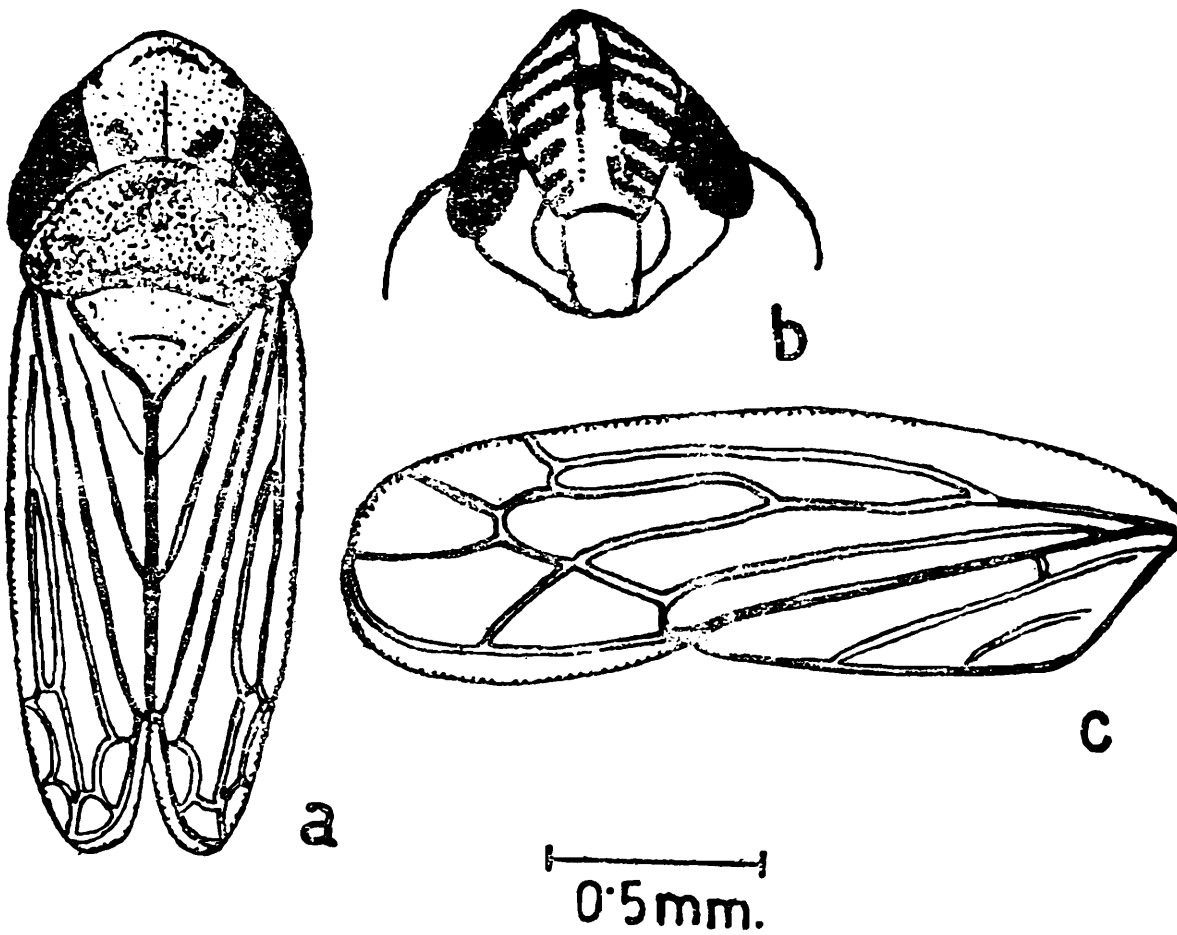
Deltocephalus intermedius Melichar, 1903, *Hom. Fauna Ceylon*, 205.

Recilia intermedia (Melichar) : Rao, 1989, *Hexapoda*, **1** (1) : 75, fig. 67-68.



Text fig. 27. *Recilia maculata* (Pruthi) a. Habitus. .dorsal view; b. Face. .ventral view; c. Fore wing. .dorsal view; d. Female genitalia. .ventral view

Recilia intermedia (Melichar)



Text fig. 28. *Recilia intermedia* (Melichar) a. Habitus. .dorsal view; b. Face. . ventral view; c. Fore wing. .dorsal view

Diagnosis : Pronotum pale ochraceous, anterior margin rounded, posterior margin truncate. Scutellum broader than long, lateral margins sinuate. Fore wing with four apical and three anteapical cells and a small appendix.

Male 2.66 to 3.3 mm long and 0.67 to 0.78 mm wide.

Female 2.74 to 3.33 mm long and 0.75 to 0.78 mm wide.

Distribution : This is known from India and Sri Lanka.

Genus **Paramesodes** Ishihara, 1953

Paramesodes Ishihara, 1953, *Matsuyama agric. Coll. Sci. Rep.*, **11** : 45; Type-species : *Athysanus albinervosus* Matsumara; Linnavuori, 1962, *Suomal. elain-ja kasvit. Seur. Van Julk.*, **24** (3) (=*coexitianus*) ; Wilson, 1983, *Ent. Scand.*, **14** :

Diagnosis : The genus includes broad, flattened species of pale yellow to brown colouration with prominent black submarginal band on vertex between the eyes.

Wilson (1983) revised the genus *Paramesodes* and reported 11 species out of which eight were new from the old world. Wilson also synonymised *Paramesodes ishurdii* Mahmood & Meher of Pakistan with *P. lineaticollis* (Distant).

In India the genus *Paramesodes* is known by species viz., *P. lineaticollis* Distant and *P. pusae* Wilson and *P. montanus* Rao.

Paramesodes montanus Rao

(Text fig. 29, a-c)

Paramesodes montanus Rao, 1989, *Hexapoda*, **1** : (1) : 75, fig. 69-74.

Diagnosis : Vertex four times as broad as long, shorter than pronotum and wider than long with a broad transverse fasciae between the eyes. Pronotum with seven longitudinal fasciae. Pygofer broad, process extending beyond posterior margin of lobes.

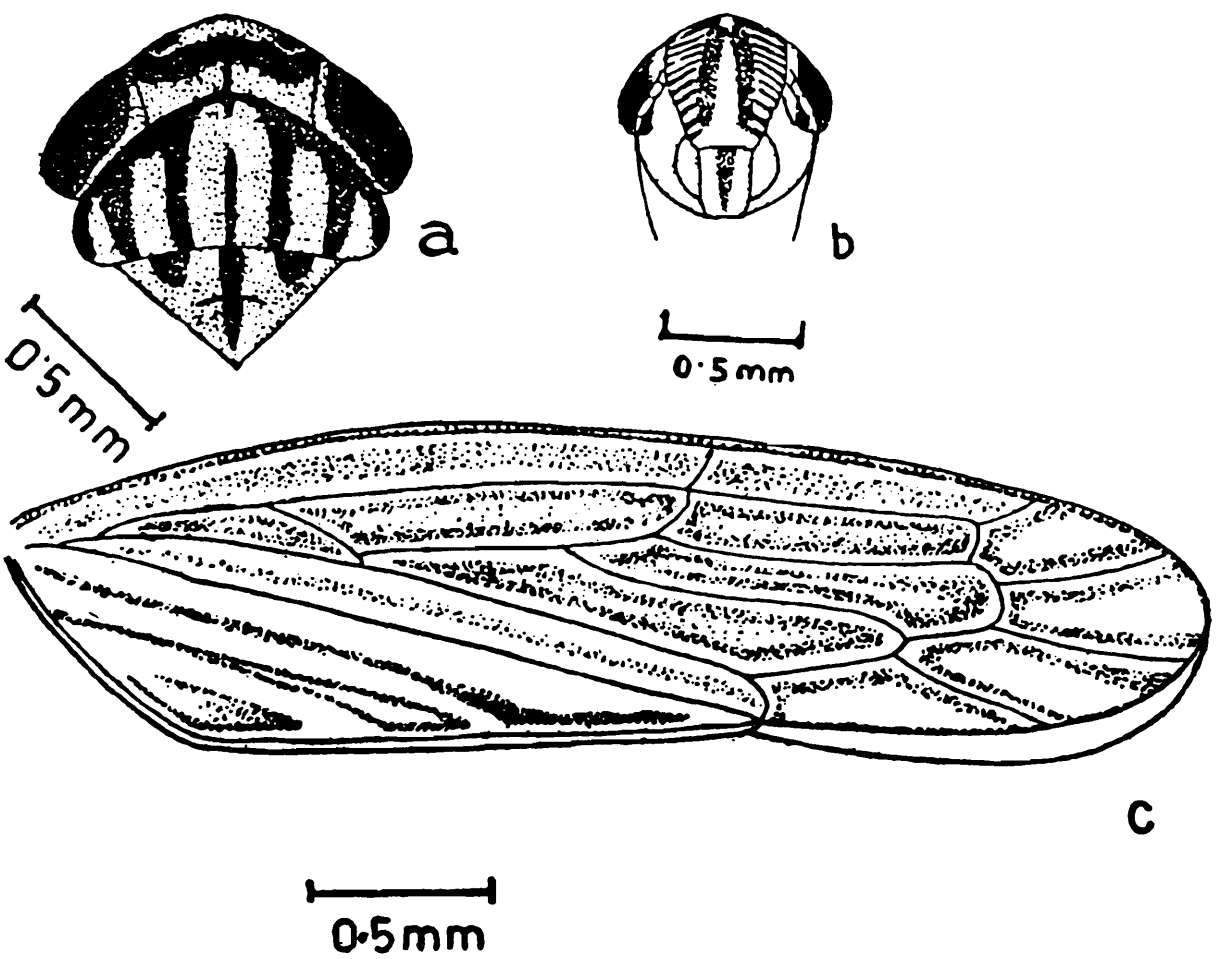
Male 6.27 mm long and 1.76 mm wide, female 6.32 mm long and 1.67 mm wide.

Distribution : Sonapahar, Meghalaya.

Tribe **Doraturini** Ribaut

Vertex with anterior margin thickened as in *Doratura* and *Doraturopsis* or may be smooth from vertex to face; usually brachypterous. Sc and R in hind wing join the apical sector. Plates triangular, broadly or narrowly rounded, apically or obliquely truncate; connective and aedeagus distinctive, connective long and branched at anterior end of style. Aedeagus with thick shaft, gonopore subapical. Ovipositor long, extending beyond pygofer,

Paramesodes montanus Rao



Text fig. 29. *Paramesodes montanus* Rao a. Head and thorax. .dorsal view; b. Face .ventral view; c. Fore wing. .dorsal view

Genus **Aconurella** Ribaut, 1948

Aconurella Ribaut, 1948, *Bull. Soc. Hist. nat. Toulouse,* **83** : 57; 1952, *Faune, Fr.,* **57** : 10; Type-species : *Thamnotettix prolixus* Lethierry; Lindberg, 1954, *Commentat. biol.,* **14** (1) : 217; Ghauri, 1974, *Bull. ent. Res.,* **63** : 553; Anufriev, 1978, *Trudy. Vses. ent. Obschch.,* **60** : 163.

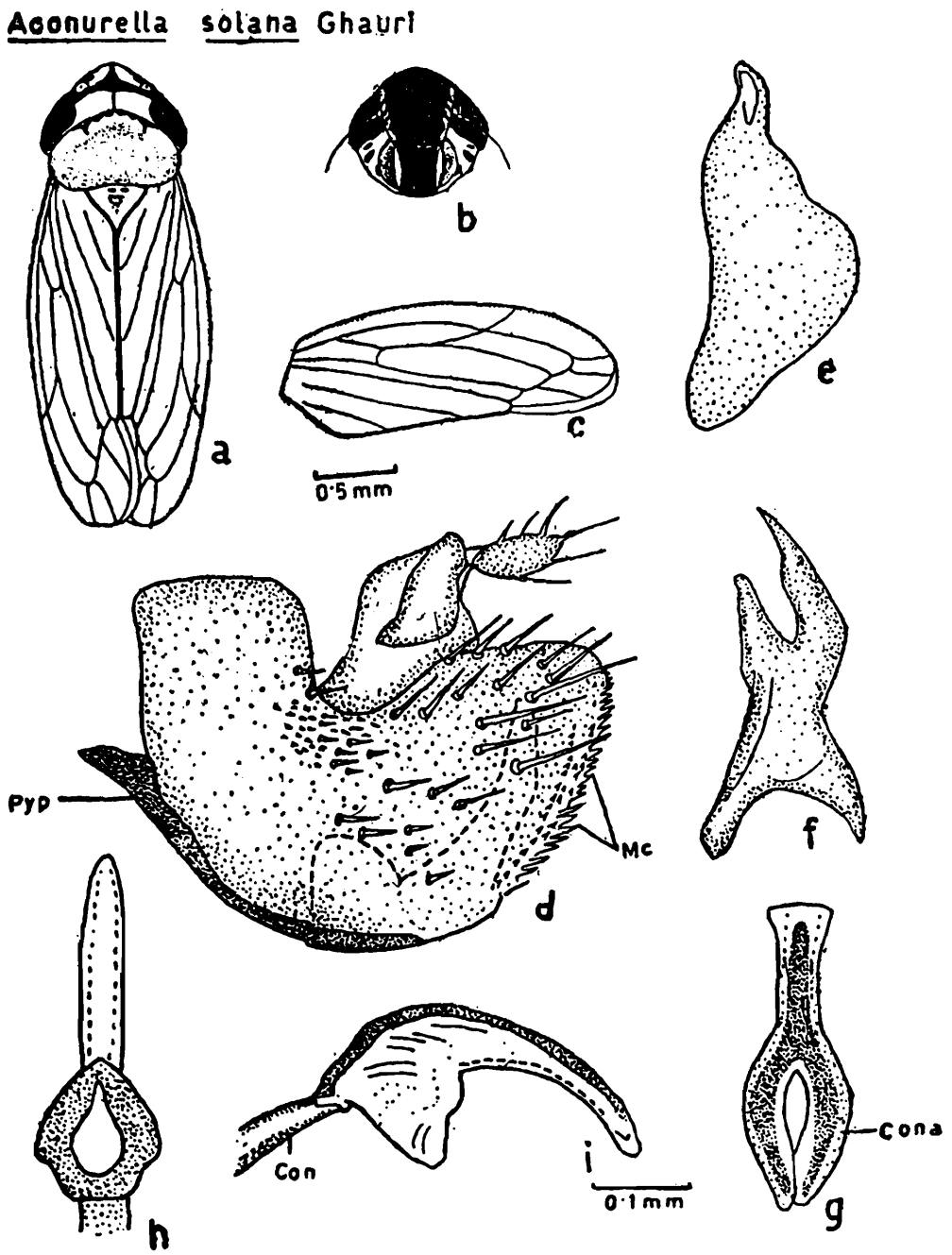
Diagnosis : Ribaut (1952) characterised the genus.

The genus is well distributed in Palearctic and Oriental Regions. Ghauri (1974) reported *Aconurella solana* and *A. erebus* (Distant) from India of which only *A. solana* occurs in the Khasi Hills.

Aconurella solana Ghauri, 1974

(Text fig. 30, a-i)

Aconurella solana Ghauri, 1974, *Bull. ent. Res.*, **63** : 533.



Text fig. 30. *Aconurella solana* Ghauri a-Habitus. .dorsal view; b-Face. .ventral view; c-Forewing. .dorsal view; d-Pygofer. .lateral view; e-Male plate .ventral view; f-Style. .dorsal view; g-Connective. .dorsal view; h-Aedeagus. .dorsal view; i-Aedeagus. .lateral view

Vertex ochraceous with a transverse black fascia on the anterior margin, shorter than pronotum. Face black, as long as broad, clypeus piceous, laterally ochraceous, a large black patch on disc; lora small, black, not reaching the apex of clypellus; genae ochraceous lower margins just reaching the posterior margins of lora. Pronotum dark brown, longer than vertex, anterior margin with small irregular black spots, minutely striate; anterior margin round, posterior margin almost truncate, scutellum small with a large piceous disc leaving the lateral margins ochraceous, transversely impressed in the middle, two minute black spots above the transverse line. Forewing hyaline, veins dark, abdomen black.

Male genitalia : Pygofer with postero-ventral marginal and submarginal areas wih a dark and dense comb of spines, disc with large and small setae, but not extending beyond the serrations. Male plate small, broad at base, blunt at apex. Style broad at base, pre-apical lobe long and curved, apophysis long. Connective Y-shaped with arms close together. Aedegus with a well developed dorsal apodeme, shaft long, gonopore apical.

Female genitalia : Seventh sternum broad, posterior margin produced in the middle with a piceous spot at the disc; pygofers dark brown with stout bristles at the posterior margin; ovipositor dark brown extending to the posterior extremity of abdomen.

Measurements : Male 2.8 to 2.94 mm long and 0.8 to 0.84 mm wide. Female 2.94 to 3.3 mm long and 0.94 to 0.98 mm wide.

Host : Collected chiefly from *Solanum tuberosum.*

Specimens examined : Meghalaya : Shillong, Elephant Falls, 1 ♂, 1 ♀, 6.x.1977, M. S. Jyrwa, Coll.; Shillong, Fruit Garden, 1 ♂, 11 ♀♀, 8.xi.1977, M. S Jyrwa, Coll.; Nongklah, 2 ♂♂, 3 ♀♀, 4.xii.1977, K. R. Rao, Coll.; Dumpeep hills, 1 ♂, 2 ♀♀, 15.i.1978, K. R. Rao, Coll.

Distribution : It is probable that the species is distributed throughout the sub-himalayan range. Earlier it was reported from Simla only.

Remarks : This species closely resembles *Aconurella erebus* (Distant) but can be distinguished from it by the structure of male pygofer. In *A. solana* the postero-ventral margin is serrated along more than half its length whereas in *A.* erebus it is entire, free of serrations. Male plates are much shorter than pygofer in *A. solana* but they are slightly longer than pygofers in *A. erebus*. *A. solana* also resembles *A. sibirica* (Leth.) but differs from it by the aedeagus not being swollen.

Tribe **Fieberiellini** Wagner

Fairly narrow frontoclypeus, apically wider, anteclypeus. There are distinct though not sharp carinae above the antennae. The genital valve is short, transverse. Plates, long with slightly subapically curved outer margins, and with long marginal hair-like setae. Styles long, slightly curved with scarcely developed apophysis for articulation with connective; connective with greatly divergent branches lying almost in a straight line. Pygofer long and anal tube tapering.

Genus **Phlogotettix** Ribaut, 1942

Phlogotettix Ribaut, 1942, *Bull. Soc. Hist. nat. Toulouse,* 262; Type species : *Jossus cyclops* Mulsant and Rey, 1855.

Phlogotettix indicus Rao

(Text fig. 31, a-c)

Phlogotettix indicus Rao, Hexapoda, **1** (1) : 77, fig. 75-82.

Diagnosis Vertex shorter than pronotum, with a large circular spot in mid dorsal region the spot touching the posterior margin of vertex. Scutellum large, triangular. Fore wing with four apical cells and well developed appendix. Aegeagus with pre-apical lobe and ventral processes of the same length; ventral processes of aedeagus directed dorsally and terminated by a pair of divergent processes.

Male 4.6 mm long and 1.6 mm wide. Female 4.68 mm long and 1.28 mm wide.

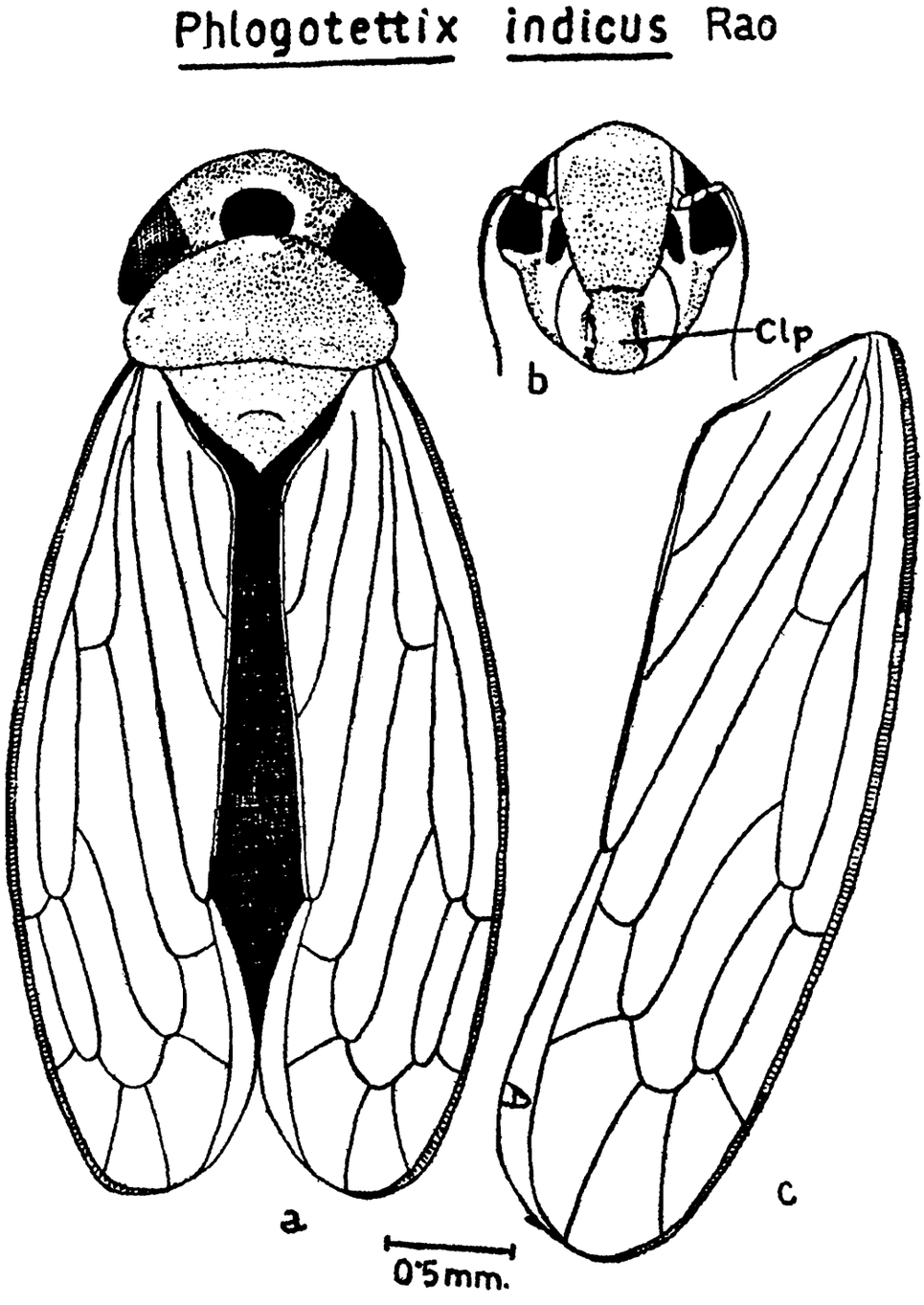
Distribution : Ranikor, Meghalaya.

Tribe **Stirellini** Emeljanov

Small leafhoppers. Head about as wide as pronotum, apex blundy subconial; clypellus long, parallel-sided and extending beyond the normal curve of genae; genae expanded, lateral margins sinuated, crown distinctly longer medially than next to eye; forewing rather short, often brachypterous, when fully developed not exceeding tip of abdomen in male and not exceeding pygofers in female. Male genital capsule large, plates short, triangular; connective elongate, anteriorly forked, aedeagus U-shaped, simple, tubular. Ovipositor much longer than pygofer.

The tribe Stirellini as defined here includes the Nearctic genera viz., *Stirellus* Osborn and Ball, *Penestirellus* Beamer and Tuthill, *Gillettilla* Osborn,

Kinonia Ball; and the Old World genus *Doratulina* Melichar as defined by Vidaste. Of these *Doratulina* is represented in the Khasi Hills



Text fig. 31. *Phlogotettix indicus* Rao a. Habitus. .dorsal view; b. Face. .ventral view; c. Fore wing. .dorsal view

Genus **Doratulina** Melichar, 1903

Doratulina Melichar, 1903, *Hom. Fauna, Ceylon,* **198**; Type-species : *Doratulina jacosa* Melichar; Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 391; Pruthi, 1930, *Mem. Indian Mus.*, **11** : 26, 29; 1934, *Ibid.*, **11** : 97; 1936, *Ibid.*, **11** : 11; Evans, 1947, *Trans. R. Ent. Soc. Lond.*, **98** : 232; Ishihara, 1953, *Matsuyama agric. Coll. Sci. Rep.*, **11** : 10; 1954, *Dobutusugaku zasshi,* **63** : 377; *Vilbaste,* 1965, *Notul. ent.*, **45** : 1 (genus distinct from *stirellus*); Viraktamath 1976, *Orient. Insects,* **10** (1) : 79; 1980, *Entomon.*, **5** : 135.

Diagnosis : Melichar defined the genus as under : "Vertex triangular, produced as in *Deltocephalus*. Its anterior margin rounded, not cornered; hexagonal beneath, face narrowed to the clypeus; pronotum shorter than vertex, tegmina leathery, short, slightly truncated behind" The genus however includes macropterous forms as well, having forewing with distinct veins.

Vilbaste (1965) reviewed the genera *Stirellus* Osborn and Ball, *Aconura, Lethierry, Aconura auct, Doratulina* Melichar and a host of other genera erected by Distant (1908, 1916) and Pruthi (1936). He synonymised *Phrynophyes* Kirkaldy, 1906, *Arya* Distant, 1908; *Campbellinella* Distant, 1918; *Bituitus* Distant, 1918; *Paternus* Distant, 1918; *Voluscenus* Distant, 1918; *Nandidrug* Distant, 1918; *Allectus* Distant, 1918 *Galerius* Distant, 1918, *Paivanana* Distant 1918; *Bella* Pruthi, 1930; *Sunda* Pruthi, 1936; *Aconura* Ribaut, 1948 and auct; *Umesdena* Ishihara, 1961 with *Doratulina* Melichar, 1903. He also opined that a further subgeneric division of the genus will be necessary based, on different head shapes. Following this clue, Viraktamath (1976b) erected the subgenus *Cymbopogonella*. Viraktamath and Viraktamath (1980) redescribed *Doratulina notatus* (Dsitant).

Doratulina is represented in the Khasi Hills by four species, and a key to separate them is included.

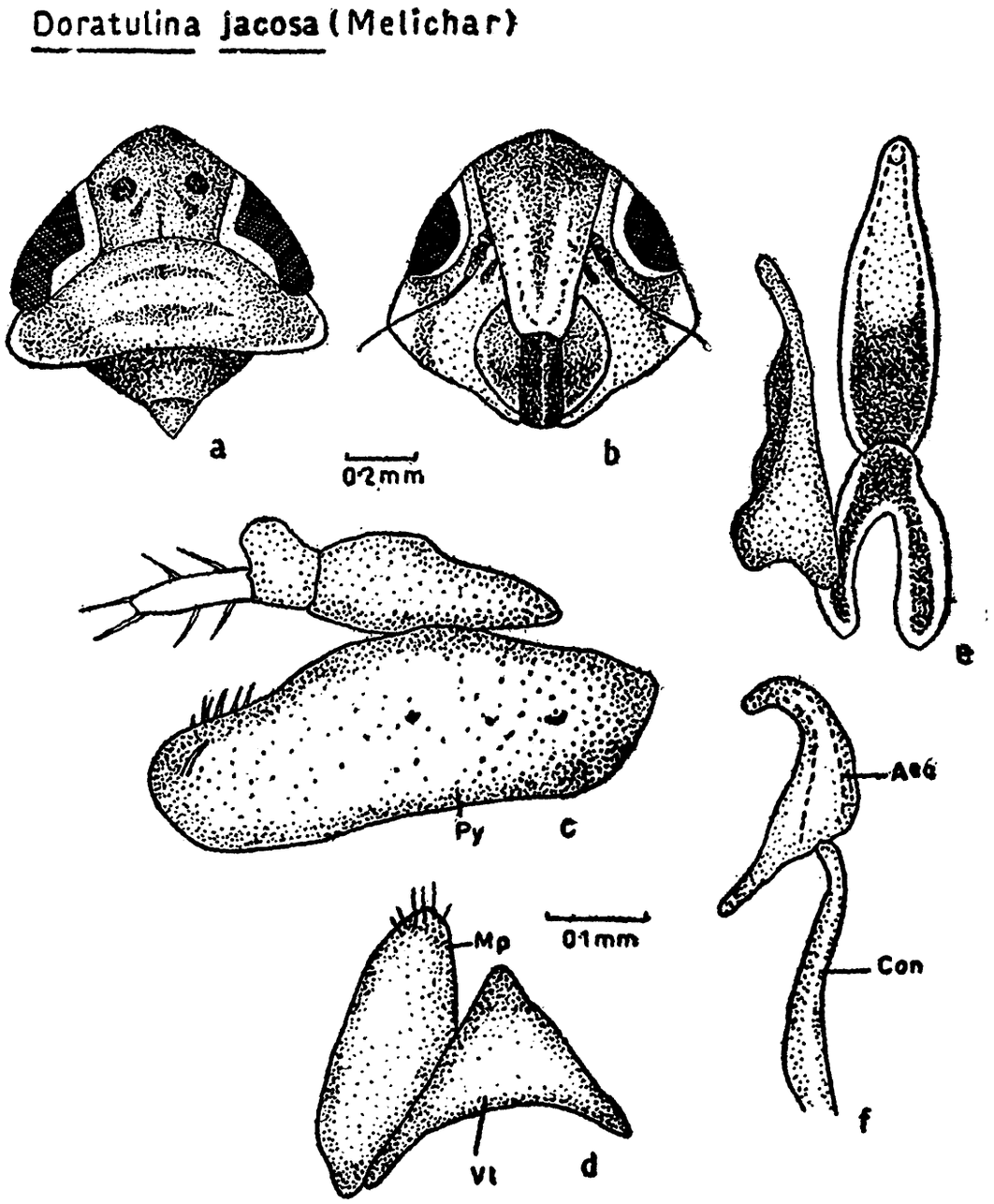
Key to the species of Doratulina Melichar from the Khasi Hills

1. Brachypterous, abdomen with five pale longitudinal fasciae	...	*jacosa* Melichar
——Macropterous abdomen without fasciae	...	2
2. Vertex with either black or sanguineous markings	...	3
——Vertex without such markings	...	*solitaris* (Melichar)
3. Vertex with two round black spots; a large piceous spot below antennal pits	...	*indra* (Distant)

——Vertex with a transverse sanguineous fascia before eyes, two oblique dark spots near base; no spots below antennal pits ... *rubrolineata* (Distant)

Doratulina jacosa (Melichar)

(Text fig. 32, a-f)



Text fig. 32. *Doratulina jacosa* (Melichar) a-Head and thorax. .dorsal view; b-Face .ventral view; c-Forewing. .dorsal view; d-Valve and Male plate.... ventral view; e-Connective, Aedeagus and Style. .dorsal view; f-Connective and Aedeagus. .lateral view

Doratulina jacosa Melichar, 1903, *Hom. Fauna Ceylon*, 199; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 393; Pruthi, 1936, *Mem. Indian Mus.*, **11** : 110; Evans *Trans. R. ent. Soc. Lond.*, **98** : 232.

Vertex dark brownish with two round piceous spots near each eye on disc; a pair of small piceous streaks below eyes. Face dark brown; frontoclypeus long, finely punctate, piceous; clypellus pale ochraceous, margins parallel; lora short, united to clypellus beyond its middle; genae running through lower margins of lora; a foveate patch below eyes, piceous. Pronotum dull brownish, shorter than vertex, a pair of small reddish spots on the anterior margin and a narrow piceous submarginal band anteriorly, posterior part of pronotum finely striate. Scutellum with a basal spot and two angular obscure piceous spots. Forewing short only covering abdomen at base, posteriorly truncate, longitudinal veins simple. Abdomen pale yellow with five pale brownish longitudinal stripes. Apex of posterior femora and inner and lower sides of the same black.

Male genitalia : Pygofer large with an obscure small denticle on the posterior rounded margin. Valve triangular. Male plate small with fine setae on the caudal end. Connective Y-shaped, arms well separated. Style long, narrow with the apophysis turned laterad, pre-apical lobe not well developed Aedeagus with a well developed dorsal apodeme, shaft long and slender, sinuate.

Measurements : Male 2.50 to 2.66 mm long and 0.80 to 0.82 mm in wide

Specimens examined : India : Meghalaya : Mawsynram, 3♂♂, 5.xii.1977, K. R. Rao, Coll.

Distribution : This species is known from Sri Lanka and Japan.

Remarks : This species can be distinguished from all other species of the genus by the forewing being short and covering the abdomen at base only, and in being posteriorly truncate and also by five brownish longitudinal marks on the abdomen.

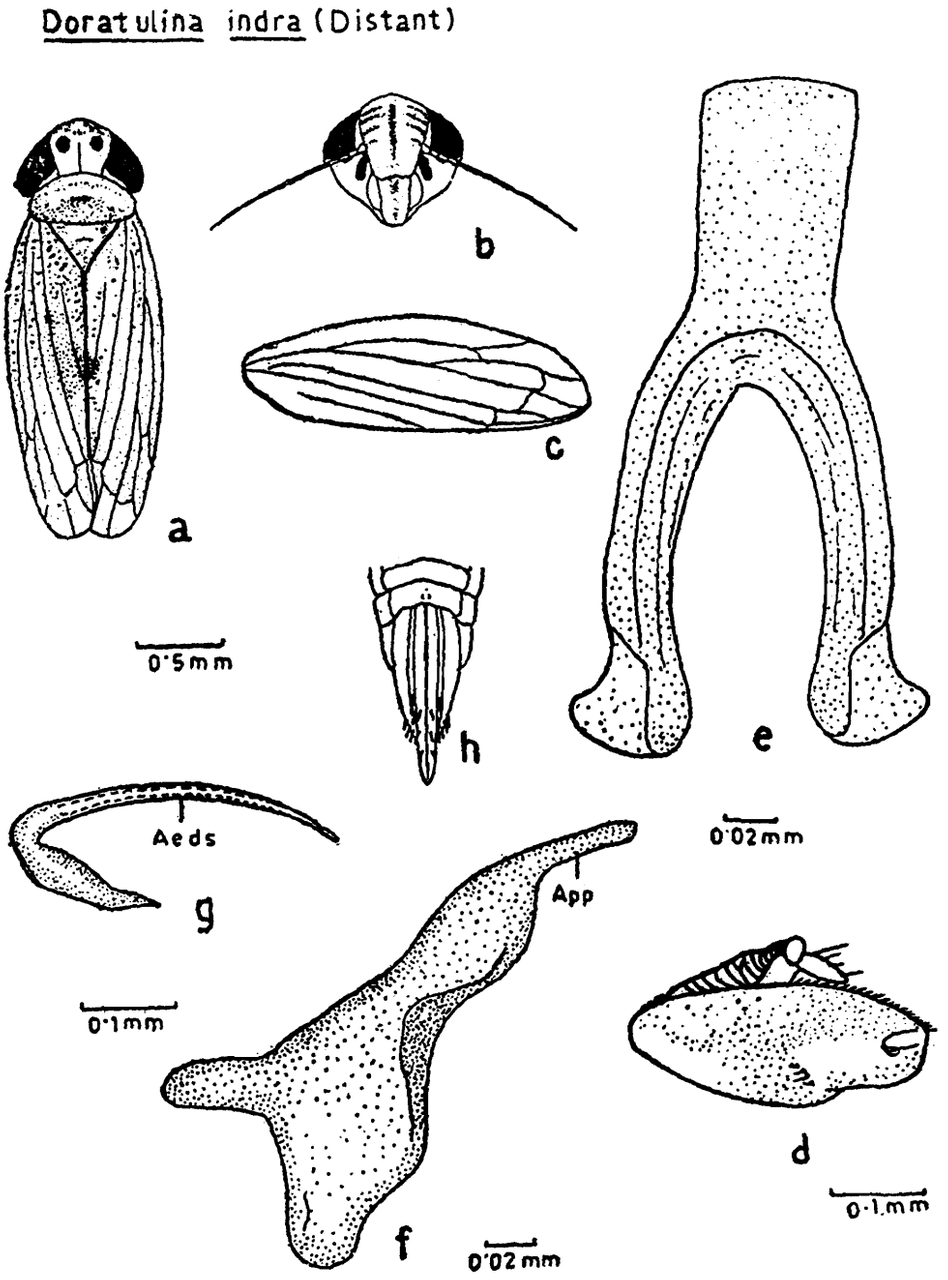
Doratulina indra (Distant)

(Text fig. 33, a-h)

Typhlocyba indra Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 415.

Paivanana indra : Distant, 1918, *Fauna Br. India,* Rhynchota, **7** : 95 (=*Typhlocyba indra* Distant) ; Matsumura, 1931, *Insecta matsum.*, **6** : 190; Pruthi 1934, *Mem. Indian Mus.*, **11** : 98 ; Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 237.

Doratulina indra : Vilbaste, 1965, *Notul. ent.*, **45** : 10.



Text fig. 33. *Doratulina indra* (Distant) a-Habitus. .dorsal view; b-Face. .ventral view; c-Forewing. .dorsal view; d-Pygofer. .lateral view; e-Connective .dorsal view; f-Style. .dorsal view; g-Aedeagus. .lateral view; h-Female genitalia. .ventral view

Vertex ochraceous, rounded at apex with two circular spots slightly above disc piceous. Face brownish ochraceous; frontoclypeus long, broad at base, lateral margins pale ochraceous, rest of the area brownish ochraceous; clypellus long, pale ochraceous; lora small, outer margins in close apposition with margins of genae; a large foveate marking below each antenna, piceous. Pronotum ochraceous, as long as vertex. Scutellum pale ochraceous, triangular. Forewing ochraceous at the costal and claval margins and greyish elsewhere: apical clls four, appendix small. Abdomen greyish ochraceous.

Male genitalia : Male plate small, narrow with setae on the mesial border. Pygofer small, its caudal end truncate, dorsal margins minutely setulose, a small denticle-like structure dorsall on posterior side. Connective Y-shaped with arms widely divergent. Style broad at base, pre-apical lobe moderately developed. Aedeagus with a well developed apodeme, shaft long and narrow.

Female genitalia: Seventh sternum short, posterior margin sinute and notched at the centre. Pygofers long, ovipositor long, slender, extending beyond posterior extremity of abdomen, pygofers and ovipositor with stout setae.

Measurements : Male 2.8 to 3.06 mm long and 0.9 to 0.92 mm wide. Female 2.96 to 3.24 mm long and 0.88 to 1.2 mm wide.

Host: Collected from plants containing chiefly *Mikania micrantha* HB & K.

Specimens examined : India : Meghalaya : Shillong, Fruit Garden, 2 ♂♂, 2.xi.1976, K. R. Rao, Coll.; Nongklah, 9 ♀♀, 1.xii.1977, K. R. Rao, Coll.; Puksora, 1 ♂, 15 ♀♀, 7.xi.1977, K. R. Rao, Coll.; Shillong, Tripura Castle Road, 2 ♀♀, 23.ix.1977, M. S. Jyrwa, Coll.

Distribution : This is reported from India, Bengal.

Remarks : This species closely resembles *D. durga* Distant in general colouration and shape of vertex but differs from it in the presence of two prominent black spots on the vertex between the anterior margin of the eyes.

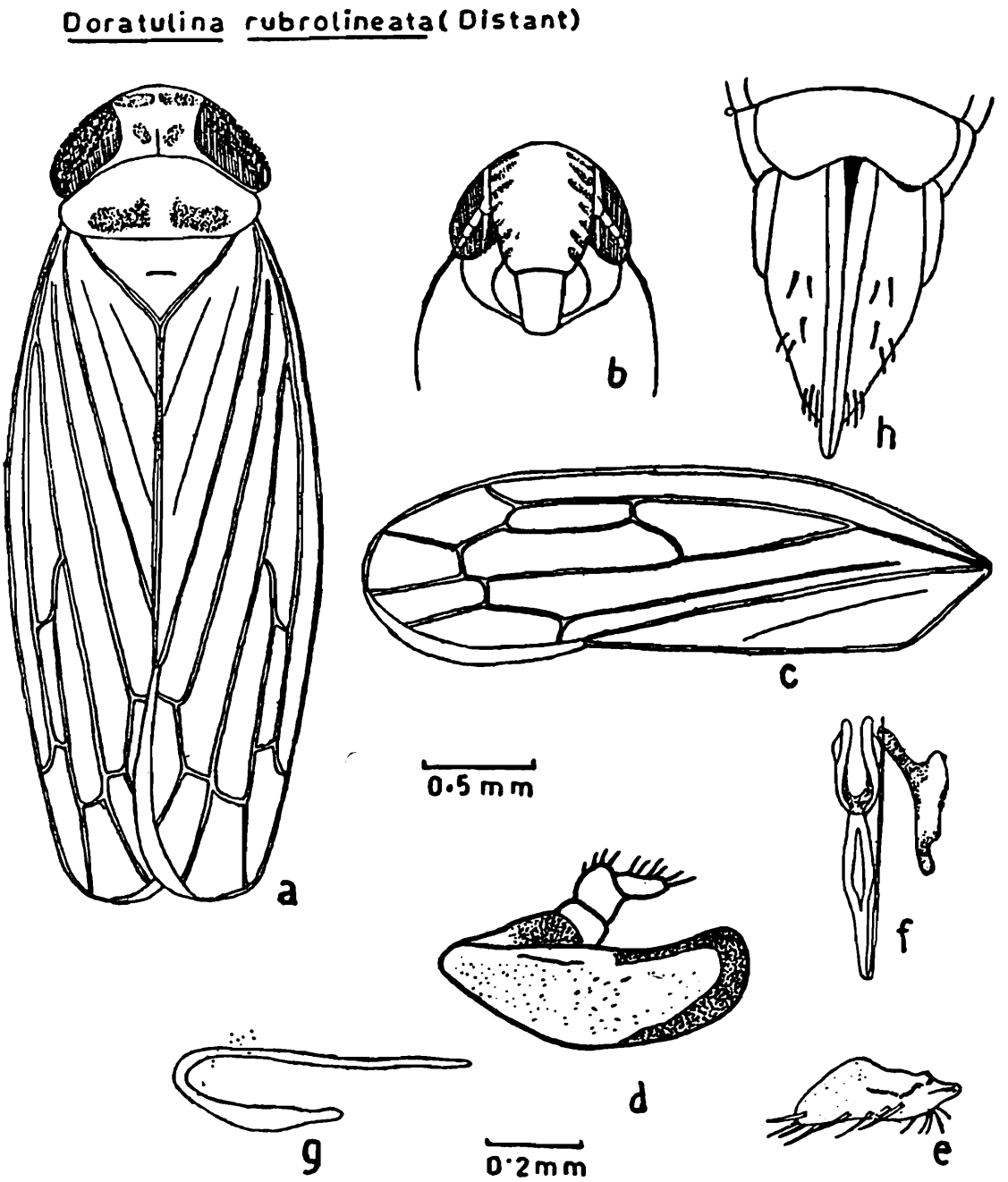
Doratulina rubrolineata (Distant)

(Text fig. 34, a-h)

Arya rubrolineata Distant, 1908, *Fauna Br. India.* Rhynchota, **4** : 322; **Pruthi,** 1930, *Mem. Indian Mus.,* **11** : 40; Evans, 1947, *Trans. R. ent. Soc. Lond.,* **98** : 229.

Doratulina rubrolineata : Vilbaste, 1965, *Notul. Ent.,* **45** : 10 (=*Arya rubrolineata* Distant)

Arya rubrolineata : Rao, 1967, *J. Bombay nat. His. Soc.,* **64** (1) : 130; 1980, *Rec. Zool. Surv. India,* **76** : 193; 1981, *Ibid.,* **78** : 2.



Text fig. 34. *Doratulina rubrolineata* (Distant) a-Habitus. .dorsal view; b-Face. ventral view; c-Forewing. .dorsal view; d-Pygofer. .lateral view; e-Male plate. .ventral view; f-Aedeagus, Style and Connective. .dorsal view; g-Aedeagus. .lateral view; h-Female genitalia. .ventral view

Vertex pale ochraceous, rounded anteriorly with a transverse sanguineous fascia between the eyes and interrupted in the middle; a small patch on either side of the dark median line sanguineous. Face ochraceous; frontoclypeus long, broad at base with 7-8 brown lateral fasciae, frontoclypeus long, broad at apex; lora small, convex not reaching the apex of clypellus; a spot on either side of the antennal base piceous, pronotuom greyish ochraceous. Scutellum ochraceous with a transvtrse impressed line in the middle. Forewing long with a small appexdix. Abdomen ochraceous, legs pale ochraceous.

Vertex pale ochraceous, rounded anteriorly with a transverse sanguineous fascia between the eyes and interrupted in the middle; a small patch on either side of the dark median line sanguineous. Face ochraceous; frontoclypeus long, broad at base with 7-8 brown lateral fasciae, frontoclypeus long, broad at apex; lora small, convex not reaching the apex of clypellus; a spot on either side of the antennal base piceous, pronotum greyish ochraceous. Scutellum ochraceous with a transverse impressed line in the middle. Forewing long with a small appendix. Abdomen ochraceous, legs pale ochraceous.

Male genitalia : Pygofer, large, rounded posteriorly and with an obscure denticle on its posterior side. Male plate small with setae on the lateral margins; connective Y-shaped, the arms well separated. Aedeagus with a short dorsal apodeme, shaft long, slender, gonopore apical.

Female genitalia : Seventh sternum broad, posterior margin deeply concave, pygofers convex with stout setae on the disc, ovipositor long, stout, extending to posterior extremity of abdomen.

Measurements : Male 4.01 to 4.45 mm long and 0.96 to 0.99 mm wide. Female 4.79 to 4.84 long and 1.0 to 1.18 mm wide

Specimens examined : India : Meghalaya : Umran, 2 ♂♂, 3 ♀♀ 3.xi.1975; M. S Jyrwa, Coll.; Shillong, Nongthumai, 6 ♀♀, 4.xi.1976, M. S. Jyrwa, Coll.; Mawsynram, 1 ♂, 5.xii.1977, K. R. Rao, Coll.; Mawrapat 1 ♂, 5 ♀♀, 3.xii.1977, K. R. Rao, Coll.; Puksora, 16 ♀♀, 1.xii.1977, K. R. Rao, Coll., Malki Forest, 12 ♀♀, 6.i.1978, K. R. Rao, Coll.

Distribution : It is reported from Bengal, Assam and Manipur.

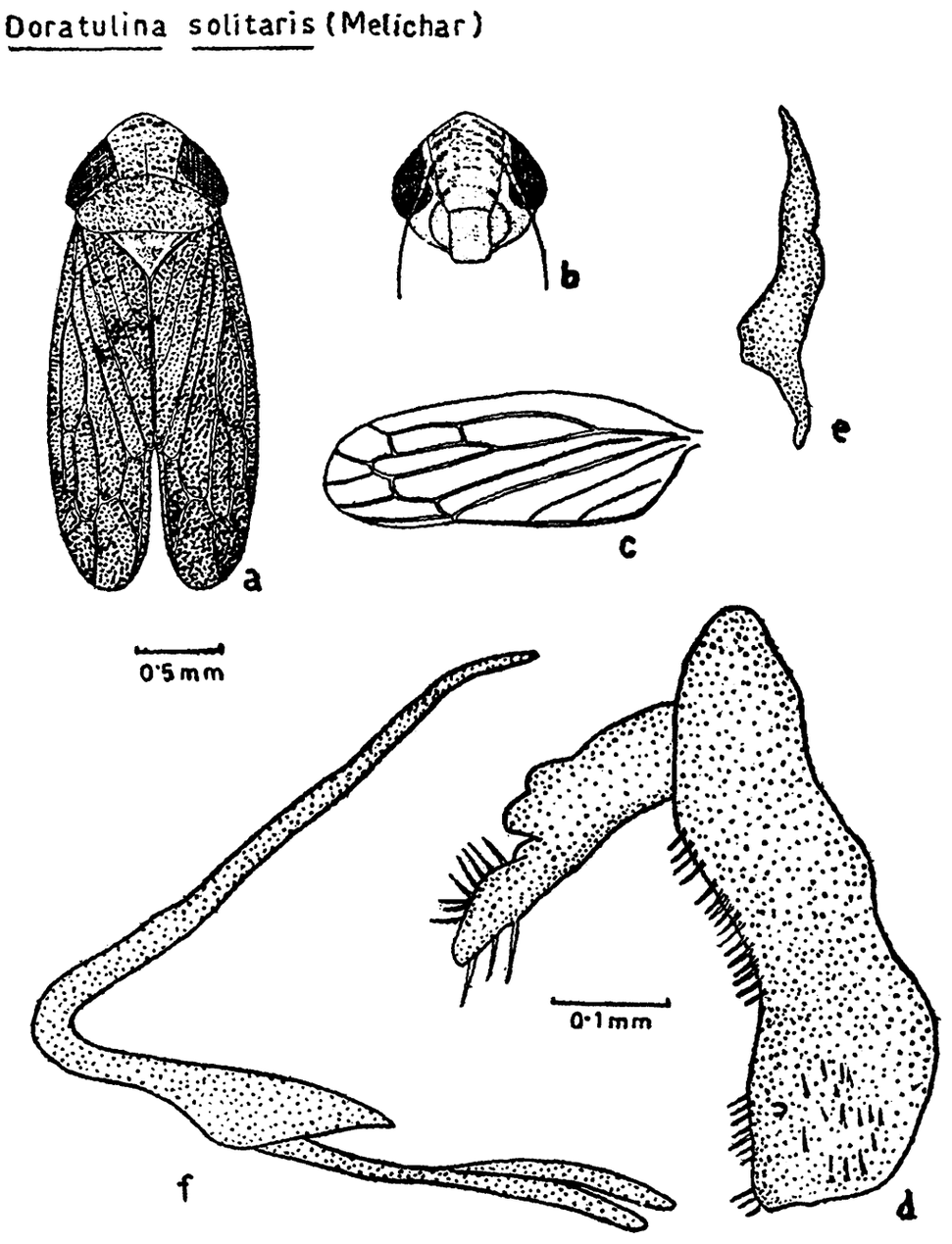
Remarks : Rao (1967) showed that the transverse sanguineous band on vertex varies from a single transverse band to two isolated transverse spots.

Doratulina solitaris (Melichar)

(Text fig. 35, a-f)

Aconura solitaris Melichar, 1903, *Hom. Fauna Ceylon, 188.* Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 379.

Doratulina solitaris Vilbaste, 1965, *Notul. ent.*, **45** : 10.



Text fig. 35. *Doratulina solitaris* (Melichar) a-Habitus. .dorsal view; b-Face. ventral view; c-Forewing. .dorsal view; d-Pygofer. .lateral view; e-Style. .dorsal view; f-Aedeagus and Connective. .lateral view

Vertex triangular, brightly ochraceous, lower margin pale ochraceous and centrally impressed with a thin line, a pair of small brownish dots on either side of the median line which are often absent. Eyes ferrugineous. Face punctate all over. Frontoclypeus long with four to five short transverse dull fuscorufous fasciae. Clypellus long, lora short, convex, not reaching the apex of clypellus ; genae enclosing lower margin of lora. Pronotum pale ochraceous, obscurely ridged longitudinally ; scutellum triangular piceous marking at base and beyond middle an arcuate impression on the disc. Forewing hyaline with four apical cells and a small appendix.

Female genitalia : Seventh sternum broad, concave and notched at the middle in the posterior margin. Pygofers large, pale ochraceous with short setae at the lateral margins. Ovipositor long, thin, extending beyond the posterior extremity of abdomen.

Measurements : Male 2.88 mm long and 1 mm wide. Female 3.36 mm long and 1.02 mm wide.

Host : Collected by sweeping on *chromolaena odoratum* (Linn.)

Specimens examined : 1 ♂, 1 ♀ , India : Meghalaya : Ranikor, 10.xii.1977, K. R. Rao, Coll.

Distributions : It is so far known from India and Sri Lanka.

Remarks : Two dark elongated spots near base of vertex and two transverse linear impressions near anterior margins of pronotum with a central ridge observed by Melichar, are noe discernible in the specimens at hand. However, they agree with the rest of the description of the species. It resembles *D. columbensis* in the general shape of body, but can be distinguished from it by the obscure impressions on the vertex and by the absence of marginal spots on lora.

Tribe **Scaphoideini** Oman

Head subacuminate. Forewing long with well developed appendix. Male plate short subtriangular. Pygofers with stout setae. Connective Y-shaped. Aedeagus usually with a pair of paraphyses gonopore apical or subapical.

Genus **Scaphoideus** Uhler, 1889

Scaphoideus Uhler, 1889, *Trans. Maryland, Acad. Sci.*, **1** : 33 ; Type-species : *Jassus immistus* Say ; Distant, 1908, *Fauna Br. India.* Rhynchota, **4** : 371, 1918, *Ibid.*, **7** : 64.

Hussa Distant, 1918, *Fauna Br. India,* Rhynchota, **7** : 68; Type-species : ***Hussa*** *insignis* Distant.

Bolanus Distant, 1918, *Fauna Br. India,* Rhynchota, **7** : 89; Type-species : ***Bolanus*** *laeticus* Distant.

Scaphoideus : Oman, 1949, *Mem. ent. Soc. Wash.,* **3** 120 (=*Lonenus* De Long; =*Angenus* De Long; =*Latenus* De Long; Barnett, 1977, *Trans. Am. ent. Soc.,* **102** (4) : 494 (=*Hussa* Distant) ; 1979, *J. Kans. ent. Soc.* **52** (3) : 471 ; Anufriev, 1978, *Trudy, Vses. ent. Obschch.,* **60** : 135.

Diagnosis : Leafhoppers usually with brown or yellowish brown colouration and with orange or yellow patterns on the body. Head triangular, vertex as long as wide between, eyes or longer. Pronotum more curved infront than behind. Forewing long with moderately developed appendix; outer anterior anteapical cell small, placed obliquely in relation to costal margin and usually acuminate distally; outer claval vein curved distally and joining the commissural margin almost at right angles.

Apex of male pygofer variously shaped with stout, long pencils of setae; connective Y-shaped with fused or attached apical paraphyses aedeagus with shaft tubular, with or without a pair of apical or subapical processes often articulated with the membranous and sclerotised anal collar processes. Ovipositor extending well beyond gonopore in females.

A cosmopolitan genus, *Scaphoideus* Uhler is represented in all the principal zoogeographical regions. Distant (1908, 1918) reported 18 species from the Indian region. Matsumura (1932) and Barnett (1977b) have synonymised Distant's genera *Bolanus* and *Hussa* respectively with *Scaphoideus*. *Scaphoideus coloratus* Rao is reported from here.

Key to the species of Scaphoideus occurring in the Khasi Hills

Vertex with six connected vertical black fasciae between eyes; pygofer with five stout setae; outer of paraphyses before apex and inner margin of aedeagal shaft with minute denticles, arms of connective close to each other; apex of aedeagal shaft minutely bifid ... *assamensis* Distant

——Vertex with transverse and arcuate sanguineous fasciae between eyes; pygofer with numerous slender setae; margins of parameres and aedeagal shaft entire; arms of connective slightly divergent; apex of aedeashaft simple ... *coloratus* Rao

Scapholdeus assamensis Distant

(Text fig. 36, a-h)

Scaphoideus assamensis Distant, 1918, *Fauna Br. India, Rhynchota,* **7** : 67.

Dark brownish species; vertex slightly shorter than width between eyes, ochraceous with a spot at apex and six piceous linear patches connected with each other between eyes. Eyes with dark maculations. Face ochraceous, frontoclypeus with lateral brownish stations. Pronotum about as long as scutellum, dark brownish, anterior margin black one median and two lateral thin longitudinal lines, pale luteous. Scutellum with a dark piceous patch at each basal angle and an obscure pale brownish longitudinal patch on the disc; forewing brownish with dark prominent veins and dark markings in claval area, four oblique dark brown fasciae at subcostal area beyond middle.

Male genitelia : Pygofer large with five long setae at dorsal area, its margin minutely serrated. Connective short, Y-shaped, its arms close to each other, paraphyses of aedeagus long, united at the middle with 3-4 small denticles on the lateral margins beyond middle, apices pointed. Style long with pre-apical lobe well developed and provided with long setae, apophysis long, narrow and curved laterad; aedeagus with well developed dorsal apodeme, shaft long, bifid with two papillose structures at apex.

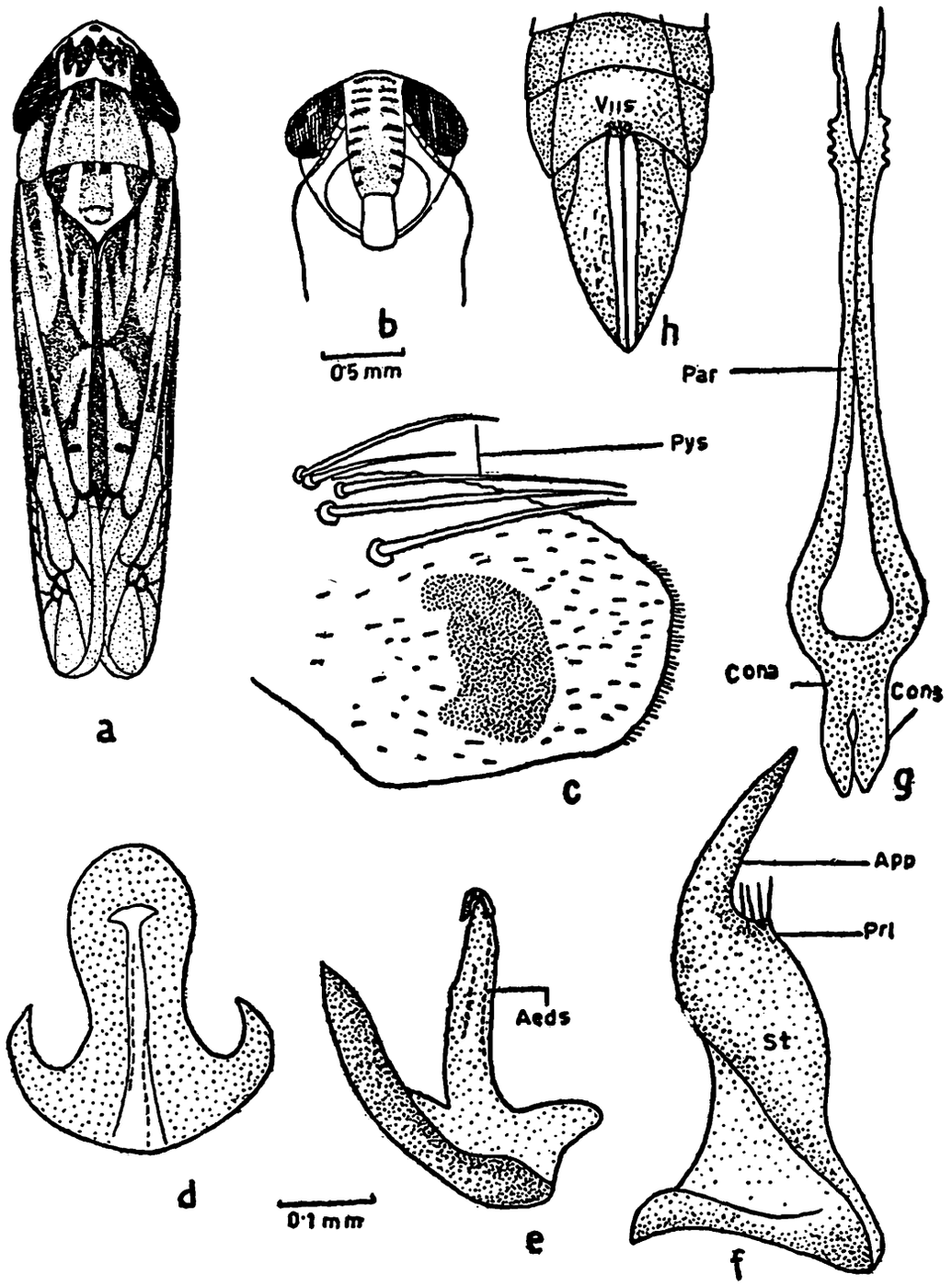
Female genitalia : Hind margin of seventh sternum concave with a median notch.

Measurements : Male 5.22 mm long and 1.32 mm wide; female 5.91 mm long and 1.43 mm wide.

Host : Collected by sweeping on grasses.

Specimens examined : India : Meghalaya : Shillong, Malki forest, 1 ♂, 23.ix.1975, K. R. Rao, Coll.; Shillong, Malki forest, 1 ♀ , 19.v.1978, K. R. Rao, Coll.

Scaphoideus assamensis Distant



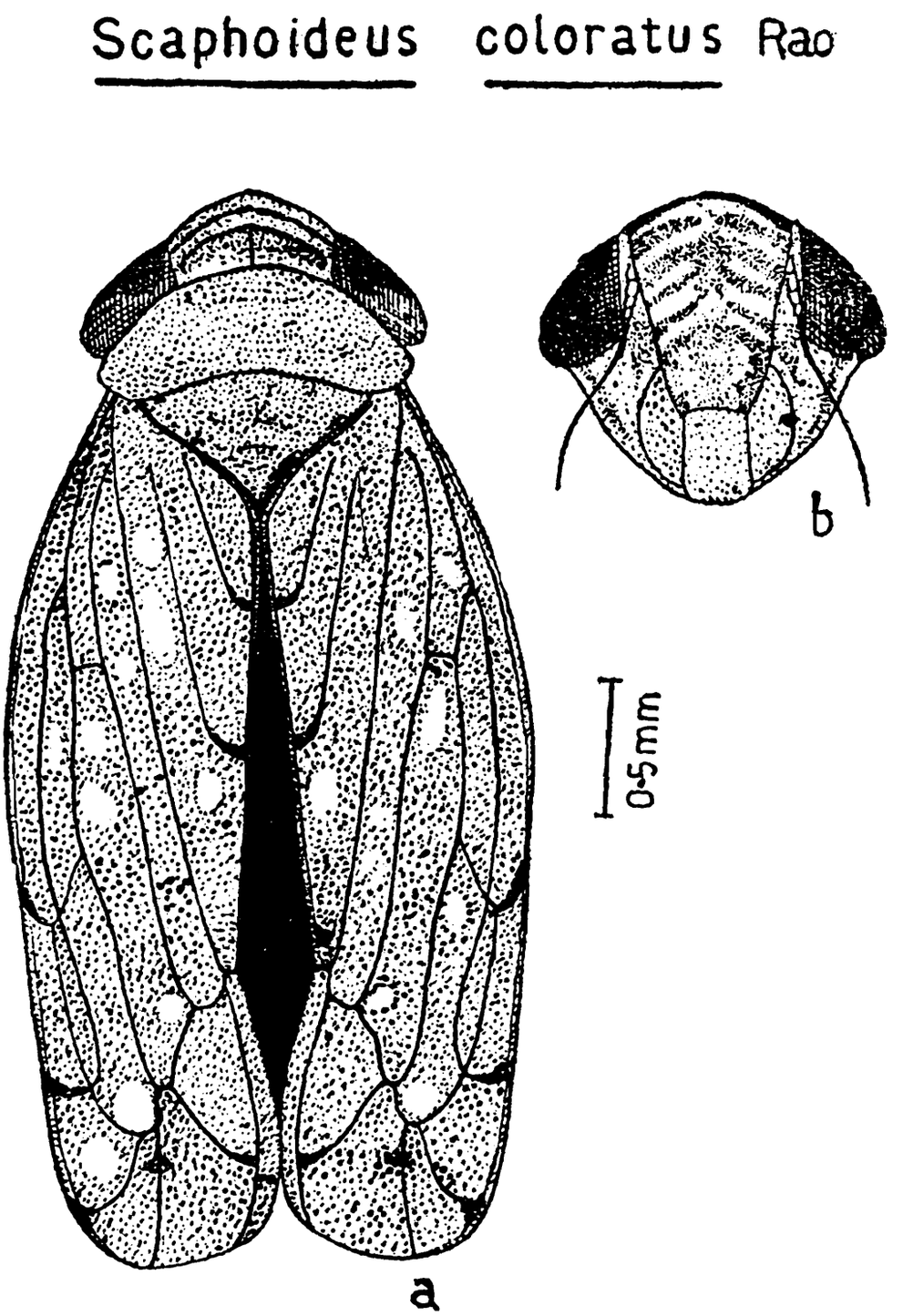
Text fig. 36. *Scaphoideus assamensis* Distant a?Habitus. .dorsal view; b-Face. ventral view; c-Pygofer. .lateral view; d-Aedeagus. .dorsal view; e-Aedeagus. .lateral view; f-Style. .dorsal view; g-Connective and paraphyses. .dorsal view; h-Female genitalia. .ventral view

Distribution : After Distant's description in 1918 from Assam, this species has not been reported from anywhere, which makes the present one is second record.

Remark : The colouration of vertex is very distinct among the known species of *Scaphoideus*. This species resembles *S. stigmaticus* Distant in having three carinations on the pronotum and similarity in proportions of head, pronotum and scutellum.

Scaphoideus coloratus Rao

(Text fig. 37, a-b)



Text fig. 37. *Scaphoideus coloratus* Rao a. Habitus. .dorsal view; b. Face. .ventral view.

Diagnosis : Vertex with transverse and arcuate sanguineouos fasciae between eyes. Pygofer with numerous slender setae; margins of paraphyses and aedeagal shaft entire; arms of connective slightly divergent; apex of aedeagal shaft simple.

Distribution : Shillong Nongthumai, Meghalaya.

Male 4.34 to 5 mm long and 1.1 to 1.15 mm wide.

Tribe Euscelini Naudé

Body form often robust. Elytra with two or three closed ante-apical cells. Connective robust, Y- shaped, branches distinctly diverging and articulate with aedeagus; other characters as in Deltocephalini.

The tribe Euscelini is distributed in all all the principal zoo geographical regions of the world. Three geners have been collected from the Khasi Hills viz., *Nephotettix* Matsumura, *Cicadula* Zetterstedt and *Exitianus* Ball.

Genus **Exitianus** Bull, 1929

Exitianus Ball, 1929, *Trans. Am. ent. Soc.*, **55** : 5 ; Type species : *Cicadula obscurinervis* Stål, 1859.

Mimodrylix Zachvatkin, 1935, *Wiss. Ber. Moskauer Staats. Univ.*, **4** : 108; Type species : *Athysanus capicola* Stål, 1855.

Exitianus : Evans, 1947, *Trans. R. ent. Soc. Lond.*, **98** : 233 (=*Mimodrylix* Zachvatkin); Oman, 1949, *Mem. ent. Soc. Wash.*, **3** : 153; Ross, 1968, *Bull. Br. Mus. nat. Hist.* (Ent.) **22** : 1-30; Gahuri, 1972, *Bull. ent. Res.*, **61** : 689; 1974, *Ibid.*, **63** : 531.

Diagnosis : Oman (1949) and Ross (1968) have redescribed the genus.

The genus *Exitianus* has been recorded from all the continents except Antarctica. Ross (1968) distinguished five distinct groups of *Exitianus* from the Old World viz., *okahandia* group, *nanus* group, *obscurineruis* group, *distanti* group and *taeniaticeps* group. *Ghauri* (1972, 1974) described four new species from Africa. Distant (1908, 1918) described four species from India under the genus *Athyasanus* Burmeister and *Phrynomorphus* Curtis, but Ross (1968) transferred all of them to *Exitianus* viz., *E. nanus, indicus, coronatus* and *E. ootacamundus*. Only (four) species are reported

from India viz., *E. indicus* (Distant), *E. coronatus* (Distant) and *E. taeniaticeps* (Kirsch.) Sohi and Kapur (1973) out of which the first two are collected and studied from the Khasi Hills.

Key to the species of Exitianus occurring from the Khasi Hills

(modified from Ross, 1968)

Dorsum of head yellow with a short transverse and two more anterior rounded rigidly defined black spots (Text fig. 24, a) ... *coronatus* (Distant)

——Dorsum of head with a single arcuate dark line reaching linear margin of eyes (Text fig. 23, a) sometimes with additional light brown suffusions ... *indicus* (Distant)

Exitianus indicus (Distant)

Athysanus fusconervosus de Motschulsky, 1863, *Bull. Soc. Nat. Mosc.*, **36** : 97.

Athysanus indicus Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 344.

Athysanus atkinsoni Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 345.

Phrynomorphus fusconervosus : Distant, 1918, *Fauna Br. India,* Rhynchota, **7** : 51 (*Athysanus fusconervosus* Dist.).

Exitianus indicus : Ross, 1968, *Bull. Br. Mus. nat. Hist.*, (Ent.) **22** : 12.

Measurements : Male 3.92 to 4.24 mm long and 1.2 to 1.28 wide. Female 4.72 to 5.2 mm long and 1.6 to 1.68 mm wide.

Host : Collected by sweeping chiefly on *Mikania micrantha* HB & K.

Specimens examined : India : Meghalaya : Shillong, Nongthumai, 2 ♂♂, 10 ♀♀, 14.viii1975, M. S. Jyrwa, Coll.; Sonapahar, 14 ♂♂, 48 ♀♀, 29.xi 1977, K. R. Rao, Coll; Jakriem, 2 ♂♂, 9 ♀♀, 4.xii.1977, K. R. Rao, Coll.; Balat, 5 ♂♂, 21 ♀♀, 8.xii.1977, K. R. Rao, Coll; Ranikor, 10 ♂♂, 16 ♀♀, 9.vii.1977, K. R. Rao, Coll.

Distribution : Throughout the Indian sub-continent.

Remarks : This species resembles *E. coronatus* (Dist.) in the markings on vertex, but can be distinguished from it by the presence of a single arcuate dark line on head. Apex of the apophysis of style is pointed in *coronatus* whereas it is not so in *indicus*.

Exitianus coronatus (Distant)

(Text fig. 38, a-i)

Phynomorphus coronatus Distant, 1918, *Fauna Br. India,* Rhynchota, **7** : 52.

Athysanus kumaonis Baker, 1925, *Philip. J. Sci.*, **27** : 537 *nom. nov. Pro. Athysanus coronatus* Distant, 1918 not *Athysanus coronatus* Berg, 1879.

Exitianus kumaonis : Metcalf, 1967, *General catalogue of the Homoptera, Euscelidae,* **10** (1) : 324.

Exitianus coronatus : Ross, 1968, *Bull. Br. Mus. nat. Hist.* (Ent.) **22** : 14.

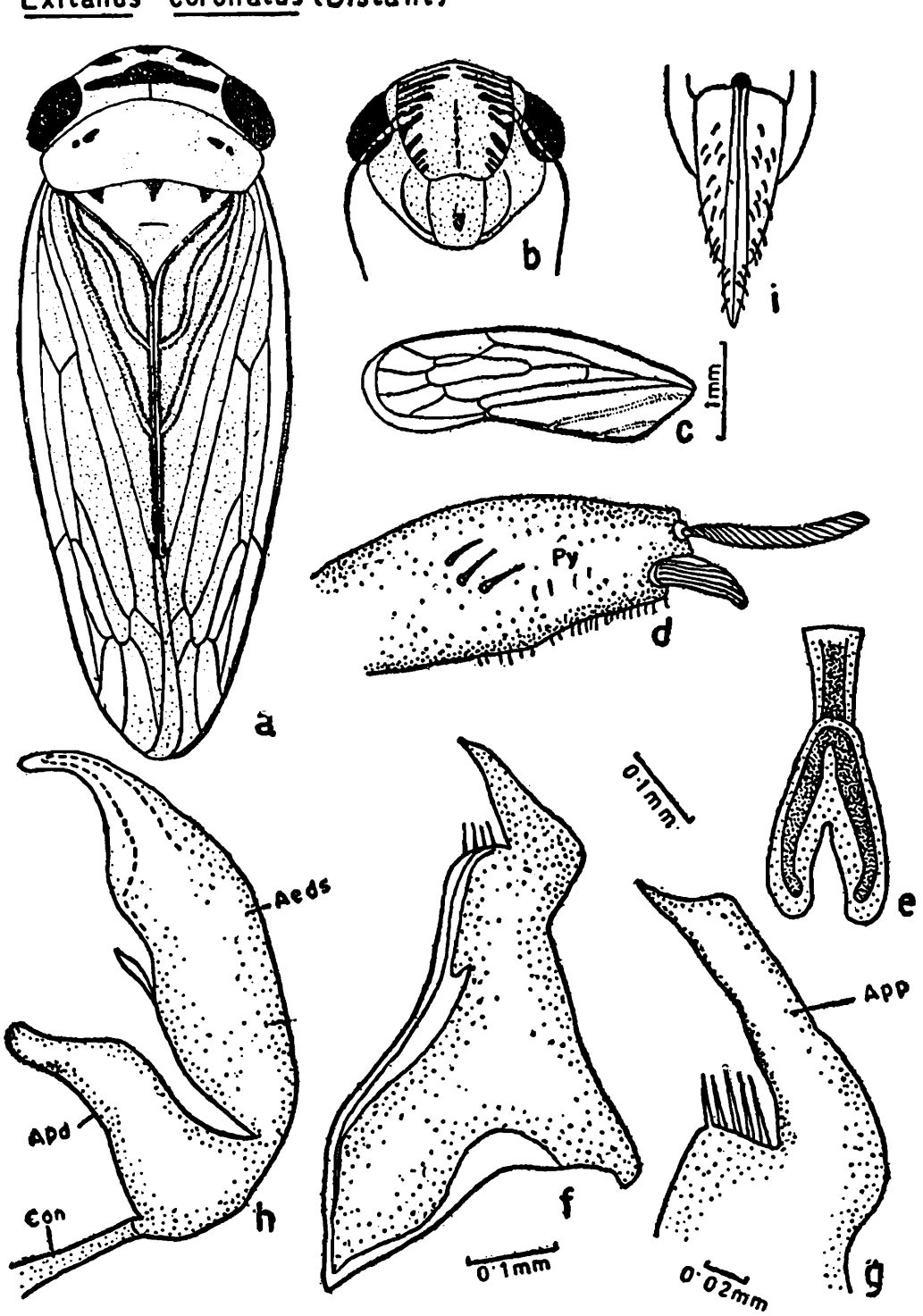
Vertex *ochraceous,* round in front, two small piceous spots at the anterior margin near eyes; a broad transverse piceous band on the disc between the eyes. Face broader than long, frontoclypeus ochraceous with a median and transverse fuscous striae; lora large, not reaching the apex of clypellus. Pronotum pale ochraceous in anterior margin with an interrupted arched piceous line submarginally. Posterior margin of scutellum greyish ochraceous with one basal and two angular spots dark brown, transversely impressed in the middle. Forewing hyaline, veins dark, appendix well developed covering the apex of forewing, apical cells four and ante-apical cells three, inner and outer apical cells sometimes divided. Abdomen and legs ochraceous, posterior femoral spinulation 2+2+1.

Male genitalia : Pygofer caudally flattened, first spine long, directed dorsally, second spine short, stout, pointed at apex and directed posteriorly. Male plate triangular with long, stout setae on lateral and sublateral margins. Style large with pro-apical lobe well developed, apophysis stout, terminating in a small pointed spine, mesial margin of apophysis at base obtuse and raised. Connective Y-shaped. Aedeagus with a well developed dorsal apodeme, shaft broad at base terminating in narrow tube, gonopore ovate subapical.

Female genitalia : Seventh sternum large with the posterior margin notched; pygofers convex; ochraceous; ovipositor long, extending beyond the posterior extremity of abdomen.

Measurements : Male 4.04 to 4.36 mm long and 1.28 to 1.4 mm wide. Female 4. to 5.6 mm long and 1.4 to 1.52 mm wide.

Host : Collected from plants containing *Osbeckia crinata* Benth.



Text fig. 38. *Exitianus coronatus* (Distant) a-Habitus. .dorsal view; b-Face. .ventral view; c-Forwing. .dorsal view; d-Pygofer. .lateral view; e-Connective dorsal view; f-Style. .dorsal view; g-Apex of style. .dorsal view; h-Aedeagus. .lalateral view; i-Female genitalia. .ventral view

Specimens examined: India : Meghalaya : Shillong, Elephant Falls, 6 ♂♂, 21 ♀♀, 20.xi.1976, K. R. Rao, Coll.; Shillong Fruit Garden,

9 ♂♂, 12 ♀♀ 29.viii.1977, M. S. Jyrwa, Coll.; Shillong, Umroi 10 ♂♂, 21 ♀♀ 12.ix.1977, S. K. Chanda, Coll.; Nongklah, 30 ♂♂, 42 ♀♀, 29.xii.1977, K. R. Rao, Coll.; Sonapahar, 9 ♂♂, 12 ♀♀, 20.xi.1977, K. R. Rao, Coll.; Balat, 1 ♂, 15 ♀♀, 8.xi.1977, K. R. Rao, Coll.; Ranikor, 6 ♂♂, 12 ♀♀, 7.xii.1977, K. R. Rao, Coll.

Distribution : This species is so far known only from North India (U.P.)

Remarks : *E. coronatus* closely resembles *E. indicus* but can be distinguished from it by the well defined black spots. Spine no. 2 of *E. coronatus* is stouter and less curved than spine no. 2 of *E. indicus*.

Genus **Nephotettix** Matsumura, 1902

Nephotettix Matsumura, 1902, *Termeszetr. Fuz.*,**25** : 378; Type-species : *Selenocephalus cincticeps* Uhler; Distant, 1908, *Fauna Br. India*, Rhynchota, **4** : 317; 1918, *Ibid.*, **7** : 60; Merine, 1936, *Philip. j. Sci.*, **61** : 373; Evans, 1947, *Trans. R ent. Soc. Lond.*, **198** : 236; Ishihara, 1953, *Matsilyama, agric. Coll. Sci. Rep.*, **11** : 39; 1964, *Trans. Shikoku ent. Soc.*, **8** : 39-44; 1983, *Proc. 1st International Symp. Leafhoppers and Plant hoppers of economic importance*, London, C.I.E., **459**; Mathur, 1953, *Indian Forest Leaft.*, **121** (3) : 158; Linnavuori, 1960, *Insects, Micronesia*,, **6** : 231; Nielson, 1968, *Tech. Bull. U.S. Dep. Agric.*, **1382** : 269; Ishihara & Kawase, 1968, *Appl. Ent. Zool.*, **3** : 119; Ghauri, 1971, *Bull. ent. Res.*, **60** : 481.

Diagnosis : The genus *Nephotettix* includes leafhoppers having always green colour with black markings on head, face, pronotum, forewing and other parts of the body and showing variable degres of sexual dimorphism Female with reduced black markings. Ghauri (1971) subsequently provided an excellent redescription based on the type material. He provided common and differential characters for the genera *Nephotettix* and *Exitianus*.

Owing to its economic importance, the genus has attracted the attention of many entomologists and in recent times many significant contributions have been made on the biotaxonomy of the genus.

Nielson (1979) listed six viral and mycoplasma diseases transmitted by *Nephotettix virescens* (Distant) and *N. nigropictus* (Stål) from all over the world, two of these diseases being known from India viz., the Rice Tungro and the Yellow Dwarf. The former is a viral and the latter a mycoplasma disease. Sivaramakrishnan and Sen Sarma (1978) demonstrated the transmission of sandal spike disease by *Nephotettix virescens* in the laboratory but field studies in this regard are wanting.

Ghauri (1971) recognised nine species of *Nephotettix* for the world out of which *N. virescens, N. nigropictus, N. malayanus* and *N. paryus* occur in India. Three species namely *N. virescens, N. nigropictus* and *N. malayanus* are found in the Khasi Hills. Ramakrishnan (1983) worked on morphometrics of the species of *Nephotettix.*

Key to the species of Nephotettix from the Khasi Hills

(Modified & adopted from Ghauri, 1971)

1. Vertex with a transverse submarginal black band ; anterior margin of pronotum marked by a transverse blakc band which is sometimes very thin ; discal spot on forewing in males touch the claval sutures ; aedeagus with eight pairs of spines (in lateral aspect) ... *nigropictus* (Stål)

——Vertex without submarginal band or if present, only traces behind the ocelli ; anterior margin of pronotum without black band ; discal spot on the forewing when present never touchts the claval suture ; aedeagus with four or five pairs of spines ... 2

2. Vertex slightly longer medially then next to eye ; pygofer with one stout spine ; aedeagus with four pairs of spines ... *palayanus* Ishihara & Kawase

——Vertex much longer medially than next to eye ; pygofer with four small spines besides one stout spine ; aedeagus with five pairs of spines ... *virescens* (Distant)

Nephotettix nigropictus (Stål)

Thamnotettix nigropicta Stål, 1870, *Ofvers. K. Svenska. Ventensk. Akad. Forth.*, **27** : 740.

Nephotettix apicalis (de Motschulsky) : Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 360 (=*Pediopsis apicalis* de Motschulsky ; =*Pediopsis nigromaculatus* de Motschulsky =*Thamnotettix nigromaculatus* Kirby =*Thamnotettix nigropicta* Stål ; =*Nephotettix nigropictus* Kirkaldy) ; Misra, 1980, *Indian Dep. Agric. Mem. ent. ser.*, **5** 207-239 ; Ishihara, 1964, *Trans. Shikoku ent. Soc.*, **8** : 42 ; 1968, *Appl. Ent. Zool.*, **3** : 123 ; Nielson, 1968, *Tech. Bull. U.S. Dep. Agric.*, **1382** : 269.

Nephotettix nigropictus : Ghauri, 1971, *Bull. ent. Res.*, **60** : 491 (=*Thamnotettix nigropictus* Stål, =*Nephotettix apicalis sensu* Distant and *sensu* Ishihara) ; Rao, 1980, *Rec. Zool. Surv. India*, **76** : 193 ; 1981, *Ibid.*, **78** : 3 ; Hongsaprug, 1983, *Proc. 1st International Symp. Leafhoppers and Plant hoppers of economic importance London*, C.I.E., **68** ; Claridge, 1983, *Ibid.*, 117 ; Wilson, 1983, *Ibid*, 128 ; Siwi & Roechan, 1983. *Ibid.*, 262-275 ; Ramakrishnan, 1983, *Ibid.*, 328 ; Inoue, 1983, *Ibid.*, 341-342 ; Ishihara, 1983, *Ibid.*, 459-460 ; Viraktamath, 1983, *Ibid.*, 490-491.

The species has been described in detail by Ghauri (1971) and hence not further described here.

Measurements : Male 4.01 to 4.13 mm long and 1.1 to 1.23 mm wide. Female 4.62 to 5.11 mm long and 1.21 to 1.37 mm wide.

Host : *Oryza sativa*

Specimens examined : India : Meghalaya : Umsing, 1 ♂, 10 ♀♀ , 22.x.1974, M. R. Rhynth, Coll. ; Umroi, 4 ♂♂, 60 ♀♀ 12.x.1977, S. K. Chanda, Coll. ; Nongstoin, 65 ♀♀ , 27.xi.1977, K. R. Rao, Coll ; Sonapahar, 3 ♂♂, 20 ♀♀ , 28.xi.1977, K. R. Rao, Coll. ; Nongklah, 19 ♀♀ , 1.xii.1977, K. R. Rao, Coll.; Mairang, Maria Road, 3 ♂♂, 10 ♀♀ , 2.xii.1977, K. R. Rao, Coll ; Jakriem, 2 ♂♂, 25 ♀♀ , 4.xii.1977, K. R. Rao, Coll. ; Satmowedon, 1 ♂, 2 ♀♀ , 5.xii.1977, K. R. Rao, Coll. ; Ranikor, 2 ♀♀ 45 ♀♀ , 7.xii.1977, K. R. Rao, Coll. ; Balat, 1 ♂, 35 ♀♀ , 8.xii.1977, K. R. Rao, Coll. ; Dumpeep Hills, 5 ♂♂, 40 ♀♀ , 20.i.1978, M. S. Jyrwa, Coll. ; Upper Shillong, 2 ♂♂, 56 ♀♀ , 20.xi.1978, P. B. Thapa, Coll.

Distribution : New Guinea, Phillipines, China, Laos, Hongkong, South Vietnam, Thailand, Malaysia, Burma, Pakistan, Nepal, India and Sri Lanka.

Remarks : *N. nigropictus* resembles closely the African species *N. modulatus* Melichar in the presence of three parallel black bands—the marginal and submarginal on vertex and the anterior band on pronotum. It also bears a resemblance to another African species viz., *N. afer* Ghauri in having inner black margin of clavus and discal spot on corium touching claval suture. However, it can be distinguished from both these by the aedeagus having eight pairs of spines on the lateral side whereas the African species do not possess the aedeagal spines at all.

Nephotettix virescens (Distant)

Cicada bipunctata Fabricius, 1803, *Syst. Rhyng.*, **78**, *nom. praeocc.* by *Cicada bipunctata* Scopoli, 1763. *Methodo Linnaena* : 115.

Thamnotettix bipunctata Stål, 1869, *Svenska Vetensk. Akad. Handl.*, **8** : 82.
Nephotettix bipunctata Matsumura, 1902, *Termeszetr. Fuz.*, **25** : 379 (=*Thamnotettix bipunctatus* Fabricius)

Selenocephlus virescens Distant, 1908, *Fauna Br. India, Rhynchota*, **4** : 291.
Nephotettix bipunctatus : Distant. 1908, *Fauna Br. India*, **4** : 359 (=*Cicada bipunctata* Fabricius, =*Thamnotettix bipunctatus* (Stål) ; Misra, 1920, *Indian Dep. Agric. Mem. ent. ser.*, **5** : 207-239.

Nephotettix impicticeps Ishihara, 1964, *Trans. Shikoku, ent. Soc.*, **8** : 42 ; (*nom. nov.* for *Cicada bipunctata* Fabricius, 1803, *not Cicada bipunctata* Scopoli, 1763, *not Cicada bipunctata* Linnaeus, 1767, *not Cicada bipunctata* Gmelin, 1789) ; Ishihara & Kawase, 1968, *Appl. Ent. Zool.*, **3** : 123.

Nephotettix virescens : Ghauri, 1971, *Bull. ent. Res.*, **60** : 484 ; Rao, 1981, *Rec. Zool. Surv. India*, **78** : 3 ; *Hongsaprag*, 1983, *Proc. Ist International Symp. Leafhoppers and Plant hoppers of economic importance London* C.I.E., 88 ; Claridge, 1983, *Ibid.*, 117 ; Wilson, 1983, *Ibid.*, 128 ; Siwi & Roochan, 1983, *Ibid.*, 263-275 ; Ramakrishnan, 1983, *Ibid.*, 328 ; *Inoue*, 1983, *Ibid.*, 341-342 ; Ishihara, 1983, *Ibid.*, 460-461 ; Viraktamath, 1983, *Ibid.*, 490-491.

This species has been described in detail by Ghauri (1971) and hence not further described here.

Measurements : Male 3.96 mm to 4.56 mm long and 1.1 to 1.26 mm wide ; Female 4.45 to 4.51 mm long and 1.21 to 1.37 mm wide.

Host : *Oryza sativa.*

Specimens examined : India : Meghalaya : Umsing, 5 ♂♂, 20 ♀♀, 22.x.1976, M. R. Rynth, Coll. ; Umroi, 12 ♂♂, 48 ♀♀ , 12.xi.1977, S. K. Chanda, Coll. ; Sonapahar, 25 ♂♂, 55 ♀♀ , 28-29.xi.1977, K. R. Rao, Coll. ; Nongklah, 5 ♂♂, 40 ♀♀ , 1.xii.1977, K. R. Rao, Coll. ; Mairang, 10 ♂♂, 25 ♀♀ , 2.xii.1977, K. R. Rao, Coll. ; Satmowedon, 10 ♂♂, 45 ♀♀ , 3.xii.1977, K. R. Rao, Coll. ; Jakriem, 10 ♂♂, 25 ♀♀ , 4.xii.1977, K. R. Rao, Coll ; Puksora, 12 ♂♂, 40 ♀♀ , K. R. Rao, Coll. ; Balat, 10 ♂♂, 50 ♀♀ , 8.xi.1977, K. R. Rao, Coll. ; Sohryngkham, 10 ♂♂, 45 ♀♀ 13.i.1978, K. R. Rao, Coll. ; Sohryngkham, 10 ♂♂, 45 ♀♀ , 13.i.1978, K. R. Rao, Coll. ; Shillong, Nongthumai, 3 ♂♂, 30 ♀♀ , 15.i.1978, M. S. Jyrwa, Coll. ; Shillong, Malki Forest, 3 ♂♂, 15 ♀♀ , 20.xi.1977, K. R. Rao, Coll.

Distribution : Pakistan, India, Sri Lanka, Burma, China, Hongkong, South Vietnam, Thailand, Loas, Malaysia, and Indonesia. In India it has a wide distribution,

Remarks : This is one of the most common species found in rice fields. Males resemble *Nephotettix nigropictus* and *N. cincticeps* in general colour and can be separated from them by the rounded dorsal and ventral corners of pygofers and in having fewer spines on dorsal carinae of aedeagus. Females can be distinguished from other species by the immaculate head, pronotum and clavus. Some females, however, may have apical third of tegmen black.

Nephotettix malayanus Ishihara & Kawase

Nephotettix malayanus Ishihara & Kawase, 1968, *Appl. Ent. Zool.*, **3** : 119-121 ; Ghauri, 1971, *Bull. Ent. Res.*, **60** : 496 ; Rao, 1981, *Rec. Zool. Surv. India*, **78** : 3-4 ; *Hongsapurg*, 1983, *Proc. Ist International Symp. Leafhoppers and Plant hoppers of economic importance London*, C.I.E. 89 ; Wilson, 1983, *Ibid.*, 128-131 ; Siwi & Roechan, 1983, *Ibid.*, 263-275 ; Inoue, 1983, *Ibid.*, 341-342.

Variations of discal spots on forewing :

Ghauri (1971) described the species in detail along with other species of the genus. The important diagnostic character of this species is its vertex rounded anteriorly. The males have apical margins of vertex black and the submarginal band is represented by short bars behind ocelli, whereas,, females have fine broken lines. According to Ishihara and Kawase (1968) a central black spot is present or absent on the forewing and the aedeagus has 4-5 spines on either side. Ghauri (1971) in his redescription of the species, reported four pairs of spines instead, but did not make any mention of the presence of a discal spot on the forewing. The present material shows that the discal spot is present on the forewing and that the aedeagus has four pairs of spines, though not in a separated condition as observed by Ghauri (1971) and Hongsaprug (1983). Rao (1981) noticed intraspecific variations in specimens studied from Assam with reference to discal spot on forewing, number of aedeagal spines and in the size of the submarginal band on the vertex. Viraktamath (personal communication) also noticed variations in aedeagal spines. It is clear that this species exhibits intraspecific variations.

Measuremenes : Male 3.78 to 4.18 mm long and 1.2 to 1.32 mm wide. Female 4.36 to 4.4 mm is long and 1.4 to 1.44 mm wide. Females

without discal spot on forewing; 3.94 to 4.56 mm long and 1.32 to 1.48 mm wide.

Host: *Oryza sativa*

Specimens examined : India : Meghalaya, Sonapahar, 5 ♂♂, 8 ♀♀, 28.xi.1977, K. R. Rao, Coll.

Distribution : Malay Peninsula, Philippines, China, Surma, India and Sri Lanka. In India, it was recorded from Calcutta, Madhupur (W. Bengal), Kahitama, Manas (Assam) and Alleppy (Kerala). The present record is new to Khasi Hills.

Remarks : This species resembles *Nephotettix nigropictus* in colour pattern but can be distinguished by the male pygofer spine being elongate and the distodorsal and distoventral corners of pygofer being rounded. The aedeagal shaft in *N. malayanus* is almost straight and elongate in ventral aspect.

Genus **Cicadula** Zetterstedt, 1840

Cicadula Zetterstedt. 1840, *Insecta Lapponica,* **1** : 296; Type-species : *Cicadula guadrinotata* Fabricius; Pruthi, 1930, *Mem. Indian Mus.,* **11** : 53; Distant, 1908, *Fauna Br. India,* Rhynchota, **4** : 366; Ribaut, 1952, *Fauna Er.,* **57** : 152; Ishihara, 1953, *Matsuyama, agric. Coll. Rep.,* **11** : 40; Mathur, 1953, *Indian Forest Leaft.,* **121** (3) : 158.

Diagnosis : Oman (1949) redescribed the genus in detail.

Pruthi (1930) described a number of new species in *Cicadula* viz., *fletcheri, indica, indrina, maculata* and a new variety, *Cicadula* (*Deltocephalus*) *montanus macropterous.* He transferred *Deltocephalus montanus* Distant to *Cicadula.* Now all the above species have been relegated to different genera. Ghauri (1963) transferred *C. fletcheri* to *Deltocephalus.* Emeljanov (1964) transferred *C. indica* and *D. montanus* to *Aconurella.* Sawai Singh (1973) transferred *C. indica* to *Macrosteles.* Now in this work *Cicadula maculata* has been transferred to *Recilia.*

The genus is known in the Indian sub-continent by *C. vaga* Melichar. *Cicadula compressa* Rao is reported from Khasi Hills.

Cicadula compressa Rao

(Text fig. 1, a-e; 2, f-n)

Cicadula compressa Rao, 1989, *Hexapoda*, **1** (1) : fig. 91-104.

Diagnosis : Vertex with two large fuscous spots on the anterior margin and two small spots on the laeeral margin. Fore wing with costal and claval areas pale brown, rest of the area dark brown. Aedeagal shaft compressed, strongly curved dorsoventrally, with two pairs of processes.

Male 3.68 to 4.28 mm long and 1.04 to 1.2 mm wide.

Female 3.75 to 4.06 mm long and 1.12 to 1.2 mm wide.

Distribution : Shillong, Meghalaya.

Tribe Jassargini Emeljanov

Head fairly elongate, usually with a flat pentagonal vertex which is sharply, though not abruptly delineated from the face. Face slightly elongated with an apically tapering clypellus and frenula, the upper margins of which are only slightly above the upper margin of the clypellus so that inner margin of the frenula border on the frontoclypeus for a short distance only. The inner margins of eyes always with a groove facing the antennal scapes. Pronotum with long lateral margin without carinae. Conneceive characteristic, being rackept-shaped wieh its branches always apically joined. Genital plates, style and aedeagus of variable shape.

Genus **Khasiana** Rao. 1989

Khasiana Rao, 1989, *Hexapoda*, **1**(1) : fig.

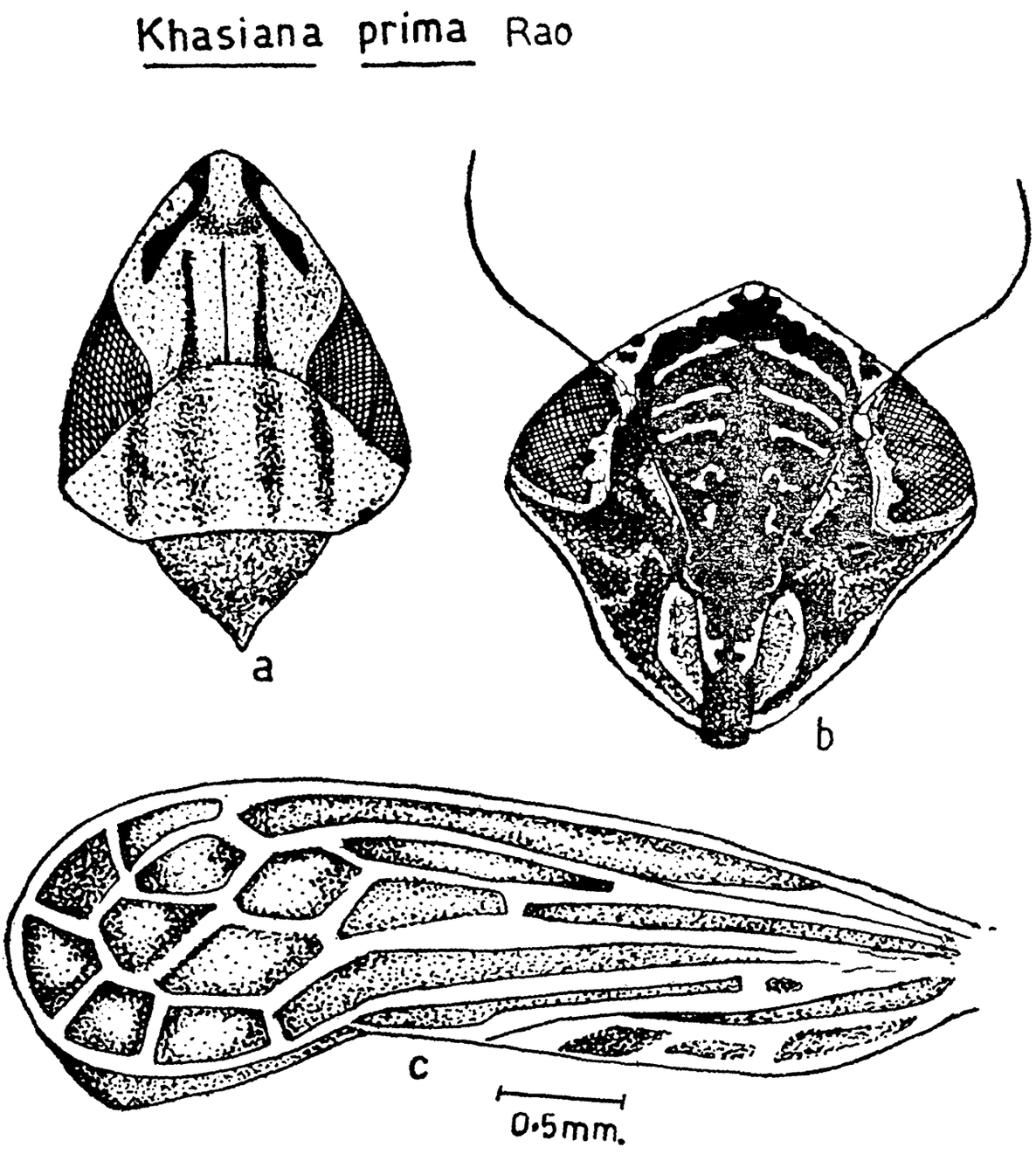
Diagnosis : Vertex triangular, as long as pronotum. Male pygofer with a caudal articulated lobe; male plate with an elongated process.

Type species : *Khasiana prima* Rao.

Khasiana prima Rao

(Text fig. 39, a-c)

Khasiana prima Rao, 1989, *Hexapoda*, **1**(1) :



Text fig. 39. *Khasiana prima* Rao a. Head and thorax. .dorsal view; b. Face.., ventral view; c. Fore wing. .dorsal view

Diagnosis : Vertex with ehe fusctus longitudinal fasciae on the antero-lateral margins before eyes, and centrally two longitudinal fasciae. Pronotum with four ochraceous longitudinal bands from anterior to posterior margin. Aedeagal shaft stout basally, narrowed towards epex and strongly curved anteriorly.

Male 2.57 mm long and 0.7 mm wide.

Distribution : Balat, Khasi Hills, Meghalaya.

IX. DISCUSSION

In the present work the study of leafhoppers of Khasi Hills has revealed 42 species, many of them being new and many exhibiting variations at the intra-specific level. From the point of zoogeography, the leafhoppers of Khasi Hills provide an interesting admixture of various elements, being cosmopolitan, Holarctic, Ethiopian and oriental in distribution. Some leafhoppers belonging to certain genera are observed to have restricted distribution in India occurring in Eastern Himalayas, Assam or Southern block including Sri Lanka and showing their Indo-Chinese and Malayan affinities. All tsese points are discussed here in detail.

With regard to species diversity and intraspecific variations, it is seen that Hecalinae and Deltocephalinae constitute the largest numbers as against Aphrodinae, Evacanthinae, Nirvaninae, Coelidiinae, Penthimiinae and Acostemminae. Intraspecific differences were noticed in species of *Nephotettix* which exhibit wide variations in the number of aedeagal spines. *N. malayanus* shows variations in the presence or absence of discal spots on forewings. *Exitianus coronatus* shows variations in ehe nature of markings on vertex and scutellum. *Macrosteles brevis* Rao exhibits markings of vertex. However, detailed internal examination of these specimens reveals that these are only individual differences. With regard to *Recilia maculata* (Pruthi), males figure more in the collections in the post-monsoon season, whereas Pruthi (1930) found more males in summer *Hecalus porrectus* showed variations in markings on the forewing in the two sexes. Many species with Holarctic and Palearceic affinities are intermingled in this area, besides having Indo-Chinese and Malayan affinities.

Regarding zoogeography, the leafhopper fauna of the Khasi Hills has representative genera from all the zoogeographical regions. The genera *Exitianus* Ball, *Macrosteles* Fieber, *Balclutha* Kirkaldy, *Scaphoideus* Uhler, and *Hecalus* Seål are cosmopolitan in distribution. The genera *Stroggylocephalus* Flor and *Phlogotettix* Ribaut which are being reported here for the first time from the Oriental Region, are actually Holarctic genera whereas *Nephotettix* Matsumura, *Acostemma* Signoree, *Glossocratus* Fieber, *Doratulina* Melichar, *Nirvana* Kirkaldy, *Chudania* Distant, *Dussana* Distant, and *Onukia* Matsumura are Oriental. *Nephotettix*, *Acostemma* and *Chudania* are however, also found in Africa. The genus *Evacanthus* Le Peletier and Servielle is both Oriental and Palearctic in distribution. *Taharana* Nielson is also Oriental in distribution but is reported here for the first time from India.

Medlicott and Blanford (1879) were one of the earliest workers to remark on the phenomenon of discontinuous distribution of fauna and flora. Discontinuity is observed between southern block including Sri Lanka and the Eastern Himalayas, Assam, Burma and Malaya. Many workers have observed this phenomenon in several groups of animals especially in Amphibia and Reptilia. It is interesting to note that some leafhoppers of the genera, *Gurawa*, *Evacanthus*, *Dussana* and *Doratulina* are discontinuously distributed in India. Some species of *Evacanthus* and *Doratulina* are restricted in distribution to Eastern Himalaya, Assam or to Southern block including Sri Lanka (vide Table No. 3), and display their Indochinese and Malayan affinities.

X. SUMMARY

The study consists of leafhoppers belonging to nine subfamilies of the family Cicadellidae from Khasi Hills. They are Aphrodinae, Evacanthinae, Nirvaninae, Coelidiinae, Penthimiinae, Acostemminae, Drabescinae, Hecalinae and Deltocephalinae.

Of the nine subfamilies dealt with here, only the genera of one subfamily viz., Deltocephalinae have been grouped under various tribes. They are nine: Opsiini Emeljanov; Macrostelini Kirkaldy; Doraturini Ribaut; Fieberiellini Wagner; Stirellini Emeljanov; Scaphoideini Oman; Euscelini Naudé and Jassargini Emeljanov. The above arrangement proposed by Nast (1972) is accepted with the following modifications. In the tribe

TABLE 3

Discontinuous distribution of taxa from the Khasi Hills, studied in this work

Name of taxon	East India	DISTRIBUTION IN South India Sri Lanka	Indo-Chinese and Malayan	Other areas
Doratulina solitaris (Melich.)	Khasi Hills	Sri Lanka	—	—
Doratulina jacosa (Melich.)	Khasi Hills	Sri Lanka	—	Japan
Doratulina rubrolineata (Dist.)	Khasi Hills, Manipur, Assam, Bengal	—	—	—
Doratulina indra (Dist.)	Khasi Hills, Bengal	—	—	—
Evacanthus extremus (Walk.)	Khasi Hills, Assam	—	Fukien	Northern India, Punjab
Evacanthus repexus (Dist.)	Khasi Hills, Sikkim, Bengal	—	—	U.P., H.P., Punjab
Dussana guaerenda Dist.	Khasi Hills	Palani Hills, Sri Lanka	Fukien	—
Gurawa vexillum Dist.	Khasi Hills, Eastern Himalayas	Kodaikanal, South India	—	—
Onukia connexia (Dist.)	Khasi Hills, E. Himalayas, Kurseong	—	—	—

Deltocephalini *Paramesodes* is also included in addition to *Recilia*. *Nephotettix* and *Exitianus* (which are included in Stirellini, and *Cicadula* which is included in Athysanini by Nast) are here included in Euscelini; *Scaphoideus* is included in a distinct tribe Scaphoideini Oman and Jassargini is recognised as a valid tribe.

A total number of 2145 leafhoppers were identified out of which 13 are new to science. One new genus has been proposed. Three new combinations and one new synonymy have been recognised.

Physiographical features of Khasi Hills along with climate and vegetation have been described.

Scientific methods of collection, preservation and techniques used for taxonomical studies on leafhoppers have been included. A brief review on economic importance of leafhoppers has been provided.

Various characters of morphological significance including genitalia have been well described in identification of leafhoppers. Details of various trends in classification of the subfamilies of Cicadellidae have been discussed. A key for separating the subfamilies has been constructed which serves to separate 23 subfamilies of Cicadellidae. Necessary keys to separate genera and species in the study area have been provided.

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