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The Delphacid Plant-hoppers  
( Homoptera: Fulgoroidea, Delphacidae )  
of  
East and West Pakistan (A part of Oriental Region)

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A Taxonomic, Ecological and Economic Study

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THESIS

Presented to the Department of Zoology, University  
of Karachi in fulfilment of the requirement for the  
Degree of Doctor of Philosophy

by

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## ABSTRACT.

RANA, PARVIN. A study of the Delphacid plant hopper species (Homoptera, Fulgoroidea, (Delphacidae) of East and West Pakistan (A part of Oriental region) (under the direction of Professor Mohammad Afzal Hussain Qadri).

The present study is confined to the species of Delphacinae. The material examined is mostly from Dacca, Comilla, Mymonsingh, Rajshahi, Khulna Rangpur (East Pakistan); and Karachi, Lower Sind area, Quetta and Punjab (West Pakistan). The results of the investigations made by the study of the material mentioned above were checked with the type specimens of their authors at the British Museum (Natural History) London.

In all nineteen genera and twenty six species are described or redescribed of which all of the genera except Sogata Distant 1906 are new records. Out of twenty six, nine new species are described. Redescription of a genus is followed by the description of its species or new species.

## BIOGRAPHICAL SKETCH.

Rana Parvin Mirza, daughter of Mr. Farrukh Mirza, who comes from Royal Family, was born on eighth day of December, 1937 in the city of Delhi, India. She received her primary education in Muslim Girls High School, Aligarh, India, and migrated to West Pakistan in September 1947. Her parents settled in Karachi. In 1948 she was admitted to Government Girls Secondary School, Karachi. She topped in 8th. class Karachi Board Examination of 1951 and was awarded merit scholarship of Rs. 185/- per month for three years (1951-1954). During High School education she was nominated as sports Captain and won the Championship of Net-ball, Badminton and Deck-Tennis etc. Besides she was Patrol Leader of Girls Guide in 1953-1954. She has been the best social worker and sold the maximum number of tickets for Red Cross Society of Pakistan for which she was awarded a Silver Medal encarved "Khadima-e-20um". She has been the best speaker of her age and often won the first prizes in school debates competitions. She was elected as president of Students Union in 1953-54. In 1954 she appeared at the High School Examination of Karachi Board of Secondary Education, and passed in Second Division.

During Intermediate Studies in Sind Muslim Science College Karachi, she was elected as Secretary of Chemistry Society for one year. In the same year she won the First Prize in High Jump and Second Prize in Broad Jump. She passed the F.Sc. Examination in 1957 with good second division.

In 1959 she graduated from D.J. Science College Karachi, and during studies she used to take part in variety programmes and was awarded First Prize for the best performance in a drama.

In 1959 she joined the Karachi University and received the Master's Degree in Second Division with special training in Entomology. Later on she was offered Research Fellowship in the School of Basic Entomology of Agricultural Research Council of Pakistan to work on "Taxonomical Studies of Delphacidae of Fulgoroidea". She published three research papers in "PIOSA PROCEEDINGS", "SCIENTIST", and "UNIVERSITY STUDIES", of Karachi University.

She has been to London in connection with her research work in British Museum Natural History London in 1965.

In 1966 she was married to Mr. M.A. Jabbar Khan son of Dr. M.A. Rahman Khan and has <sup>two</sup> daughters Afshan Jabbar Khan, and Huma Jabbar Khan.

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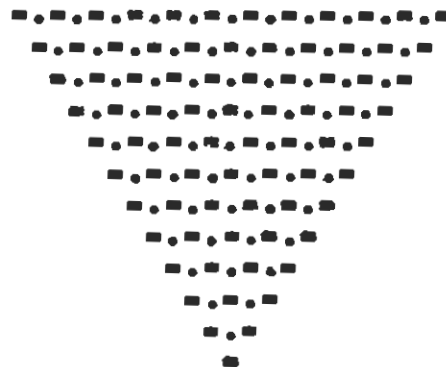
## TABLE OF CONTENTS

	Page.
LIST OF PLATES.....	ix
INTRODUCTION.....	1
REVIEW OF LITERATURE.....	6
MATERIALS AND METHOD.....	12
MORPHOLOGY.....	19
NOMENCLATURE.....	21
CHARACTERISTICS OF THE FAMILY DELPHACIDAE.....	23
TAXONOMY OF THE DELPHACIDAE.....	27
CLASSIFICATION.....	33
Key to Sub-families of Delphacidae.....	33
Sub-family Asiracinae.....	34
Sub-family Delphacinae.....	35
Key to tribes of Sub-family Delphacinae.....	36
Tribe Alohini..MUR.....	37
Genus <u>Ilburnia</u> ..WHITE.....	38
<u>Ilburnia Umerkotiensis</u> n.sp.....	40
Tribe Tropidocephalini..MUR.....	42
Key to the genera of Tribe Tropidocephalini of Pakistan.....	43
Genus <u>Purohita</u> ..DISTANT.....	44
<u>Purohita padrii</u> n.sp. ....	46
Genus <u>Tropidocephala</u> ..STAT.....	49
<u>Tropidocephala brunnipennis</u> ..SIGNARET.....	52
Genus <u>Pundaluoya</u> ..KURKALDY.....	54
<u>Pundaluoya ernesti</u> ..KURKALDY.....	57

Genus <u>Eoerysa</u> ... <u>MUIR</u> .....	59
<u>Eoerysa flavocapitata</u> .. <u>MUIR</u> .....	61
Tribe Delphacini.. <u>MUIR</u> .....	63
Key to the genera of tribe Delphacini of Pakistan.....	66
Genus <u>Zuleika</u> .. <u>DISTANT</u> .....	70
<u>Zuleika bengalensis</u> .. <u>DISTANT</u> .....	72
Genus <u>Perkinsiella</u> .. <u>KIRKALDY</u> .....	74
<u>Perkinsiella insignis</u> .. <u>DISTANT</u> .....	76
Genus <u>Perigrinus</u> .. <u>KIRKALDY</u> .....	78
<u>Perigrinus maidis</u> .. <u>KIRKALDY</u> .....	81
Genus <u>Cemus</u> .. <u>FENNAH</u> .....	83
<u>Cemus afshani</u> .. <u>N.S.P.</u> .....	86
Genus <u>Nilaparvata</u> .. <u>DISTANT</u> .....	89
<u>Nilaparvata lugens</u> .. <u>STAL</u> .....	93
Genus <u>Eurya</u> .. <u>FIEBER</u> .....	96
<u>Eurya Ishtiaqii</u> n.sp.....	98
Genus <u>Sardia</u> .. <u>MELICHAR</u> .....	100
<u>Sardia rostrata</u> .. <u>MELICHAR</u> .....	103
Genus <u>Cornacella</u> .. <u>METCALF</u> .....	105
<u>Cornacella frontalis</u> .. <u>METCALF</u> .....	106
Genus <u>Sogata</u> .. <u>DISTANT</u> .....	107
Key to the species of the Genus Sogata in Pakistan.....	111
<u>Sogata pusana</u> .. <u>DISTANT</u> .....	112
<u>Sogata Striatus</u> n.sp.....	114
<u>Sogata tandojamiensis</u> n.sp.....	116



Genus <u>Numatodes</u> .. <u>FENNAN</u> .....	118
<u>Numatodes qadrii</u> n.sp.....	120
Genus <u>Unkanodes</u> .. <u>FENNAN</u> .....	123
<u>Unkanodes cornicaudatus</u> n.sp.....	125
Genus <u>Delphax</u> .. <u>FABRICIUS</u> .....	126
<u>Delphax qadrii</u> n.sp.....	129
Genus <u>Sogatella</u> .. <u>FENNAN</u> .....	131
Key to the species of the genus Sogatella in Pakistan.....	135
<u>Sogatella furcifera</u> .. <u>HERYATH</u> .....	136
<u>Sogatella longifurcifera</u> .. <u>ESAKI + ISHIGURO</u> .....	140
<u>Sogatella Kolophon</u> .. <u>KIRKALDY</u> .....	143
<u>Sogatella palludum</u> .. <u>KIRKALDY</u> .....	146
Genus <u>Toya</u> .. <u>DISTANT</u> .....	148
Key to the species of the genus Toya in Pakistan.....	151
<u>Toya attenuata</u> .. <u>DISTANT</u> .....	152
<u>Toya albinotata</u> .. <u>CRAWFORD</u> .....	154
<u>Toya propinqua</u> .. ( <u>F. EBER</u> ).....	156
Economic importance of delphacid plant hoppers in Pakistan.....	158
Bibliography.....	169



## LIST OF PLATES

	Page.
PLATE 1. <u>Ilburnia Umerkotiensis</u> .. <u>V.S.P.</u> .....	189
2. <u>Purohita Qadrii</u> n.sp.....	191
3. <u>Tropidocephala brunnipennis</u> .. <u>SILVERSTEIN</u> .....	193
4. <u>Pundaluoya ernesti</u> .. <u>KIRKALDY</u> .....	195
5. <u>Eocuryssa flavocapitata</u> .. <u>MULLER</u> .....	197
6. <u>Zuleika bengalensis</u> .. <u>DISTANT</u> .....	199
7. <u>Perkinsiella insignis</u> .. <u>DISTANT</u> .....	201
8. <u>Perigrinus maidis</u> .. <u>KIRKALDY</u> .....	203
9. <u>Cemus afghanii</u> n.sp.....	205
10. <u>Nilaparvata lugens</u> .. <u>SJAL</u> .....	207
11. <u>Euryssa ishtiaquii</u> n.sp.....	209
12. <u>Sardia rostrata</u> .. <u>MELICHAMP</u> .....	211
13. <u>Coronacelia frontalis</u> .. <u>METCALF</u> .....	213
14. <u>Sogata pusan</u> .. <u>DISTANT</u> .....	215
15. <u>Sogata striatus</u> n.sp.....	217
16. <u>Sogata tandojamiensis</u> n.sp.....	219
17. <u>Numatodes Qadrii</u> n.sp.....	221
18. <u>Unkanoles cornicaudatus</u> n.sp.....	223
19. <u>Delphax Qadrii</u> .. <u>V.S.P.</u> .....	225
20. <u>Sogatella furcifera</u> .. <u>HARYATI</u> .....	227
21. <u>Sogatella longifurcifera</u> .. <u>ESAKI &amp; ISHIHARA</u> .....	229
22. <u>Sogatella kolophon</u> .. <u>KIRKALDY</u> .....	231
23. <u>Sogatella palludum</u> .. <u>KIRKALDY</u> .....	233
24. <u>Toya attenuata</u> .. <u>DISTANT</u> .....	235

25. Toya albinotata..CRAWFORD.....237  
26. Toya propinqua.....FIEBER.....239

## INTRODUCTION.

The family Delphacidae has been defined by various authors, including Distant (1906), Muir (1915, 1924, 1930), Metcalf (1943), Caldwell and Martorell (1950), and Fennah (1956). Practically all workers define as "small insects varying from about 2-10 or 12mm., rather elongate; eyes large, hemispherical, usually deeply emarginate below at base of antennae; head and thorax conspicuously keeled, keels variable in number, extent, and prominence; frons usually longer than broad; clypeus triangular; rostrum long; antennae always two jointed, variable in form and length, with a long seta at tip of II; ocelli two, at base of each gena near lower margin of eye. Pronotum tricarinate, about as long as vertex, extending down on each side almost to base of fore coxae; scutellum longer, acute between elytra, three to five carinate legs rather long and slender; fore and middle coxa long almost as long as femora; hind coxa large, stout, with a small tooth posteriorly, hind tibiae with two to five lateral spiniform spurs on spines, and a large movable spur (calcar) at apex; latter variable in form from spiniform or cultrate to tectiform with margin dentate; tarsi three, basal is the longest. Elytra

of two types brachypterous and macropterous; former may reach less than half way to tip of abdomen or more, truncate at apex, obscurely veined; latter longer than abdomen, often setigerous on veins, venation variable; clavus with two veins joined specially; corium with three at base, all but one less branched veins. Wings sometimes wanting or reduced, usually nearly as long as elytra, hyaline and folded one. . Abdomen about as long as thorax; male genital segment usually more or less cylindrical, truncate at apex, with a pair of claspers (genital styles) and anal tube within aperture. Female genitalia ventral, consisting of a long, usually cylindrical, acute ovipositor sheath which reaches to the tip of the abdomen, anal tube at tip of abdomen".

From the morphological stand point, the authoress considers the evolutionary development of the posterior tibial spur as the most important character of the family. No other family within the super family Fulgoroidea shows this character.

The present study has been undertaken at the suggestion of Dr. M.A.H. Qadri and as aimed, primarily, to gain an insight into the Oriental Delphacids and to give the future work<sup>ers</sup> an idea about the immense wealth of genera and species

from that region. It by no means presents the whole picture of the family in the Oriental Region. The scope of the present study is confined, mostly, to the collection made by Dr. Qadri from the East and West Pakistan. This was all of the material available in collection. The material examined is mostly from Dacca, Comilla, Mymensingh, Rajshahi, Khulna, Rangpur (East Pakistan); and Karachi and its rural areas Lower Sind area, Quetta and Punjab (West Pakistan). The results of the investigations made by the study of the material mentioned above were checked with the type specimens of their authors at the British Museum (Natural History) London.

In all, nineteen genera and twenty six species are described of which all of the genera except Sogata Distant 1906 are new records. Out of twenty six, nine new species are described. The most interesting feature about East and West Pakistan *except Baluchistan* Delphacidae is the absence of Asiracinae. This sub-family contains the most primitive forms of the family and is represented by more than twenty genera and numerous species distributed over the Americas, Asia, Malaysia, Australia, Newzealand,

The South Pacific Islands, and even the Seychelle Islands. But the fact that the only 20 genera and twenty six species of Delphacidae are so far known from Pakistan indicates that it is premature to draw any conclusions from their absence.

Zoogeographically the area of the present study falls into the Oriental Region according to the divisions made by Sclater and Wallace and accepted by Metcalf (1933), de Beaufort (1951), and Darlington (1957). Thus it covers the whole of the Indo-Pak sub-continent South of the Himalayan range in addition to Ceylon, Burma, Thailand, and the greater Sunda Islands, including the Philippines and Borneo. The material examined by the authoress is from East and West Pakistan. No material from other parts of the region were examined. However, the authoress paid a visit to the British Museum in London and examined most of Distant's type species and type specimens, all of which were from India and most of them require considerable rearranging to place them in the correct genera and tribes.

The knowledge of Delphacid genera of the Oriental Region has been slight and no systematic studies of this family were undertaken in earnest since the time of W.L. Distant (1906-1912) who made the

first and last major taxonomic contribution to the knowledge of Delphacids of the Oriental Region. Distant, however, did not cover the entire Orient as his work was mostly confined to India and Ceylon. In most cases he quoted Melicher's (1903) descriptions, or followed them very closely, for the forms from Ceylon.

Systematic study of any particular group can hardly be considered complete unless it covers all the major faunal regions of the world. Metcalf (1933: 106) has drawn attention to the relationship of the zoogeographic regions and taxonomy and has stressed the necessity of classifying the fauna on the basis of geographic boundaries. The present knowledge of the family Delphacidae, is drawn to a considerable extent from the Palaearctic and Nearctic Regions and no such progress can be claimed for the Oriental Region at any time.



## REVIEW OF LITERATURE.

Family Delphacidae was not recognised by the earliest European systematic entomologists. But Fabricius recognised the group by describing the genus Delphax in 1728. Although the group was not given family rank until 1815, when Leach so recognised it. Metcalf, Z.P. (1943) regrets the necessity of making a change in the well known family name Delphacidae. The generic name Delphax Fabricius 1798 is preoccupied by Delphax Walbaum 1792 (Mammalia). The next available name for this genus is Araeopus Spinola 1839, which will replace Delphax Fabricius and the family name will be Araeopidae. Since the relevant volume of the general catalogue of Hemiptera, Fascicle IV Fulgoroidea, part 3 Araeopidae by Z.P. Metcalf 1943, appeared, the case has been considered by the International Commission on Zoological Nomenclature and their findings regarding the family name Araeopidae were published in opinion 602, Bulletin of Zoological Nomenclature, Vol. 18.1961. They designated Crassicornis Panzer 1796 as the type species of Delphax Fabricius 1798, and rejected all previous type selection, and this name was placed on the official list of generic names in Zoology. Thus the name Araeopus was rejected and the name of

the family being based on the type genus, is accordingly Delphacidae.

Fabricius (1798), Spinola (1839), Stal (1855), Fieber (1866), and White (1878) were pioneer workers in this field.

The systematic entomologists of the first half of the nineteenth century described the more common forms. Notable contributions to the taxonomy of the family Delphacidae were made by Latreille, Burmeister, Boheman, Herrich-Schaeffer, Germar, Say, Guerin Hemeville, Spinola, Amyot, and Serville.

In this group Stal worked on collection from various parts of the world, other conspicuous European workers during this period were Kirschbaum and Melichar in Germany; Flor and Shalberg in Sandinavia, Marshall, Scott, and Edwards in England; Walker and Distant, who worked over the rich collections in the British Museum, Van Duzee, Uhler, Ashmead, Osborn and Fitch in the United States, and Berg in Argentina. Since the turn of the century many notable contributions have been made by Muir and Kirkaldy, especially on the Pacific faunas; Crawford, Swezey, Ball, Dozier, Fowler and others on the fauna of Americas; Matsumara, Esaki and Kato on the species from

Japan; Oshanin and Kusnezov in Russia; Jacobi, Haupt and Jensen-Haarup in continental Europe; and China in England.

Work on the Oriental Delphacidae did not start until the early part of the present century. Perhaps very small size of the member of the group caused by the earlier workers to avoid them. A more extensive study of the oriental Delphacidae was made by Distant (1906) who monographed the sub-family Delphacinae in his work. On Rhynchota in the Fauna of British India Series, Vol.III, 1906 and Vol.VI, 1916. Distant's work on the oriental Delphacidae was an attempt to study the group on a faunastic basis and the work was therefore handicaped. Distant (1906) himself has realized this. He wrote in the introductory remarks.

"With the conclusion of this the third volume of the Rhynchota, the account of the Indian Insects belonging to that order is carried to the end of the family Fulgoridae. The preparations of this volume has been an arduous piece of work as the insects described in it are obscure and little known. More specially does this apply to the forms included in the Fulgoridae. The admirable classification of this family initiated by Stal and continued by

Dr. Melichar, of Vienna, left untouched a large amount of material that had to be examined and worked out.

Though it is hoped that the present volume which throws much additional light on the natural sequence and affinities of the minor groups of this family it must yet be born in mind that the work as a whole is primarily designed for collectors in India as an aid to the identification of insects, which, though probably numerous enough in that country and of economic importance have not been much collected or observed".

These remarks were true to a great extent and Singh-Pruthi (1930) when published his work mentioned several discrepancies in Distant's work and remarked. "Working in England Distant was far away from India, naturally his work could not be a complete one, and collecting trips undertaken during the last two or three years by myself or by some of my colleagues in Zoological Survey of India have yielded numerous new and interesting genera and species, some of which are described in the present paper. Distant's work deserves some further comments. Distant is the author of over 60 percent of the genera and species described from India, but unfortunately his descriptions of new

forms based as they often were in single specimens, and those too sometimes carded and mutilated, are very inadequate. He hardly look into Consideration important structures like the genitalia whose importance in affording reliable generic and specific characters is recognized by workers on almost all groups of insects. Furthermore with a few exceptions, Distant did not make any remarks on the position of the new forms he established".

The remarks of Dr. Pruthi made above, are correct for the most part though the present authoress does not agree with the criticism about the failure to take into account the genital structures of the Delphacids. Techniques and methods of approach to any problem change with the time.

In the days of Distant perhaps not many entomologists of the world thought about the genital structures as important factors in taxonomic studies. Although the male genitalia are the court of last appeal in specific determinations in this family; and the known genera need revision, with the characters of the male genitalia used to determine their bounds and phylogenetic relationship. Fieber was the first to recognise the importance of the male genitalia for specific determinations, and his

work gave real impetus to the studies of a group of Entomologists who made their contributions during the last half of the nineteenth century and the first part of the twentieth century.

Muir and Giffard (1924, P.19) suggested that a study of the phallic characters would eventually give us a better understanding. While all true systematists agree that specific identity rests entirely upon phallic characters no one has attempted generic revision by consultation of these characters. Following Muir and Giffard, Dr. Beamer (1945-46) and his students have made a start in this direction and have illustrated that congeneric species have similar phallic character.

## MATERIAL AND METHOD.

The present work has been primarily a study of preserved specimens, dry and wet, in a manner such as to expose the salient anatomical features as clearly as possible. The entire technique employed has been intended to yield an accurate picture of the genital capsule, internal male genitalia and the wings. The materials used consisted of a few pairs of fine needles, number 0 to 00 (Minutem nadeln) mounted in wooden handles, a pair of extra fine forceps, examining stage, piece of carborundum, microvials, and slides.

For most of the work the authoress has utilized the techniques of Oman (1949) and Young (1952), and *Mahmoud (1967)*, with slight modifications.

The available material was initially sorted under magnification into groups with similar external characters, for example, shape, size, color, markings etc. Next males and females were separated and the step consisted of relaxing the dried insects. The authoress used a "Desicator" for this purpose into which water was placed in the bottom chamber instead of anhydrous salt. A twelve to twenty four hours period was enough to

relax the insects. The specimens were then taken out and each placed on a piece of soft rubber with the head of the pin down, bringing the dorsal side of the insect in touch with the rubber surface. A slight pressure of a needle detached the abdomen from the thorax without causing any damage to the rest of the specimen. The abdomen was next placed in glass cells of half-inch diameter to which was added 20 percent Potassium Hydroxide Solution. Each cell was numbered corresponding to a number placed on the pin with the insect. A set of such glass cells were put in a covered petri dish for maceration process. Oman (1949) and some other workers have recommended a 10 percent solution of Caustic Potash and then heating the material. In the authoress, experience 20 per cent Caustic Potash Solution without any heat gives better results. Treatment for six to ten hours or overnight in the Caustic Potash Solution was sufficient length of time depending upon the degree of sclerotization. The progress of the maceration process was ascertained by occasional examination of the material under the stereoscopic microscope. Maceration was stopped when the tissues could be forced out of the abdomen with a slight pressure



of a needle. When maceration was complete the material was washed in distilled water, using a small capillary pipette. This device prevents loss of the minute parts during washing. A total washing for fifteen minutes was sufficient to remove all traces of caustic potash. The abdomen was then immersed in a few drops of glycerine. A few minutes were allowed the glycerine to penetrate well.

The material was examined grossly with the genital capsule attached to the abdomen. Next the capsule was detached from the abdomen with the help of fine needles and transferred to a cavity slide in which a drop of glycerine had been added. Examination in toto was made with a stereoscopic microscope. After in toto examination the internal genitalia was dissected so as to bring the various parts out of the capsule. The conjunctiva around the anal tube was first loosened and next the needles were passed between the aedeagus and the anal tube to sever the membranous connection. It was not necessary to remove the anal tube completely from the capsule.

The next step was to detach the styles from the male plates. One of the needles was inserted through the anterior opening of the capsule (caused by the removal of the abdomen) and placed laterad of and in contact with one of the styles at the base. The other needle was inserted below the anal tube and in its point placed near the first. A slight pressure of the second needle loosened the connection between the style and plate. The process was repeated for the other style. The genitalia were then pulled out of the capsule. In some cases where the genitalia were not easy to detached from the plates, one side of the capsule at the base was cut and the entire covering was pulled to one side there by exposing the genitalia which were then removed. The dissection was so made was studied under a compound microscope from different angles. During the course of the entire examination whether under low or high magnifications the dissection was never covered with a coverslip. The method enables examination of any portion of the genitalia from any desired angle or aspect.

Proper orientation is very necessary for drawing the structures. For this a small quantity of Boric Acid ointment was used as an adhesive. It

was smeared in a fine streak on the cavity slide prior to adding glycerine. The structures were oriented under a binocular stereoscopic microscope. The structure to be drawn was attached to the ointment by one of its margins. The slide was then transferred to the compound microscope fitted with an Abbe camera lucida. Drawings were made on special ~~Vellum~~ Sketching paper with medium hard pencil and subsequently inked by India ink. Different structures were drawn at different magnifications depending upon their size. Most of the drawings have been made at 100x magnification. After the drawings were made, the genitalia were removed from the adhesive and placed into the empty abdomen. The capsule and the abdomen (with the genitalia) were then placed in a micro vial containing a drop of glycerine. The microvial was corked and pinned. The pin was thrust through the protruding cork in a manner that the vial remains slanted downwards at about  $45^{\circ}$ . This is very important as it helps to prevent glycerine from coming in contact with the cork which would result in the blackening of the whole preparation and rusting the pin. There is a difference of opinion among various workers regarding the

advisability of detaching the genitalia. Young (1952) has drawn attention to the two points of view. Workers who believe in keeping the genitalia within the capsule object that in dissection there is a chance of distortion. This objection can be discounted if at the time of making a drawing one particular aspect is taken into consideration, particularly in the case of style. The authoress in the present work, has drawn the style in its broadest aspect, except in some cases, where the apex was drawn a second time in lateral aspect. To prepare wings for study, a fore and hind wing of one side were removed from a dry specimen (specimens fresh from the relaxing chamber are not suitable). The wings removed were placed on a microscope slide in a drop of 96% alcohol. Alcohol helps in straightening the folds (in the case of hind wing) and also prevents growth of fungi. The wings were properly oriented while in alcohol and the slide was left to dry. When dried, it was covered with a 35mm square cover slip which was attached by small drops of glue dropped at four corners. The slide was then placed in a drier to remove the traces of moisture after which an air-dry mount of wings

was ready for examination. Wings were also sketched with the aid of a camera lucida.

During the study some specimens collected from East Pakistan had been preserved in alcohol. This resulted in sticky wings and shriveled bodies and posed a difficulty in removing the wings from the body when the specimens were dried. These specimens acquired degreasing by using a solution of half Xylene and half 98% alcohol then pure Xylene. The specimens from alcohol were first put into the alcohol-xylene mixture and after a few minutes transferred to xylene. This treatment helps to dissolve all the waxy material and loosens the stuck wings. After this treatment the insects were dried and mounted on points.

In the present work descriptions of new species have been based on the male specimens and their genitalia. In the cases of the older species the authoress has used the descriptions of previous workers who had studied all the species available as the types were not seen by the present authoress. In such cases a reference to the description as well as to the figures has been made in text. In one or two cases the species is based on a single specimen.

## MORPHOLOGY.

It is not within the scope of the present work to present a detailed morphological study of Delphacid ~~leaf~~-hoppers. Important contributions in this regard include Metcalf (1913), Muir (1915), Singh-Pruthi (1925a), Snodgrass (1935, 1957), Padri (1949, 1960), and Evans J.W. (1957). In the present treatment, works of Snodgrass (1935, 1957) and Singh-Pruthi (1925a) have been used as a guide for terminology of the various anatomical structures. Further reference is made to Metcalf (1913), regarding the male and female genitalia structures.

The course of description of genera and species the authoress uses a few terms which require explanation. The term "robust", "medium", and "small" have been used for the form of species. The term "robust" is used for those species which are biggest in size within the group, "medium" for those having average size of 5mm. and "small" for those specimens which are smallest within the group. In the mesothorax the authoress uses "scutum" for the second tergite partially covered by the pronotum. This has been described by Kramer (1950) in the tettigelline leaf-hopper, Aulacizes irrorata (Fabricius), and in the cercopid, Lepyronia quadrangularis (Say). It is

the anterior portion of the "scutellum" of earlier taxonomic studies of leaf-hoppers. The area between the lateral and posterior margins of the pronotum has been called the humeral area. In the specific description of the expression "pronotum" at its greatest width "means" the greatest width of the pronotum in the transverse plane from the edge or one lateral margin to the other. In describing the style the "cephalic" and "Caudal" portions have been referred to. These relate to the parts proximal and distal of the connective respectively. "Pygofera" refers to the genital segment which usually is in the form more or less of a cylinder; the "Anal tube" is the circular piece surrounding the "Anal style", which is usually the most posterior organ; the "Genital styles" are the paired claspers within the aperture of the pygofera and are very variable shape; the "Penis" (so called), when visible, projects ventrad from below the lower margin of the anal tube. The other terms are easily understood.

## NOMENCLATURE.

The family name either Delphacidae or Araeopidae for past several years have been an issue of nomenclatorial differences of opinion. Thus workers have employed in the past more than one name for both the family and the sub-family. Ashmead (1890), Distant (1906), Spooner (1912), Crawford (1914), Melichar (1914), Giffard (1917), Muir (1930), Fullaway (1937), and many others used the family name as Delphacidae, while Metcalf (1913) have used Delphacida as sub-family of the family Fulgoridae. Later on Metcalf (1943), Ishihara (1949) have used Araeopidae as family name and Araeopinae as sub-family. The story is that the family Delphacidae was not recognized by the earliest European Systematic Entomologists. But the genus Delphax was erected by Fabricius in the supplement to his Entomologia Systemica in (1798, pp. 511-522). In <sup>(1792)</sup>~~(1792)~~ Walbaum listed but did not accept or adopt Klein's 1744 genera of fishes and aquatic mammals, and among these appeared a genus Delphax.

According to opinion 21 of the International Commission the fact that Walbaum published Klein's 1774 genera in 1792 does not make them valid. The genus Delphax Fabricius is accordingly not



preoccupied and is valid. The group was not given family rank until 1815, when Leach so recognised it. But Metcalf, Z.P. (1943) regrets the necessity of making a change in the well known family name Delphacidae. He claims that the generic name Dolphax Fabricius 1798 is preoccupied by Delphax Walbaum 1792 (Mammalia). The next available name for this genus is Araeopus 1839, which will replace Delphax Fabricius and the family name will be Araeopidae.

Since the relevant volume of the General Catalogue of Hemiptera Fascicle IV Fulgoroidea, part 3 Araeopidae (Delphacidae) by M.P. Metcalf, 1943, appeared, the case has been considered by International Commission of Zoological Nomenclature and their findings regarding the family name Araeopidae were published in opinion 602, Bulletin of Zoological Nomenclature, Vol.18, 1961. They designated Crassicornis Panzer 1796 as the type species of Delphax Fabricius 1798, and rejected all previous type selection, and, this name was placed on the official list of generic names in Zoology. Thus the name Araeopus was rejected and the name of the family being based on the type genus, is accordingly Delphacidae.

## CHARACTERS OF THE FAMILY DELPHACIDAE LEACH.

The family Delphacidae is the largest family of the Fulgoroidea. The catalogue (Metcalf, Z.P. 1943) contains 137 genera and 1,114 species. This family includes some of the smallest Fulgorids. Even the larger species seldom measure more than 8 or 9 mm. to the tips of the fore wings and the smaller species are frequently less than 2 mm. in length. The head is usually small and relatively simple, but in a few genera it is elaborately developed, being some times as long as the rest of the body. The antennae are usually simple, with short basal segment and a short globular or somewhat elongate, teret second segment and with a terminal flagellum. The antennal segments together are usually not much longer than the short head and short thorax combined. Occasionally either the first or the second or both segments are greatly elongated. Such antennae may be considerably flattened or the basal segment may be prismatic in shape with the entire length exceeding the total length of the body.

The thorax is usually short with the pronotum and mesonotum conspicuous, generally provided with median and lateral carinae. The pronotum tends to be collar like; the mesonotum triangular in outline. The fore wings or tegmina of the

Delphacidae occur quite com only in three forms:-  
 a very short fore wing with reduced venation,  
 covering the basal segments of the abdomen only  
 -----brachypterous; or of moderate  
 length covering most of the abdomen and with  
 fairly well developed venation -----  
 Koeliopterous; and lastly a fore wing usually  
 longer than the abdomen, frequently much longer,  
 with fully developed venation -----macropterous.  
 The venation of the macropterous fore wing is  
 characteristic for the family as a whole. In the  
 fore wing sub-costa is typically two-branched.  
 Radius is coalesced with sub-costa for about half  
 of its length, when it diverges suddenly, then  
 coalesces near the middle of its course with media  
 one plus two. It then diverges towards the costal  
 border of the wing. Media is typically three  
 branched, the branches represented being media  
 one, media two and media three plus four or  
 media one plus two, and media three and media  
 four. Media three plus four frequently coalesces  
 for a short distance with cubitus one. Sometimes  
 these two veins are connected by a short cross  
 vein. Cubitus is three branched. Hind wings are  
 usually present, sometimes much reduced in  
 specimens with brachypterous or koeliopterous  
 fore wings. In specimens with macropterous fore

wings, the hind wings are well developed, with a fairly constant arrangement of the principal veins and cross veins. In the hind wings subcosta and radius are coalesced for more than half of their length and media is unbranched. Cubitus is typically three-branched, cubitus one "a" coalescing for almost its entire length with media, being separated only at its tip. The vannal and jugal areas of the hind wing are considerably enlarged.

The prothoracic and mesothoracic legs are usually simple, of the typical homopterous pattern, with three segmented tarsi. Infrequently the fore and middle femora and tibia may be flattened and considerably enlarged. The hind legs have the femora and tibiae elongated, the latter usually with two conspicuous spines on the outer margin. The calcar or spur at the apex of the tibia is characteristic of this family. There are three distinct types of the calcars which Muir uses as the basis for the separation of the sub-families and tribes used in the present thesis. The spine-like, subulate calcar is the most primitive. The next stage is the solid cultrate spur, which may have both surfaces convex or the inner surface concave. The most

highly developed is the laminate or tectiform calcar, which is sometimes greatly enlarged.

With the increase in the number of known species and of our knowledge, it becomes necessary to divide and sub-divide the groups of species included in the various sections of the Fulgorids; whether we consider the main divisions as families or sub-families is a matter of personal opinion. Personally the authoress thinks it is more natural and expedient to consider the Delphacidae as a family, and the divisions as sub-families.

~~TAXONOMY OF THE DELPHACIDAE.~~

When working out Pakistan Delphacidae the authoress found it expedient to tabulate as many of the genera of the family as possible and give characters necessary to locate them with accuracy. The following characters have been of great use to the authoress and it will be of use to others equally and for this reason alone she describes it.

**HAND TIBIAL SPUR.**

~~THE SPUR:~~ As this organ is the characteristic feature of the family it is not surprising that its shape should be of taxonomic value; unfortunately many species have been described with only a mere reference to its existence. The authoress is not aware of any one making primary use of it for dividing the family into divisions or sub-families before Kirkaldy, who was followed by Crawford.

The spine like subulate spur is the most primitive and some of its possessors show the more generalized form of the tegmina. The solid cultrate spur with both surfaces convex, appear to be the next stage, which is followed by the inner surface becoming concave and eventually laminate.

**THE ANTENNAE:** These organs come next to the spur for usefulness in taxonomic work; there appears to be but little specific variation and in absence of

the sexual differences found in some of the other families of Fulgoroidea. The terete form is probably the more primitive, and the short basal joint more primitive than the longer basal joint.

THE MESONTAL CARINAE: These are of great utility as they are always mentioned by describers and of their presence or absence there is little dispute.

THE PRONOTAL CARINAE: Among some of the more difficult genera bearing laminate spur, it is necessary not only to recognize the presence of these carinae but also their shape and extension. Unless this is done it will be difficult to keep apart several genera containing different forms, and it will lead to the formation of one or more unwieldy genera of polymorphic characters, whose species it will be more difficult to locate than are the present genera. This has been the case with Crawford, work on the North American forms and it will be still worse if the same methods are applied to the genera of the world.

It is generally possible to recognize two forms, those divergingly curved posteriorly, or following, to a great extent, the contour of the hind margin of the eye, and which plainly do not reach the hind margin; and those which, although diverging posteriorly are straight or convergingly curved,

and meet the hind margin or approach it exceedingly closely.

**CARINATION OF HEAD:** In these we have the most unsatisfactory taxonomic characters, for in so many species they are obscured at the junction of vertex and face, and there is considerable variations in such characters as the furcation of the median frontal carinae. In Homoptera such variation is common in all characters which undergo a great alteration at the last ecdysis. According to Muir (1915) in all nymphs of Delphacidae with which he is acquainted there are two medio-longitudinal carinae on the face which, in certain species amalgamate to a greater or lesser extent; the extent of amalgamation being variable. For this reason it has been necessary to place certain genera in two or three locations.

**TIBIAL SPINES OF THE HIND LEGS:** They have been used for taxonomic purposes, but they do not appear to be of great value for there is great specific variation; usually there is one at the base, one about middle and several at apex. It is possible that the proportional length of the first-joint of hind tarsus and the absence or presence of one or two spines near the middle can be used more than they have been, also the



proportional length of the front tibiae.

For specific work it is absolutely necessary that the male genitalia be examined and a use of it for generic distinction is possible in certain groups.

With the increase in the number of known species and of our knowledge, it becomes necessary to divide and sub-divide the groups of species included in the various sections of Fulgorids; whether we consider the main divisions as families is a matter of personal opinion. Personally the authoress thinks it is more natural and expedient to consider the Delphacidae as a family, and the divisions as sub-families.

The classification of this family, whatever arrangement we may use, shows parallel development and convergence. Arranged in the present order we see parallel development in carination of head and thorax, in lengthening and broadening of vertex and in the proportional length of joints of legs in each of the divisions. Another point clearly shown is the improbability of most or all of the characters used for taxonomic purposes being of vital importance to the individual or species.

For the most part generic concepts have been based upon chrotic characters such as shape of calcar, head and cranial topography which is often variable within the same species, is often obscure, and is limited in possibilities. In the small forms (Delphacini) this procedure has resulted in considerable generic confusion. Muir and Giffard (1924.P.19) have stated that the trick is not to separate species but to recognize the relationships among them. They also suggested that a study of the phallic characters would eventually give us a better understanding. While all true systematists agree that specific identity rests entirely upon phallic characters no one has attempted generic revision by consultation of these characters. Following Muir and Giffard, <sup>(1924)</sup> Dr. Seamer (1945-46) and his students have made a start in this direction and have illustrated that congeneric species have similar phallic characters.

A limited fauna is a poor place to attempt any revision, especially in this group because many forms are distributed over the semi-tropic and tropical regions of the world and some forms are entirely cosmopolitan. The present classification into genera is so confused that it is frequently

necessary to identify a species before it can be placed in its accepted genus. Metcalf's statement (1938, P.280.) that there are 120 genera in synonymy in this family, gives an indication of the magnitude of the task facing those who work with the Delphacids. In the present work the authoress has attempted to associate related species even though there remains considerable uncertainty as to the correct name for some of the groups so found. The authoress listed twenty six forms from East and West Pakistan and believe that many more will be taken. The forms are so numerous that she has departed from the usual procedure and have resorted to use of tribe and sub-family to break them down into more wieldy groups.

## C L A S S I F I C A T I O N .

Key to the sub-families of the family Delphacidae.

- . Fulgorids, with movable spur on hind tibia.....  
.....Delphacidae.
- 1. (2) Post-tibial spur subulate, with cross-section  
either circular or angular, apex more or less  
acuminate, without teeth on side.....  
.....Asiracinae.
- 2. (1) Post tibial spur, cultrate or sub-cultrate  
or laminate, with or without teeth on hind edge  
.....Delphacinae.

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or laminate, with or without teeth on hind edge  
.....Delphacinae.

## SUB-FAMILY ASIRACINAE.

Fulgorids, with movable spur on hind tibiae. Post-tibial spur subulate, with cross-section either circular or angular, apex more or less acuminate, without teeth on side.

The most interesting feature about <sup>Oriental</sup> ~~Pakistan~~ Delphacidae is the absence of <sup>record of</sup> the Asiracinae. The sub-family contains the most primitive forms of the family, and is represented by more than twenty genera and numerous species distributed over the Americas, Asia, Malaysia, Australia, New Zealand, the South Pacific Islands, and even the Seychelle Islands. But the fact that only 19 genera 26 species of Delphacidae are so far known from East and West Pakistan indicates that it is premature to draw any conclusion from their absence.

## SUB-FAMILY DELPHACINAE.

Delphacids with movable spur on hind tibiae. Post-tibial spur solid, either cultrate, laminate, foliaceous or sometimes tectiform. Inner surface of the spur concave or both surfaces convex, distinct teeth or no teeth along hind edge.

## KEY TO THE TRIBES OF THE SUB-FAMILY DELPHACINAE.

1. Post-tibial spur cultrate, solid, both surfaces convex, distinct teeth along the hind edge ....  
.....Alohiui.
2. Post-tibial spur cultrate, solid but with inner surface concave; no teeth along hind edge .....  
.....Tropidocephalini.
3. Post-tibial spur laminate or foliaceous, sometimes tectiform, with or without teeth along hind edge.....Delphacini.



## TRIBE ALOHINI MUIR.

Macropterous or brachypterous. Either slender, elongate, broader or more robust forms. First joint of antennae very short, broader than long or distinctly longer than broad. Second joint short and thick either ovate-form, sub-ovate form, cylindrical or only slightly enlarged at middle. A single or double median frontal carinae present, in case of single carina it is forked at extreme base and in case of two median carinae they approximate at base or apex, or both, or even meeting together, but not forming a stalk.

Tegmina reaching well beyond middle of abdomen or very short, not reaching to middle of abdomen.

Head not elongated or enormously elongated, longer than thorax and abdomen combined.

Mesonotum with rounded or flattened disc with or without a distinct depression dividing the disc from the posterior angle.

Post-tibial spur cultrate, solid, both surfaces convex, distinct teeth along the hind margin.

## GENUS ILBURNIA WHITE 1878.

- HAPLOTYPE** Ilburnia (Ilburnia) ignobilis (n.sp.)  
1878 White, Proc. Zool. Soc. London  
1878:471.
- TYPE** Ilburnia ignobilis 1915 Muir, Canadian  
Ent. 47:264.
- Ilburnia** 1878 White, Proc. Zool. Soc. London  
1878:471. subgen.n. of Ilburnia.
- Nesosydne** 1907 Kirkaldy, Proc. Hawaiian Ent. Soc.  
1:161 gen.n.  
1908 Kirkaldy, Proc. Hawaiian Ent. Soc.  
1:202.  
1910 Kirkaldy, Fauna Hawaiiensis Suppl:  
576, 577, 583.
- Ilburnia** 1915 Muir, Canadian Ent.47:264. subgenus  
of Ilburnia:212.
- Nesosydne** 1915 Muir, Canadian Ent.47:212, 265.:270  
1916 Muir, Proc. Hawaiian Ent. Soc.3:172.  
:172.:184:185. 214.200, 201.  
1917 Muir, Proc. Hawaiian Ent. Soc.3:304.  
1917 Giffard, Proc. Hawaiian Ent. Soc.3:342
- Ilburnia** 1919 Muir, Canadian Ent.51:6. Equals  
Nesosydne Kirk.  
1922 Giffard, Proc. Hawaiian Ent. Soc.  
5:107, 113.  
1924 Muir and Giffard, Bull. Hawaiian  
Sugar Pl. Assoc. 15:7.
- Ilburnia** 1939 Neave, Nomenclator Zoologicus 2:767.
- Nesosydne** 1940 Neave, Nomenclator Zoologicus 3:325.

Head not elongate; frons with a single median  
carina simple or forked; antennae with a  
first segment distinctly longer than broad;  
second segment cylindrical or only slightly  
enlarged at middle.

Mesonotum with disc flattened, no distinct  
depression between disc and scutellum.

Tegmina brachypterous, usually surpassing middle of abdomen, veins distinct.

Post tibial spur cultrate, solid, with inner and outer surfaces convex, with distinct teeth on posterior margin.

ILBURNIA UMERKOTIENSIS (n.sp.)

(Plate 1)

Holotype (1 male); (Paratype 5)

Mustard Yellow, fuscous between carinae of face and on gena, forming two narrow lines on face and continuing into the apical portion of vertex, brownish between carinae of thorax, on mediolateral portion of abdomen, apex of labium and claws. Tegmina hyaline, light mustard yellow, veins darker, the subcostal, claval and middle of the median and cubital cells brownish, a darker mark running over the membrane from base of subcostal cell to apex of clavus; granules very sparse and minute bearing black hairs. Female brachypterous; length 2.7mm.; tegmen 1.3mm. Similar in coloration to male.

Male brachypterous; length 2.3 mm.; tegmen 1mm.

Vertex longer than broad (1 to 8), sides subparallel, apex truncate, length of face more than twice the width (2.25 to 1), slightly broadened on apical half, median carina simple but slightly thickened on basal third; antennae reaching to middle of clypeus or beyond, basal joint very slightly shorter than apical joint; legs long, hind femora reaching beyond apex of abdomen, tibiae considerably longer than femora, tarsi considerably shorter than tibiae, first joint very slightly longer than other two, spur considerably

shorter than first tarsus. Tegmina reaching to middle of abdomen.

Opening of pygofer about as long as wide, each anal angle of pygofer produced into rounded process which nearly meet in middle line and nearly surround the anal segment; anal segment without spines; genital styles slightly curved, narrowed in the middle, apical half subdiamond shape; aedeagus tubular, orifice at apex slightly ventrad, two small flanges at base on dorsal aspect, three large spines on dorsal aspect near apex; diaphragm produced into a ridge in middle with a shagreened surface.

Recorded from Umerkot (Sind), on grass.

## TRIBE TROPIDOCEPHALINI MUIR.

Post-tibial spur cultrate, solid but with inner surface concave; no teeth along hind edge.

Antennae about length of face or slightly longer than face; first joint of antennae either about equal to second, slightly or much longer than second, or about the length of the face; first joint either terete, flattened, foliaceous or subsagittate; antennal joints sub-equal in length or 2-3 length of second or much longer than second.

Lateral carinae of vertex and face only moderately developed or forming deep keels. In some forms vertex triangular with curved sides or quadrate. Sometimes the vertex considerably elongate; lateral edges of face arcuate or straight, sub-parallel, length of vertex equal to width at base; in profile clypeus not bent at right angle to face. Lateral carinae of vertex and face forming deep keels.

Key to the genera of Tribe Tropidocephalini  
of Pakistan.

1. Post-tibial spur not awl-shaped, not circular  
in cross-section.....2
2. Spur thick, flattened, or concave on inner  
face, margin without teeth.....3
3. Lateral carinae of frons and vertex only  
moderately developed.....5
4. Lateral carinae of frons and vertex deeply  
foliate.....Purohita
5. Vertex sub-triangular with sides slightly  
convex, sometimes elongate.....  
.....Tropidocephal  
Mesonotum longer than vertex and pronotum  
together.....Punjalucya
6. Median carinae of frons simple or forked only  
at extreme base.....7
7. Vertex at base more than twice as broad as an  
eye in the same line.....Eosuryga

GENUS PUROHITA DISTANT 1906.

ORTHOTYPE *Purohita corvina* (n.sp.) 1906 Distant  
Fauna British India 3:470.

TYPE *Purohita cervina* 1915 Muir, Canadian  
Ent. 47:267.

PUROHITA 1906 Distant, Fauna British India  
3:470, (gen.n.) :465.(Key).  
1907 Kirkaldy, Bull. Hawaiian Sugar  
pl. Assoc. 3:129.  
1907 Distant, Ent. Monthly Mag. 43:10  
(Listed).  
1907 Antram, Jour. Bombay Nat. Hist.  
Soc. 17:1024.  
1912 Waterhouse, Index zool. 11:258.  
(Listed).  
1915 Muir, Canadian Ent. 47:212, 267.  
(Listed) :270.(key).  
1915 Shumacher, Mitt. Zool. Mus.  
Berlin 8:136. (Listed).  
1935 Schulze, Kukenthal and Heider,  
Nomenclator animalium 4(210:2969).  
(Listed).  
1940 Neave, Nomenclator Zoologicus  
3:1047. (Listed).

Head with eyes narrower than pronotum;  
vertex very narrow, extending little  
in front of eyes, laterally strongly  
ridge and anteriorly prominent, medially  
very obsolete carinate; face long,  
narrow, medially and laterally carinate,  
strongly depressed and impressed between  
eyes, and thence obliquely widened to  
clypeus, which is also medially and  
laterally carinate, lateral carinae



of frons and vertex deeply foliate; antennae inserted in a groove on under surface of eyes, first joint very long and broad with a central ridge, on each side of which the surface is obliquely reclined, second joint barely half the length of first, thickened but much narrower and with spinous hairs.

Pronotum scarcely longer than vertex, tricarinate; mesonotum longer than head and pronotum together, tricarinate.

Tegmina longly passing the apex of the abdomen, longitudinally veined, a series of transverse veins at about one-third from apical margin, beyond which the longitudinal veins are distinctly thickened and the central one furcate at apex, most of the veins are also finely and some-what obscurely granulate.

Tibiae without spines, but with a long, robust, apical spur, thick flattened or concave on inner face, margin without teeth, spur not awl-shaped and not circular in cross section.

PURCHITA ADRII (sp.n)

(Plate 2)

Holotype (1 male); (Paratype 4)

Head ochraceous, vertex darkly ochraceous, frons light brown, clypeus and gena ochraceous brown, single ocelli located on each side to the anterior of the eye; antennae two segmented, long and broad, small flagellum arises from the terminal segment, 1st. antennal segment thrice the length of the 2nd. one; frontoclypeal suture divides the head into two portions; the length of the frons and vertex together is more than half of the length of clypeus and labrum together; the labrum is narrow towards the tip; three longitudinal sutures of which the median "mid cranial sulcus", and the lateral "Latero clypeal sutures" present. Pro-, meso-, and metanotum brown, the lateral areas of the pronotum darker than basal area; mesonotal carinae pale and distinct and its posterior angles are sub-lobate.

Tegmina sub-hyaline, longer than hind wing, transverse veins absent.

Legs ochraceous brown, fore and middle leg is similar, a long robust apical spur on hind tibiae which a large number of small spines at the inner margins. Seven on the lateral margin, one at the

base, one on the mid portion at the outer margin and rest of the spines at the apex; tarsi three jointed and their apices black.

The male external genitalia comprises of a pair of parameres, which are situated in the genital chamber ~~of~~ formed by the 9th. and 10th. segments; the terminal portions of the parameres are hook like, hooks rounded at apex, basal portion thickened and somewhat flattened bearing an aedeagal funnel which is a long median tube arising from the phallobase, a pair of aedeagal hooks present, pygofer large and prominent.

In female, ovipositor complete, all the three pairs of valves are very well developed, the dorsal valves are pointed and highly sclerotized at their apices, the inner ones elongated and reach as far as the tip of the abdomen. It is recorded from the Government Fruit Farm of Mirpur Khas on Bamboo (*Dendrocalamus*). It is near to *Purohita arundinacea* Distant (1907) which was recorded on bamboo in India. This species prevails in Mirpur Khas and likely to be pest of Bamboo.

The eggs are deposited deeply into the tissue of the leaves on either side of the mid-rib. The nymphs and adults are concealed under the

whorls of sheathin; leaves among; a mass of the flocculent, waxy secretion. The nymphs are greatly flattened horizontally, antennal joints sub-equal and cylindrical; face with two median carinae; hind tibial spur as in adult.

GENUS TROPIDOCEPHALA STAL 1855.

- HAPLOTYPE: Tropidocephala flaviceps (n.sp.) 1855  
stal, Ofv. Svenska. Vet. Akad. Forh.  
12:93.
- TYPE : Tropidocephala flaviceps 1907 Kirkaldy,  
Bull. Hawaiian Sugar Pl.Assoc. 3:141.
- TYPE : Tropidocephala flaviceps 1912 Oshanin,  
Kat. Paark. nemip.
- TYPE : Tropidocephala flaviceps 1915 Muir,  
Canadian Ent. 47:267.
- TYPE : Tropidocephala flaviceps 1916 Distant,  
Fauna Bri. India 6:143.
- TYPE : Tropidocephala flaviceps 1921 Muir,  
Proc. Hawaiian Ent. Soc. 4:481.
- TYPE : Tropidocephala flaviceps 1929 Haupt,  
Zool. Jahrb. Syst. Okol. 58:208.
- TYPE : Tropidocephala flaviceps 1925 Haupt,  
Tierwelt Mitteleuropas 4(3):129.
- Tropidocephala 1853 Stal, Ofv. Svenska Vet. Akad.  
Forh. 10:266.
- Conicoda 1900 Matsumura, Ent. Nachr. 26:258.  
(n.gen).
- Tropidocephala 1902 Melichar, Ann. Mus. St. Petersburg  
7:90(15). Equals Conicoda Mats.
- Orchesma 1903 Melichar, Homoptera-Fauna Ceylon:  
94:225.
- Ectopiopterygo 1906 Kirkaldy, Bull. Hawaiian Sugar  
-delphax Plant Assoc. 1(9):412(Gen.n):313.
- Samara 1906 Distant, Fauna British India  
3:478.
- Nephropsia 1915 Muir, Canadian Ent. 47:266. To  
Tropidocephala Stal.
- Tropidocephala 1940 Neave, Nomenclator Zoologicus  
4:579.

Vertex at most less than three times as long as broad, flattened, dorsally, triangular with sides more or less curved, sometimes elongate; lateral carinae of vertex and frons not foliate; antennae with first segment smoothly cylindrical, if at all flattened then longer than broad with lateral margins subparallel.

Pronotum well developed, tricarinate; mesonotum tricarinate; legs moderately short, post-tibial spur cultrate, solid, with inner surface concave, no teeth along posterior margin, or, with only a single tooth at apex.

Tegmina gradually amplify from base to apex, the veins almost wholly longitudinal, those from base to apical area granulate and apically longitudinally globosely elevated, followed by a prominent ~~or~~ reverse vein, thence the veins are again longitudinal, very finely granulate, the upper most curved to apical costal margin, the second very strongly bifurcate before apex.

A characteristic of this genus is the long curved penis and penis guide.

Owing to their being both specific and individual variation of head, and the facies of many species

very similar the species of this genus are hard to identify with certainty unless the genitalia be described, or still better, figured; it is unfortunate that Matsumura makes no remarks on the genital characters in his monograph. A characteristic of this genus is the long curved penis and penis guide.

TROPIDOCEPHALA BRUNNIPENNIS SIGNORET 1860.

1860. Tropidocephala brunnipennis Signoret, Ann. Soc. Ent. France (3) 8:185; Pl.5, Figs.2, 2a, 2b.(n.sp.).
1900. Conicoda graminea Matsumura, Ent. Nachr. 26:259(n.sp.)
1902. Tropidocephala maritima (Sic) Melichar, Ann. Mus. Zool. St. Petersburg 7:90(15) (Comparative note) Equals Conicoda(maritima) (Sic) Mats.
1906. Ectopiopterygodelphax eximius Kirkaldy, Bull. Hawaiian Sugar Pl.Assoc. 1(9):412 (n.sp.): 313 (Listed).
1907. Tropidocephala (Conicoda) graminea Oshanin, Verz. Palaeark. Hemip. 2(2):300 (Listed). Equals Conicoda graminea Mats.
1914. Tropidocephala philippina Melichar, Philippine Jour. Sci. 9:273. (n.sp.)

Brown, darker over abdomen, vertex, and nota; a dark mark on basal segment of antennae and on second segment; the carinae of frons, vertex and thorax white or light. Tegmina uniformly light brown with similarly coloured veins; wings hyaline with light brown veins.

Female a little longer than male in size and darker in colour.

Length of male 1.7mm; Tergum 1.8mm; Wing 1.4mm; Vertex as long as pronotum, width at base 1.5 times the length. The lateral carinae of frons not continued at apex, and meeting but continuing on to clypeus. The pygofer is cut back on latero-dorsal margin with the ventral and ventrolateral margins projecting, a small quadrate projection on



medio-ventral margin. The aedeagus has the spine from its base so characteristic of many of this genus.

Recorded from Comilla (East Pakistan) on grass; Muree (West Pakistan) on vegetables.

## GENUS PUNDALUOYA KIRKALDY 1902

- ORTHOTYPE     Delphax ernesti 1902 Kirkaldy, Jour.  
Bombay Nat. Hist. Soc.14:52.
- TYPE           Pundaluoya ernesti 1906 Distant Fauna  
British India 3:467.
- TYPE           Fundaluoya ernesti 1915 Muir, Canadian  
Ent. 47:267.
- TYPE           Delphax ernesti 1919 Muir, Canadian  
Ent. 51:7.

1902 Kirkaldy, Jour. Bombay Nat. Hist.  
Soc. 14:52 (gen.n.)

1903 Melichar, Homop, Fauna Ceylon.:93.  
:94.95. (Comparative note.:225.(Listed).)

1906 Distant, Fauna British India  
3:467,:465.(Key).:474,476 (Comparative  
note.)

1907 Kirkaldy, Bull. Hawaiian Sugar.  
Pl. Assoc.3:132.  
To peregrinus Kirkaldy. (Error.)

1912 Waterhouse, Index Zool.11:258.  
(Listed).

1915 Muir, Canadian Ent.47:212,267.  
(Listed.):297(Key).

1915 Schumacher, Mitt. Zool. Mus. Berlin  
8:132 (Listed.)

1916 Distant, Fauna British India 6:134.  
Equals peregrinus Kirk. (Error.)

1917 Muir, Canadian Ent. 51:7. (Notes.)

1928 Jacobi, Arkiv Zool. 19:43. (Note).

1935 Schuzle, Kukenthal and Heider,  
Nomenclator animalium 4(21):2968. (listed)

1940 Neave, Nomenclator Zoologicus  
3:1045. (Listed).

Head narrower than pronotum; vertex short,  
broad, much broader than long, quadrate,  
marginally and centrally carinate,  
lateral carinae of frons and vertex only

moderately developed, eyes large and oblique; face a little longer than broad, marginally and medially strongly carinate, the median carination bifurcate at base, obliquely narrowed to clypeus from the region of the eyes; clypeus medially and laterally carinate; antennae inserted beneath the eyes first segment not more than half as long as second, second joint very robust with short spiny hairs.

Pronotum short about as long as vertex, marginally strongly and medially more obscurely carinate; mesonotum longer than vertex and pronotum together, tricarinate.

Tegmina elongate, nearly three times longer than broad, basal half of costal margin sometimes arched and gibbous, apical margin rounded, the veins finely granulose, three longitudinal veins emanating from basal cell, the upper and lower bifurcating beyond middle, a strongly sinuated transverse line formed of transverse veins crossing tegmen beyond middle.

Posterior tibiae with a long robust apical spur, spur not awl shaped, not circular in cross section, thick, flattened or concave on inner face. The type of this genus, Delphax ernesti Kirby, has the tibial spur cultrate, thick, concave on the inner surface, without teeth on the hind margin.

Muir placed it in the Tropidocephalini. The carination of the head is similar to that of Belocera Muir, but, apart from the spur, the terete antennae distinguishes it from that genus as well as Perkinsiella Kirk. There is no carination on the lateral margin of the pronotum. The genus Peregrinus Kirk is quite distinct in general facies, shape and carination of head and thorax.

PUNDALUOYA ERNESTI KIRBY 1891.

(Plate 4)

1891. Delphax ernesti Kirby, Jour. Linn. Soc. Zool. 24:140; Pl. 5, Fig. 14. (n.sp.)
1891. Delphax simplex Kirby, Jour. Linn. Soc. Zool. 24:141.
1902. Pundaluoya ernesti Kirkaldy, Jour. Bombay Nat. Hist. Soc. 74:52; Pl. B, Figs. 3, 3a (illustrated, notes.) Equals Delphax ernesti Kby.
1903. Pundaluoya ernesti Melichar. Homop. Fauna Ceylon:94; Pl. 11, Figs. 12a, b, c. (Described, illustrated.) Equals Delphax ernesti Kby. :225. (Listed).
1906. Pundaluoya ernesti Distant, Fauna British India 3:467; Fig. 254. (Described, illustrated.) Equals Delphax ernesti.
1906. Pundaluoya simplex Distant, Fauna British India 3:468; (Described.) Equals Delphax simplex Kby.
1916. Pundaluoya ernesti Muir, Philippine Jour. Sci. 11:384.
1919. Pundaluoya simplex Muir, Canadian Ent. 51:7.
1921. Pundaluoya ernesti Muir, Proc. Hawaiian Ent. Soc. 4:484.

Testaceous; head, face, and thorax strongly tricarinate; tegmina sub-hyaline, with a broad brown bar at one-fourth of their length, running from the costa obliquely forward to the inner margin, this is followed by a row of three black dots, the first considerably below the costa, and the last resting on the inner margin, the outer half of the tegmen is clouded, leaving a <sup>ut</sup> similar vitreous space on the costa, below which the shade is darkest, round the apex of the wing are eight black dots, two of which stand on the costa, within the clear space,

and there is another insolated spot near the inner margin at about half its length; the veins of the tegmina are set with hairs and in the clouded space are black, spotted with testaceous; wings hyaline. Length excluding tegmen 2.5mm. expanded tegmen 10mm.

Male pygofer moderately large, aperture relatively small, margin sinuate; genital styles occupying most of aperture, hook-shaped, acute, and almost touching at tip.

Habitat :- Dacca (East Pakistan) on grass.

GENUS EOEURYSA MUIR 1913.

- ORTHOTYPE Boeurysa flavocapitata (N.sp) 1913 Muir,  
Proc. Hawaiian Ent. Soc. 2:249.
- TYPE Boeurysa flavocapitata 1915 Muir, Canadian  
Ent. 47:263.
- EOEURYSA 1913 Muir, Proc. Hawaiian Ent. Soc. 2:249  
(Gen.n).  
1915 Muir, Canad. Ent. 47:212, 263(Listed)  
:302(Key).  
1929 Schulze Kukenthal and Heider,  
Nomenclator animalium 2(10):1155(Listed).  
1935 Wu, Cat. Ins. Sinensium 2:120 (Listed).  
1939 Neave, Nomenclator Zoologicus 2:247  
(Listed).

Vertex at base more than twice as broad as an eye in the same line; at most only slightly longer than broad, often equal to width or even shorter; junction of vertex and face acutely angular; the median keel on face distinct; median carina of frons simple or forked only at extreme base; antennae with basal segment not subtriangular, cylindrical or slightly compressed, short as long as broad or a little longer.

Keel on scutellum distinct; mesonotum tricarinate. Basal segment of post tarsus devoid of spines on side; post tibial spur not awl-shaped, not circular in cross section, thin, usually deeply

concave on inner face, margin with or without teeth.

Genital styles articulated on the ventral edge of pygofer, not within it.

The genus differs from EUMETOPINA in having the junction of vertex and face acutely angular; the median keel on face and scutellum distinct and the genital styles articulated on the ventral edge of pygofer not within it.



EOEURYSA FLAVOCAPITATA MUIR 1913.

(Plate 5)

1913. Eosuryse flavocapitata Muir, Proc. Hawaiian Ent. Soc. 2:249. (n.sp).  
 1930 Eosurysa flavocapitata Muir, Treubia 12:30 (Listed.)  
 1935. Eosurysa flavocapitata Wu, Cat. Ins. Sinensium. 2:120. (Listed.)

Length 2.8mm., vertex, base of face, pronotum except the lateral margins and pleura of abdomen yellowish, rest brown, hind legs lighter. Tegmen 2.8mm, light brown, veins dark with small hairs having granules; wings smoky hyaline with brown veins.

9th. abdominal segment bears the male genitalia while accessory hooks, diaphragm are born on the 10th & 11th segments.

Male pygofer slightly emarginated medio-ventrally; anal segment short, a strong, inward pointing spine on each ventro-lateral edge; genital styles reaching to anal segment, attached to the medio-ventral edge of pygofer, gradually tapering to apices which are curved outward.

While conducting a survey of Sugarcane crop at Gopalpur, Rajshahi (East Pakistan), Adri, M.A.H. (1964) detected a serious infestation

of a leaf-hopper pest. This leaf-hopper has not been recorded previously from India or Pakistan. The general form of the hopper has a close resemblance to the genus Tropidocephala Stal. The authorities of the British Museum have determined it as Eoeuryssa flavocapitata Muir. This was however recorded by Muir from China and Federated States of Malaya in 1920, on sugarcane and Sorgham.

The eggs of this hopper are deposited deep into the tissue of sugarcane leaf along either side of the mid rib. Nymphs and adults live highly concealed within the whorls of sheathing leaves near the top of the sugarcane plant.

The injury first appears in the form of drying of leaves. It is followed by appearance of sooty molt and red streaks on the leaves.

The pest is wide spread in the East Pakistan and it is feared that growing cultivation and transport of the sugarcane from one place to another will help this pest to assume an international status.

## TRIBE DOLPHACINI.

Less slender or broad forms. In profile head either semicircular or not wide or nearly as wide as pronotum. In some forms head either narrower than pronotum or including eyes, distinctly wider than pronotum. In some cases the head including eyes not wider than pronotum, in profile more or less angular at apex of vertex. Head and thorax twice or more than the width of head, including eyes. Antennae with one or both segments distinctly flattened; first antennal joint long, sub-parallel sided or semi-foliaceous, antennae may or may not be as long as face and clypeus together. First joint of antennae triangular, sub-triangular or sagittate. In some forms the antennae is very short, first joint not longer than second. In few cases antennae long, first joint much longer than second.

One or two medio-longitudinal carinae present, in case of double they meet together at base and apex. In the forms where one medio-longitudinal frontal carinae present it is simple or furcate. Two medio-longitudinal frontal carinae, distinct throughout or approximate at one or both ends, or forked near base. Median frontal carinae forked at apex or base. Length of face considerably

greater than width or length of face equal to width between eyes, or face angular, as wide as long. Face longer than wide, carinae of face distinct, especially at base and over vertex, it may be broad as broad as long, median longitudinal carinae very faint, especially at base, dividing face into three sub-equal parts. In some forms face either almost circular, sides nearly straight, sub-parallel or nearly as broad as long. In some cases the face much longer than head or face very long and slender or longer than broad, but not greatly so. Face with lateral edges more arcuate or nearly parallel. Vertex with or without a ridge between eyes, it may be distinctly broader than long or much narrower in proportion to length. Apex of vertex either sub-angular, making vertex somewhat 5-sided or conical or vertex truncate, but little rounded, square or little longer than wide, not 5-sided, perceptibly longer than broad, apex narrower than base. In some cases vertex double the length of pro and mesonotum together or it may be slightly longer than wide.

Two or three carinae on pronotum, either divergingly curved, not reaching hind margin or straight, reaching hind margin sometimes convergingly curved posteriorly, reaching hind margin, or all but doing

80.

Lateral keels of pronotum divergingly curved posteriorly, not reaching hind margin.

Another and intermediate femora and tibiae compressed and foliaceous; legs simple, not foliaceous; first joint of hind tarsus longer than the other two together. Spur with fine teeth on hind margin or first joint of hind tarsus not so long as the other two together, spur with minute tooth at apex, but none on hind margin, or very minute hair like ones; first joint of hind tarsus distinctly longer than the other two together or hind tarsus hardly as long as the other two together.

KEY TO THE GENERA OF TRIBE DELPHACINI OF  
PAKISTAN.

1. Post-tibial spur wedge shaped, or thin and tectiform ----- 2.
2. Post-tibial spur tectiform, with teeth on margin ----- 3.
3. Frons with median carinae forked near middle ----- 4.
- Frons with median carina simple, or forked at base, or with two carinae separate to apex ----- 11.
4. Antennae with basal segment triangular and compressed ----- 5.
- Antennae with basal segment cylindrical ----- 7.
5. Vertex much broader than long ----- 6.
- Vertex twice as long as wide; head in profile more or less angular at apex of vertex, face flattened ----- Zuleika
6. Postclypeal not short, longer than basal segment of antennae; post-tibial spur rather long, with more than 30 teeth, pygofer with a pair of processes ventrally on hind margin ----- Perkinsiella.
7. Profemora and protibiae not foliately expanded ----- 8.
8. Lateral carinae of pronotum straight, attaining hind margin ----- 9.

- . Lateral carinae of pronotum curved laterad,  
not attaining hind margin -----
- 9. Form robust; frons not more than twice as  
long as broad; pygofer without a medioventral  
process ----- Peregrinus.
- 10. Vertex broader at base than long in middle  
line; basal antennal segment fully twice as  
long as broad ----- Cemis.
- 11. Frons with a single median carina. ----- 1
- 12. Basal segment of post-tarsi with one or more  
spines laterally ----- Nilaparvata.
- . Basal segment of post-tarsi without teeth  
laterally ----- 1;
- . Basal segment of post-tarsi not so long as  
the other two together, spur with minute  
teeth at apex, but none on hind margin, or  
very minute hair like ----- Euryss.
- 13. Post-tibial spur with 13 teeth or more ----- 14
- 14. Head with eyes not broader than pronotum ----- 15
- 15. Vertex longer than broad at base ----- 16
- 16. Second antennal segment distinctly less than  
three times as long as first ----- 17.
- 17. Basal segment of antennae relatively shorter,  
second segment distinctly longer than  
first ----- 18.
- 18. Rostrum not attaining post trochanters ----- 19.

19. Frons about three times as long as broad  
----- Sardia.
- . Frons relatively shorter ----- 20.
20. Lateral carinae of pronotum straight or  
curved laterad, evidently not reaching  
hind margin ----- 23.
- . Lateral carinae of pronotum straight or  
convex, reaching hind margin or very  
nearly so ----- 21.
21. Sub-median carinae of vertex meeting  
before apex of vertex ----- 22.
22. Basal segment of antennae little longer  
than broad; second segment less than  
three times as long as broad-----Coronacella.
- . Basal segment of antennae fully twice as  
long as broad; second segment atleast three  
times as long as broad-----Sogata.
- . Basal segment of antennae cylindrical,  
about as long as broad at apex; median  
carinae of frons narrowly forked at about  
two-fifths from base -----  
-----Numatodes.
- . Basal segment of antennae more than twice  
as long as broad at apex; median carinae  
of frons forked at extreme base of frons;  
clypeus scarcely two-thirds as long as  
frons two and a half times as long as  
broad-----



- Basal segment longer than second; head not broader than prothorax, wide or nearly as wide as pronotum; clypeus normal; frons tricarinate ----- Delphax.
23. Rostrum reaching to mesotrochanters, short in relation to length of frons and clypeus; slender, delicately formed species usually with a pale median stripe on head and thorax ----- Sogatella.
24. Antennae not slender, scarcely or not surpassing frontoclypeal suture ----- 25.
25. Sublateral carinae of vertex meeting at apex of vertex or on base of frons, lateral pronotal carinae not very strongly divergent, or if so, then not straight; post-tibial spur with fewer than forty teeth ----- 26.
26. Lateral carinae of pronotal disc curved laterad, or if straight, extending directly towards tegulae. No white median stripe present dorsally. Abdomen of female in ventral view not narrowly triangular in outline, but more bluntly rounded distally ----- Toya.

GENUS ZULEIKA DISTANT 1912.

HAPLOTYPE Zuleika bengalensis (n.sp.) 1912 Distant,  
Ann. Mag. Nat. Hist. (8) 9:193.

TYPE Zuleika bengalensis 1915 Muir, Canadian  
Ent. 47:268.

TYPE Zuleika bengalensis 1916 Distant, Fauna  
British India, 6:144.

Zuleika 1912 Distant, Ann. Mag. Nat. Hist. (8)  
9:193. (Gen.n).  
1915 Muir, Canadian Ent. 47:212,268.  
(Listed.):301.(Key).  
1916 Distant, Fauna British India 6:144.  
(Described).  
1918 Muir, Canadian Ent. 51:7. (Notes).  
1940 Neave, Nomenclator Zoologicus 4:708.  
(Listed).

Vertex narrow, nearly twice as long as  
broad, the lateral margins carinate and  
from which emerge two short oblique  
carinations between the eyes which  
converge at apex, eyes longer than broad,  
continued over the anterior pronotal  
angles; face long about twice as long as  
broad, a little widened towards clypeus,  
the lateral margins straight, slightly  
oblique, distinctly carinate and slightly  
recurved, centrally strongly carinate,  
the anterior margin with the apical angles  
somewhat prominent; clypeus a little more

than half as long as face, the disk tumid, the lateral margins carinately recurved.

Pronotum short, tricarinate, lateral carinae of pronotum slightly divergently curved, the lateral angles somewhat ampliate; mesonotum about as long as vertex and pronotum together, tricarinate.

Tegmina not reaching the apex of the abdomen, the apical margins rounded, venation very coarse and distinct.

Posterior tibiae somewhat long; with a spine near base and another near middle, apex with a long, strong spur, spur as long as the first tarsus, broad, laminate, with small teeth on the hind margin; first tarsus slightly longer than the other two together.

ZULEIKA BENGALENSIS DISTANT 1912.  
(Plate 6)

- 1912 Zuleika bengalensis Distant, Ann. Mag. Nat. (8) 9:194.  
1916 Zuleika bengalensis Distant, Fauna British India 6:144; Fig. 104. (Described, Illustrated).

Head, pronotum, and mesonotum ochraceous; Eyes, face and clypeus black; body beneath and legs, and abdomen above, ochraceous; tegmina with a slightly virescent tint, inner and apical margins pale ochraceous, the apical margin and a spot near middle of inner margin black. Vertex narrow, nearly twice as long as broad, the lateral margins carinate and from which emerge two short oblique carinations between the eyes which converge at apex, eyes longer than broad.

Pronotum short, tricarinate, the lateral angles somewhat ampliate; mesonotum about as long as vertex and pronotum together, tricarinate; face long, about twice as long as broad, a little oblique, distinctly carinate and slightly recurved, centrally strongly carinate, the anterior margin with the apical angles somewhat prominent; clypeus a little more than half

as long as face, the disc tumid, the lateral margins carinately curved.

Tegmina not reaching the apex of the abdomen, apical margins rounded, venation very coarse and distinct; posterior tibiae somewhat long, with a spine near base and anterior near middle, apex with a long, strong, mobile spur.

Length of the body 3.5mm.

GENUS PERKINSIELLA KIRKALDY 1903

ORTHOTYPE Perkinsiella saccharicida (n.sp.) 1903  
Kirkaldy.

TYPE Perkinsiella saccharicida 1915 Muir,  
Canadian Ent. 47:266.

- Perkinsiella 1903 Kirkaldy, Entomologist 36:179  
(Gen.n.)  
1906 Kirkaldy, Bull. Hawaiian Sugar  
Pl. Assoc. 1(9):404. (Notes:405 (Key to  
species)410 (Comparative note).  
1907 Kirkaldy, Bull. Hawaiian Sugar  
Pl. Assoc. 3:126 (Key) 135 (Key to  
species) Equals Phacelastor Kirk.  
1908 Kirkaldy, Proc. Hawaiian Ent.  
Soc. 1:201 (Key).  
1911 Muir, Bull. Hawaiian Sugar plant  
Assoc. 9:4 (notes, key to species).  
1915 Muir, Canadian Ent. 47:212, 266  
(Listed):297 (Key).  
1916 Muir, Philippine jour. Sci. 11:378  
(notes, key to Philippine species).  
1919 Muir, Canadian Ent. 51:7 (Compara-  
tive note).  
1922 Kershaw and Muir, Ann. Ent. Soc.  
America 15:208 (morphology of genitalia).  
1926 Muir, Bull. Hawaiian Sugar Pl.  
Assoc. 18:17 (Comparative note).  
1940 Neave, Nomenclator zoologicus  
3:670 (Listed).

Vertex much broader than long; frons  
with median carinae forked near middle;  
clypeus in profile not angulate at  
middle; post clypeus not short, longer  
than basal segment of antennae; antennae  
with basal segment triangular and  
compressed, but not saggitate. Mesonotum  
tricarinate.

Pattern on tegmina on five and six apical cells, granules on veins pallid and fine.

Post tibial spur rather long, with more than 30 teeth, tectiform with teeth on margin.

Pygofer with a pair of processes ventrally on hind margin directed dorsad and lying close to each other. Anal tube with a pair of claw-like appendages. Aedeagus short and stout, asymmetrical, provided with two subapical teeth ventrally.

This genus was erected by Kirkaldy for saccharicida in 1903. It differs from Dicranotropis in the first joint of antennae being broader at the apex than at the base and both joints somewhat flattened, not cylindrical also in the presence of two spines on ventral margin of pygofer.

PERKINSIELLA INSIGNIS DISTANT 1912

( Plate 7 )

1912. Pundaluoya insignis Distant, Ann. Mag. Nat.  
 1919. Perkinsiella insignis Muir, Canadian Ent.  
 51:7. Equals Pundaluoya insignis Distant.  
 1936. Perkinsiella insignis Pemberton, Proc. Int.  
 Soc. Sugar Cane Techn. 5:118(1). (Listed).  
 1936. Perkinsiella insignis Swezey, Bull. Hawaiian  
 Sugar plant. Assoc. Div. Ent. 21:101. (Listed).  
 1936. Perkinsiella insignis Swezey, Hawaiian Plant  
 Rec. 40:101. (Listed.)

Head, pronotum and mesonotum ochraceous,  
 lateral areas of pro and mesonota black,  
 lateral margins more or less minutely  
 spotted with testaceous, abdomen above black;  
 body beneath black; legs pale testaceous,  
 femora and apices of tibiae mostly black;  
 tegmina sub-hyaline, more than basal half  
 brownish ochraceous where the veins are  
 brownly granulose, apical area piceous, with  
 a large <sup>3</sup>stigmatal triangular spot above and  
 a marginal series of smaller spots greyish  
 white; Wings hyaline, the veins fuscous;  
 vertex short, broad, marginally and centrally  
 carinate, the anterior margins of the eyes;  
 Face sometimes distinctly bicolorous, then  
 between the eyes being castaneous, tricarinate.

Male macropterous; length 2.0mm. Median



frontal carina forking between one-third and one-fourth from base; vertex slightly broader than long, carinae typical; antennae extending slightly beyond the base of clypeus, second segment nearly twice the length of first; lateral pronotal carinae diverging posteriorly, straight or very slightly curved, not reaching hind margin. Hind basi-tarsus about the same length as other two together, Spur large, thin, sub-tectiform, with very many minute, black teeth on hind margin.

The medio-ventral margin of genitalia produced into two small round projections. Pygofer, the genital styles and spine of anal segment darker brown.

Habitat :- Collected from Rajshahi, (East Pakistan) on paddy.

GENUS PEREGRINUS KIRKALDY 1904

- ORTHOTYPE Delphax maidis 1904 Kirkaldy, Entomologist 37:176.
- TYPE Perigrinus (Stg) maidis 1915 Muir, Canadian Ent. 47:266.
- ORTHOTYPE Peregrinus maidis 1916 Van Duzee, check list Hemip. America 83.
- TYPE Delphax maidis 1924 Muir, and Giffard, Bull. Hawaiian Sugar Pl. Assoc. 15:11.
- TYPE Peregrinus maidis 1935 Osborn, Sci. Surve. Porto Rico and Virgin Island 14:240.
- PEREGRINUS 1904 Kirkaldy, Entomologist 37:175 (gen.n)  
 1906 Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 1(9):407 (Listed) Equals Dicranotropis Van Duz: 408, 411. (Comparative note).  
 1907 Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:132. (Notes.) Equals Pundaluoya Distant. (in part):127. (Key):135. (Comparative note).  
 1914 Crawford, Mon. Delphacidae.:593. To Dicranotropis Fieb. (Error.)  
 1914 Van Duzee, Psyche 21:165. (Distinct).  
 1915 Muir, Canadian Ent. 47:299. (Key).  
 1916 Distant, Fauna British India 6:134. To Pundaluoya Kirk. (Error).  
 1917 Van Duzee, Cat. Hemip. America:769 (Listed).  
 1935 Osborn, Sci. Surve. Porto Rico and Virginia Islands 14:234. (Key):240. (Listed.)  
 1940 Neave, Nomenclator Zoologicus 3:658. (Listed).

Small forms at most 5mm., usually much less, vertex as broad as long, furcate or slightly rounded at apex, carinae of head distinct; facial carina forking in

basal third of frons; medio-lateral carinae of vertex converging apically, continued separately on the frons, where they unite; frons robust, not more than twice as long as broad, median carina forked near middle; antennae with basal segment cylindrical, segment 1st. and 2nd. sub-equal in length. 2nd. considerably longer than 1st., 1st. longer than broad, head truncate or rounded specially or Y-shaped carina present, narrower than pronotum, lateral pronotal carinae straight diverging, attaining hind margin; mesonotum with less than five carinae.

Fore wings elongate, brachypterous wing twice as long as broad.

Pro-femora and pro-tibia not foliately expanded; post tibial calcar narrow, almost triangular in cross section with base concave, spur tectiform with teeth very minute on margin; basal meta-tarsus without pro-apical spines.

Male anal segment without posterior Projections. Styles with apices approximate and strongly toothed.

Aedeagus very long and slender. Pygofer not folded laterally, without a medio-ventral process, aedeagus very long, slender, spine like, heavily sclerotized, external.

Besides the lateral pronotal carinae the general shape and the genitalia separate this genus from Dicranotropis. The head is much narrower and the thorax not so wide or stout.

PEREGRINUS MAIDIS KIRKALDY 1904  
( Plate 8)

1890. Delphax maidis Ashmead, Psyche 5:323; Figs. A-G.  
 1894. Delphax psylloides Lethierry, Indian Mus. Notes 3:105, Figs. A-K. (n.sp.)  
 1897. Dicranotropis maidis Van Duzee, Bull. Buffalo Soc. Nat. Sci. 5:240.  
 1903. Liburnia psylloides Melichar, Homop. Fauna Ceylon: 101; Pl. 11, Fig. 22.  
 1904. Peregrinus maidis Kirkaldy, Entomologist 37:176. Equals Delphax maidis Ashm. Equals Dicranotropis maidis Van Duz. 175.  
 1906. Pundaluoya simplicia Distant, Fauna British India 3:468; Fig. 255. (n.sp. illustrated).  
 1907. Peregrinus maidis Kirkaldy, Ann. Soc. Ent. Belgique 51:125 (5) Equals Pundaluoya simplicia Dist. 301 Equals Liburnia Psylloides Leth:123 (3), 124(4).  
 1939. Perigrinus maidis Osborn, Meadow and Pasture Insects 1939:161. (Notes).  
 1940. Perigrinus maidis Swezey, Hawaiian Plant Rec. 44:158 (Economics).

Length 4-5mm. General color orangish-yellow with indefinite white stripes on notum. More or less fuscous beneath except meta-thorax. Fore wing with fuscous stripe following cross veins to dorsal apex than curved across wing to central apex; three apical spots along costa and one along commissural at center of clavus dark. Width of vertex 0.22; width of frons, 0.26; 1st. antennal segment 0.15, 2nd. 0.26 mm. Head small, considerably narrower than pro-thorax rather strongly carinate; vertex moderately broad, almost square,

produced a little before eyes; frons rectangular; median carina forked about opposite ocelli. Antennae rather long, stout; 1st. segment more than half as long as 2nd.; 2nd. rather asperose.

Pronotum rather long, broad, lateral carinae straight, often not reaching hind margin; scutellum long.

Legs long, hind tibiae longer than femora; calcar about half as long as basal tarsus, margin very finely dentate.

Anal segment of male with a ventro-posterior ridge. Pygofer opening small, roundish, styles with bifid apex and sub-apical both in ventral aspect. Aedeagus stylate, with long pre-apical dorsal process and two short ventral spurs anterior to process.

Generally reported on corn (Qadri 1963) among shrubs, weeds and grasses.

Habitat: Collected from Jessore (East Pakistan).

GENUS CEMUS FENNAH 1964.

Type species, Cemus leviculus Fennah 1964. Vertex broader at base than long in middle line, broadly and obtusely rounding into frons, as broad at apex as at base, lateral margins somewhat concave, apical margin transverse with submedian carinae not prominent, Y-shaped carina distinct, submedian carinae uniting on frons, basal compartment of vertex wider at hind margin than greatest length, frons in middle line longer than wide at widest part, widest at level of ocelli, lateral, medial carinae forked at level of ocelli, clypeus at base slightly wider than frons at apex, postclypeal disc about as long in middle as broad at base; rostrum reaching to post-trochanters, with apical segment about as long as subapical; antennae reaching almost to level of apex of post-clypeus, basal segment longer than broad, second segment longer than first, ocelli distinct, very close to anterior margin of gena.

Pronotum with disc shorter in middle line than broad at anterior margin, lateral carinae concave, not attaining hind margin. Total length of mesonotum in macropterous form longer than that of scutellum.

Fore and middle femora and tibia a little compressed but not, or only feebly, foliately expanded. Post tibial spur tectiform with about 30 teeth on margin. Abdomen of male with anterior margin of seventh sternum obtusely but distinctly angulate at middle. Posterior margin of eighth sternum shallowly convex throughout, median portion rather flattened. Anal segment of male short, ring like, lateroapical angles more or less tumid, each produced ventrad in a slender spinose process. Pygofer short dorsally, long and strongly convex ventrally, posterior opening relatively small, much longer than broad, dorsolateral angles feebly produced, strongly inflected, diaphragm long dorsoventrally, with dorsal margin weakly concave, deeply incised medially, medioventral process short, broader than long, quadrate, and ornamented at middle of its dorsal margin with one or two processes. Genital style simple, narrow, usually distally to acute apex, directed dorsad, in posterior view only weakly diverging.

This genus is a member of the PHYLLODINUS group. It is separable from PHYLLODINUS by the many toothed spur and the normal fore legs; from PHACALASTOR by the proportions and cylindrical shape of the first antennal segment, and by male genitalia



structure, from Asiracina by the shape of the head, the normal fore legs, the relatively short first antennal segment, and the pattern of the male genitalia; from the closely allied Peliades it is separated by the relatively long common vein in the clavus, by the normal fore and middle legs, and by the shape of the seventh and eighth abdominal sterna, and Platypareia by the proportions of the antennae, shape of head, and structure of the male genitalia.

GENUS APSHANII (n.sp.)  
( Plate 9 )

Holotype (1 male); (3 Paratypes)

Vertex shorter sub-medially than broad at base (about 1:1.1), broadly and obtusely rounding into frons, as broad at apex as at base, lateral margins slightly concave, apical margin transverse with sub-median carinae not prominent, Y-shaped carina distinct, sub-median carinae uniting on frons, basal compartment of vertex wider at hind margin than greatest length (2.5:1), and than median length (3.4:1), frons in middle line longer than wide at widest part (about 1.8:1), widest at two-fifths from base, lateral margins straight below level of ocelli, weakly convergent, median carina forked at level of ocelli, clypeus at base slightly wider than frons at apex, post-clypeal disc as long in middle as broad at base, in profile moderately convex, anteclypeus in profile strongly curved caudad, so that entire clypeus in profile is rather strongly convex; rostrum reaching to post-trochanters, apical segment about as long as sub-apical; antennae reaching almost to level of apex of post-clypeus basal segment longer than broad (2.7:1), with a longitudinal carina below, second segment longer than broad (2.9:1) and longer than first (nearly 1.4:1), cylindrical; ocelli distinct, contiguous

with anterior margin of gena.

Pronotum with disc shorter in middle line than broad at anterior margin (1:1.3), lateral carinae concave, not nearly attaining hind margin. Total length of mesonotum in macropterous form longer than that of scutellum (2.2:1). Post-tibial spur with 30 teeth.

Fuscous; carinae of head and thorax, spots on frons, a suffusion along upper side of basal antennal segment and carina below it, second antennal segment in part, femora, tibiae and tarsi apically, a suffusion along post-femora, stramineous; lateral lobes of pronotum and tegulae, creamy-white.

Tegmina hyaline, veins concolorous with granules fuscous, a linear marginal spot in apical third of clavus, a crescentic band from node to anal angle, then sub-marginally to apex of tegmen, a suffusion overlying apical branch of "R" in membrane and a suffusion overlying anterior branch of "M" in membrane, fuscous. Wings hyaline with fuscous veins.

Anal segment of male short, ring-like, latero-apical angles slightly tumid, each produced ventrad in a moderately long, slender spinose process. Pygofer with dorso-lateral angles weakly produced

mesad, obtuse, the apex not clearly defined; diaphragm with dorsal margin shallowly concave, deeply incised and a little produced caudad medially; medio-ventral process in form of a shallow quadrate lobe. Aed<sup>g</sup>agus long, laterally compressed, slightly decurved distally, a broad flagellum arising at apex, directed dorsad and cephalad, widest at its middle where its dorsal margin is produced cephalad in a small peg-like process and strongly to left in a longer stout spinose process, flagellum tapering in its distal portion, acute at apex. Genital styles moderately long, tapering distad, in posterior view with inner margin straight.

Male:- length, 2.7mm.; tegmen, 3.0mm.

This species differs from Cemus pulchellus (Distant) and Cemus leviculus (Fennah) in the shape of the posterior opening of the pygofer and of its pale marginal area, and in the shape of the genital styles, which are not sinuate in posterior view.

Habitat:- Collected from Comilla (East Pakistan) on grass.

GENUS NILAPARVATA DISTANT 1906.

- ORTHO TYPE Nilaparvata greeni (n.sp.) (Delphax lugens) Stal 1906. Distant, Fauna British India 3:473.
- TYPE Nilaparvata greeni 1907 Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:149.
- TYPE Nilaparvata greeni 1915 Muir, Canadian Ent. 47:266.
- TYPE Nilaparvata greeni 1923 Muir, Philippine Jour. Sci. 22:174.
- TYPE Nilaparvata greeni 1924 Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. 15:16.
- TYPE Nilaparvata sordescens 1925 China, Ann. Mag. Nat. Hist. (9) 16:479.
- TYPE Nilaparvata greeni 1935 Osborn, Sci. Surv. Porto Rico and Virgin Islands 14:255.
- Nilaparvata 1906 Distant, Fauna British India 3:473 (Gen.n.) 465 (Key).
- Kalpa 1906 Distant, Fauna British India 3:474 (Gen.n.) 465 (Key).
- Delphax 1907 Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:149 (Notes, key to Australo Fujjian species).
- Nilaparvata 1907 Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:149 (Listed) To Delphacodes.
- Kalpa 1915 Muir, Canadian Ent. 47:212 (Listed): 302. (Key, note).
- Nilaparvata 1915 Muir, Canadian Ent. 47:212, 266, 300 (Listed):302 (Key, note).
- Kalpa 1919 Muir, Canadian Ent. 51:8. To Delphacodes Fieb. (Error).
- Nilaparvata 1924 Muir and Gifford, Bull. Hawaiian Sugar Pl. Assoc. 15:5 (Key):16 (Notes) Equals Kalpa Dist.
- 1935 Osborn, Sci. Surv. Porto Rico and Virgin Islands 14:234 (Key):255. (Note)

- Kalpa :248 (comparative note).  
 1939 Neave, Nomenclator Zoologicus  
 2:817 (Listed).  
 Nilaparvata 1940 Neave, Nomenclator Zoologicus  
 3:335 (Listed).

Small forms, at most 5mm.; usually much less. Head narrower than pronotum, vertex longer than broad, lateral margins strongly carinate, their anterior angles a little prominent, two oblique discal carinations commencing at about middle of lateral margins and angularly meeting slightly in front of anterior margin, the basal margin ridged; face elongate, very much longer than broad, centrally and laterally carinate, the carinations very broad at prominent; the central one furcate at base, apical margin strongly ridge, frons with a single median carina; clypeus, strongly, broadly, laterally and medially carinate; antennae inserted beneath eyes, second joint much longer than first; incrassate and granulose.

Pronotum about as long as vertex, centrally, laterally and anteriorly carinate; mesonotum faintly tricarinate.

Tegmina less than three times as long as broad, the apical margin rounded, costal and inner margins sub-parallel, crossed at about two-thirds from base by an irregular series of transverse veins, defining an apical area, in which the upper longitudinal vein obliquely bifurcates to costal margin and the lower longitudinal vein strongly bifurcates near its base; wings at base broader than tegmina.

Posterior tibiae with a spine near middle, another at apex, and with a long robust apical spur, spur tectiform with teeth on margin; basal segment of post tarsi with one or more spines laterally; spur not awl-shaped, not circular in cross section.

The genus was erected by Distant for a Ceylon species, but with the exception of one or more species on the hind basitarsus it does not differ from Delphacodesieb. As this character is constant in a long series that I have examined in British Museum

Natural History London, I think it  
best to retain the genus as any good  
character separating one or more species  
from the bulk of the species of  
Delphacodes is of value.



NILAPARVATA LUGENS STAL 1854.

(Plate 10)

1854. Delphax lugens Stal, Ofv. Svenska Vet. Akad. Forh. 11:246. (n.sp.)
1858. Delphax lugens Walker, List Homop. British Mus. Add.:325. (Listed).
1863. Delphax sordescens Motschulsky, Bull. Soc. Nat. Moscou 36:109. (n.sp.)
1891. Delphax sordescens Kirby, Jour. Linn. Soc. Zool. 24:141.
1903. Liburnia sordescens Melichar, Homop.-Fauna Ceylon:102; Pl.11, Figs. 24, 24a. (Described, illustrated). Equals Delphax sordescens Motsch. :225. (Listed).
1906. Nilaparvata greeni Distant, Fauna British India 3:473; Fig. 260. (n.sp., illustrated).
1906. Kalpa aculeata Distant, Fauna British India 3:474; Fig. 261. (n.sp., illustrated).
1907. Delphax ordovix Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:152. (n.sp.):151. (Key):13 (Listed). :153.
1907. Delphax parysatis Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:153; Pl.X, Figs. 10,11. (N.sp.):151.
1907. Dicranotropis anderida Kirkaldy, Bull. Hawaiian Sugar Pl. Assoc. 3:133. (n.sp., Key.):12.
1916. Nilaparvata greeni Distant, Fauna British India 6:141. (Listed).
1917. Delphacodes anderida Muir, Proc. Hawaiian Ent. Soc. 3:335; Pl.6, Fig.35. (Described, illustrated).
1917. Delphacodes anderida Muir, Proc. Hawaiian Ent. Soc. 3:335; Pl.6, Fig.35. (Described, illustrated).
1917. Delphacodes parysatis Muir, Proc. Hawaiian Ent. Soc. 3:333 (Listed). Equals Delphax parysatis Kirk.
1922. Nilaparvata sordescens Muir, Rec. Indian Mus. 24:350. (Notes).
1924. Nilaparvata lugens Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. 15:16. Equals Nilaparvata greeni Dist. Equals Kalpa aculeata Dist.
1940. Nilaparvata lugens Swezey, Hawaiian Plant Rec. 44:162.:162.

Body and legs very pale ochraceous; head and mesonotum pale castaneous-brown; vertex with the margins pale ochraceous, and with anterior inter spaces between the central and lateral

carinations black; face with the carinations very pale ochraceous and more or less margined on each side with piceous; clypeus pale castaneous with the carinations very pale ochraceous.

Pronotum dull pale ochraceous; mesonotum with the carinations faint and pale ochraceous; or concolorous, and this may prove to be a sexual character.

Tegmina sub-hyaline with a dull yellowish tint, the transverse veins and the apical venation fuscous, an elongate black spot at apex of clavus; wings hyaline with an opaline lustre, veins pale brownish; length excluding tegmen 2.5mm.; expanded tegmina 7mm.

Opening of pygofer wider than long, lateral and ventral margins rounded, a slight angle between lateral and ventral margins; anal emarginations large; anal angles slightly produced and curved over, angular. Diaphragm fairly long, dorsal margin shallowly concave, no distinct armature. Anal segment small, no distinct armature, but the ventral corners angular and slightly produced. Genital styles large, flat, reaching beyond dorsal margin of

diaphragm, basal angle large, acute, inner margin beyond basal angle concave, outer margin sinuate, apex broad, truncate. Aedeagus small, tubular. The type of this genus, Nilaparvata greeni Distant is the same as Dicranotropis anderida Kirkaldy and the same as what Melichar identified as Delphax sordescens may not be correct. The authoress falls in with the view of Dr. Bergroth and shall consider greeni as the type until the type of Delphax sordescens has been re-examined.

This species has a wide distribution from Australia to Indo-Pakistan, China and Formosa.

Habitat:- Collected from Dacca, Jessore, Dinaj Pur, Gopal Pur (East Pakistan) on Wheat and Carrot.

GENUS EURYSA FIEBER 1866.

LOGOTYPE Euryrsa lineata 1912 Oshanin, Kat. Palaark  
Hemip:118.

TYPE Euryrsa lineata 1915 Muir, Canadian Ent.  
47:263.

TYPE Euryrsa lineata 1924 Muir, and Giffard,  
Bull. Hawaiian Sugar Pl. Assoc. 15:8.

TYPE Euryrsa lineata 1935 Haupt. Tierwelt  
Mittleuropas 4(3):131.

- Euryrsa 1866 Fieber, Verh. Zool. Bot. Ges. Wien  
16:520 (Gen.n) (Key to species).  
1867 Dallas, Zoll.Rec.3:560 (Key).  
Lelphax 1868 Kirschbaum, Cicad. Wiesbaden.:19.  
(Described, key to German species).  
Liburnia 1876 Douglas and Scott, Cat. British  
Hemiptera-Homoptera.:66 (Listed).  
1886 Edwards, Hemip-Homop. British Islands  
Pt.6:57; Pl.1 Fig.19:55 (Key):58 (Key to  
species).  
Euryrsa 1896 Melichar, Cicad. Mittel-Europe:67  
(Described, key to species):50. (Key).  
1897 Horwath, Fauna Regni Hungariae:56  
(Listed).  
1929 China, Ent. Monthly Mag. 75:41.  
(Notes):42. (Key to British species).  
1939 Neave, Nomenclator Zoologicus 2:366.  
(Listed).

Form of the body small rather robust.

Head relatively short and broad. Vertex  
quadrate; carinae of face and vertex very  
obscure, especially over apex of vertex  
and base of frons; lateral carinae of  
frons and vertex only moderately developed.  
First segment of antennae not more than

half as long; as second.

The lateral pronotal carinae curved around behind the eyes and do not reach the posterior margin of the pronotum; mesonotum shorter than head and pronotum together, tricarinate.

Fore wings not elongate, always broadly rounded apically. Post tibial spur thick flattened or concave on inner face, margin with or without teeth; spur not awl-shaped, not circular in cross section.

Male genitalia not highly modified.

This genus is close to DELPHACODES but is easily recognized from most of the species of that genus by the carinae of face and vertex being very obscure, especially over apex of vertex and base of frons. From those species of DELPHACODES which have the carinae somewhat obscure, it is recognizable by the wider base of the frons and its general appearance. The male genitalia is quite distinct.

(Plate 11)

Holotype, male, paratypes 6 females.

Female 2.3mm.; tegmen 2.6mm. Similar in built and color to the male.

Male 2.1mm.; tegmen 2.4mm. Head as wide as thorax. Width of vertex slightly greater than length, apex equal to base, sides slightly concave, base considerably before the middle of eye. Length of frons 1.6 times the width, sides slightly arcuate, broadest near middle; carinae at apex of vertex and base of frons obscure. Antennae reaching slightly beyond base of clypeus, first segment slightly longer than broad, second about twice the length of first.

Lateral pronotal carinae slightly curved, diverging posteriorly, not reaching hind margin. Mesonotum tricarinate, carinae not very distinct.

Hind basi-tarsus as long as the other two together, spur not as long as basi-tarsus, thin, tectiform, the outer half thinner than the inner, no spines on hind margin.

Frons, antennae, clypeus, legs, lateral portions of pronotum, and tegulae light brown; vertex darker brown; median portion of pronotum and all the

mesonotum dark shiny brown; abdomen dark brown, lighter on basal tergites and on pleura.

Tegmina hyaline, clear, slightly fuscous over apical portion of C, Sc, and first M apical cells, veins yellowish, apical veins and apical margin slightly fuscous, granules small, bearing dark macrotrichia. Wings clear hyaline with yellowish veins.

Anal emargination of pygofer not deep, anal angles rounded, not produced, lateral margins entire, rounded ventral margin emarginate. Anal segment short, the ventral margin produced into two strong long spines, their bases contiguous but divergently curved to the apices; basad of these spines there arises two membranous appendages. The aedeagus is nearly straight, slightly flattened laterally, the apical portion flattened more than rest and dorsally produced into a round flange, opening along ventral aspect at apex, a few small spines along the margins. Genital styles forked, the outer fork large, sinuate, gradually decreasing to acute apex, inner fork small, thin, straight, with the apex curved.

Habitat:- Collected from Abbottabad (West Pakistan) on grass.

GENUS SARDIA MELICHAR 1903

- HAPLOTYPE Sardia rostrata (n.sp.) 1903 Melichar,  
Homop. Fauna Ceylon:96.
- TYPE Sardia rostrata 1906 Distant, Fauna  
British India 3:475.
- TYPE Sardia rostrata 1915 Muir, Canadian  
Ent.47:267.
- SARDIA 1903 Melichar, Homop. Fauna Ceylon:96  
Gen.n.) 225 (Listed).
- HADEODELPHAX 1906 Kirkaldy, Bull. Hawaiian Sugar  
Pl. Assoc.1(9):410 (Gen.n) 313 (Listed)
- SARDIA 1907 Kirkaldy, Ann. Soc. Ent. Belgique  
51:302 Equals Hadeodelphax Kirk.
- HADEODELPHAX 1907 Kirkaldy, Bull. Hawaiian Sugar Pl.  
Assoc.3:127 (Key) 140 (Key to species).
- SARDIA 1908 Kirkaldy, Ann. Soc. Ent. Belgique  
52:14(7) Equals Hadeodelphax Kirk.  
1916 Distant, Fauna British India  
6:141 (Listed) Equal: Hadeodelphax  
Kirk.
- HADEODELPHAX 1939 Neave, Nomenclator Zoologicus  
2:542 (Listed).
- SARDIA 1940 Neave, Nomenclator Zoologicus  
4:11" (Listed).

Head and eyes narrower than pronotum;  
vertex narrower, longer than broad at  
base, three times as long as breadth  
between eyes, when it is narrowed,  
sides nearly parallel and finely keeled,  
anterior margin straightly truncate;  
oblique carinae of vertex meeting at  
apex, or only slightly before it;  
face somewhat long, narrow, contracted



beneath eyes and than slightly broadened at sides; eyes elongately oval, sessile, concave beneath; frons about three times as long as broad, with single median carina; rostrum not attaining post-trochanter; antennae passing eyes, basal joint cylindrical, not fully three times as long as broad, second joint distinctly longer than first, distinctly less than three times as long as first, weakly clavate; ocelli present, small, situate at frontal border of eyes.

Pronotum half as long as vertex, anteriorly straightly truncate, posteriorly concave, with three long keels, the lateral one bent outwardly; mesonotum large, slightly arched, tricarinate, lateral keels converging in front, apex of mesonotum lengthened and rounded.

Tegmina very long, twice as long as the whole body, not widened behind and rather obliquely apically rounded, three longitudinal veins in corium,

the outer and inner ones forked at basal third, four apical veins, the second double, the fourth single forked, terminal cells very long especially second middle one, a forked vein in clavus the apex which does not reach the last transverse veins, between which and apex of clavus there is a space equal to one-third the length of clavus.

Legs slender, posterior tibia with two spines, posterior tarsi with the basal joint longer than the other two together, without teeth laterally and with a large dentated mobile spur at base; tibial spur tectiform with teeth on margin, with 13 teeth or more, usually deeply concave on inner face.

SARDIA ROSTRATA MELICHAR 1903.

(Plate 12)

1903. Sardia rostrata Melichar, Homop. Fauna Ceylon: 96; Pl. II, Figs. 4A, 4B. (n.sp.) illustrated: 225.
1906. Sardia rostrata Distant, Fauna British India 3:475; Fig. 262. (Described, illustrated).
1908. Sardia rostrata Kirkaldy, Ann. Soc. Ent. Belgique 52:14(7). (Note).
1913. Sardia rostrata Muir, Proc. Hawaiian Ent. Soc. 2:246.
1915. Sardia rostrata Schumacher, Mitt, Zool. Mus. Berlin 8:132.
1916. Sardia rostrata Distant, Fauna British India 6:141; Fig. 101.
1917. Sardia rostrata Muir, Proc. Hawaiian Ent. Soc. 3:329.
1928. Sardia rostrata Jacobi, Mjoberg's Exp, Australia:44.

Vertex of head rusty-yellow, spotted with at middle of apex and neck; eyes brown; face black, between the eyes sometimes yellowish except at apex, lateral and middle keels yellowish; antennae yellow with a black spot at base; genae and clypeus black keeled with yellow, the flattened middle keel with three black spots at apex which are often confluent, and on upper margin provided with two black spots visible on side veins.

Pronotum black, its posterior margin narrowly bordered with white, on front margin two continuous rusty-yellow spots which are sometime absent; mesonotum rusty brown, its apex

yellowish, two longitudinal black streaks on sides and underlying brown spots before the apex; in the male the colour is darker; vertex, pronotum, and mesonotum piceous, only apex of mesonotum yellowish.

Tegmina clouded with brown darker on apical area, with pale marginal spots between the ends of the veins, a large hyaline spot in the first apical cell, all the veins brown set with fine granules from which here and there arise small hairs; claval marginal vein yellowish-white, black at apex, and the area from apex of clavus to tegminal apex filled up with black; wings hyaline, veins brown abdomen above brown to black, in female yellowish beneath, base of ventral segments darker, in male piceous; legs pale yellow, bases of tarsal claws and spur brown. Length of the body 4 to 4.5mm.

The genitalia is near to Pluto but the styles differ in having the basal portion longer in proportion to the apical portion also differs. These differences are best seen in a side view of the styles.

Habitat:- Collected from Thatta, Chore, Mirpur Khas (West Pakistan) on grass and paddy.

GENUS CORONACELLA METCALF 1950.

ORTHOTYPE Coronacella Kirkaldyi (Muir) 1917d:329  
(Cabella Metc.)

Head with eyes not broader than pronotum; vertex longer than broad at base, submedian carina of vertex meeting before apex of vertex; frons less than three times as long as broad, with single median carina; rostrum not attaining post trochanters; basal segment of antennae little longer than broad, distinctly larger than first. Lateral carinae of pronotum straight or convex, reaching hind margin or very nearly so.

Post tibial spur tectiform, with 13 teeth or more on margin; basal segment of post tarsi without teeth laterally.

CORONACELLA FRONTALIS METCALF.

Head with eyes not broader than pronotum; vertex longer than broad at base, submedian carina of vertex meeting before apex of vertex; frons less than three times as long as broad, with single median carinae; rostrum not attaining post trochanter; basad segment of antennae little longer than broad; second segment less than three times as long as broad; distinctly larger than first.

Lateral carinae of pronotum straight or convex, reaching hind margin or very nearly so.

Post-tibial spur tectiform, with 13 teeth on margin; basad segment of post tarsi without teeth laterally.

Genital styles sinuate, clavate, spatulate at tip; pygofer at base of styles with one pair of short, rounded process, extending about to base of styles.

GENUS SOGATA DISTANT 1906.

- ORTHO TYPE Sogata dohertyi (n.sp.) 1906 Distant,  
Fauna British India 3:471.
- TYPE Sogata dohertyi 1907 Kirkaldy, Bull.  
Hawaiian. Sugar Pl. Assoc. 3:149.
- TYPE Sogata dohertyi (Sic) 1915 Muir.  
Canadian Ent. 47:267 .
- TYPE Sogata doughertyi (Sic) 1917 Muir, Proc.  
Hawaiian Ent. Soc. 3:321.
- TYPE Sogata dohertyi 1919 Muir, Canadian Ent.  
51:8.
- TYPE Sogata dohertyi 1924 Muir, and Giffard,  
Bull. Hawaiian Sugar Pl. Assoc. 15:12.
- TYPE Sogata dohertyi 1935 Osborn, Sci. Surv.  
Porto Rico and Virgin Islands 14:242.
- LIBURNIA 1966 Stal, Hemiptera Africana 4:179  
(gen.n.) Equals Delphax Auct. Equals  
Embolophora Stal (Error.):176. (Key).  
1873 Marschall, Nomenclator Zoologicus  
1873:369.  
1882 Scudder, Nomenclator Zoologicus  
Univ. Index:175. (Listed).
- SOGATA 1917 Muir, Proc. Hawaiian Ent. Soc. 3:321,  
324.
- LIBURNIA 1925 Hesse, Ann. South African Mus. 23:169.  
Equals Embolophora Stal. (Error).
- SOGATA 1935 Osborn, Sci. Surv. Porto Rico and  
Virgin Islands 14:234.:242.
- LIBURNIA 1939 China, Ann. Mag. Nat. Hist. (11)  
4:582.583.
- SOGATA 1939 Neave, Nomenclator Zoologicus 2:938.  
1940 Neave, Nomenclator Zoologicus 4:216.

Head including eyes distinctly narrower  
than pronotum; vertex a little longer

than broad, slightly widened at base; sub-median carinae of vertex meeting before apex of vertex; face very long and narrower, more than twice as long as broad, laterally and medially strongly carinate, frons not three times as long as broad, with single median carina; rostrum not attaining post trochanters; antennae inserted near lower margin of eyes, basal segment fully twice as long as broad, second joint much longer than first and moderately incrassate, second segment atleast three times as long as broad; clypeus slightly broader than face, laterally and medially carinate.

Pronotum about as long as vertex, tricarinate, lateral carinae of pronotum straight or convex, reaching hind margin or very nearly so; mesonotum tricarinate.

Tegmina longly passing apex of abdomen, much longer than broad, the apex somewhat conically rounded, veins longitudinal crossed beyond middle by an irregular series of transverse veins, beyond which on upper half, several oblique veins extend



to costal margin.

Posterior femora unspined, post tibial spur tectiform with 13 teeth or more on margin, basal segment of post tarsi without teeth laterally.

Aedeagus heavily sclerotised, external, short, tubular, laterally compressed, without a basal process; pygofer varies, but not folded laterally, without a medioventral process.

Muir and Giffard (1924) have stated that this group is a convenient dumping ground for species which if placed in other genera would break down their character; however in their work they have largely eliminated this defect and with few exceptions have assembled a homogeneous group of species.

Sogata is closed to Delphacodes but the species are more slender, the head is slightly longer and narrowed, and most forms have a little dorsal stripe. The lateral pronotal carinae sometimes do not reach the posterior margin but they are not tightly curved behind the eyes as they

are in Delphacodes. The facial carina is variable at point of the furcation but this is probably of little generic significance. The male genitalia are simple and are best defined by reference to the illustrations of the species.

This genus is a convenient home for a certain number of species with weak and uncertain generic characters, which, if placed in other genera, break down their character. This has led Fowler and others to sink certain genera into one, thereby bringing together some totally different groups of insects and making their generic characterization very difficult. With a large group of species like we have in Delphacodes, it is much the best plan to the genotype as far as possible, even if we have to recognize one or more small, weak genera. It approaches Prokelisia Osborn very closely.

KEY TO THE SPECIES OF THE GENUS SOGATA  
IN PAKISTAN.

1. Lateral margins of face straight, face  
broadest at apex, base truncate-----2.
- 2(3). Parameres broadly truncated at their  
apices and elongated; Aedeagus short and  
conical; anal segment short-----Pusana.
- 3(4). Parameres thickened, truncated at the base.  
Aedeagus heavily sclerotized, external,  
short and conical, without a basal process.  
Anal segment short and ring like-----  
-----striatus nov
- 4(3). Parameres bilobed and slightly asymmetrical,  
one of the arms is a little thicker than the  
other one. Aedeagus heavily sclerotized,  
external, short, tubular, laterally compressed,  
without a basal process -----  
-----tandojaniens  
- nov.

SOGATA PUSANA DISTANT 1912.  
(Plate 14)

- 1912 Sogata pusana Distant, Ann. Mag. Nat. Hist. (8)  
9:191.  
1916 Sogata pusana Distant, Fauna British India  
6:139; Fig. 100:140.  
1917 Sogata pusana Fletcher, Proc. Ent. Con. Pusa  
2:177.  
1919 Sogata pusana Muir, Canadian Ent. 51:8  
Sogata pusana Misra, Mem. Dept. Agr. India Ent.  
Ser. 5:209; Text Fig. 1.  
1922 Sogata pusana Muir, Rec. Indian Mus. 24:351.

Face black with the carination brownish ochraceous, the black stripes of the face in Sogata Pusana get narrower at the vertex, clypeus ochraceous, vertex ochraceous.

Pronotum and mesonotum ochraceous, the lateral areas of the pro and mesonotum more or less piceous.

Legs ochraceous, posterior tibiae with a short apical mobile spur, with 19 teeth on the spur.

Abdomen above black more or less transverse testaceous, near base and the lateral margins minutely spotted with the same colour, body beneath blackish.

Tegmina pale brownish, sub-hyaline, wings hyaline, the veins fuscous, wings broader

but shorter than tegmina with a short triangular cell near apex.

The parameres of Sogata pusana are broadly truncated at their apices and elongated; aedeagus short and conical; anal segment short.

It is collected from Karachi, Thatta, Hyderabad, Tharparker and Tandojam. It is a pest of Paddy (*Oryza sativum.*); Wheat (*Triticum sativa.*) and collected also on grass.

SOGATA STRIATUS (Sp.nov.)

(Plate 15)

Holotype (1 male); (Paratypes 2.)

Cranium with black stripes on gena, frons and clypeus; frons, clypeus and labrum dark ochraceous brown, vertex brown; antennae inserted near lower margin of eyes; basal segment fully twice as long as broad, second joint much longer than first and moderately incrassate, second segment at least three times as long as broad.

Pronotum about as long as vertex, tricarinate, lateral carinae of pronotum straight, reaching hind margin; mesonotum tricarinate.

Tegmina sub-hyaline, tinted with brownish ochraceous, which becomes a little darker on apical area, the outer margin of which is broadly fuscous, inwardly, linearly connected with the apices of the longitudinal veins, the longitudinal veins minutely spotted with fuscous. Wings hyaline, the veins darker.

Posterior femora unspined, post-tibial spur tectiform with 18 teeth, basal segment of post-tarsi without teeth laterally.

Anal segment short and ring like. Aedeagus heavily sclerotized, external, short and conical, without a basal process; pygofer not folded, without a

medio-ventral process, nooks on pygofer; parameres thickened, truncated at the base.

Collected from Karachi, Thatta, Mirpurkhas, Tandojam and Khirpur (West Pakistan). It infests Jowar (*Andropogon sorghum*); Bajra (*Pennisetum typhoideum*); and cheekoo (*Sapata Sp.*).

The status of this pest will be determined in a few years which might bring out facts in relation to seasonal and periodic incidence.

SOGATA TANDOJAMIENSIS (Sp. Nov.)

(Plate 16)

Holotype (1 male); (16 Paratypes); (10 Allotypes)

Head including eyes distinctly narrower than pronotum; vertex a little longer than broad, sub-median carinae of vertex meeting before apex of vertex; face very long and narrow, pale brownish; small black spot on cheek; the carination on face dark brownish.

Pro-, meso and metanotum ochraceous; pronotum as long as vertex, tricarinate, lateral carinae of pronotum slightly convex, reaching hind margin; mesonotum tricarinate.

Tegmen pale, veins fuscous, a dark spot on claval suture, wings hyaline.

Posterior femora unspined, post-tibial spur tectiform; basal segment of post-tarsi without teeth laterally.

Aedeagus heavily sclerotized, external, short, tubular, laterally compressed, without a basal process; pygofer not folded laterally, without a medio-ventral process; parameres bilobed and slightly asymmetrical, one of the arms is a little thicker than the other one.

Sogata tandojamiensis is widely occurring in Hyderabad and Tharparkar. It is a major pest of paddy (*Oryza* Sp.)



and Wheat (*Triticum* Sp.) in said districts.

This species can easily be distinguished from *S. striatus* and *S. pusana* by the presence of a small black spot on cheek and a dark spot on claval suture of the tegmina and bilobed parameres which are asymmetrically thickened. It is a mechanical carrier of a plant disease (Black fungus) or Red Rice in Thatta and Lower Sind districts.

GENUS NUMATODES FENNAH 1964.

**TYPE** *Numatodes antricauda* Fennah 1964 : 146.

Head not as wide as pronotum, in profile subacute. Vertex longer than broad at base, basal compartment wider at hind margin than long in middle to fork of Y-shaped carina, frons fully twice as long as broad, widest near middle, median carina narrowly forked at about two-fifths at from base; antennae with basal segment cylindrical, about as long as broad, second segment about three times as long as first; ocelli distinct. Pronotum with disc longer in middle line than broad at anterior margin, lateral carinae not attaining hind margin.

Profemora longer than procoxae, post tibial spur moderately thin, with about thirty teeth.

Anal segment of male moderately short, collar-like, lateroapical angles apparently not produced. Pygofer short, lateral margins of pygofer each lateroventrally produced dorsocaudal in shallow triangulate lobe. Aedeagus rather long, tubular, laterally compressed, acute at apex; Genital styles large.

The deeply forked frontal carina and pattern of male genitalia serve to place this genus in the Dicranotropis group. The short cylindrical first antennal segment suffices to separate it from Phyllodinus and its allies. From Dicranotropis it differs in more delicate structure and in the thirty-toothed calcar. It is perhaps nearest to Thriambus, but stands apart in the relatively elongate vertex, the shape of the frons, the exceptionally short basal antennal segment and the pattern of the male genitalia. From Numata it differs in the relatively much shorter first antennal segment, in genitalic pattern and in bodily size.

NUMANODES DADRIL. (n.sp.)  
(Plate 17)

Holotype (1 male); Paratype (3 males)

Vertex longer sub-medially than broad at base (1.2:1), strongly rounding into frons, rather narrower at apex than at base, lateral margins almost straight, apical margin convex-truncate, with sub-median carinae slightly prominent, Y-shaped carina moderately distinct, sub-median carinae uniting on frons, basal compartment of vertex wider at hind margin than greatest length (1.7:1), and than median length (nearly 2:1), frons in middle line longer than wide at widest part (2.2:1), widest at two-thirds from base, lateral margins distinctly convex, median carina forked at two-fifths from base; clypeus at base not wider than frons at apex, post-clypeal disc as long as broad at base, in profile almost straight, anteclypeus in profile moderately curved caudad, so that entire clypeus in profile is shallowly convex; rostrum surpassing meso-trochanters; antenna attaining; fronto-clypeal suture, basal segment as long as broad, second segment longer than first (3:1); ocelli distinct. Pronotum with disc longer in middle line than broad at anterior margin (1.3:1), lateral carinae strongly diverging, not attaining hind margin. Total length of mesonotum longer than that of scutellum (2.5:1).

Post-tibial spur with 32 teeth.

Testaceous; eyes and ocelli dull red, mesonotum just outside lateral carinae and pronotum immediately behind eyes, stramineous; legs and abdominal sternites, pale testaceous; genitalia, except pygofer dorsally, castaneous piceous, paler on ventral surface.

Anal segment of male moderately short, collar-like, lateroapical angles apparently not produced. Pygofer short, posterior opening as long as broad, dorsolateral angles strongly produced, acute at apex and inflected to meet in middle line, enclosing anal segment, lateral margins in profile concave, diaphragm with dorsal margin deeply excavate in a narrow U-shape, lateral margins of pygofer each lateroventrally produced dorsocaudal in a shallow triangulate lobe; medioventral process obsolete. Aedeagus rather long, tubular, laterally compressed, acute at apex, with a slender flagellum arising apically and extending cephalad above aedeagus. Genital styles large, basal portion stout, granulate, strongly setiferous; thence angulately bent cephalad at middle and recurved laterodorsad at apex, smooth, and tapering in apical third, subacutely rounded at tip.

Male (macropterous): length, 1.9mm.; tegmen, 2.5mm.

This species is well distinguished by the unusual form of the pygofer.

Habitat:- Collected from Comilla (East Pakistan)  
on grass.

GENUS UNKANODES FENNAH 1956.

TYPE Unkana saporona Mats. 1935 : 74.

Unkanodes Fennah for Delphacodes sapporūna  
Mats. 1956. Body slenderical.

Head a little narrower than pronotum. Vertex width at base not exceeding the width of eye. Vertex shallowly rounded at apical margin and longer than broad; carinae of vertex and frons distinct. Frons longer than broad, with median carina forked at extreme base. Antennae cylindrical, basal segment two and a half times as long as broad.

The combined length of pronotum and mesonotum is equal to the maximum width of latter. Pronotum tricarinate, laterad discal carinae almost straight, slightly curved laterally, not reaching hind margin and not in line with mesonotal carinae. Mesonotum longer than head and pronotum together, tricarinate.

Legs teret, not at all compressed, post tibial calcar with about twenty two teeth, basal segment of post tarsus devoid of spines.

Tegmina sub-hyaline.

Parameres bilobed, each lobe hooked at the apices, anal segment short ring like, aedeagus short and pointed tube, caudal hooks truncated.



UNKANODES CORNICAUDATUS (Sp.n.)

(Plate 18)

Holotype (Male), Paratype (25, males), Allotype 50; Cranium with black stripes on gena, frons and clypeus and labrum dark ochraceous brown, vertex dark brown, antennae with second segment black with terminal setae.

Mesotergum black and meet at the centre, laterotergites black in colour, protergum dark laterally; mesoplurites dark; prothoracic sclerites dark.

Tegmina sub-hyaline, a black spot on the middle of the anal margin of the tegmina, this is the chief characteristics of the species.

Legs ochraceous, tibial apices black, 22 teeth on the hind tibial apical mobile spur.

Parameres bilobed, each lobe hooked at the apices, anal segment short ring like, aedeagus short and pointed tube, caudal hooks truncated, three spines on the lateral side of the aedeagus.

This species is an important pest of potato (*Solanum* Sp.); Maiz (*Zea-mays.*); Cabbage (*Brassica* Sp.) in Quetta and builds up a big population during August and September.

Habitat:- Collected from Quetta, Ziarat, Sawat and Muree (West Pakistan) on wheat, Maiz and Potato.

GENUS DELPHAX FABRICIUS 1798.

- HAPLOTYPE Delphax crassicornis 1839 Spinola, Ann. Soc. Ent. France 8:336.
- TYPE Araeopus crassicornis 1840 Duponchel, Rev. Zool. 2:204.
- TYPE Araeopus crassicornis 1901 Kirkaldy, Entomologist 34:340.
- TYPE Araeopus crassicornis 1903 Kirkaldy, Entomologist 36:215.
- TYPE Araeopus crassicornis 1912 Oshanian, Kat. Palaark. Hemip. 177.
- TYPE Delphax crassicornis 1914 Crawford, Mon. Delphacidae; 603.
- TYPE Delphax crassicornis 1915 Bergroth, Canadian Ent. 47:215.
- TYPE Araeopus crassicornis 1915, Muir, Canadian Ent. 47 :261.
- DELPHAX 1798 Fabricius, Suppl. Entomologica Syst: 511:522 (Gen.n).  
1820 Goldruss, Handbuch der zoologie 1:289 (Described).  
1835 Willson, Treatise on insects :203 (Notes).
- ARAEOPUS 1839 Spinola, Ann. Soc. Ent. France 336 (Gen.n) 204 (Key).  
1867 Dallas, zool. Rec. 3:559. Equals Araeopus Stal.  
1939 China, Ann. Mag. Nat. Hist. (11) 4:584 (Listed).  
1939 Neave, Nomenclator zoologicus 1:272 (Listed).

Body large, stout; head large, about as broad as prothorax, rather weakly carinate;

vertex broad, as broad as long, rounded in front, scarcely produced before eyes; frons broad, sides rounded or angulate, longer than broad, tricarinate; antennae long; I foliaceous, not flat, rounded outward along centre, thin above and below; II nearly terete, asperose, a little shorter than I. Eyes large, deeply emarginate below.

Pronotum long, lateral carinae usually flexed outward, scutellum tricarinate.

Tegmen setigerous.

Legs very elongate; fore femora compressed; hind tibiae long, bispinose; calcar very large, tectiform, deeply concave on one surface, margin finely dentate.

In the form of the antennae this genus resembles Asiraca, but it is very distinct in the form of the calcar, as well as in some other characters. It is very apparent from the original description of this genus by Fabricius that his type species is not congeneric with the large group of species which have been for a long time erroneously called DELPHAX, or LIBURNIA

by others. In 1839 Spinola erected a new genus, ARAEOFUS, and indicated as its type species Fabricius's old species, Delphax crassicornis. His species happened to be the type of DELPHAX, however, and therefore the latter must replace the other as the accepted name for these species related to crassicornis.

DELPHAX QADRII (Sp.nov.)

Holotype 1 male.

Length of body 4mm.; width of vertex 0.29; width of frons 0.31; antennae, 1, 0.08, 11, 2.8. General colour light yellowish brown to brown; dorsum usually with a long whitish vitta extending from vertex to tip of scutellum and appearing to be continued on to the whitish margin of clavus when elytra are closed; vitta variable in distinctness, often rather broad; frons and clypeus usually black; elytra usually light brown, occasionally darker, with a more or less prominent brown macula along membrane slightly behind middle and often extending somewhat on to corium.

Head narrower than pro-thorax, strongly carinate, projecting beyond eyes at apex for about one-third its length; vertex long; narrow, about one and a half times as long as broad posteriorly; frons narrowed above, slightly but quite abruptly broadened to ocelli, thence parallel to apex; median carina sometimes forked a little below apex of head. Antennae rather short, 11 three times as long as 1.

Thorax long; pronotum moderately long, scarcely as long as vertex, lateral carinae arcuate. Legs slender; calcar large, half as long as basal tarsus,

pubescent. Elytra narrow, long, subhyaline.

Male pygofers large; anal tube with two long, acute processes on ventral margin; genital styles large at base, abruptly narrowed midway, thence deeply emarginate, sinuate, acute at tip.

Habitat:- Collected from Quetta (West Pakistan)  
on cabbage.

GENUS SOGATELLA FENNAH 1963.

Fennah, 1963 : 48. Orthotype, Delphax furcifera  
 Horvath, 1899;366.

Small, 3.5-4.0mm. including tegmina.

Body slender, total length, including tegmina, about  
 four times with a level of tegulae.

Vertex longer than broad at base, lateral margins  
 carinate, parallel or slightly convergent distad,  
 apical margin truncate, with submedian carinae  
 slightly prominent, posterior margin transverse,  
 submedian carinae distinct, sharp, arising from  
 lateral margins near middle and converging distad,  
 meeting in basal part of frons, Y-shaped carina  
 distinct but not prominent, posterior compartment of  
 vertex based of this carina 1.5-1.8 times as broad  
 as base as long in middle line to fork of Y-shaped  
 carina; vertex in profile very shallowly convex,  
 evenly or subacutely rounding into frons; frons  
 longer than broad, basal and apical margins truncate,  
 lateral margins carinate, almost straight or weakly  
 convex, parallel or feebly divergent to apical third,  
 then incurved; profile flate or shallowly convex,  
 median carina of frons sharp, percurrent, narrowly  
 forked basally; clypeus about as long as frons;

postclypeal disc as long as its basal width, lateral carinae sometimes apparently continuing line of lateral carinae of frons, sometimes continuing line of oblique carinae of genae, in which clypeus is basally wider than frons at apex; anteclypeus not quite as long as basal portion; entire clypeus in profile shallowly convex, sometimes rather strongly convex; rostrum short, attaining mesotrochanters but not post-trochanters subapical segment slightly longer than apical segment slightly longer than apical; genae more or less broad, obliquely transverse carina always distinct, lateral ocelli well developed eyes reniform, more or less deeply incised below, antennae little surpassing frontoclypeal suture, often scarcely attaining it, basal segment cylindrical, longer than broad at widest part, rarely twice as long; second segment longer than first, between 1.5:1 and 2:1, cylindrical, distinctly thicker than first.

Pronotum in middle line slightly or distinctly shorter than vertex, anteriorly shallowly produced between eyes, posterior margin shallowly angulately exoavate, disc tricarinate, with two impression, lateral carinae of disc diverging basad, rarely straight and almost attaining hind margin, usually more or less concave and becoming obsolete distinctly



before margin; mesonotum broader than long, lateral margins subangulately concave, disc tricarinate, median carina becoming obsolete before scutellum, lateral carinae more or less strongly diverging basad.

Legs moderately slender, profemora slightly longer than procoxa, protibiae a little longer than profemora. Post tibiae each approximately ten times as long as wide at middle, with two spines laterally and fine apically, post tarsi about as long as post tibiae, basal segment as long as other two together, post tibial spur thin, foliaceous, rather large, with a narrow minutely setose, marginal band and 17-22 black minute teeth arranged in an even row, spur not nearly extending as far as the middle spine of the basitarsal apical series, basal metatarsal segment with seven spines, second segment with four.

Tegmina relatively long, about 3.5 times as long as wide, more or less deeply rounded apically. Sc + R forked near middle of tegmen, level with entry of claval vein into commissural margin, M forked at nodal line of cross veins, Cu 1 forked, slightly distad of level of Sc + R fork, all between claval veins as long as common claval vein. Wings well developed.

Anal segment of male collar like with a pair of moderately long rather slender, spinose processes arising close to middle on distal margin, directed ventrad. Pygofer moderately long, posterior opening broadly rounded or lozenge-shaped, slightly, longer dorso-ventrally than broad, diaphragm moderately narrow at its middle, sometimes a very small medioventral process present. Aedeagus simple, tubular, usually sinuate, with two more or less complete rows of teeth, one obliquely on left side, orifice often terminal on left side. Genital styles relatively short and broad, flattened and distally furcate, or moderately long straight and tapering, moderately distad.

Female genitalia rather elongate and narrow. Seventh sternite not produced caudad in a lobe; ovipositor with their valvulae narrow, gradually and evenly widening basal half; lateral apices of eighth sternite in ventral view, produced mesad at base in rounded lobe, inner margin almost straight, distal margin very oblique and shallowly convex. Second valvulae moderately broad, straight or curved in profile, dorsal margin distinctly elevated at basal end of rows of teeth; teeth small differing in form and degree of inclination between base and apex of row.

KAY TO THE SPECIES OF THE GENUS *SOGATELLA*  
IN PAKISTAN.

1. Rostrum reaching to mesotrochanters, short in relation to length of frons and clypeus; slender, delicately formed species usually with a pale median stripe on head and thorax.-----2.
2. Aedeagus with teeth-----3.
- . Aedeagus without teeth-----6.
- 3(4) Aedeagus with a row of fourteen to seventeen small teeth running from the dorsal aspect near apex across the left side to ventral aspect near base.-----furcifera.
- 4(5) Aedeagus with about twelve coarse teeth obliquely traversing left side and five or six teeth along ventral margin-----kolophon.
- \* 5(4) Aedeagus small, straight, tubular, orifice at apex, at the base on dorsal half produced and striated as if composed of laminae-----paludum.
- \* 5(4) Aedeagus with about twelve teeth in an oblique row on left and about eleven on lower margin. . . . . longifurcifera.

SOGATELLA FURCIFERA HORVATH 1899.

(Plate 20)

- 1899 Delphax furcifera Horvath, Term. Fuzetek 22:37 2, Fig.1. (n.sp., Japan illustrated.) :366.
- 1900 Liburnia furcifera Matsumura, Ent. Nachr. 26:262. Equals Delphax furcifera Horv.
- 1905 Liburnia albolineosa Fowler, Biologia Centrali-Americana 1:135; Pl.13, Figs.14, 14a, b. (n.sp.).
- 1907 Delphax furcifera Matsumura, Annot. Zool. Japonenses 6:84, 86, 88, 89. (Listed).
- 1912 Sogata distincta Distant, Ann. Mag. Natural History. (8)9:191. (n.sp.):192.
- 1912 Sogata pallescens Distant, Ann. Mag. Nat. Hist. (8)9:192. (n.sp.)
- 1914 Megamelus alholineosus Crawford, Mon. Delphacidae:610; Pl.48, Fig. N.:604, 608. (Key).
- 1916 Sogata distincta Distant, Fauna British India 6:140.
- 1917 Opiconsiva colorata Distant, Trans. Linn. Soc. London Zool. 17:301; Pl. 50, Figs.11, 11a. (n.sp.)
- 1917 Opiconsiva insularis Distant, Trans. Linn. Soc. London Zool. 17:303, Pl.50, Figs.12, 12a. (n.sp.)
- 1939 Sogata furcifera Lever, Agr. Jour. Fiji 10:83. Equals Delphax kolophon Kirk.
- 1940 Delphacacodes furcifera Clausen, Entomophagous insects 1940:518, 518; Fig.149a. (Parasites, illustrated).

Length 2:2.5mm. Yellow to brownish with yellowish median stripe. Face and clypeus ochraceous, vertex creamy white. Pronotum creamy white, mesonotum black broadly longitudinally and centrally creamy white. Facial carina often forking at level of antennal bases. Lateral carinae of pronotum seldom reaching posterior margin. Fore wing

clear with a dorsoapical smoky area present, sub-hyaline, tinted with brownish ochraceous which becomes a little darker on apical area, the outer margin of which broadly fuscous inwardly linearly connected with the apices of the longitudinal veins, minutely spotted with fuscous, an elongated marginal piceous spot near apex of clavus, wings hyaline, veins dark.

Pygofer rounded, slightly wider than long, margins entire; anal emargination large, anal angles not prominent; diaphragm short, middle of dorsal margin roundly emarginate, the edge thickened and sub-crescent shape with the horns rounded and projecting above the margin; there is a small projection on the basal margin of the foramen of the diaphragm. The armature is liable to slight variation, so is the projection on the foramen. Anal segment median size, two large, strong spines on the ventral margin with their bases fairly wide apart. The genital styles are flat, short, broad, the apex bilobed.

Aedeagus slightly flattened laterally, slightly curved, in lateral view base broadest, apex pointed, orifice on side at apex, a row

of fourteen to seventeen small teeth running from the dorsal aspect near apex across the left side to ventral aspect near base; a few small teeth along the middle of ventral aspect.

It is nearly a cosmopolitan species and is likely to be found eventually in Eastern or Southern Europe. The authoress have seen specimens in British Museum (Natural History), London, from Japan, the type locality, Formosa, Philippines, South China, India, Ambonca, German, Fiji, Mexico, Florida, Cuba, Bermuda, Brazil, Central America, Nigeria, Egypt and Seychelles. It is therefore not structure and colour than in any other species that we have examined, the proportional length of the vertex and the condition of the lateral pronotal carinae are both variable. But this does not justify us in sinking a lot of quite different groups of delphacids into one genus. There is also variation in the pygofer and genital styles, Specimens from the West and North West pacific have the apex of genital style fairly narrow and the two prongs near together, where as those from the South West pacific, the American continent

and adjoining Atlantic Islands and Africa, have the apex much wider and the prongs wider apart. There is also a slight difference in the armature of the diaphragm and in a small projection on the ventral edge of the foramen of the diaphragm.

This species is widely distributed in West Pakistan and is collected from Abbottabad in the North and from Thatta and Karachi in the South. It also prevails in Tandojam, Quetta, Mirpur Khas and Lyallpur, Ghulamullah. It has been ascertained by the authoress that Sogatella furcifera is a serious pest of wheat (*Triticum sativum*.) and great Millet (*Andropogon longum*.) in Tandojam, Lyallpur Ghulamullah and Mirpur Khas. The out broak starts in the begining of the rainy season and the population becomes widely spread during September. The late sown paddy (*Oryza sativa*.) receives the <sup>e</sup>serious damage. More than two generations appear during July to October. In Therparker and Hyderabad Districts these hoppers attack wheat (*Triticum - sativum*.) crops heavily during winter. Sogatella furcifera may subsits on some grasses other than rice.

SOGATELLA LONGIFURCIFERA (ESAKI & ISHIHARA.) 1947

(Plate 21)

Delphacodes longifurcifera (Esaki & Ishihara.) 1947.

Vertex longer submedially than broad at base (Between 1.4:1 & 1.5:1), moderately declivous, subrectangulately rounding into frons, rather narrower at apex than at base, lateral margins almost straight, apical margin truncate with submedian carinae slightly prominent, anterior arms of Y-shaped carina distinct, median stem weak, sub median carinae only narrowly separated at apex of vertex basal compartment of vertex wider at hind margin than greatest length (1.4:1); frons in middle line longer than broad at widest part (2.3:1), widest in middle third, lateral margins only very shallowly convex, median carina simple, narrowly formed at extreme base; clypeus at base not wider than frons at apex, post clypeal disc at base not as broad as long in middle line (1:1.2), in profile very weakly convex, anteclypeus moderately convex; antennae attaining frontoclypeal suture, basal segment longer than broad at apex (1.3:1), second segment longer than broad at widest part (2.6:1) and longer than first (2.6:1), the second segment distinctly expanding distad.



Pronotum with disc longer in middle line than wide at anterior margin (1.4:1), lateral margins straight, diverging laterocaudata, not attaining hind margin; total length of mesonotum 2.7 times length of mesoscutellum.

Post tibial spur about two-third of total length of basal metatarsal segment, with about 20 teeth on margin.

Tegmina macropterous as in Sogatella kolophon, apical margin deeply rounded.

Head with carinae creamy or white; disc of frons between carinae and disc of clypeus very lightly or even moderately, suffused unevenly with fuscous, antennae testaceous; median portion of disc of vertex and of mesonotum, mesoscutellum and pronotum except immediately behind eyes, white or creamy-white tegulae and dorsolateral angles of pygofer; pale stramineous or sordid white; mesonotum with posterolateral margins tawny, sometimes irregularly suffused fuscous, lateral fields of mesonotum, and pleurites. At least in their middle portion, and abdomen, fuscous, fore and middle legs pallid, a little infused, hind legs stramineous.

Tegmina hyaline, with a very faint tawny yellowish suffusion.

Male genitalia closely similar to those of Sogatella vibix. Pygofer with dorsolateral angles not inflected, genital styles with mesal (inner) margin subrectangularly produced in basal half.

Habitat:- Collected from Karachi, Thatta, Hyderabad Mirpurkhas (West Pakistan); Rangpur and Dacca (East Pakistan) on Jowar, Wheat, Paddy and grass.

SOGATELLA KOLOPHON KIRKALDY 1907.  
(Plate 22)

1907. Delphax kolophon Kirkaldy, Bull. Hawaiian Sug. Pl. Assoc. 3:157; Pl. 15, Figs. 9:11. (n.sp.)  
 1916. Delphax kolophon Muir, Philippine Jour. Sci. 11:385.  
 1917. Delphax kolophon Muir, Proc. Hawaiian Ent. Soc. 3:328. To Megamelus furcifera Horvath.  
 1920. Megamelus kolophon Muir, Bull. Ent. Res. 10:143; Fig. 6 (Notes).  
 1929. (Sogata furcifera) kolophon Muir, Ann. Mag. Nat. Hist. (10) 4:212. (Comparative note).  
 1933. Delphax kolophon Caresche, Bull. Econ. Indochine 36:498. To Sogata pallescens Dist.  
 1935. Delphax colophon (Sic) Osborn, Sci. Surv. Porto Rico and Virgin Islands 14:243. To Sogata furcifera (Sic.) Horv.

Vertex longer submedially than broad at base (1.2:1) evenly rounding into frons. Slightly narrower at apex than at base, basal compartment of vertex wider at hind margin than greatest length (1.5:1) and than median length (1.8:1) frons in middle line longer than wide at widest part, widest at two-thirds from base, lateral margins almost parallel, median carina forked at one-seventh from base; clypeus at base slightly wider than frons at apex, postclypeal disc as broad as long in middle, anteclypeus in profile shallowly convex, profile of entire clypeus only moderately convex; antennae reaching to frontoclypeal suture, basal segment longer than broad (1.6:1), second segment twice

as long as first.

Pronotum with disc longer in middle line than broad at anterior margin (1.1:1) lateral carinae almost straight, strongly diverging based, not nearly attaining hind margin; total median length of mesonotum exceeding length of mesoscutellum. Post-tibial spur with 19 teeth.

Testaceous, or sordid stramineous; disc of vertex, pronotum and mesonotum, yellowish white, lateral fields of mesonotum orange brown, procoxae and mesocoxae, pleurites, abdomen, except laterally, and pygofer fuscous. Tegmina hyaline, a faint suffusion in posterior half, fuscous, wings hyaline, veins light brown.

Pygofer a little longer than broad, in profile in upper margin slightly declivous, dorsolateral angle distinctly produced caudad. Genital style short, each with outer apical angle broadly and strongly produced, acute apically. Aedeagus with about 12 coarse teeth obliquely traversing left side and 5 or 6 teeth along ventral margin.

Members of this species are most readily recognised by the proportions of the vertex,

the sordid coloration of the intercarinial areas of the frons and clypeus by the light orange brown tint of the lateral fields of the mesonotum and the dilute fuscous suffusion along the posterior half of each tegmen.

**Habitat:** Collected from Comilla, Cox's Bazar, Dacca, Dinaj pur, Rang pur, Jessore and Khulna (East Pakistan) on grass and Paddy.

## SOGATELLA PALUDUM KIRKALDY 1910

- 1910 Kelisia paludum Kirkaldy, Fauna Hawaiian Suppl. :579. (n.s.p.)
- 1916 Kelisia paludum Muir, Proc. Hawaiian Ent. Soc. 3:198.
- 1917 Kelisia paludum Giffard, Proc. Hawaiian Ent. Soc. 3:345.
- 1917 Kelisia paludum Muir, Proc. Hawaiian Ent. Soc. 3:310; pl. 5, Figs. 18, 18a, :330:298:311.
- 1922 Kelisia Paludum Giffard, Proc. Hawaiian Ent. Soc. 5:109.:110.
- 1924 Sogata paludum Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. 15:13; Pl. 6, Figs. 133-135. Equals Kelisia paludum Kirkaldy.
- 1927 Sogata paludum Muir, Fulgoroidea of Samoa:12. Equals Kelisia paludum Kirk.

The opening of the pygofer wider than long, round, anal emargination large, angular and produced; diaphragm short, dorsal margin U-shaped with a conical projection in middle which has a curved line of small teeth running from apex to each basal corner and a few scattered around the base. Anal segment large with two large, laterally flattened spines which in lateral view have their bases projecting considerably beyond anal segment. Genital styles flat, fairly broad, apex truncate with the outer corner rounded and the inner corner produced, basal angle rounded, curved with a few minute teeth on the margin, apical of basal angle the inner margin concave, outer margin nearly straight or slightly sinuate.

Aedeagus small, straight, tubular, orifice at apex, at the base on dorsal half produced and striated as if composed of laminae.

This species has a wide distribution in the Pacific, being known from Hawaii, Laysan, Fiji, Australia, Philippine, Java, Ceylon. This is the first record from Pakistan.

Habitat:- Khulna, Cox's Bazar, Memonsingh, Comilla, Dinajpur (East Pakistan) on grass and paddy.

GENUS TOYA DISTANT 1906.

- ORTHOTYPE Toya attenuata (n.sp.) 1906 Distant  
Fauna British India. 3:472.
- TYPE Toya attenuata 1915 Muir, Canadian Ent.  
47:267.
- TYPE Toya attenuata 1924 Muir, and Giffard,  
Bull. Hawaiian Sugar Pl. Assoc. Div.  
Ent. 15:18.
- TOYA 1906 Distant, Fauna British India 3:472.  
(gen.n.):465. (Key).  
1912 Waterhouse, Index Zool. No.11.1912:  
304 (Listed).  
1915 Muir, Canadian Ent.47:212, 267.  
(Listed).:297.  
1915 Schumacher, Mitt. Zool. Mus. Berlin  
8:132 (Listed).  
1919 Muir, Canadian Ent. 51:8. (Notes).  
To Delphacodes Fieb. (Error).  
1924 Muir and Giffard, Bull. Hawaiian  
Sugar Pl. Assoc. Div. Ent.15:18. To  
Delphacodes Fieb. (Error).  
1935 Matsumura, Ins. Matsumuraana 10:78  
(Listed).

Head with eyes not broader than pronotum,  
vertex narrower, a little longer than  
broader, with a transverse ridge between  
the eyes, behind which the surface is  
quadrangularly foveate, and in front of  
which it is tricarinate; the apices  
of the carinae being distinctly promi-  
nent, sublateral carinae of vertex  
meeting at apex of vertex or on base of



frons, vertex not longer than broad at base; face long and narrow, more than twice as long as broad, medially and laterally carinate, the central carination furcate at base, moderately amplified on posterior half; frons with a single median carina clypeus tricarinate; antennae not slender, scarcely or not surprisingly frontoclypeal suture, basal segment of antennae not three times as long as broad, second joint of antennae slightly more than twice the length of the first. Pronotum slightly wider than vertex, between the eyes truncate, tricarinate, lateral pronotal carinae not very strongly divergent or, if so, then not straight its posterior margin concavely sinuate, lateral carinae of pronotal disc curved laterad or if straight extending directly towards tegulae, no white median stripe present dorsally; mesonotum tricarinate.

Tegmina about twice as long as body apically rounded, the veins longitudinally, crossed beyond middle by an irregular series of transverse veins,

on apical area three oblique veins extend to costa.

Posterior tibiae with two spines, one before and the other near apex, and with a long robust apical, mobile tectiform spur with fewer than forty teeth on margin; basal segment of post tarsi with out teeth laterally, slightly longer than the other two together.

Abdomen of female in ventral view not narrowly triangular in out line, but more bluntly rounded distally.

KEY TO THE SPECIES OF THE GENUS TOYA  
IN PAKISTAN.

- . Vertex with a transverse ridge between  
eyes-----2.
- 1(2). Aedeagus ovate in cross-section, slightly  
sinuate, broad at base and narrowed in  
basal third; dorsal spur present preapi-  
cally; orifice apical-----attenuata.
- 2(3). Aedeagus tubular, thin, curved dorsal,  
orifice at apex, two small spines near  
dorsal margin of orifice and a small one  
on left side slightly before apex, a row  
of some nine spines on right side about  
middle -----albinotata.
- 3(2). Aedeagus small, sub-tubular, largest at  
base, straight, orifice at apex, a few  
small spines on dorsal aspect near  
apex-----propinqua.

TOYA ATTENUATA DISTANT 1906

(Plate 24)

1906. Toya attenuata Distant, Fauna British India  
3:472; Fig. 259. (n.sp.) Illustrated.
1919. Toya attenuata Muir, Canadian Ent. 51:8.  
To Delphacodes attenuata Distant.
1926. Toya attenuata Muir, Ann. Mag. Nat. Hist.  
(9) 17:54 (Listed). To Delphacodes propinqua.

Vertex of head piceous, the ridges brownish-ochraceous; eyes dull black, their extreme margins brownish-ochraceous; Face black with the carinations dull ochraceous; clypeus similarly marked and colored as face; pronotum piceous brown, the carinations dull ochraceous; mesonotum piceous; the carinations and extreme lateral areas dull ochraceous; tegmina hyaline with an ochraceous tint, the veins pale fuscous, legs yellowish with the tarsal claws black; length including tegmen 3mm.

Male anal segment small; dorso-posterior spines long, slender. Pygofer usually greatly elongated at dorso-posterior angles. Usually curved inward, but sometimes much reduced and little curved. Style broad, flat, narrowed towards apex where it is slightly broadened; apex truncate with inner angle slightly more produced than outer. Aedeagus ovate in cross-section, slightly sinuate, broad at base and

narrowed in basal third; dorsal spurs  
present preapically; orifice apical.

Habitat:- Rajshahi (East Pakistan)  
on grass.

TOYA ALBINOTATA CRAWFORD 1914.

(Plate 25)

1914. Megamelus teapae albinotata Crawford, Mon. Delphacidae:670 (n.var.)  
 1924. Delphacodes albinotata Muir and Giffard, Bull. Hawaiian Sugar Pl. Assoc. 15:36; pt.4, Gig. 46; pt.5, Gig. 100. Equals Megamelus teapae.  
 1935. Delphacodes pellucida Osborn, N.Y. Acad. Sci. 14:248-249.

Average length 2.4mm.; width of vertex 0.17; width of frons 0.20; 1st. antennal segment 1mm., 2nd. 0.19mm. General color glossy black to dark brown over entire body surface except pronotum being brown over entire body surface except pronotum being whitish at least on posterior half or more; genae pale; antennae and legs yellow; elytra black, except anterior corner of corium and anterior third of membrane yellow to hyaline. Head short, narrower than prothorax, rather weakly carinate; vertex short; frons rather long, sides almost straight; rectilinear, more than twice as long as broad, rather weakly carinate; antennae reaching to clypeus. 1st. segment about half as long as second. Dorsum weakly carinate; elytra rather glossy, veins distinctly setose, typical in venation. Legs moderately long, slender; hind tibiae longer than femora; calcar long, acute at tip, margin finely dentate.

Opening of pygofer about as long as broad, margins entire, round, anal emargination large, wide, anal

angles round, not produced. Diaphragm short, dorsal margin widely U-shaped with slightly sinuous, no armature but the middle slightly projecting lip shape. Anal segment fairly large and long, the armature in the form of a flat, rounded plate arising on each side near base. Genital styles reaching nearly to anal tube, flat, broad at base, basal angle rounded, inner margin slightly concave on apical half, convex on basal half, apex truncate with the inner angle produced, outer angle rounded. Aedeagus tubular, thin, curved dorsal, orifice at apex, two small spines near dorsal margin of orifice and a small one on left side slightly before apex, a row of some nine spines on right side about middle.

Habitat:- Collected from Abbottabad (West Pakistan) on Potato (*solanum tuberosum*).

TOYA PROPINQUA (FIEBER) (n.comb.)

(Plate 26)

1866. Delphax propinqua Fieber, Verh. Zool. Bot. Ges. Wien 16:525; Pl.VII, Fig.24.
1868. Delphax hamulata Kirschbaum, Cicad. Wiesbaden :38.
1886. Delphax propinqua Then, Kat. Osterreichischen Cicad. 1886:15.(Listed).
1896. Liburnia propinqua Melichar, Cicad. Mittel-Europa:79; Pl.V, Figs.48-50. Equals Delphax hamulata Kirschb.:71.
1897. Delphax propinqua Horvath, Fauna Regni Hungariae:56.
1902. Delphax propinqua Lanbertie, Bull. Soc. Ent. France 1902:325.
1907. Delphax propinqua Matsumura, Annot. Zool. Japonenses 6:88.
1914. Liburnia tuckeri Barber, Bull. American Mus. Nat. Hist. 33:529.
1914. Megamelus terminalis Crawford, Mon. Delphacidae: 632; Pl.48, Figs. F.K.
1917. Delphacodes propinqua Muir, Proc. Hawaiian Ent. Soc. 3:335.
1917. Delphacodes neopropinqua Muir, Proc. Hawaiian Ent. Soc. 3:335; Pl.6, Fig.38.
1919. Delphacodes subfusca Muir, Canadian Ent. 51:38; Fig.12.
1923. Liburnia tuckeri Metcalf, Jour. Elisha Mitchell Soc. 38:173; Pl.70, Fig.710.
1939. Delphacodes propinqua Glick, Tech. Bull. United States Dept. Agr. 673:27.

Length 3-3.3mm. General color yellowish-testaceous. Fascial carinae margined with fuscous, often the space between entirely fuscous. Pronotum lighter than mesonotum. Fore wing slightly milky; veins yellowish; granulations fuscous apically. Opening of pygofer wider than long, margins entire, lateral and ventral margins rounded with a small angle where



they meet; anal emargination large, anal angles large, produced, curved downward and inward and broadly rounded at apex. Diaphragm short dorsal margin V-shaped broad at bottom and produced into a small bifurcation. The middle of the diaphragm raised to near foramen, the armature being slightly rounded or stagreen along the sides. Anal segment small, sunk deeply into anal emargination, anal spines large, straight, acuminate, bases near together, diverging to apex. Genital styles in situ flat, fairly broad, slightly narrowed in middle, apex truncate, basal angle projecting; in flat view inner margins concave, outer sinuate, broadest at base. Aedeagus small, subtubular, largest at base, straight, orifice at apex, a few small spines on dorsal aspect near apex. There is some variation in the number and position of the minute spines at apex, the size of the basal angle of the genital styles and the size of the furcation of the armature of diaphragm.

Habitat:- Karachi, Thatta, Tandojam (West Pakistan); Dacca and Gopalpur (East Pakistan) on Paddy, Wheat and Maiz.

ECONOMIC IMPORTANCE OF DELPHACID PLANT - HOPPERS  
IN PAKISTAN.

The family Delphacidae while of much economic importance in the warmer tropical portions of the world contains only a few real important pests among their members in East and West Pakistan. The real injury caused by these insects however, is without doubt not fully appreciated and given due consideration by most entomologists. Only those who <sup>have</sup> undertaken an intensive study of those small insects, some of which are very minute, realize just what damage is being done by them.

This is due principally to the fact that they suck their nourishment from the leaves and stems of plants in the form of sap, often unnoticed, until the leaves begin to wither, curl and distort, then becoming discolored and dying. The sap is sucked up by means of long beak or sucking tube that by means of certain piercing organs is capable of penetrating even very hard and tough tissues.

Until recently comparatively little attention had been paid in East and West Pakistan to the sap sucking insects of sugarcane for, with one or two exceptions, they cause no obvious injury to the growth of the cane.

The sugar industry of the Pakistan has also only recently become concerned about certain important diseases of sugarcane which are, or may be, transmitted by insects. In 1953 Fiji disease of sugarcane appeared in the cane plantations along the east coast of Madagascar, and fear that it might find its way to Mauritius focused attention upon the presence of Delphacid, Perkinsiella saccharicida Kirkaldy (1903), a known vector of the disease.

The sugarcane leaf hopper, perkinsiella saccharicida is a rather serious pest of sugarcane and at one time threatened the entire crop in Hawaii.

Perkinsiella is a pacific genus, and this species has evidently been carried with its food-plant, Sugarcane, in the egg state. In that manner it was introduced from Australia to Hawaii, when it did great harm to the sugar industry till parasites were introduced from Fiji and Australia which now control it. This insect is widely distributed over the tropics but does not occur in East and West Pakistan fortunately.

Perkinsiella saccharicida Kirkaldy (1903) is a sugarcane insect well known from the writings of

Hawaiian publications, while Metcalf (1943) gives a complete bibliography of many publications dealing with the species up to 1940. Perkinsiella saccharicida is considered to be of Australian origin (Zimmerman, 1948) and the distribution given by Bos (1953) is as follows — Queensland, Hawii (accidentally introduced from Queensland), Formosa (accidentally introduced from Hawii), Java, Mauritius and Natal. To this list of countries may now be added Reunior Island, when the insect was collected by J.R. Williams in 1951 (Williams and Mamet, 1954) and Madagascar, when it was collected at several localities along the east coast and also at Ambanje and Nossi Be in the north west in 1954. Hall (1955) has since recorded it from Madagascar when it has assumed considerable importance owing to the outbreak then of Fiji disease of sugarcane.

Muir (1926) was apparently the first to record Perkinsiella saccharicida from Mauritius. Swezey (1936) also recorded it from the island and Virson (1938), after searching cane fields, verified these records and stated that adults were comparatively rare and could only be found after patient search, he also noted the occurrence of parasitism by an undertermined Dryinid.

Perkinsiella insignis prevails in Sind and Panjab areas on sugarcane crop but it was not recorded as a serious pest or vector of any viral, bacterial or fungal disease of sugarcane crop, but Dr. Qadri (1963) during the survey of sugarcane crop at Gopalpur, Rajshahi, (East Pakistan) detected a serious infestation of a <sup>Plant</sup> leaf-hopper pest. This <sup>Plant</sup> leaf hopper has not been recorded previously from India or Pakistan. The general form of the hopper has a close resemblance to the genus Tropidoccephala stall. The authorities of the British Museum have determined it as Eoerysa flavocapitata Muir. This was however recorded by Muir from china and Federated states of Malaya in 1920, on sugarcane and sorgham.

The eggs of this hopper are deposited deep into the tissue of sugarcane leaf along either side of the mid rib. Nymphs and adults live highly concealed within the whorls of sheathing leaves near the top of the sugarcane plant.

The injury first appears in the form of drying of leaves. It is followed by appearance of sooty mold and red streaks on the leaves. The pest is wide spread in the East Pakistan and it is feared

that growing cultivation and transport of sugar-cane from one place to another will help this pest to assume an international status.

Dr. Qadri (1953) made observations and study of relative abundance of Perkinsiella insignis and Eoecyrsa flavocapitata. Muir .

A new species is recorded from the Government Fruit Farm of Mirpurkhas on bamboo (Dendrocalamus sp.). It is near to Purchita arundinacea Dist (1906) which was recorded on bamboo in India. The species prevails in Mirpurkhas (Sind) and likely to be the pest of bamboo. It is named as Purohita Qadrii n. sp. The eggs of this species are deeply deposited into the tissue of the leaves on either side of the mid rib. The nymphs and adults are concealed under the whorls of sheathing leaves among a mass of the flocculent, waxy secretion.

Another species Purohita cervina, <sup>distant</sup> which does not exist in Pakistan is a serious pest of Bamboo in Formosa, Kanshirei (Muir 1916).

Perhaps a single species that do most damage in West Pakistan is the corn delphacid, Perigrinus maidis Kirkaldy 1904. It produces decided injury to young corn plants in Sind areas.

So far rice plant hoppers are concerned, an outbreak of Sogata tandojamiensis n. sp. occurred in district Tandojam (Sind) in the latter part of 1961 and was reported to Entomological Division, Zoology Department, Karachi University in December. Visits were paid to the fields but it was impossible to carry out extensive field observation owing to the sudden disappearance of the insect. At the second occasion on which species of Sogata was recorded as damaging paddy, was in 1962, when an outbreak occurred in Tandojam at the latter end of that year. Paddy plants at that time were stated to appear decidedly unhealthy, and opinion was expressed that their state was probably primarily due to delayed planting followed by excessive rains. A further opinion was put forward by Dr. Qadri that latest planted paddy and paddy subjected to flooding or deep water appeared to be the most susceptible to attack. At the close of the year, after two weeks of dry weather they had practically disappeared. It is certain that much of the paddy on which the insects appeared will give little if any crop, but it is at present difficult to decide if most of damage was really due to the insects or adverse climatic conditions under which the plants were growing.

Little is known regarding the sudden disappearance of the pest. A theory has also been advanced by Dr. Qadri that a variation in the acidity or alkalinity of the water may be responsible. It is, however, unlikely that any variation which does occur has any effect on the chemical composition of the cell sap. This theory originated through the discovery that if water is run off and replaced by fresh water, the insects disappear after two or three days.

It ~~has been~~<sup>was</sup> noticed in India that continuous rains are favourable to the development of Sogata, but in Tando-jam district, at least, the contrary has been observed, a heavy rain during an outbreak causing the disappearance of the pest. In the authoress opinion degree of humidity could seem to be the determining factor of the duration of an outbreak. As far as it is possible to ascertain, Sogata has never been observed in any numbers in any dry areas.

In a report from Dr. Qadri, it was pointed out that the insect feeds rather higher up the plant in the early morning, but descends latter when the sun beccmes more powerful. This change of position is less marked in the laboratory when the light is diffused.



The insect is a very restless feeder and it runs round the leaf on the slightest provocation. It is therefore, exceedingly difficult to observe the insect with a lens for the approach of one's fingers or a lens causes it to hide behind the leaf immediately.

During the operation of feeding the insect exudes small drops of clear fluid, which is said to provide a suitable medium for the development of fungus.

Paddy attacked by *sogata* spp. is readily detected in the field, the areas being distinctly yellowish and well defined. Closer examination will reveal the presence of narrow reddish brown patches on the leaves — usually the convex surface — indicating the site of oviposition.

From September 1962 until the end of April 1963, Dr. Qadri and authoress studied the plant hoppers on rice at Ghulam-ullah and also made surveys of rice growing areas in Sind. The primary objectives were to determine the cause of outbreaks and to develop control techniques that would prevent hopper damage.

*Sogatella furcifera* and *Sogatella Kolophon* were the species observed damaging rice in 1963.

The life history of S. furcifera has been studied by Miller and pagden (1930), Esaki and Hashmoto (1930), Caresche (1933), and O' Conner (1952), Females oviposit within rice stems, Nymphs and adults feed in clusters on the lower portion of rice stems. During early summer (May), the incubation period of the eggs occupies six or seven days, nymphal development is completed within two or three weeks and adults can survive far at least two weeks.

Rice planting begins in May and continues through July. The rice being sown in seed beds, then transplanted to bund fields six to eight weeks after sowing. The bunds are low, the fields are levelled, and there is no provision for irrigation. During dry periods parts of a typical fields will have pools of standing water while other parts will be high and dry.

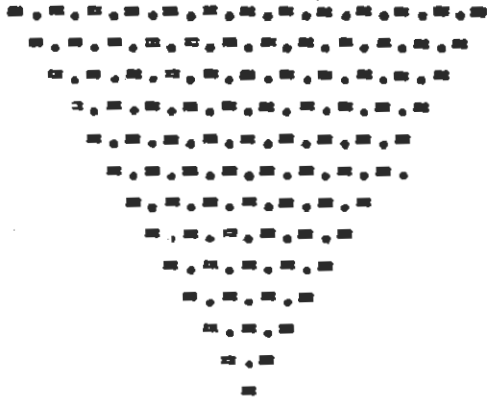
The most important weeds in field of transplanted rice are murina grass (*Ischaemum rugosum*). In grassy areas, in seed beds and in field of dry land rice, a sweep net ( a nylon bag with a D-shaped mouth, 14 in. wide at the straight edges) was used to take samples of plant hoppers. For spares population, up to 100 sweeps were made but in dense

populations, ten sweeps usually provided a sufficiently large and representative sample. In young rice the sweeps were taken any where along a transect across the seed bed or field, but in drilled rice more than three feet tall the sampling points along the transect were, of necessity, between the rows. Since sweeping was impracticable in fields of transplanted rice, samples were taken by clapping an ethyl acetate killing Jar (with a mouth of 3 in. diameter) against the base of rice stool and running it upwards, thus entrapping a portion of the plant hoppers. Whether taken by sweeps net or directly in a killing Jar the samples were examined under a binocular microscope in the laboratory and counts were made of common plant hoppers. Both net and Jar samples were regarded as relative indices for the comparison of population in different locations and at different times.

Sogatella kolophon was the dominant species in grassy habitats but rare in rice seed beds, or fields. Sogatella furcifera was the dominant species in rice seed beds.

Some of the factors or processes which must be considered in discussing localised infestations

and general out-breaks of rice plant hoppers include the amount of rain fall, the type of cultivation, the age of the rice crop, the species composition of plant hopper populations.



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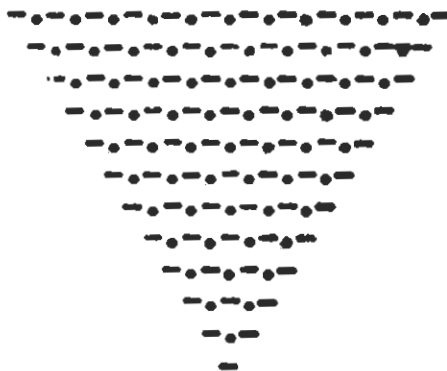


PLATE 1.

Ilburnia umerkotien<sup>s</sup>is n.sp.

- Figure:- 1. Head, anterior view.  
2. Head and thorax, dorsal view.  
3. Tegmen, dorsal view.  
4. Hind leg, lateral aspect.  
5. Male genitalia, posterior view.



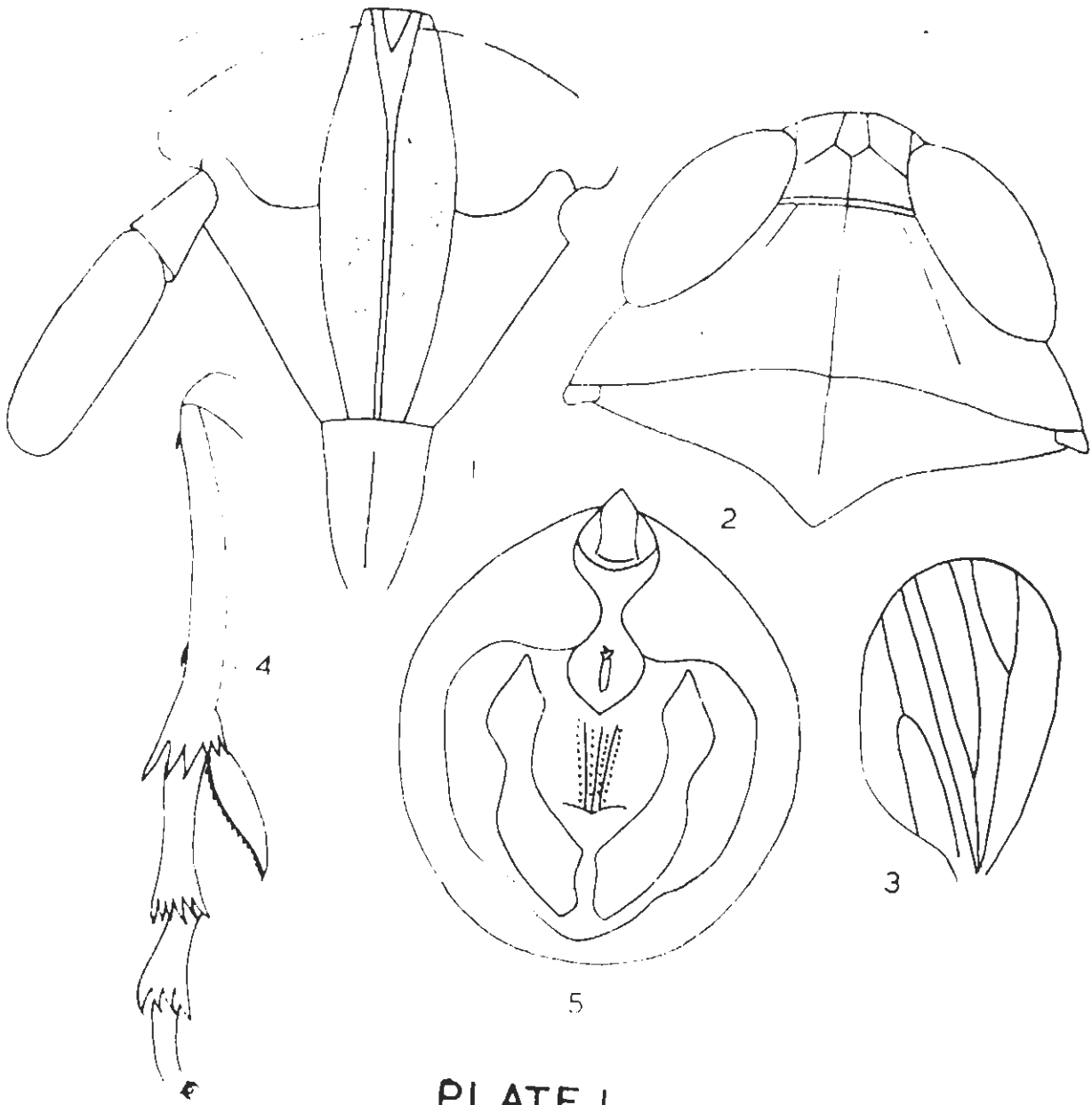


PLATE I

PLATE 2.

Purohita padrii n.sp.

- Figure:-
1. Head, anterior view.
  2. Male genitalia, posterior view.
  3. Tegmen, dorsal view.

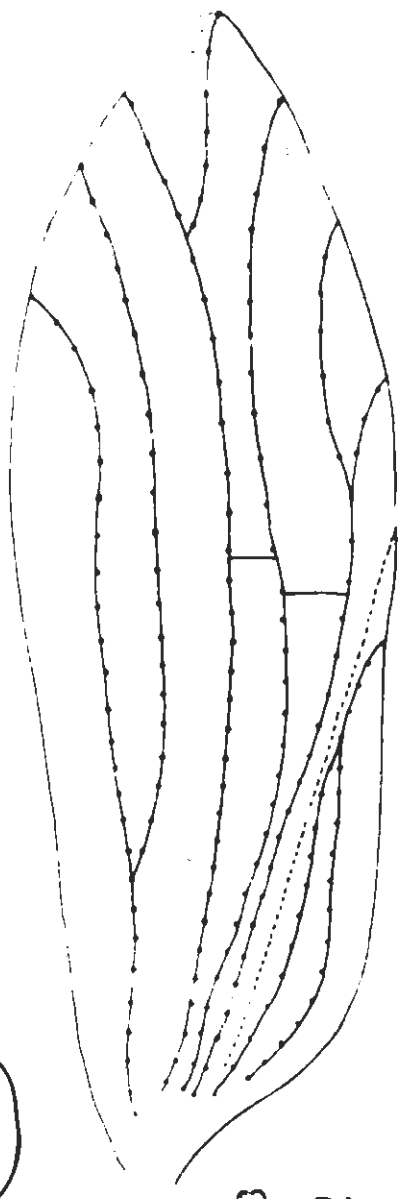
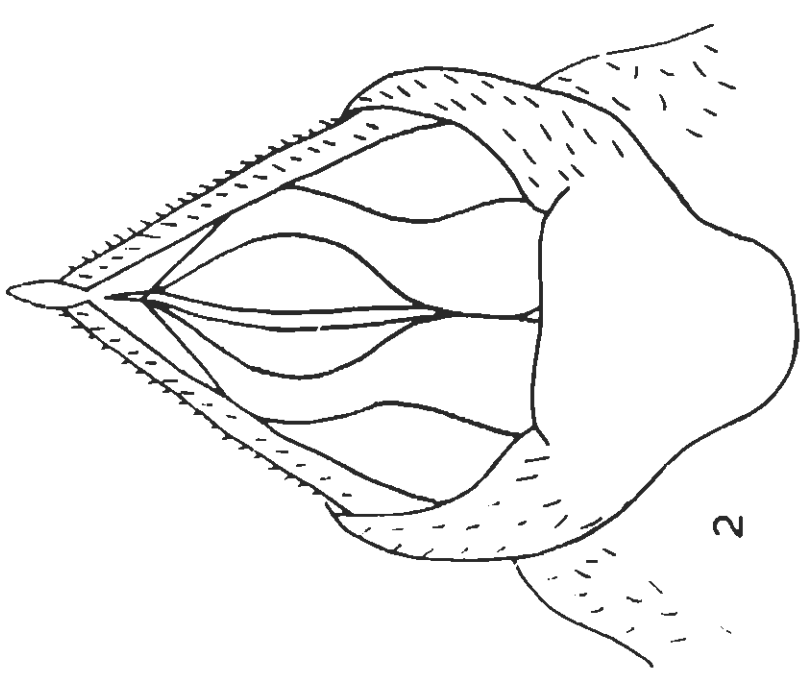
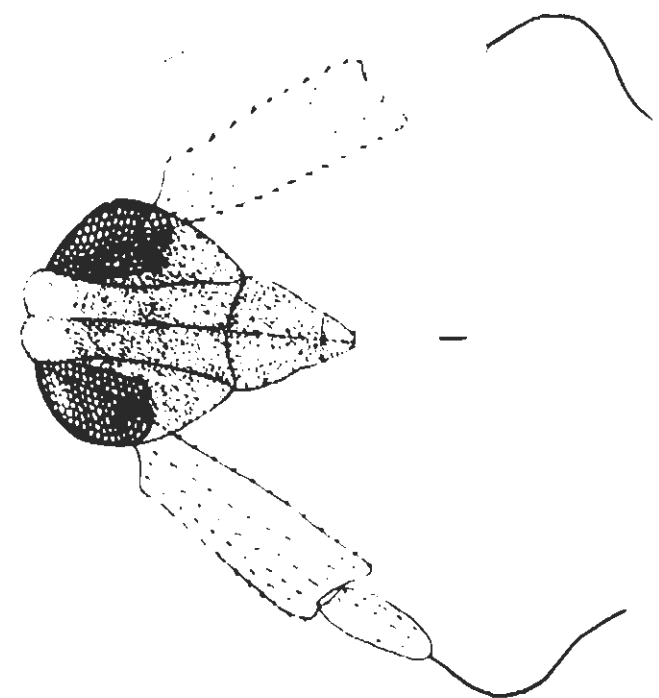
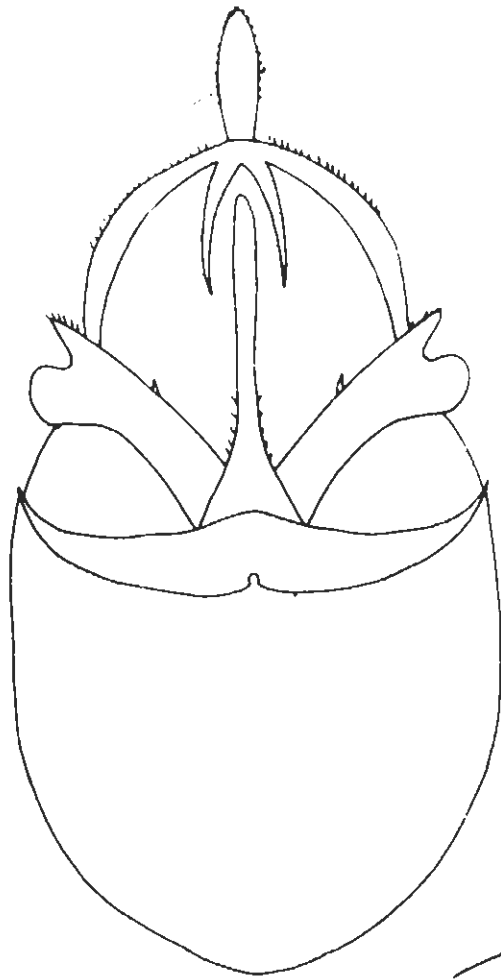


PLATE 2

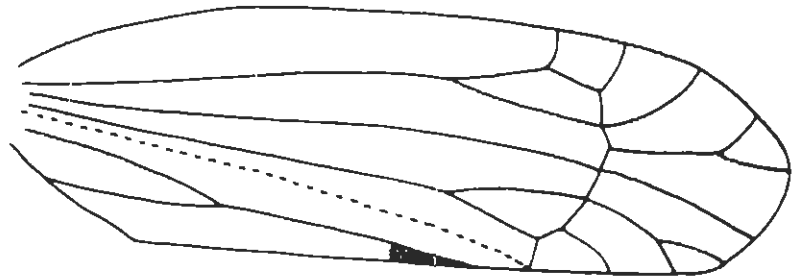
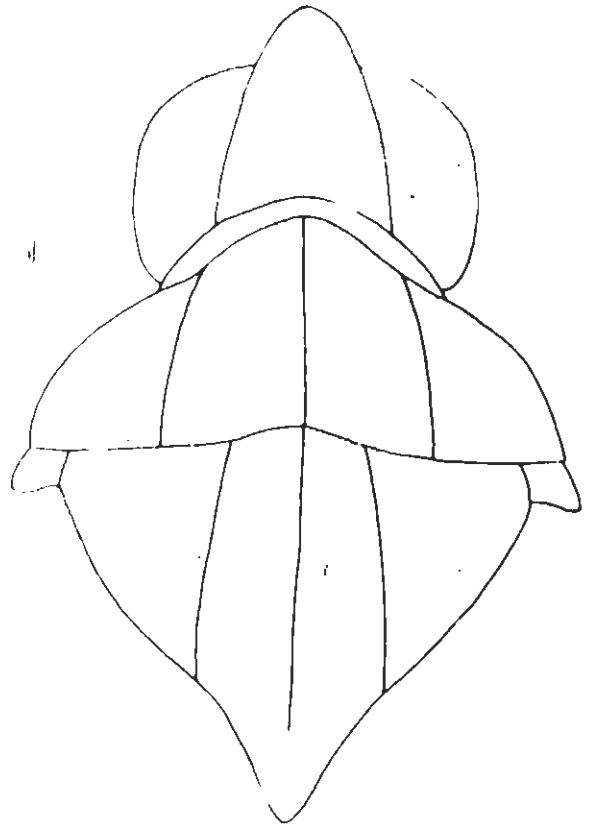
PLATE 3.

Tropidocephala brunnipennis

- Figure:- 1. Head and thorax, dorsal view.  
2. Male genitalia, posterior view.  
3. Tegmen, dorsal view.



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PLATE 3

PLATE 4.

Pundaluoya ernesti.

- Figure:-
1. Head, anterior view.
  2. Tegmen, dorsal view.
  3. Genital style, left side.
  4. Male genitalia, lateral view.

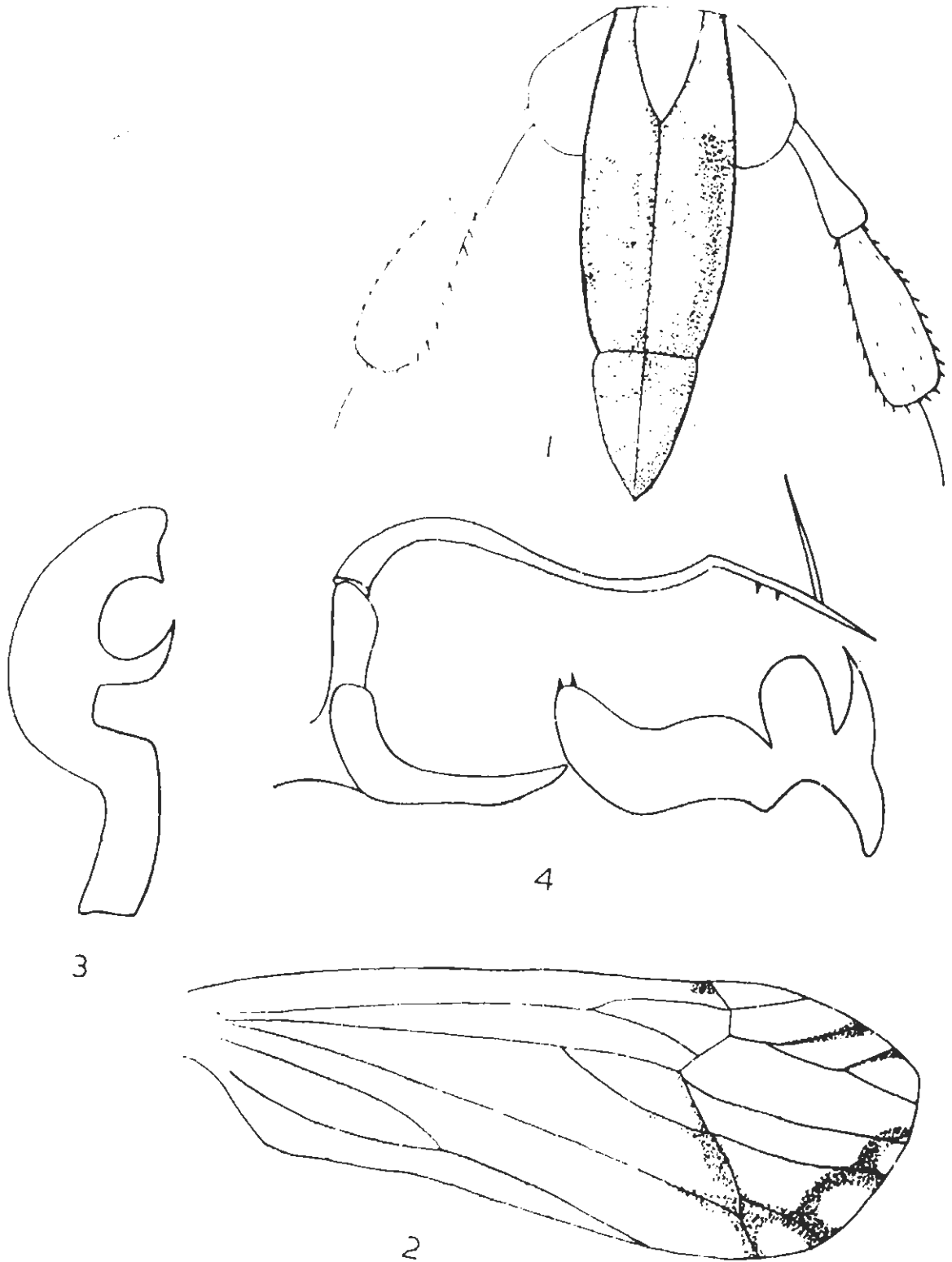


PLATE 4

PLATE 5.

Eoerysa flavocapitata.

- Figure:-
1. Head, anterior view.
  2. Head and thorax, dorsal view.
  3. Parameres and aedeagus.
  4. Male genitalia (dissected).
  5. Paramere.
  6. Aedeagus and aedeagal funnel.
  - 7 . Tegmen, dorsal view.
  8. Hind wing, dorsal view.
  9. Hind leg, lateral aspect.



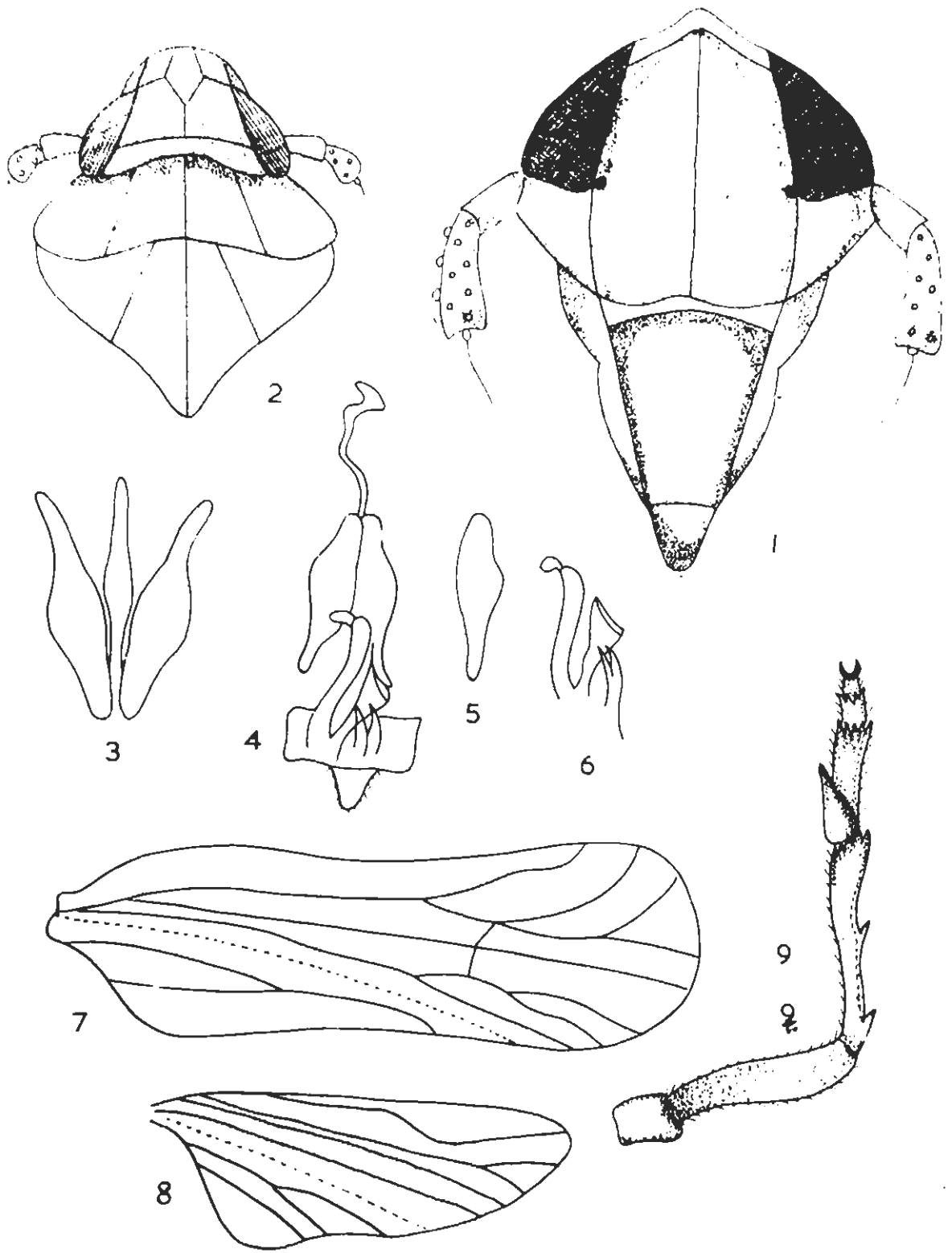
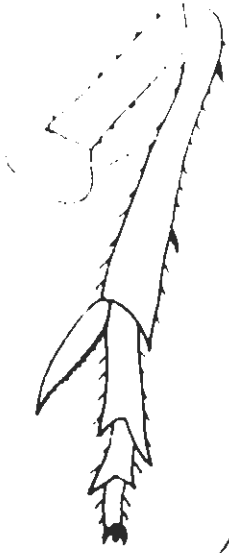


PLATE 5

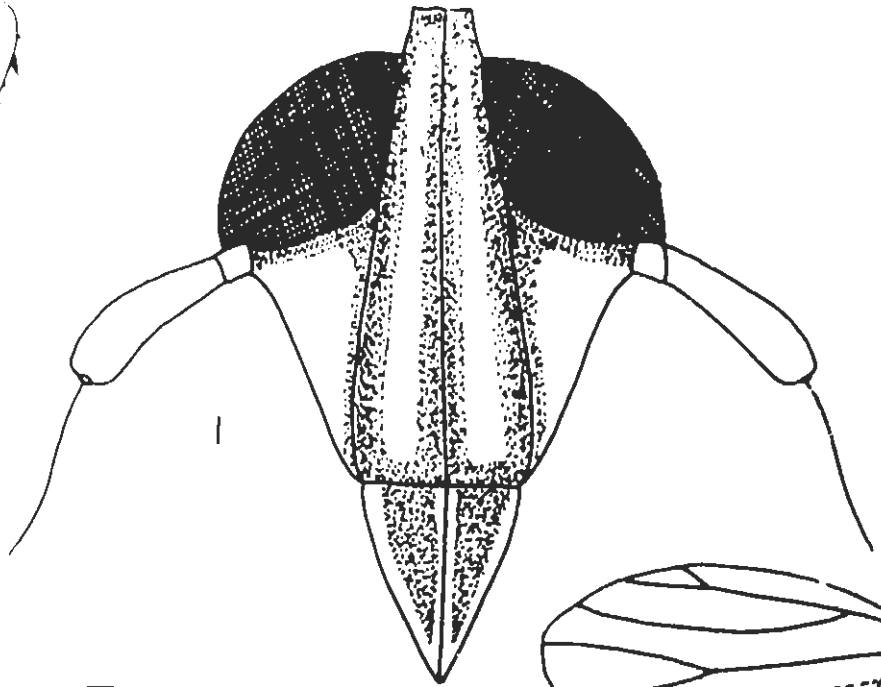
PLATE 6.

Zuleika bengalensis.

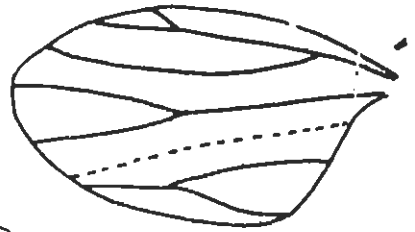
- Figure:-
1. Head, anterior view.
  2. Hind leg, lateral aspect.
  3. Head and thorax, dorsal view.
  4. Tergum, dorsal view.
  5. Male genitalia, posterior view.



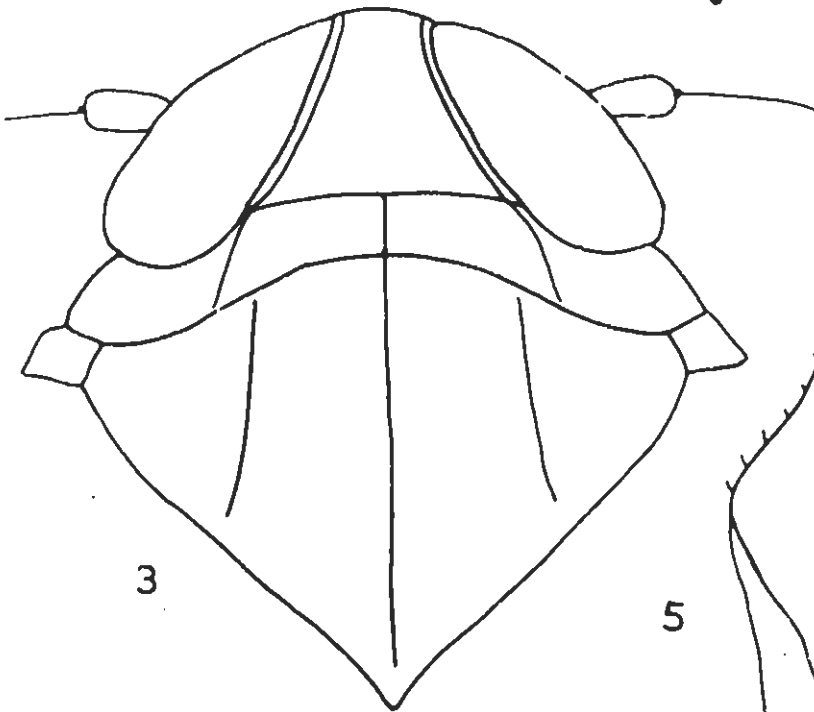
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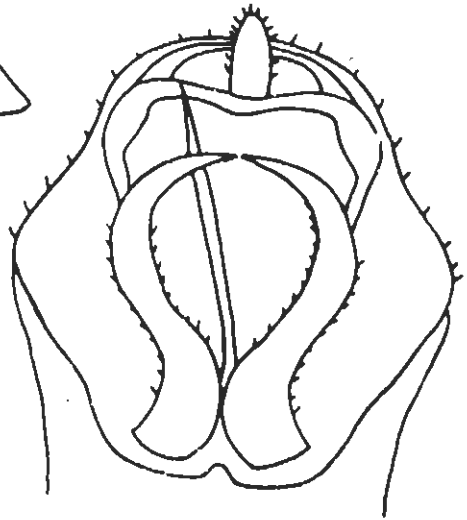
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PLATE 6

PLATE 7.

Perkinsiella insignis.

- Figure:-
1. Head, anterior view.
  2. Head and thorax, dorsal view.
  3. Hind leg, lateral aspect.
  4. Male genitalia, posterior view.
  5. Tegmen, dorsal view.

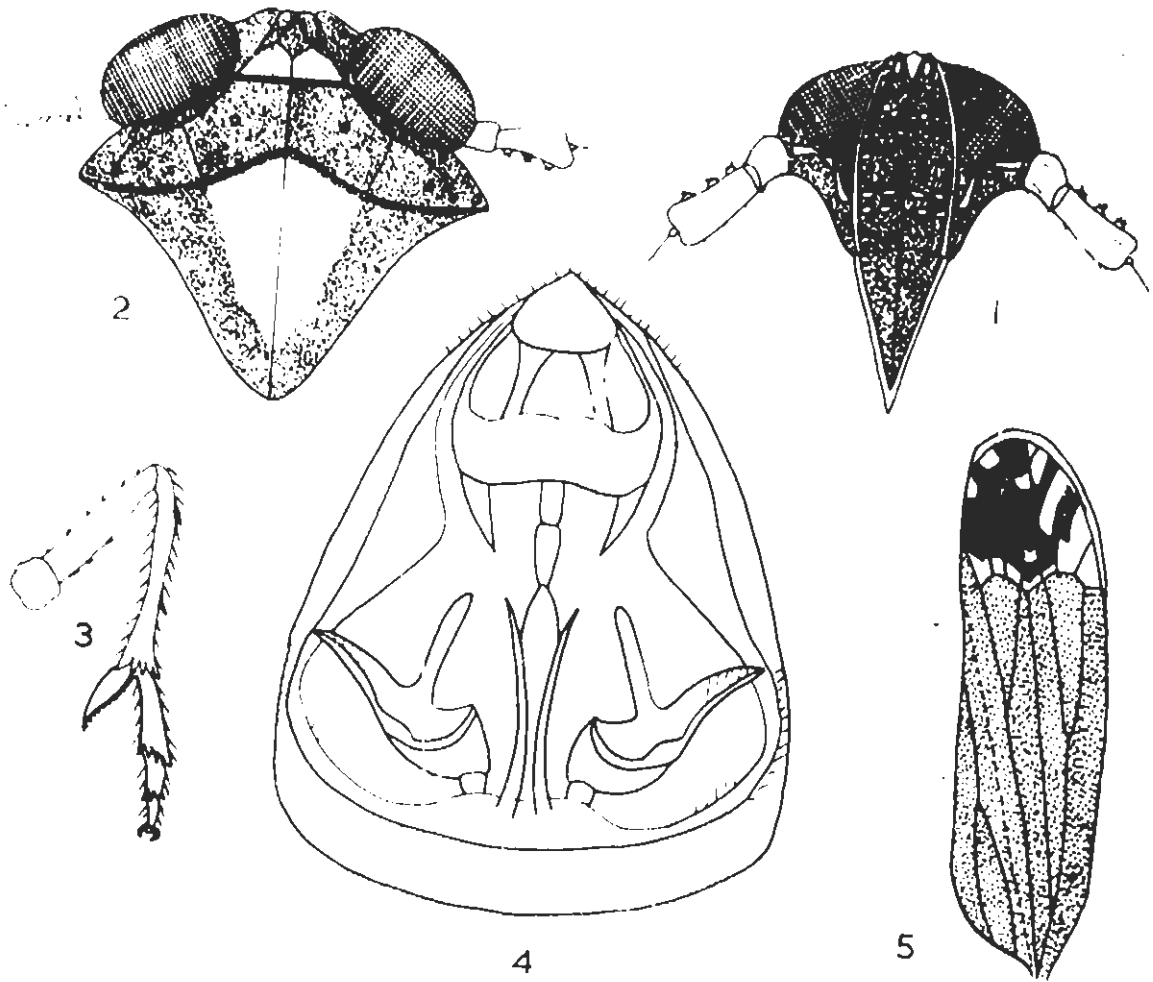
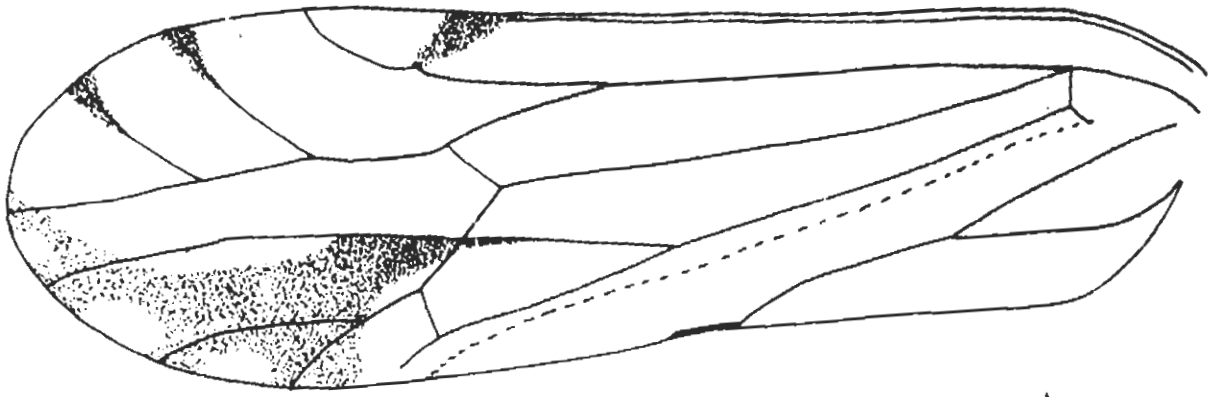


PLATE 7

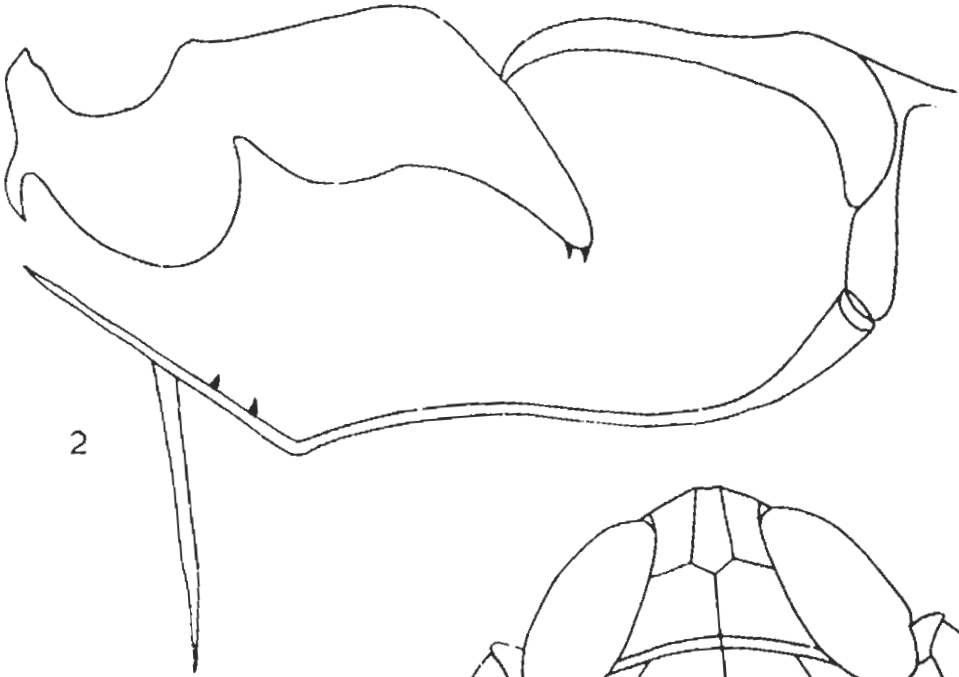
PLATE 8.

Perigrinus maidis.

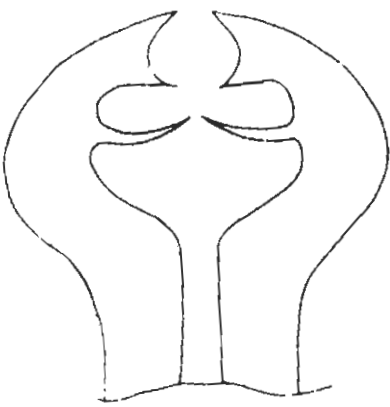
- Figure:-
1. Tegmen, dorsal view.
  2. Male genitalia (Dissected).
  3. Genital style.
  4. Head and thorax, dorsal view.



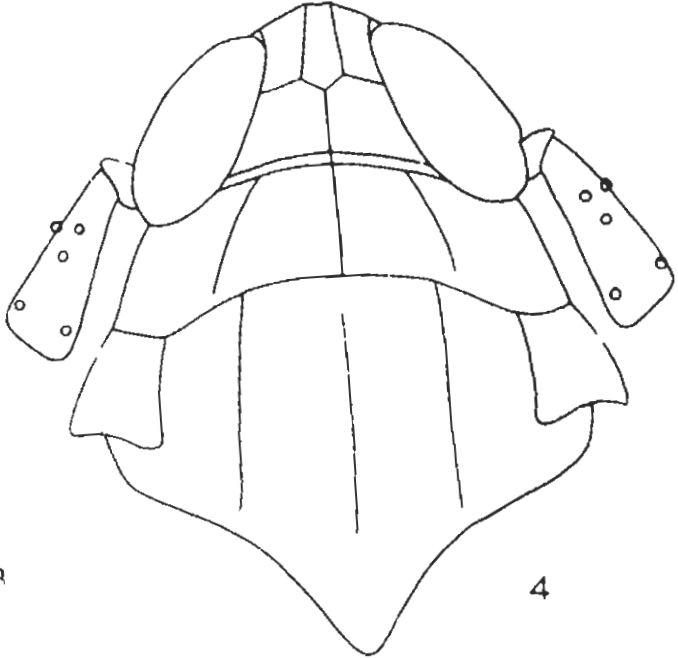
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PLATE 8

PLATE 9.

Cemus afshani n.sp.

- Figure:- 1. Head and thorax, dorsal view.  
2. Male genitalia.  
3. Aedeagus.  
4. Genital style.



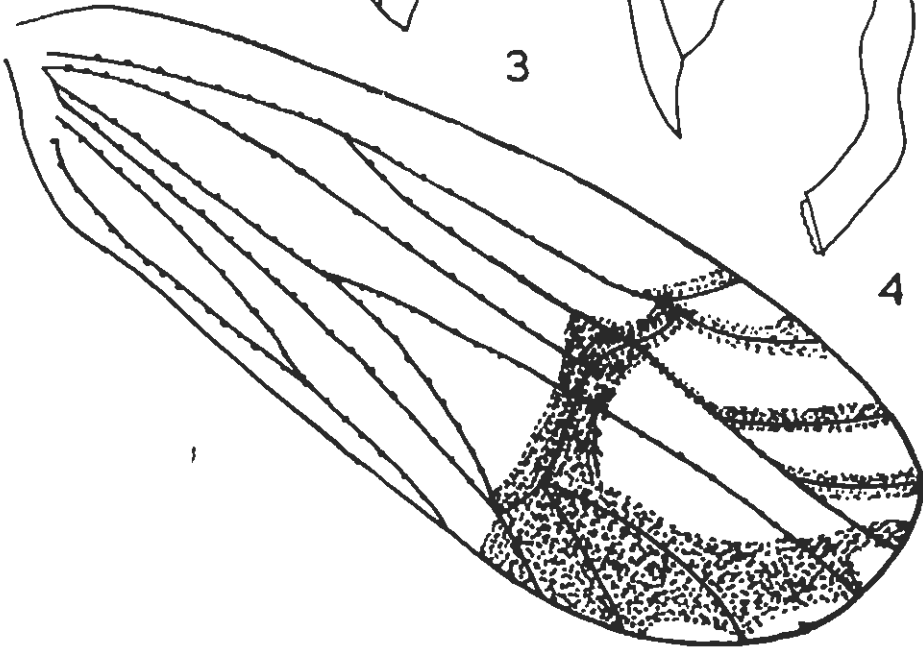
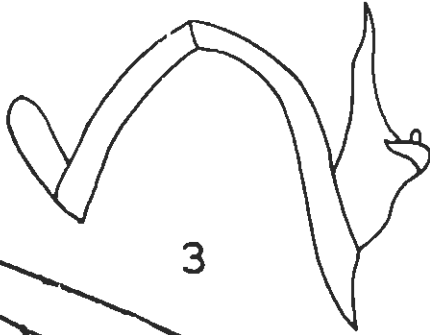
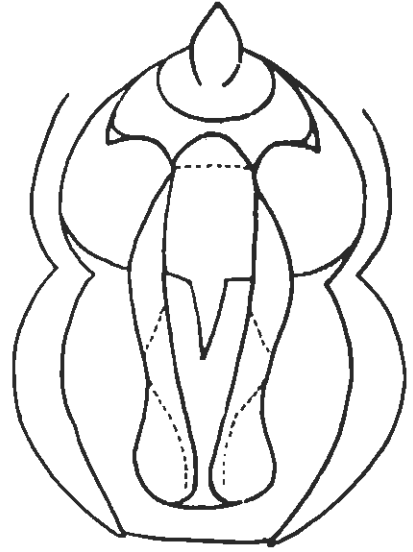
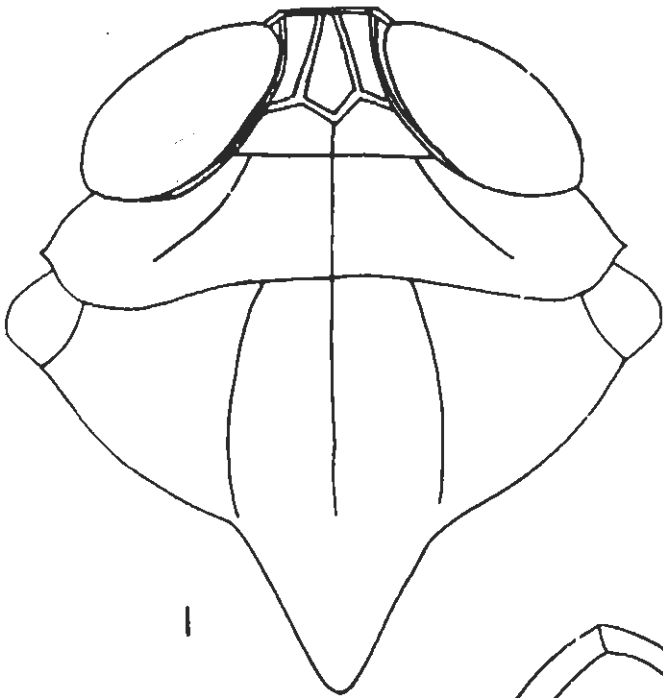


PLATE 9

PLATE 10.

Nilaparvata lugens.

- Figure:-
1. Head and thorax, dorsal view.
  2. Male genitalia, posterior view.
  3. Parameres.
  4. Tergon, dorsal view.

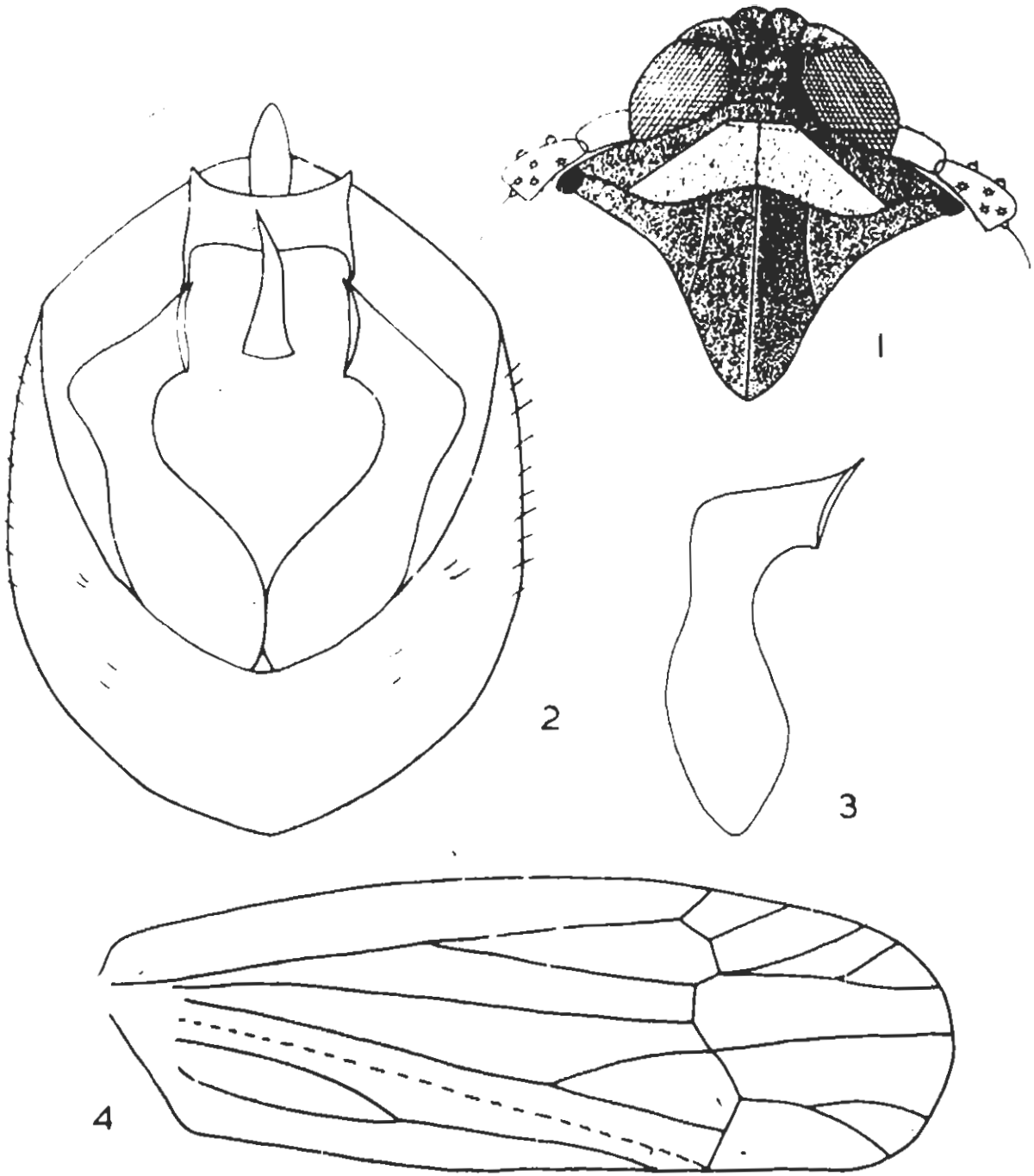
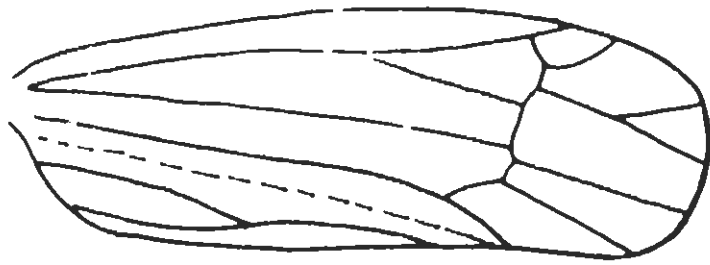


PLATE 10

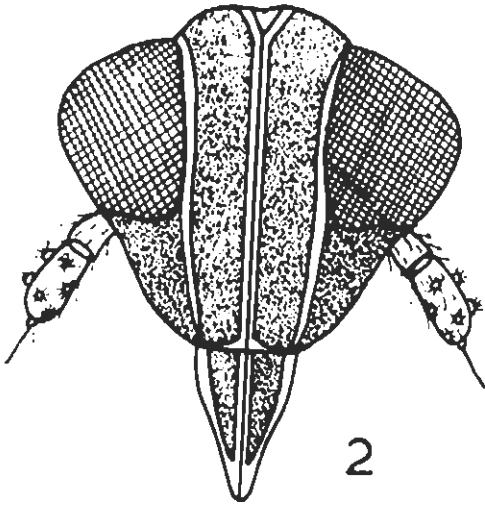
## PLATE 11.

Eurya ishtiaqui n.sp.

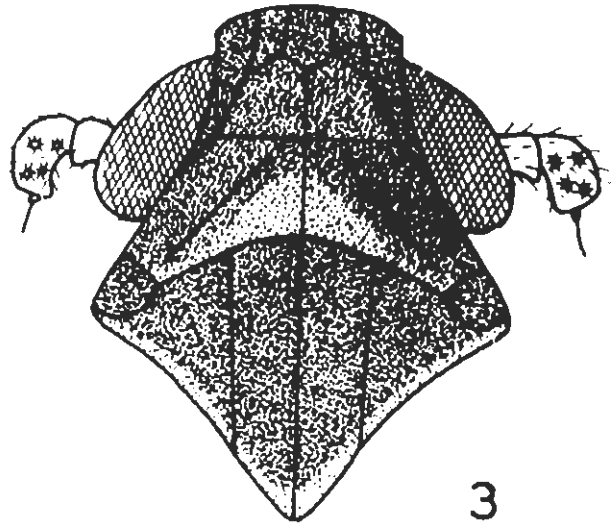
- Figure:-
1. Egg, dorsal view.
  2. Head, anterior view.
  3. Head and thorax, dorsal view.
  4. Right genital style.
  5. Male genitalia, lateral view.



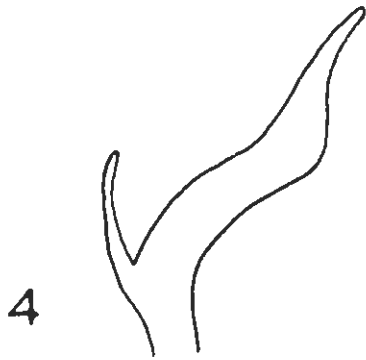
1



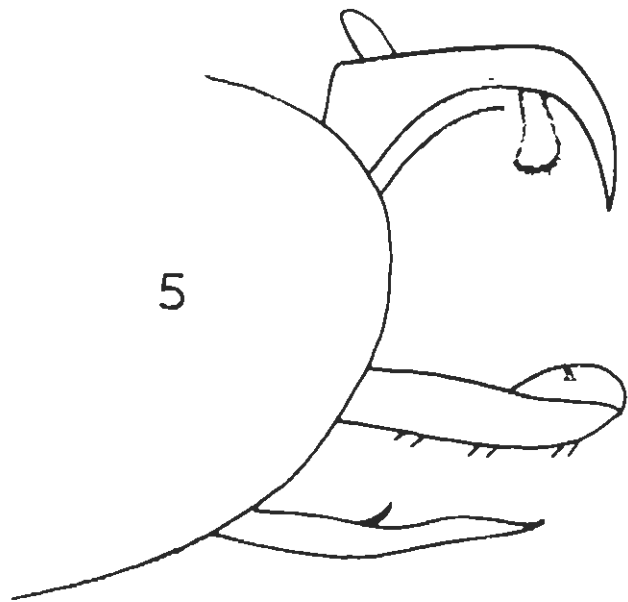
2



3



4



5

PLATE II

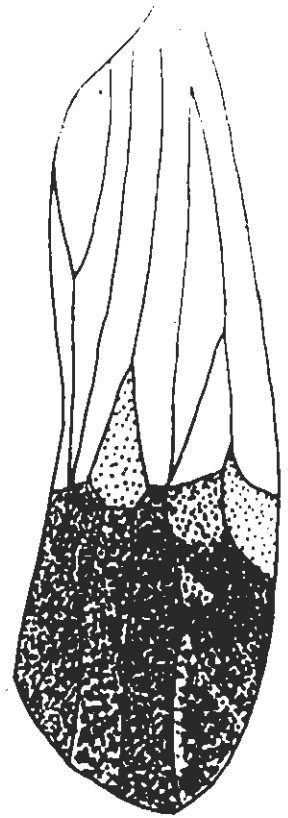
PLATE 12.

Sardia rostrata.

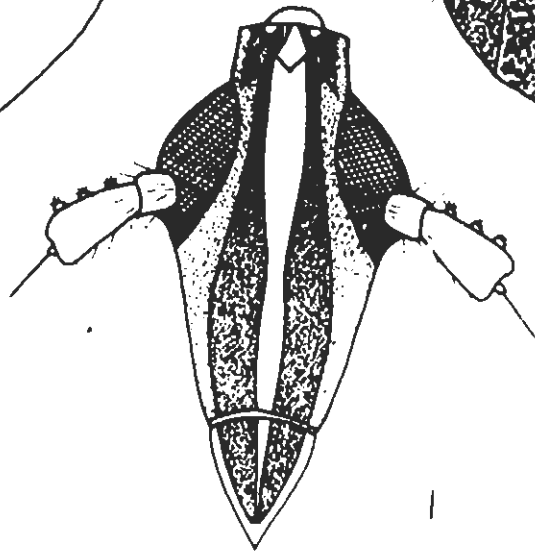
- Figure:-
1. Head, anterior view.
  2. Male genitalia, posterior view.
  3. Tegmen, dorsal view.



2



3



1

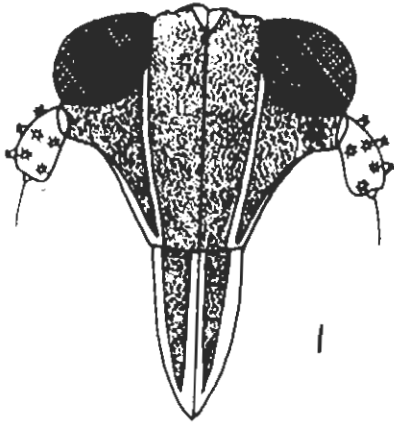
PLATE 12

## PLATE 13.

Goroncella frontalis.

- Figure:-
1. Head, anterior view.
  2. Head and thorax, dorsal view.
  3. Hind leg, lateral aspect.
  4. Tergon, dorsal view.
  5. Male genitalia, posterior view.





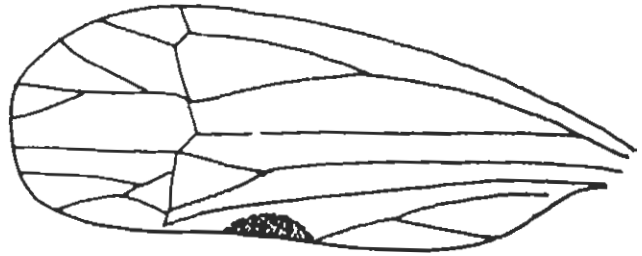
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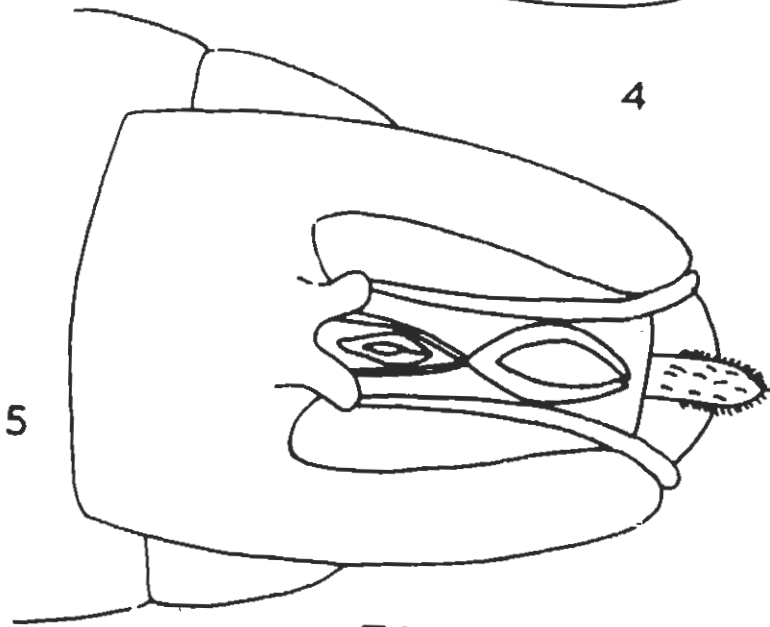
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3



4



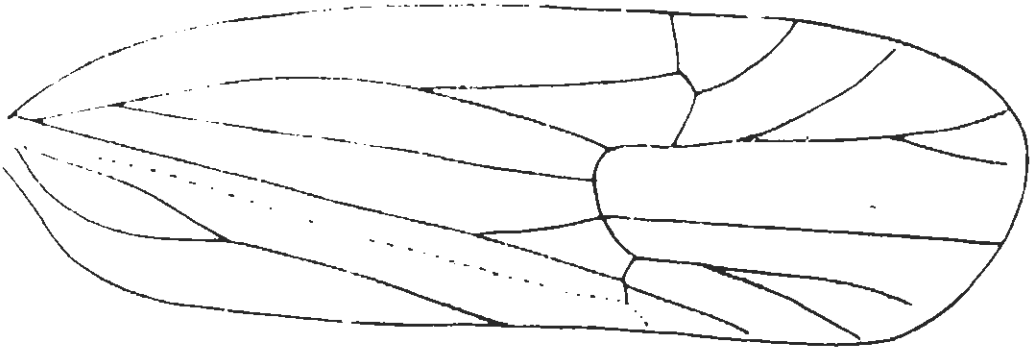
5

PLATE 13

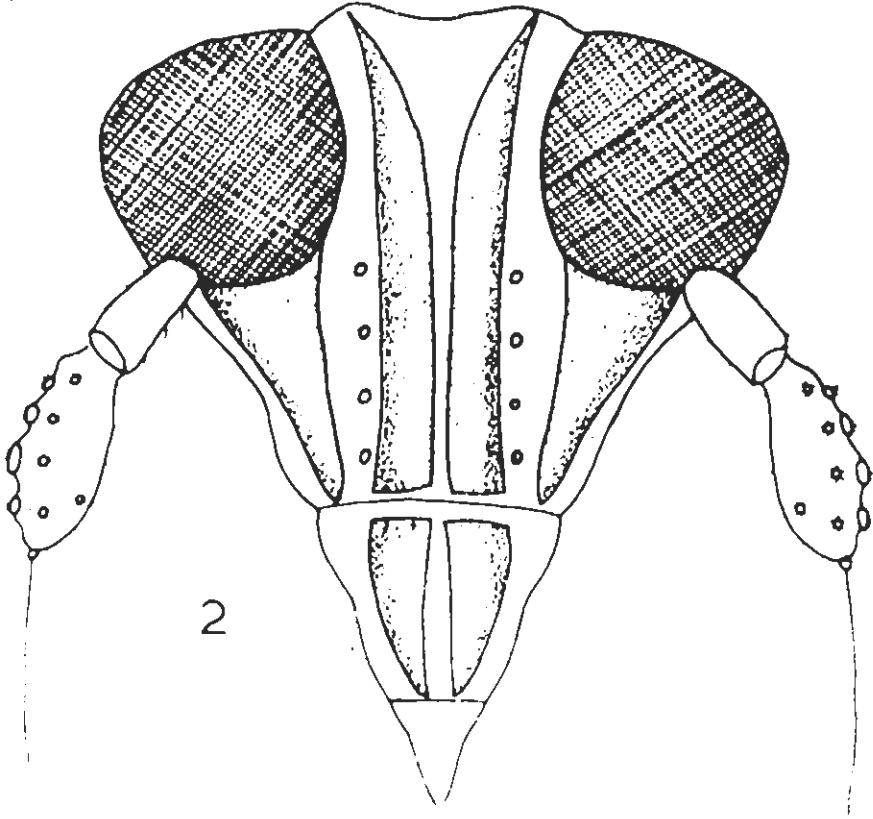
PLATE 14.

Sogata pusana.

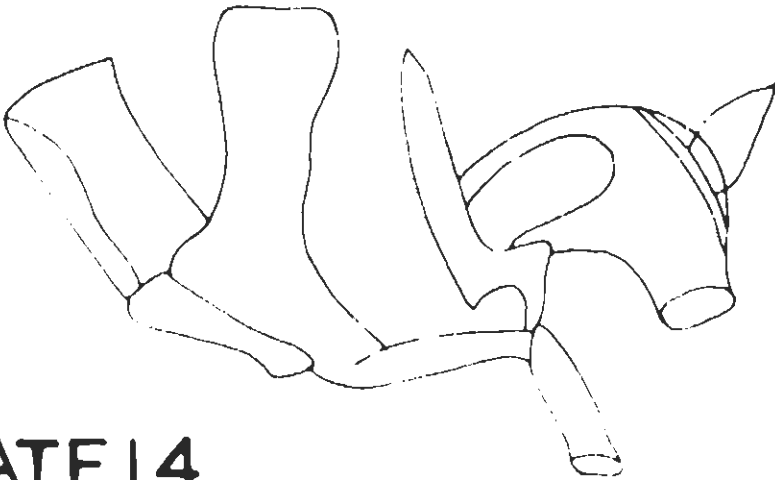
- Figure:- 1. Tegmen, dorsal view.  
2. Head, anterior view.  
3. Male genitalia (Dissected).  
4. Aedeagus.



1



2



3



4

PLATE 14

PLATE 15.

Sogata striatus n.sp.

- Figure:-
1. Head, anterior view.
  2. Tegmen, dorsal view.
  3. Hind leg, lateral aspect.
  4. Male genitalia (Dissected).

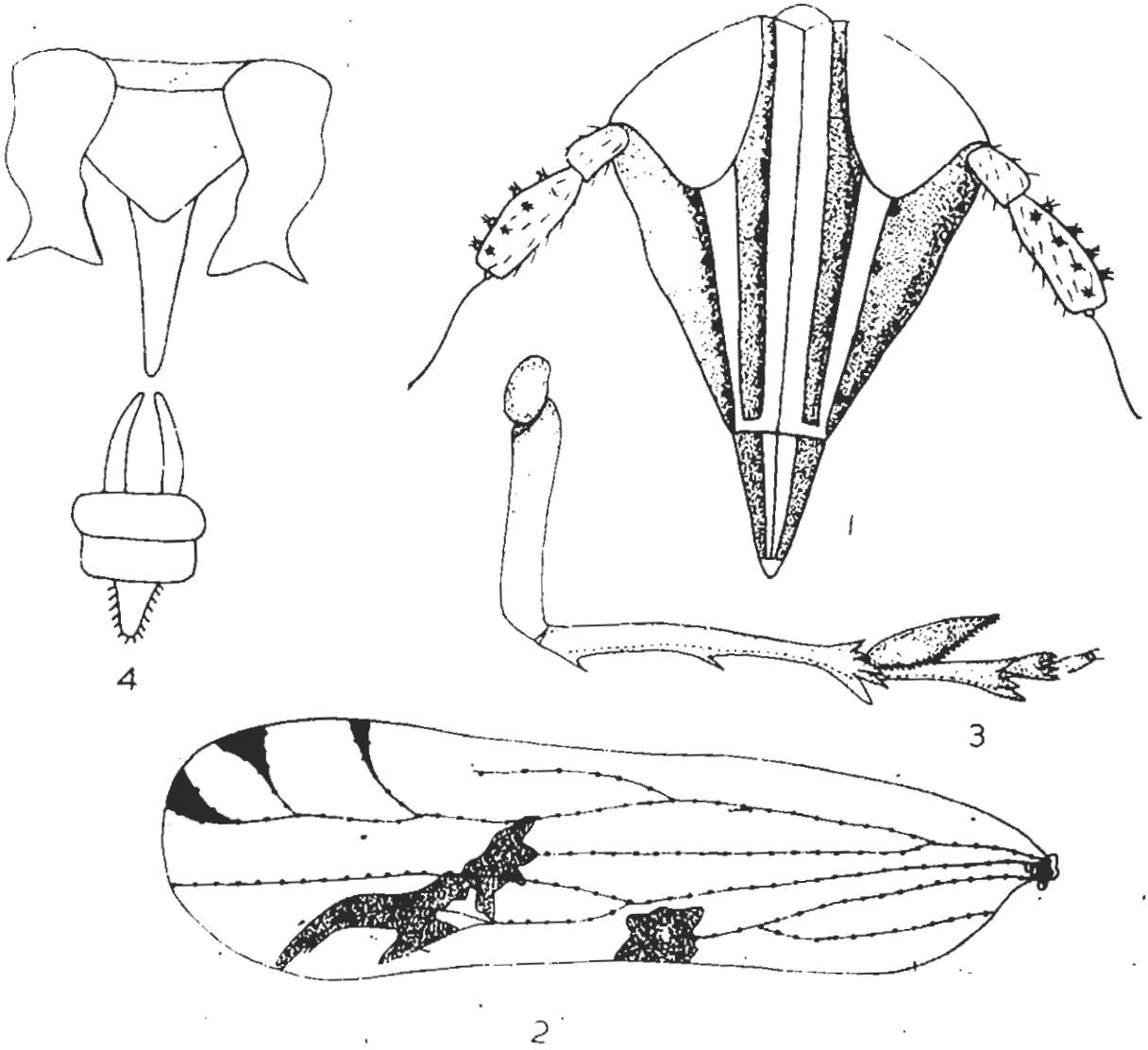


PLATE 15

PLATE 16.

Sogata tandojaniensis n.sp.

- Figure:- 1. Head, anterior view.  
2. Head and thorax, dorsal view.  
3. Tegmen, dorsal view.  
4. Upper-----Aedeagus, Lower-----Paramere.  
5. Male genitalia (Dissected).

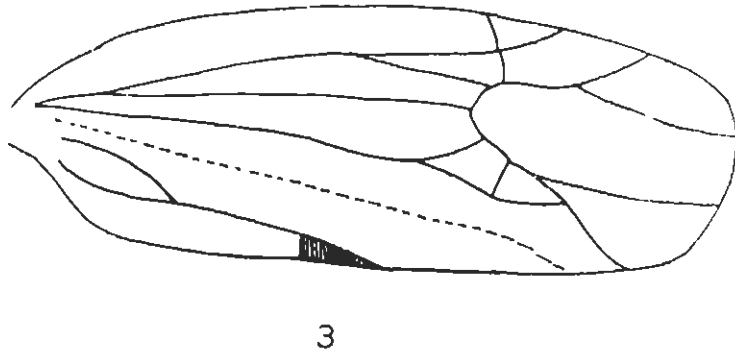
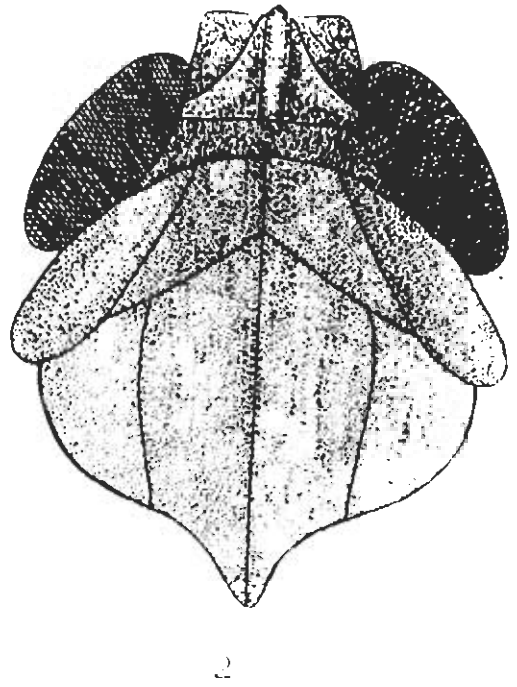
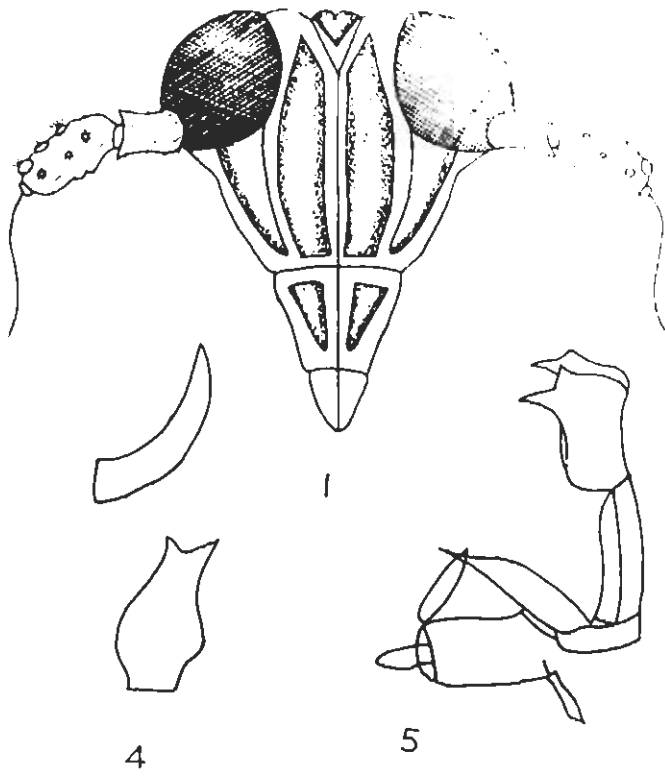


PLATE 16

PLATE 17.

Numatodes gadrii n.sp.

- Figure:- 1. Head, anterior view.
2. Head and thorax, dorsal view.
3. Tegmen, dorsal view.
4. Hind leg, lateral aspect.
5. Male genitalia, posterior view.
6. Genital style, left side.



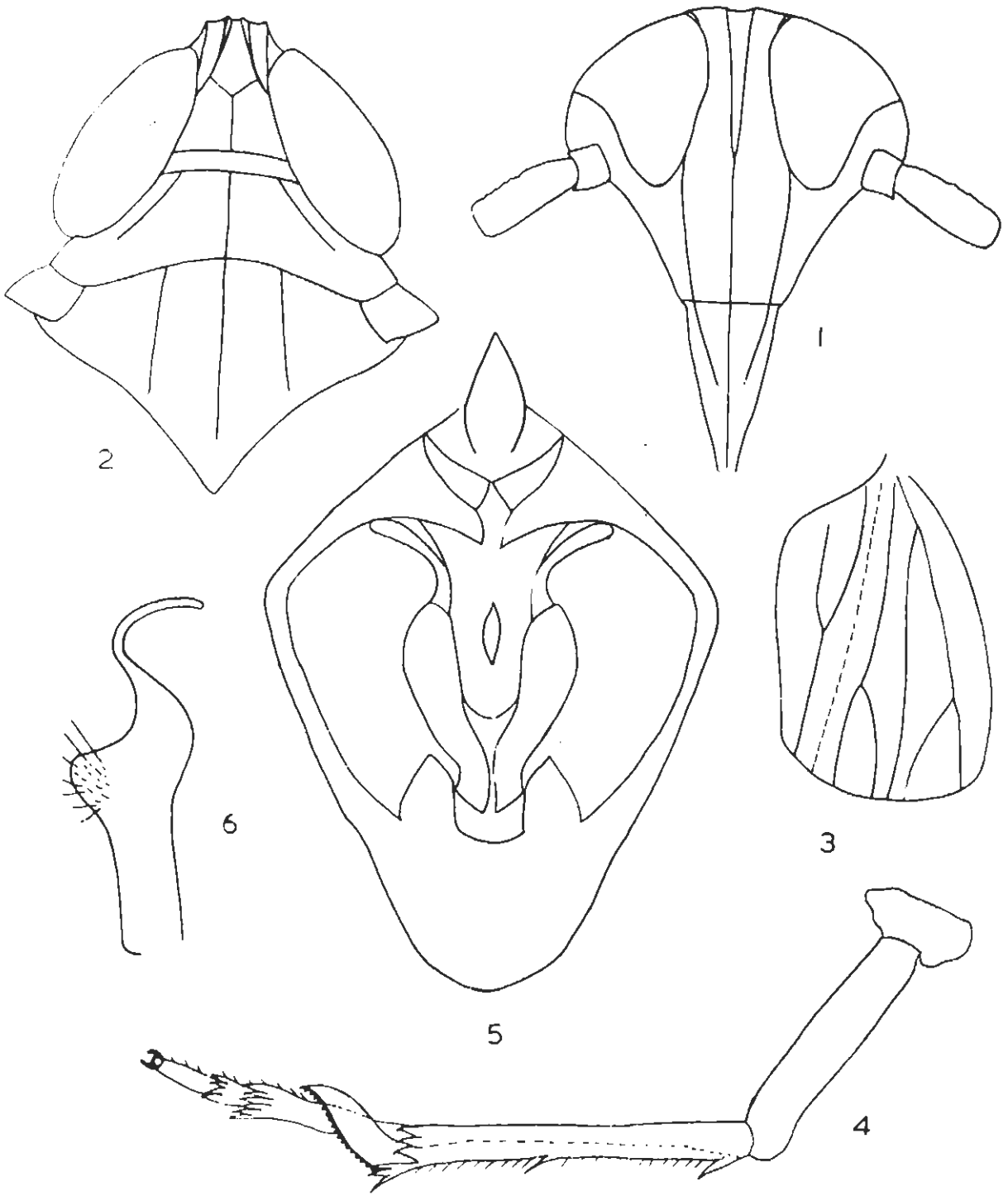


PLATE 17

PLATE 18.

Unkanodes cornicaudatus n.sp.

- Figure:- 1. Head, anterior view.  
2. Head and thorax, dorsal view.  
3. Tegmen, dorsal view.  
4. Hind leg, lateral aspect.  
5. Parameres.  
6. Caudal hooks and aedeagus.

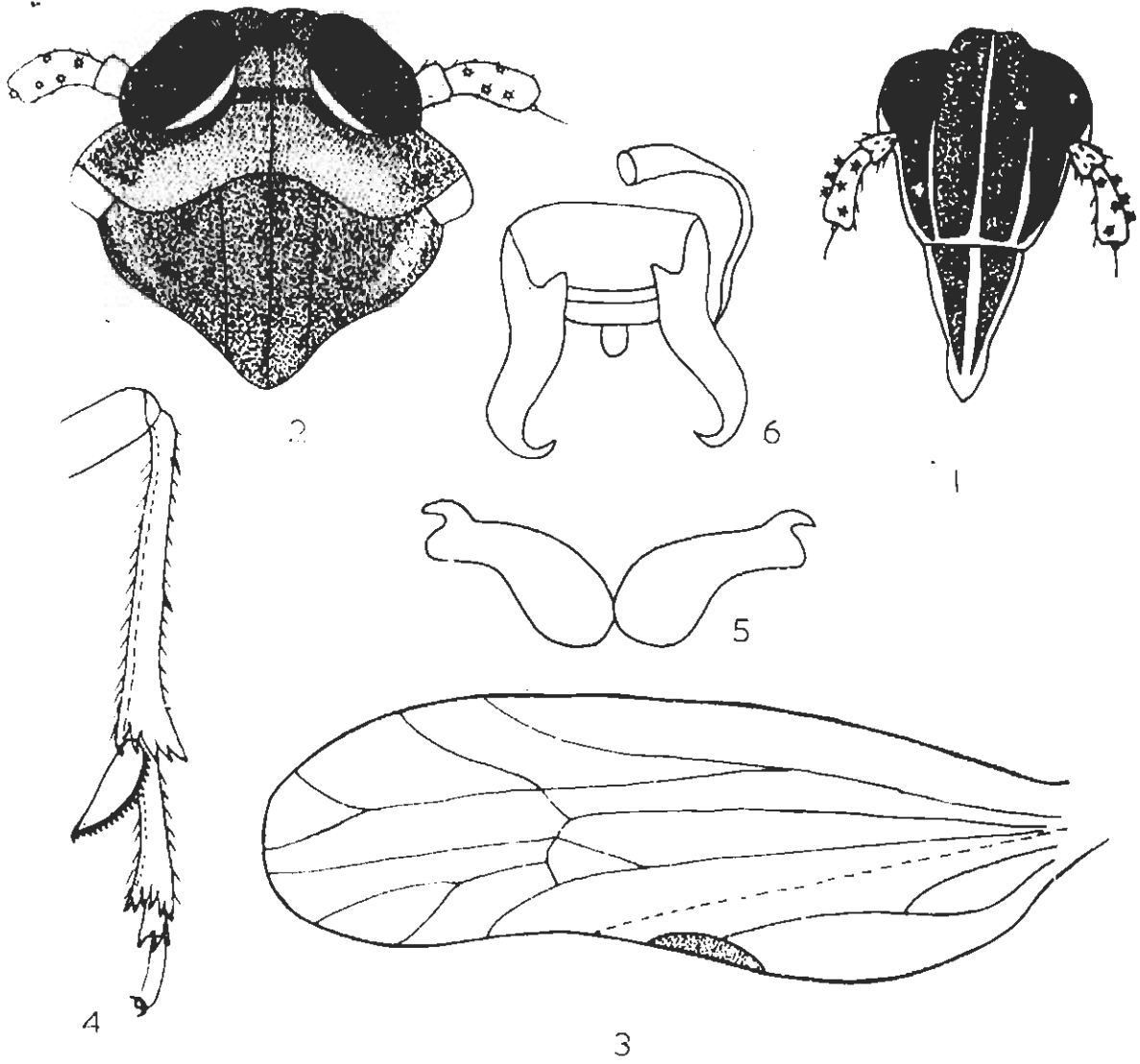
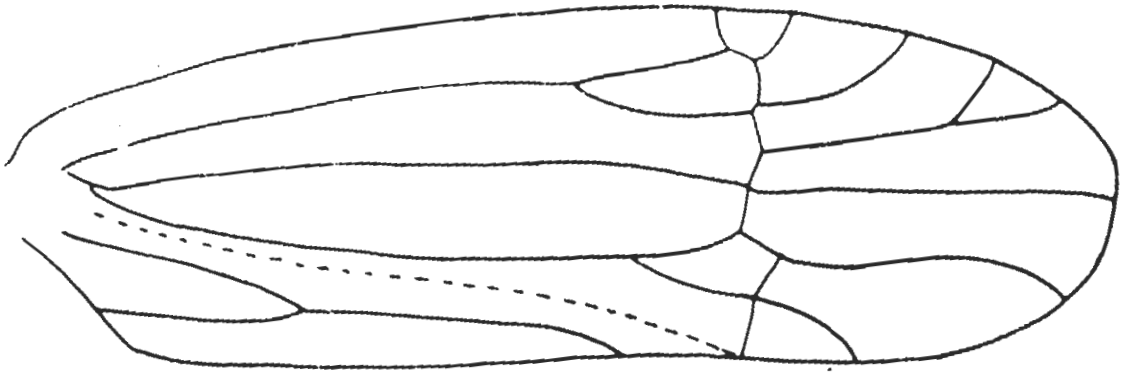


PLATE 18

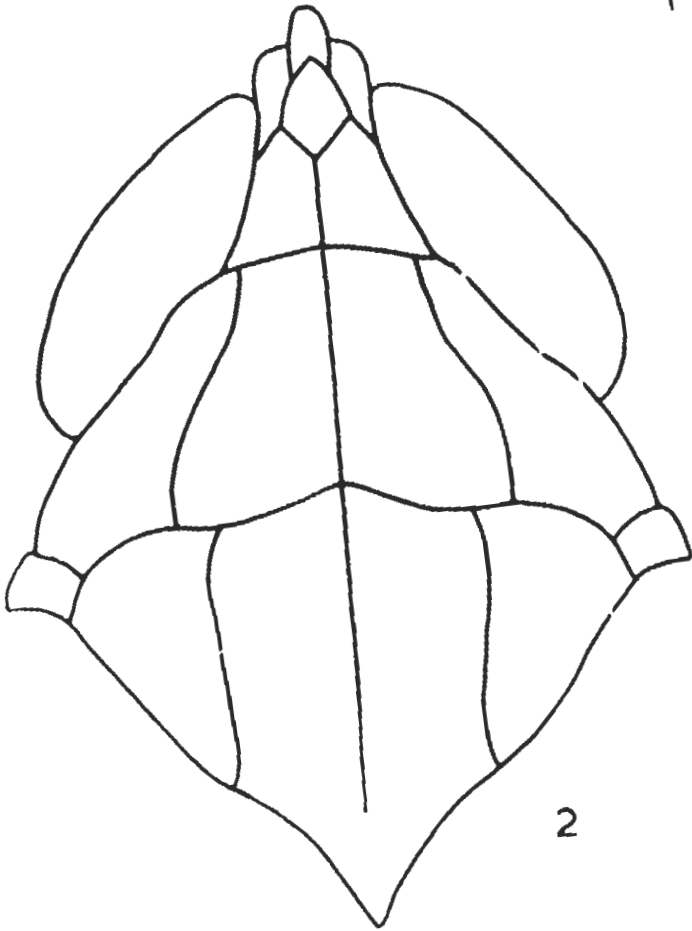
PLATE 19.

Delphax gadrii n.sp.

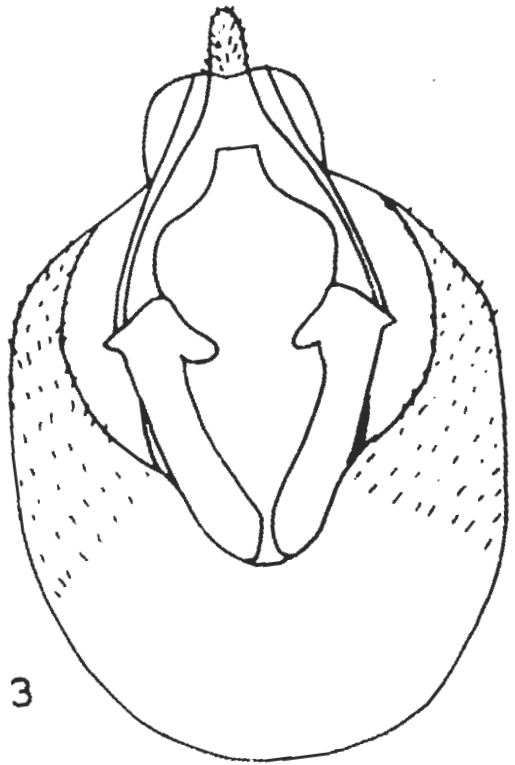
- Figure:- 1. Tegmen, dorsal view.  
2. Head and thorax, dorsal view.  
3. Male genitalia, posterior view.



1



2



3

PLATE 19

PLATE 20.

Sogatella furcifera.

- Figure:- 1. Vertex and pronotum, dorsal view.  
2. Head, anterior view.  
3. Tegmen, dorsal view.  
4. Male genitalia, posterior view.  
5. Paramere.  
6. Male genitalia, lateral view.  
7 . Aedeagus.

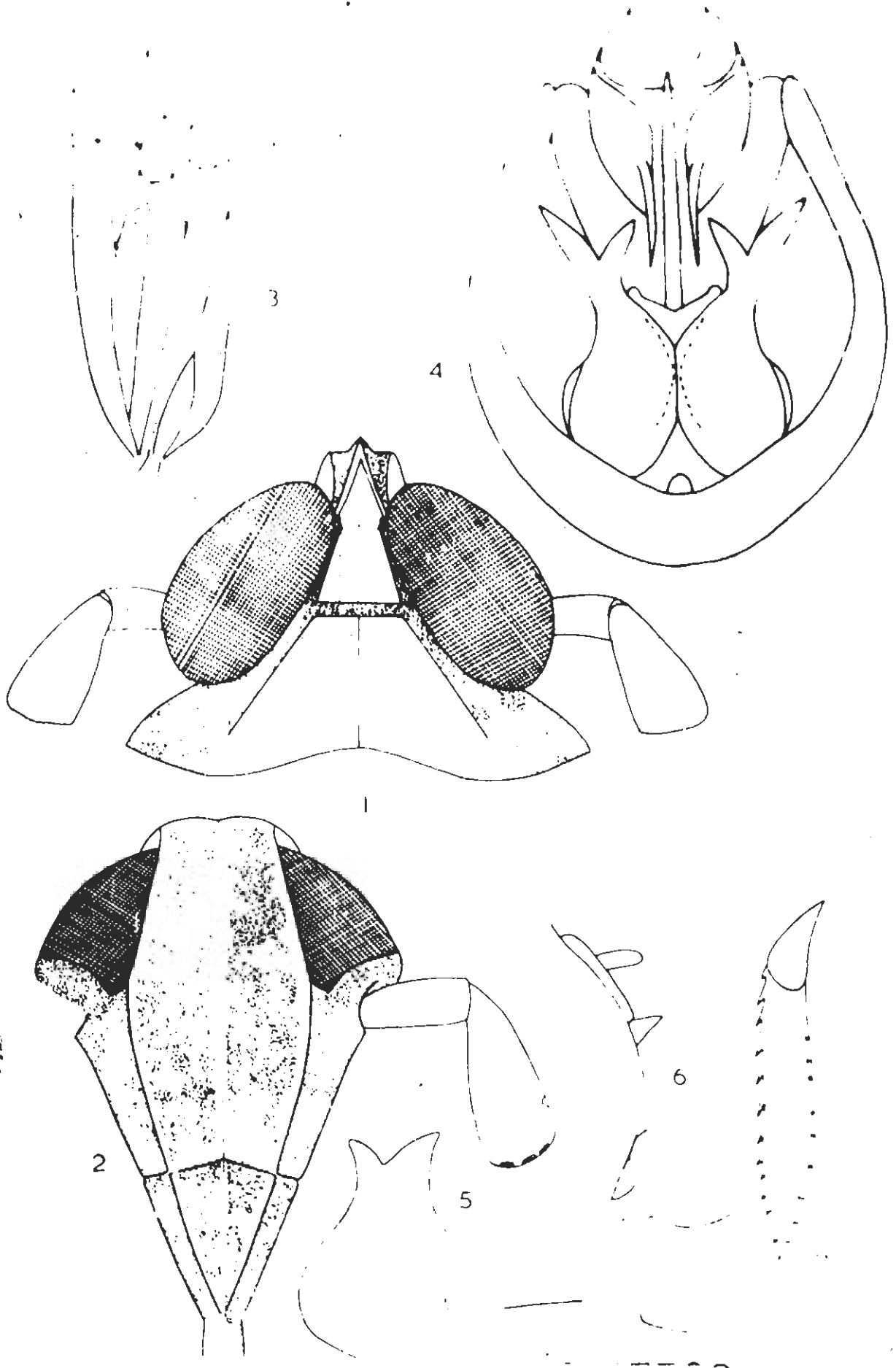


PLATE 21.

Sogatella longifurcifera.

- Figure:- 1. Head, anterior view.  
2. Head and thorax, dorsal view.  
3. Male genitalia, posterior view.  
4. Male genitalia, lateral view.  
5. Aedeagus.  
6. Paramere.  
7 . Tegmen, dorsal view.  
8. Hind wings, dorsal view.



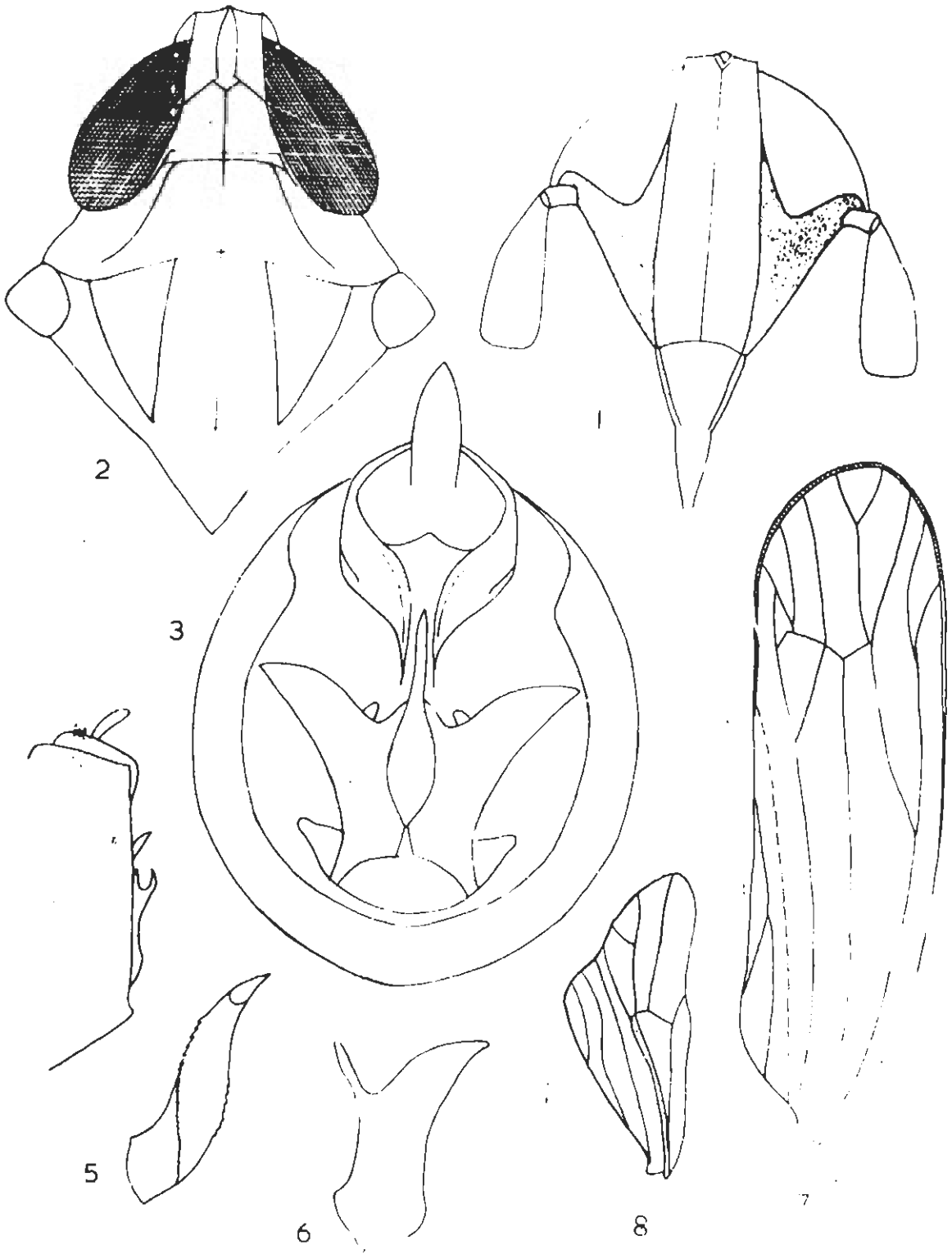


PLATE 21

PLATE 22.

Sogatella kolophon.

- Figure:- 1. Head, anterior view.  
2. Vertex and pronotum, dorsal view.  
3. Tegmen, dorsal view.  
4. Hind leg, lateral aspect.  
5. Male genitalia, posterior view.  
6. Genital style.  
7. Aedeagus.  
8. Male genitalia, lateral view.

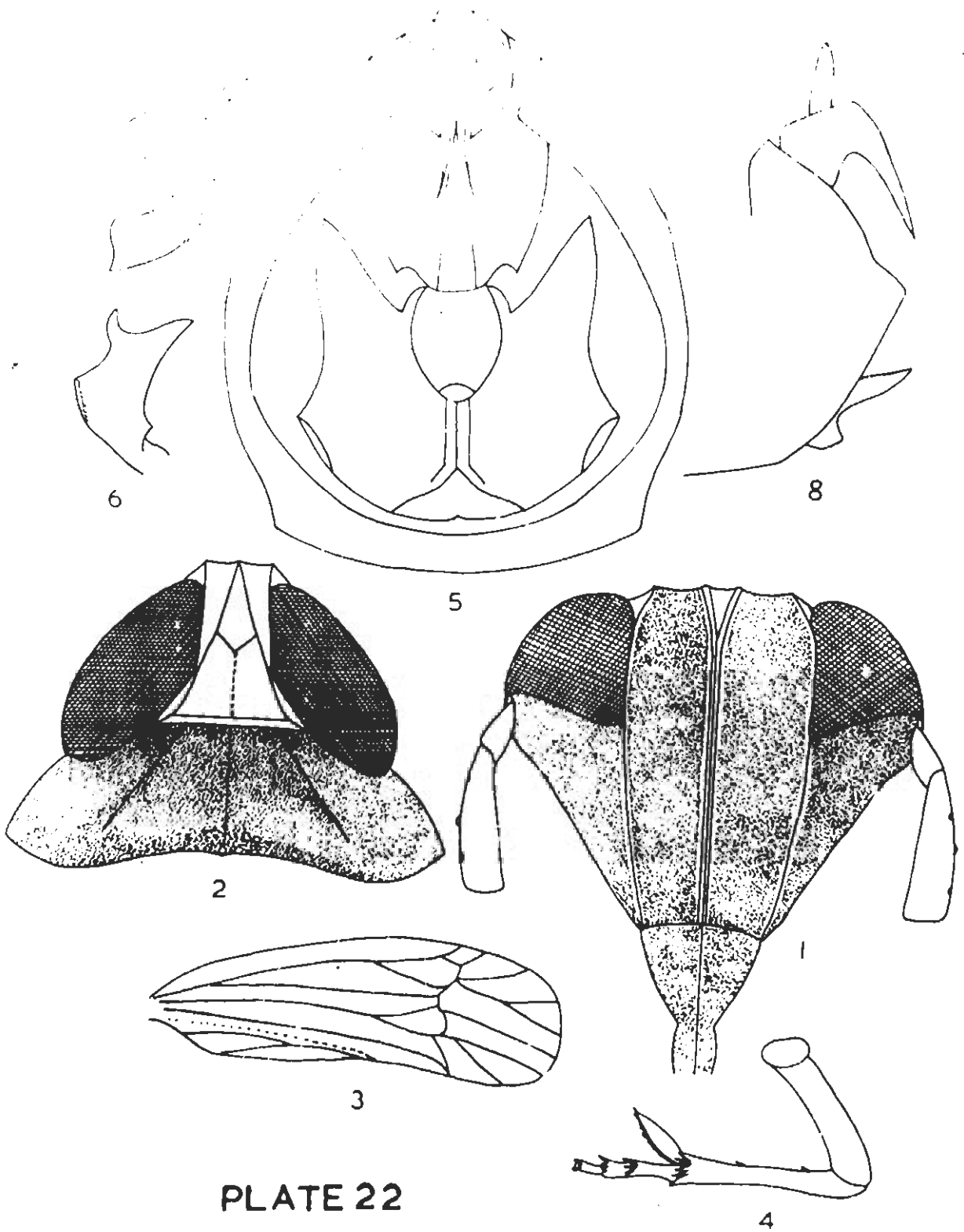


PLATE 22

PLATE 23.

Sogatella pallidum.

- Figure:- 1. Head, anterior view.  
2. Tegmen, dorsal view.  
3. Hind leg, lateral aspect.  
4. Genital styles.  
5. Male genitalia, lateral view.

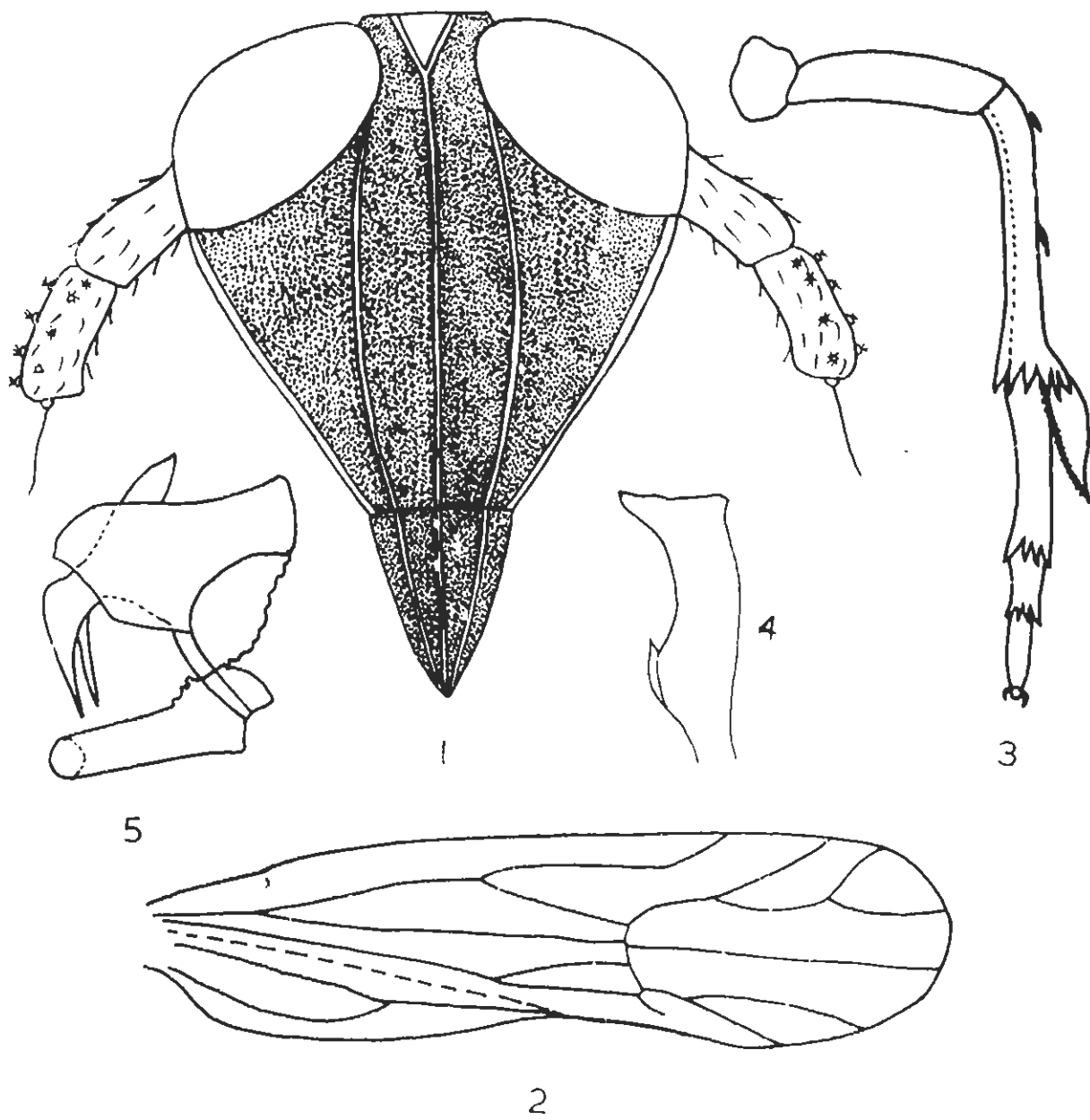
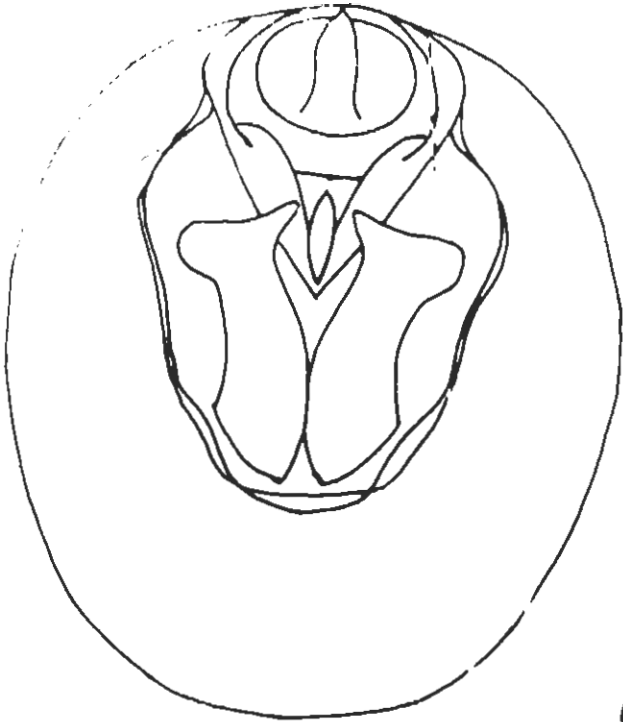


PLATE 23

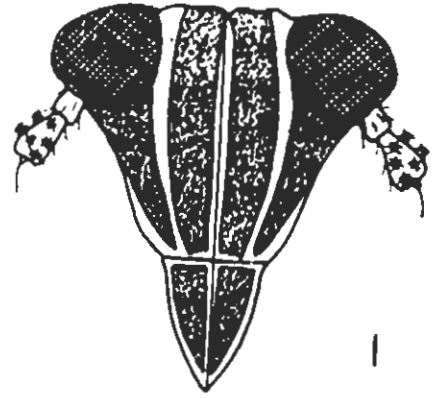
PLATE 24.

Toya attenuata.

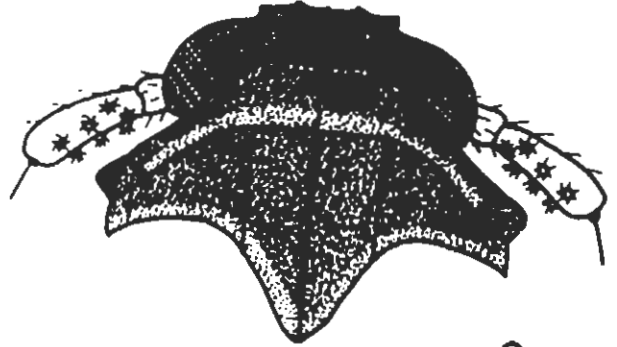
- Figure:- 1. Head, anterior view.  
2. Head and thorax, dorsal view.  
3. Male genitalia, posterior view.  
4. Tegmen, dorsal view.



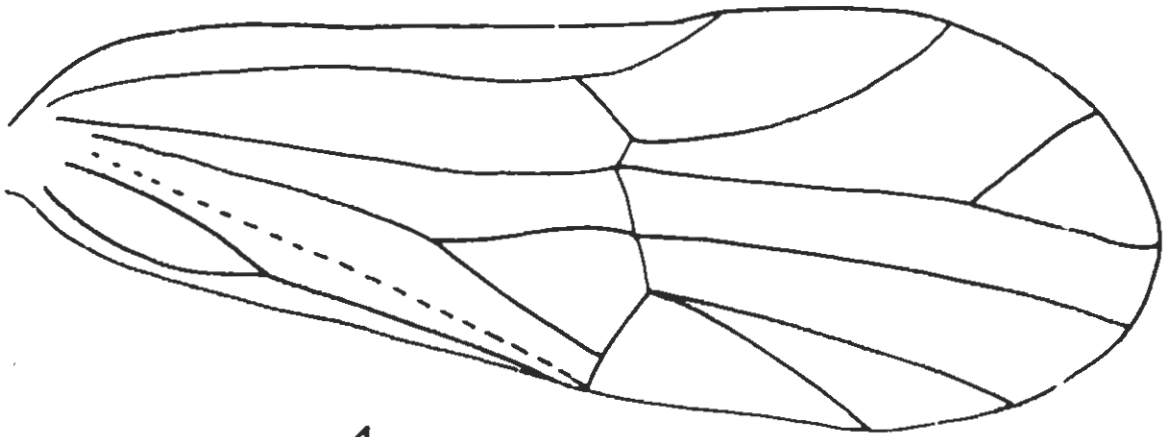
3



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2



4

PLATE 24

PLATE 25.

Toya albinotata.

- Figure:- 1. Head, anterior view.  
2. Head and thorax, dorsal view.  
3. Tegm., dorsal view.  
4. Paramera.  
5. Aedeagus.  
6. Male genitalia, lateral view.



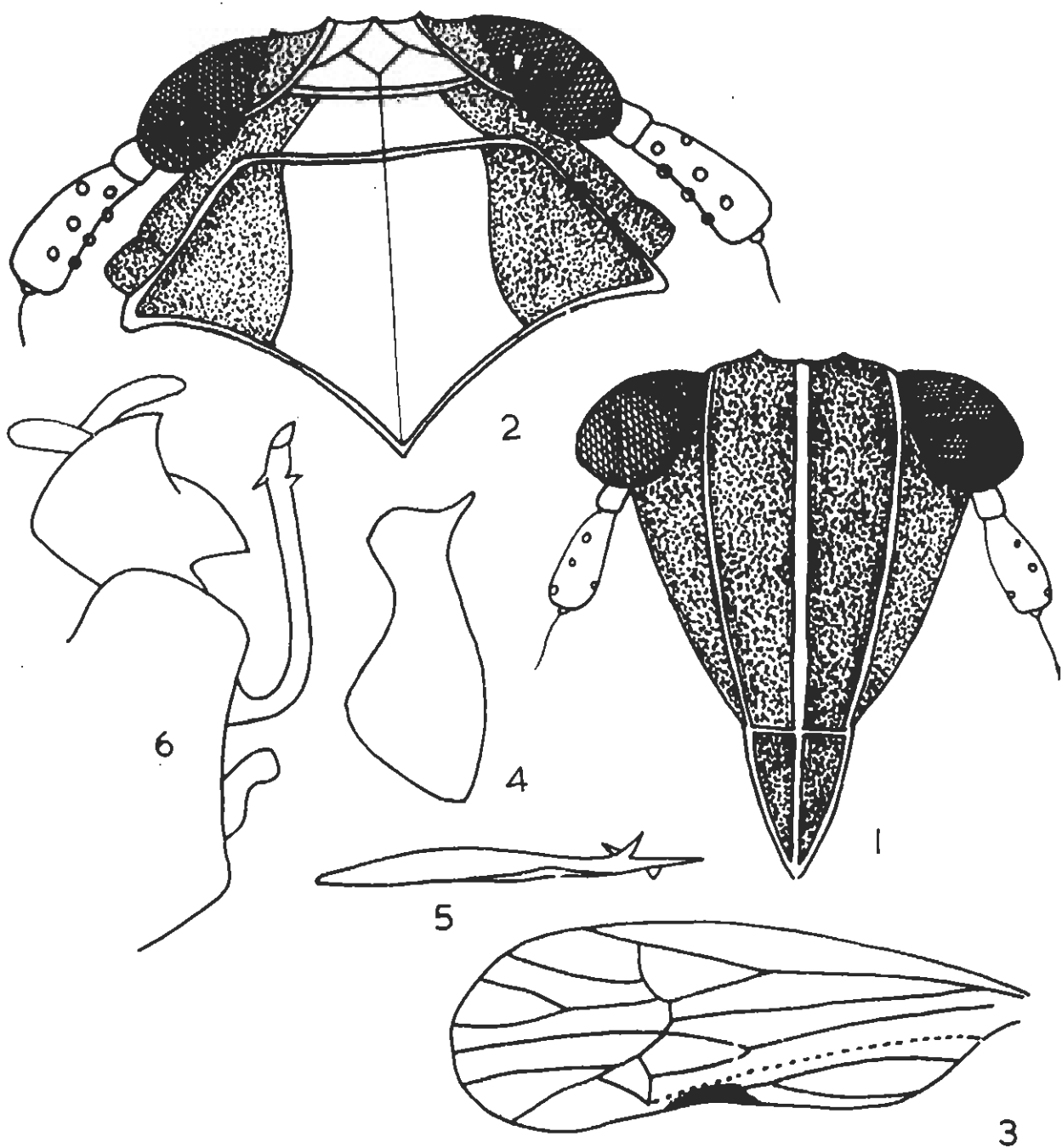


PLATE 25

PLATE 26.

Toya proxima.

- Figure:-
1. Head, anterior view.
  2. Head and thorax, dorsal view.
  3. Hind leg, lateral aspect.
  4. Tegmen, dorsal view.
  5. Paramere.
  6. Male genitalia, posterior view.
  7. Male genitalia, lateral view.

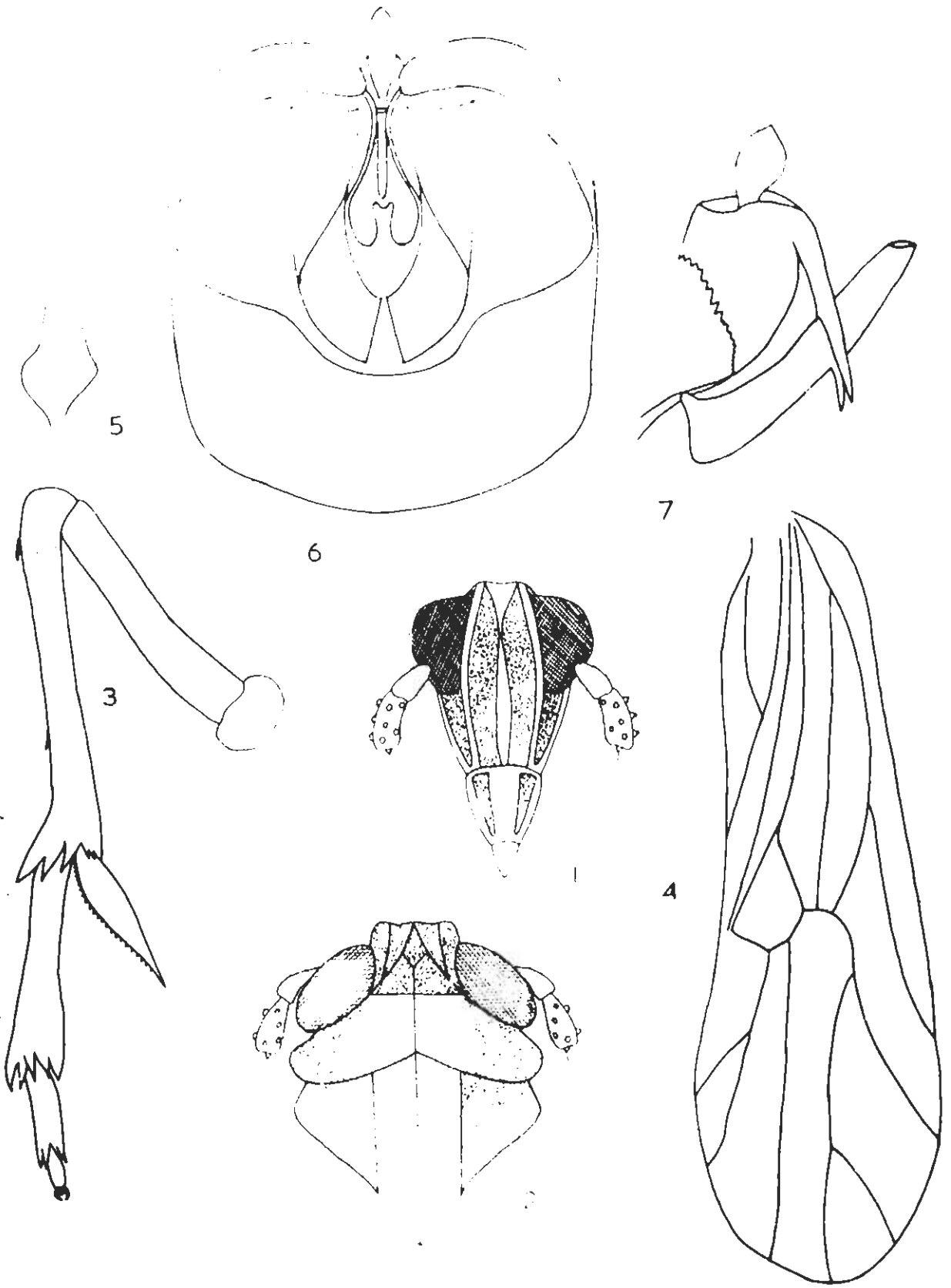


PLATE 26