PHYLOGENETIC ANALYSIS AND REVISION OF *GARGAPHIA* (*sensu lato*) HETEROPTERA: TINGIDAE) WITH DESCRIPTIONS OF ONE NEW GENUS AND THREE NEW SPECIES GROUPS

SMITH

PHYLOGENETIC ANALYSIS AND REVISION OF *GARGAPHIA (sensu lato)* (HETEROPTERA: TINGIDAE) WITH DESCRIPTIONS OF ONE NEW GENUS AND THREE NEW SPECIES GROUPS

A Dissertation

by

ROBIN MICHELE SMITH

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 1996

Major Subject: Entomology

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ABSTRACT

Phylogenetic Analysis and Revision

of *Gargaphia (sensu lato)* (Heteroptera: Tingidae)

with Descriptions of One New Genus

and Three New Species Groups. (May 1996)

Robin Michele Smith, B.S.E. Arkansas State University;

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While undertaking a revision of the large genus *Gargaphia*, evidence to support multiple genera among the species within *Gargaphia* was identified. The presence of a transverse metasternal lamina dividing the rostral canal provided a single autapomorphy for *Gargaphia (sensu lato)*. A phylogenetic analysis of 27 characters supported aggregating the species within *Gargaphia* into four species groups, one of which is described herein as a new genus. Support for monophyly of the genera and species groups is presented as is a phylogenetic analysis of their sister group relationships. Illustrations of and keys to the species of the included genera and species groups are provided and the species of the *brunfelsiae* and *nigrinervis* species groups are redescribed, one new genus and two new species are described, the revision

includes six new synonyms, 14 new combinations, and one revived status. This initial investigation into the phylogenetic relationships within Tingidae will establish a basis upon which to build cohesive investigations at the generic and eventually the tribal level.

Appreciation goes to my committee members, Dr. Joseph Schaffner, Dr. Jim Woolley, Dr. Richard Froeschner, Dr. Merrill Sweet, and Dr. Larry Keeley for their time, patience and investment in my education. Special thanks are due to Dr. Schaffner for free access to his extensive reprint files, financing one trip to the National Museum of Natural History, and other research expenses incurred during this work. Special thanks also go to Dr. Woolley for his careful attention to the phylogenetic analysis and multiple drafts of the entire manuscript and his considerable time commitment during the final stages of my degree. Dr. Froeschner provided access to specimens in the Drake and National Museum of Natural History Collections, in addition I am fortunate to have gained his friendship and to have benefitted from his experience and his ability to read from the reader's point of view rather than the researcher's point of view. My appreciation also goes to Dr. Ray Frisbie for helping at crucial moments and to Dr. Horace Van Cleave for his trust in my teaching abilities.

Thanks are due to those institutions which loaned specimens for examination including the National Museum of Natural History, Snow Entomological Museum, Florida State Collection of Arthropods, American Museum of Natural History, Texas A&M University, and to Paulo Sergio F. Ferrera for loan of specimens he collected. My appreciation also goes to Sylvaine Delongue for translation of portions of Pericart's works.

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thoughtful conversations, useful tips and shared experiences. Special appreciation goes to my office-mate Paulo Sergio F. Ferrera (Fiuza), to Jeff Pettis, Robert Jones, and Roy Vogtsberger. I appreciate Jon and Janelle Gardner for their constant encouragement and support.

To those who waited for me, your enduring patience is surpassed only by my gratitude to you. I am especially blessed by a family who is constantly supportive, encouraging and continues to believe in me. God and my family have sustained me throughout my education.

This dissertation is not to be considered as a valid publication as defined by the International Code of Zoological Nomenclature. The taxonomic and nomenclatural changes herein are not considered available nor part of the permanent, public scientific record.

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INTRODUCTION

Research on the Tingidae has been dominated by Dr. Carl J. Drake who described 46% of the known species and amassed the world's most extensive and important tingid collection. Drake's work was descriptive in nature and he wrote few keys. Aside from the characterization of many new genera and several hundred species, tingids have received scant attention from systematists (Drake and Ruhoff 1960). The subfamilies, tribes, and particularly many of the larger genera need to be thoroughly analyzed from a worldwide aspect to better understand and more precisely delimit such heterogeneous taxa. Their species then can be more naturally characterized into genera. Numerous genera at times have served as temporary repositories ("catch-alls") for many new species of doubtful or even unknown generic affinities since the days of Linnaeus and Fabricius (Drake and Ruhoff 1960). An examination of the specific names reveals that more than 100 species of tingids originally described in *Monanthia* have been transferred to other, sometimes newly created genera (Drake and Ruhoff 1960).

The lack of monophyletic genera makes difficult the application of cladistic analyses to lacebugs. *Gargaphia* appeared to be a naturally characterized genus that was amenable for a phylogenetic analysis, and therefore would serve as a starting point for determining phylogenetic relationships among the Tingidae. In this investigation, I

References cited follows the format of Annals of the Entomological Society of America.

undertook the following objectives: 1) To delimit monophyletic groups within *Gargaphia*, 2) To analyze the morphological characters for their phylogenetic usefulness in providing autapomorphies, 3) To determine the extent of overlap between *Gargaphia* and *Leptopharsa*, 4) To determine sister groups relationships within *Gargaphia (s.l.)* and 5) To revise the two predominantly South American species groups within *Gargaphia (s.s.)* including descriptions, keys to the species and illustrations.

History of *Gargaphia*

Gargaphia is in the large subfamily Tinginae and the tribe Tingini which contains over 80% of the species of Tingidae. *Gargaphia* was described in 1862 by Stål who placed it as a subgenus of *Monanthia* LePeletier and Serville. In 1873 Stål elevated *Gargaphia* to generic rank and included nine species that are presently members of the genus. Berg (1879) and Uhler (1893) each described a single species of *Gargaphia*. Champion (1897) described two new species and provided a key to the four species then known from Central America. Heidemann (1899, 1914) added two species. Van Duzee (1916) designated *G. patricia* as the type species of the genus. Drake (1917) presented a key to the six Nearctic species and included one new species of *Gargaphia*.

Gibson (1919) consolidated information on the genus, listed food plants, and provided a key to 16 of the 25 then described species. Gibson's (1919) study has remained the most thorough treatment of *Gargaphia*. Since that time, 47 additional

species have been described in 36 separate publications. Drake alone, or in conjunction with others, described 33 species (Drake 1917, 1922, 1928, 1930a, 1930b, 1931, 1935, 1939, 1941, 1954; Drake and Bruner 1924; Drake and Carvalho 1944; Drake and Hambleton 1938a, 1938b, 1940, 1942, 1944, 1945; Drake and Hurd 1945; Drake and Poor 1940, 1942). Monte added nine new species to the genus (1938a, 1938b, 1938c, 1940a, 1941a, 1941b, 1942, 1943b, 1947a). Van Duzee (1923) described two new species. Parshley (1920), Costa Lima (1922), Hussey (1957) each described a single species in *Gargaphia.* Walley (1928, unpublished MS thesis) presented the first figures of the genital capsule of Tingidae, including six species of *Gargaphia.*

Hurd (1946) reported 55 species for the world, with 26 species in North America. Drake and Ruhoff (1965) in their catalog listed 65 species and one variety for the genus. Since Drake's death in 1965, there have been only eight publications concerning *Gargaphia.* One of these was a new species description (Froeschner 1972), the remaining seven were behavioral studies of the eggplant lace bug, *Gargaphia solani* Heidemann (Kearns & Yamamoto 1981, Tallamy 1985, 1986, 1993; Tallamy & Denno 1981, 1982; Tallamy & Horton 1990).

Regional studies of Heteroptera that include references to *Gargaphia* include Blatchley (1926) who provided a key to the five eastern United States species of *Gargaphia.* Slater and Baranowski (1978) listed three species of *Gargaphia* in their Key to Adults of North American Families of Hemiptera. It should

be noted that Slater and Baranowski's figure 200 illustrating the transverse laminae in *Gargaphia* is inverted. The new world genus *Gargaphia* currently consists of 66 species with 13 North American and 53 Neotropical species.

MATERIALS AND METHODS

Material Studied

This study was based on examination of over 7,000 specimens representing 62 of the 66 species formerly placed in *Gargaphia*. Specimens were examined from the National Museum of Natural History, (USNM); The Drake Collection, (DRAKE); University of Kansas, Snow Entomological Museum, (SNEM); Florida State Collection of Arthropods, (FSCA); American Museum of Natural History, (AMNH); Texas A&M University Insect Collection, (TAMU); and other specimens as available. Type specimens of all except five species are represented and were examined at the National Museum of Natural History.

Specimens were examined using a WILD M5 dissecting microscope and a fiber optic illuminator. Approximately 32 species contained in the new species groups *G. brunfelsiae* and *nigrinervis* are redescribed.

Species Concept

The phylogenetic species concept (Cracraft 1983, 1987) in which a species is defined as "an irreducible (basal) cluster of organisms diagnosably distinct from other such clusters, and within which there is a parental pattern of ancestry and descent" was used to recognize species in the genera. This concept allows for some individual variation.

Construction of Keys

Keys to members of the former *Gargaphia* were constructed using the most conspicuous significant characters for ease of identification. A key to the species groups and one new genus is presented as well as keys to the species of *brunfelsiae* species group and *nervosa* species group.

Phylogenetic Analysis

Methods used for obtaining and coding characters and for the parsimony analysis are included in a separate section entitled Phylogenetic Analysis.

Internal Genitalia

Dissection of genitalia included a combination of my methods and those of Singh-Pruthi (1925), and Lee (1969). The genital capsule was first removed from dried specimens and placed in a warm water bath for approximately two minutes. The genital capsule was then heated in a 10% solution of KOH for 5-10 minutes. Rather than heating in KOH, the genital capsule may be immersed in 10% KOH and held at room temperature for 24-48 hours for clearing. Next, specimens were placed in a series of two warm water baths to rinse the KOH, the last one containing acetic acid, and finally placed in distilled water for dissection. The genitalia were dissected by tools fashioned from #2 insect pins and minuten pins placed in wooden stirring sticks. The parameres were spread, but left intact, the pygophore removed and the aedeagus gently probed from the anterior opening of the genital capsule. The genital capsule

was slit on the dorsal surface, taking care not to puncture the phallic membrane. After this incision, the aedeagus was inflated through a combination of osmotic pressure and delicate manual manipulation of the membranes and endosomal sclerites until the basal plates inverted and pulled away from the apodemes. After successful inflation of the aedeagus, the genitalia were stained with methyl green, enabling better observation of membranous portions. Genitalia were then transferred to a depression slide and placed in glycerine. Illustrations were made using a compound microscope with a drawing tube. Finally, genitalia were stored in a plastic genitalia vial and secured to the pin of the specimen.

Internal structures were examined for characters but were not found to elucidate any additional relationships within the genus. Lee (1969) presented an investigation of internal structures for 20 species of Tingidae and found structures useful in species identification for *Stephanitis*. Pericart (1983) found that genitalia were not useful in separating species of European Tingidae.

External Genitalia

Genital capsules are figured (Appendix A) for comparisons of shape. Parameres (Appendix A) are useful in separation of some species. These photomicrographs were taken using an Environmental Scanning Electron Microscope. The genital capsule and a portion of the abdomen was removed and placed in alcohol. Specimens were examined and preliminary figures drawn through a compound microscope and the specimens stored in glycerin inside a genitalia vial. Later the

specimen was taken from the glycerin and soaked in a series of two containers of alcohol. The specimen was then air dried and placed on a 12.7 mm AMRAY 1000 aluminum specimen mount that had been covered with a 12 mm double sided carbon conductive tab. Specimens were examined with an Environmental Scanning Electron Microscope using 3.0 torr and 10 kV. These were the most optimal conditions found for examining tingid specimens. An additional piece of carbon tape was placed beneath the specimen mount directly on the stage to decrease interference from the stage.

Illustrations

Illustrations of species are provided to confirm identification, illustrate character states and represent specific morphological features. I took photographs using a microscope-mounted Nikon camera and Kodak TMAX 100 black and white film. The insect pin was inserted into a mound of modeling clay on a portable base and the insects were positioned above a white background while viewing the specimen first through a dissecting microscope and then through the camera lens. Two arms of a fiber optic illuminator were positioned at 45° angles to the specimen. Photographs were taken at 6x for larger species and at 8x for smaller species. Line drawings of selected characters are provided to verify descriptive terms and to confirm the user's progress through the key. ESEM photomicrographs were taken using Polaroid Type 52, 4x5 negatives. Digital images were also stored for future use through Image Acquisition Archiving System (IAAS) for each photomicrograph taken.

Presentation of Label Data

Major categories most frequently used, such as distribution, host plants, and location and label data for primary type material are presented with each description in the body of this document. Specific label data for all other material examined is contained in Appendix A in a chart form to enable the reader to determine quickly if a species is recorded from a specific geographic area and where those specimens are housed. Host records are also linked to locality records and new host records may be quickly discovered by consulting Appendix A. In addition, potential hosts uncollected in specific geographic areas may be targeted from this chart for more efficient collecting in the future. It is hoped that this chart form will provide ease of information retrieval for those investigators who are interested in specific specimens.

Biological Information

Biological information on species was obtained from the literature, label data, field notes and other correspondence records. This information is recorded following each species description. Host plant information included with the species descriptions is as noted in the literature or as on specimen labels, except that generic names were updated using Brako, Rossman and Farr (1995) and Brummitt (1992). Host plants for individual specimens are also noted in the Label Data section located in Appendix A. These host records are recorded verbatim from the label data to insure no loss of information for coordinating label data and collector, this will provide a means of tracing misidentifications of host plants.

The lot numbers on specimens collected by E. J. Hambleton should be noted. Specimens were separated to morphospecies or for variation, these separations were then often found to coordinate with Hambleton's lot numbers. Lot numbers indicating a difference in collection site may indicate different habitats or hosts. Considerable effort was made to locate E.J. Hambleton's field notes. I searched the Smithsonian archives and read all of his archived correspondence. Hambleton's collection records were highly organized and meticulously documented with host plants identified for many specimens. Page after page of host identifications was found to correspond with his collection numbers and habitat descriptions. Unfortunately host identifications of Tingidae were missing. Correspondence indicated that the Tingidae were placed in separate shipments directly to Carl Drake. I also read the entire file of Drake's correspondence, both the archived and unarchived files. I found no records of Hambleton's lot numbers nor identifications that corresponded with them. I also obtained some of Hambleton's records from the USDA (United States Department of Agriculture) lab in Beltsville, Maryland, these records of host plant identifications did not correspond with Tingidae. Hambleton's surviving family members were contacted in hopes that his field notes might have been retained, but this was not the case. I have documented each of the lot numbers in Material Examined and have separated out those species which have the same locality label but different or missing lot numbers. I was told by Dr. Richard Froeschner (personal communication) that Drake often removed Hambleton's lot numbers from the pinned specimens.

Descriptions

Descriptions were produced using DELTA (DEscriptive Language for TAxonomy, Dallwitz 1980; Dallwitz, Paine and Zurcher 1993; Partridge, Dallwitz and Watson 1993) and TYPSET (Dallwitz and Zurcher 1993) and then modified when necessary. Redescription of known species and description of new species are of uniform presentation to facilitate comparisons. Each species was coded for the same characters so that characters mentioned in each description may be compared to the states present in each of the other species. Those characters that were informative at the generic level were not repeated in the species descriptions unless variation among the species was found. Only those characters that varied among the species were included in the species descriptions. Therefore, to get the entire characterization of a species, the reader should consult both the generic description and species descriptions.

Terminology

Terms follow those of Drake and Ruhoff (1965) for morphological features (Fig. 1a). New terms include **subcostal extension** (Fig. 1b) defined as that portion of the subcostal area extending onto the explanate portion of the wing. The **base of the subcostal extension** (Fig. 1b) is defined as beginning at the point of narrowing to a single row of cells and corresponds with the apex of the hypocostal lamina (located

underneath the hemelytron). The **suprasomatic area** (Fig. 1b) of the hemelytron refers to that portion of the hemelytron covering the abdomen as opposed to the explanate portion extending beyond and beside the abdomen. The **posterior marginal row of cells** of the hemelytron is shown in Fig. 2.

PHYLOGENETIC ANALYSIS

Introduction

No Tingidae have been evaluated using Hennigian principles for evidence of phylogenetic relationships. It is hoped that this study will help provide a framework for characters suitable for use in future studies within this family and will prompt further investigations into the phylogenetic relationships of this striking and highly ornate family of Heteroptera.

The genus *Gargaphia* previously has not been studied for verification of monophyly. In order to have meaningful comparisons between taxa and to establish a framework from which to further study organisms, we need to base those studies on monophyletic groups. Previously monophyly of *Gargaphia* has been based on the presence of an anterior transverse metasternal lamina. As I began a revision of this large and variable genus, questions arose about the validity of this as the sole character on which to base the genus. Characteristics that reoccur in groups split by early couplets in keys by Gibson (1919) and Drake (1917) raised suspicions about the naturalness of included taxa. Also an examination of *Leptopharsa* uncovered species that superficially resemble species of *Gargaphia*, although in *Leptopharsa* species the metasternal laminae were missing. A phylogenetic analysis was undertaken to determine the monophyly of *Gargaphia*, the extent of overlap with *Leptopharsa*, and the phylogenetic structure within *Gargaphia*.

Methods

The ingroup in this analysis consists of 62 species of the former *Gargaphia*. Previous evidence for monophyly of the ingroup was the presence of an anterior transverse laminae. New evidence for monophyly of the ingroup is presented in the results section. Operational Taxonomic Units for the ingroup were determined by a series of steps. Initially all of the 62 species were coded for 128 characters. This data set resulted in 27 phylogenetically informative characters and these 27 characters were scored for the 62 species which resulted in 17 OTU's. Three of these OTU's represent multiple species and 14 represent individual species (Table 1). Following the analysis, these OTU's were named as labelled on the cladogram (Appendix B).

Based on morphological similarities in body shape, hood and hemelytra, the large genus *Leptopharsa* is the most likely sister group to *Gargaphia*. *Leptopharsa* is not demonstrably monophyletic and consists of an assemblage of species (Hurd 1946, Drake and Ruhoff 1960). As noted above, the extent of overlap between the species of *Leptopharsa* and *Gargaphia* was in question so all species of *Leptopharsa* were initially included in the analysis. The 107 species of *Leptopharsa* were coded for 18 characters and thus divided into seven groups representing different elements of *Leptopharsa*. These seven groups, along with all members of *Gargaphia* were coded for 128 characters. OTU's resulting from this data set included three "groups" of *Leptopharsa*.

These three groups representing *Leptopharsa* along with all members of *Gargaphia* were coded for the 27 characters found to be phylogenetically informative. Eighteen terminal taxa presented in the cladogram resulted. *Leptopharsa* was reduced to one OTU and *Gargaphia* was reduced to 17 OTU's. Therefore, OTU's represent study of all known species which were then collapsed to form terminal taxa in the analysis.

Phylogenetic analysis of morphological characters was performed using PAUP (Phylogenetic Analysis Using Parsimony, Version 3.1.1, Swofford 1990; Swofford 1991). Characters were coded as binary (0,1) or multistate (0,1,2,3). All multistate characters were treated as unordered so as not to invoke assumptions about character transformations. A Branch and Bound search was employed to find the most parsimonious cladogram(s). Characters were plotted on the consensus tree by examining all possibilities for character optimiztion and retaining those that were repeated in all individual trees. The study was designed to examine the monophyly of *Gargaphia* so further evaluation of species level characters might resolve relationships among species not resolved in this analysis.

Names of new taxa are employed in the explanation of characters to avoid confusion with respect to "former *Gargaphia*" versus *Gargaphia* as characterized in this document. Characters used in the analysis are as follows:

1. Vertex

(0) Black and shiny

(1) Fuscous, not black and shiny

Comments. Species in *Astrictus* have the vertex black and very shiny. The shininess may actually be a lack of waxy secretions. This character is very distinct in *Astrictus*. Color is variable in the other groups; however none of the other species have a black vertex.

2. Bucculae

(0) extending anteriorly (Fig. 3)

(1) not extending anteriorly (Fig. 4)

Comments. This character is most easily observed in lateral view. Except for *G. patria* all species in the *brunfelsiae* and *nigrinervis* species groups have state (0); species in *Astrictus* have state (1).

3. Hood

(0) does not extend beyond head (Fig. 5)

(1) protrudes anterior to head (Fig. 6)

Comments. State (1) is limited to three species of the *brunfelsiae* species group, *G. brunfelsiae, G. differitas,* and *G. flexuosa.*

4. Hood with highest point

(0) median (Fig. 7)

(1) anterior-most (Fig. 8)

Comments. Character state (1) is limited to a few species of the *brunfelsiae* species group, all other species have state (0).

5. Hood

(0) elevated

(1) as wide or wider than high

Comments. Species in *Astrictus* are of the same general shape, only slightly elevated, but broadly expanded. Species of *brunfelsiae* and *nigrinervis* species groups are more vertically elevated and less broadly expanded.

6. Hood

(0) bulbous (Fig. 9)

(1) concave (Fig. 10)

Comments. Some species have the hood strongly concave as opposed to the hood having straight sides or slightly to strongly bulbous.

7. Hood

(0) higher than median carina (Fig. 11)

(1) lower than median carina (Fig. 12)

(2) even with median carina (Fig. 13)

Comments. As seen in lateral view, the hood may be higher, lower or even with the highest point of the median carina. Character state (1) is found in the outgroup, in *Astrictus* and in the *nigrinervis* species group.

8. Head spines

(0) short

(1) long

Comments. Species of *Gargaphia, patricia* species group have particularly long spines on the head as do four species of the *brunfelsiae* species group: *G. schulzei, G. differitas, G. inca* and *G. serjaniae.*

9. Median spine

(0) about equal to others

(1) extending beyond all others

Comments. The median spine extends beyond all other head spines (1) in species of the *brunfelsiae* species group. This character occurs in a few species of *nigrinervis* species group, other species considered in this analysis have character state (0).

10. Diameter of occipital spines

(0) equal to that of median spine

(1) reduced

Comments. The general condition in all members of the former *Gargaphia* and *Leptopharsa* is state (0). *G. patria* has the occipital spines greatly reduce and not visible extending beyond the hood, although they are present and visible in a frontal view underneath the hood.

11. Paranota

(0) widely expanded (Fig. 80)

(1) not widely expanded (Fig. 87)

Comments. This character is one that previously was used in early couplets of keys to the former *Gargaphia* (Blatchley 1926; Gibson 1919). The widespread variability of the character contributed to a delay in recognizing the genera described within this paper.

12. Wax on thorax

(0) not abundant

(1) abundant

Comments. Dried specimens of the *brunfelsiae* species group have an abundance of waxy secretions on the thorax. These waxy secretions obscure the posterior and lateral margins of the hood and contribute to the coloration patterns seen in a dorsal view. Waxy secretions also occur ventral to the paranota at the point where the paranotal expansion meets the thorax. Other species considered in this analysis have no to very little waxy secretions on the prothorax.

13. Pronotum

(0) not obviously setose

(1) obviously setose

Comments. The *patricia* species group has a heavy coat of long setae that is very obvious; species of *nigrinervis* also have obvious setae. Other species may have setae,

but not in such a dense coat as the species of the *patricia* species group.

14. Metasternal laminae

(0) open posteriorly (Fig. 14)

(1) closed posteriorly (Fig. 15)

Comments. Character state (1) is scattered throughout the species of the *brunfelsiae* species group, and is found in some members of *Leptopharsa* as well. Presence of the anterior transverse lamina was the sole character formerly used to characterize *Gargaphia*, but the posterior margin has not been considered as a character.

15. Median carina with three rows of cells at apex

(0) absent

(1) present

Comments. In the terminal taxa represented in this analysis, character state (1) is unique to *Gargaphia inca*. It is found scattered in some other genera of Tingidae. It's distribution among other taxa should be investigated and may hold some information about relationships of Tingidae.

16. Median carinal cells

(0) remaining constant or decreasing in height on posterior pronotal projection (Fig. 16)

(1) increasing in height on posterior pronotal projection (Fig. 17)

Comments. The plesiomorphic state is for the median carinal cells to remain constant or to decrease in height on the posterior pronotal projection. The derived state occurs

in some species of the *brunfelsiae* species group and a few species of the *nigrinervis* species group.

17. Costal area: number of rows of cells adjacent to anterior 1/2 discoidal area

(0) one

(1) two

(2) three

(3) four or more

Comments. The plesiomorphic state is (1), two rows of cells in the costal area.

18. Costal area

(0) wider than sutural area

(1) narrower than sutural area

Comments. This character is an autapomorphy for *Astrictus*. The plesiomorphic condition is state (0).

19. Hemelytra

(0) overlapping for the entire length of sutural area

(1) not overlapping for the entire length of sutural area

Comments. State (0) is an autapomorphy for *Astrictus* and occurs elsewhere only in *Gargaphia patria*. State (0) of the character may also be described as the R+M+Cu vein being straight or nearly so, and not flaring out.

20. Subcostal extension with nervures

(0) darkened

(1) not darkened

Comments. State (0) of this character is quite common in Tingidae and occurs in all species of the *brunfelsiae* species group, most species of the *nigrinervis* species group, and a few species in the *patricia* species group, but does not occur in *Astrictus*.

21. Subcostal extension

(0) does not widen

(1) widens toward apex

Comments. The subcostal extension widening toward the apex (1) occurs in all species of the *brunfelsiae* species group and in the *nigrinervis* species group. The plesiomorphic condition is state (0).

22. Subcostal extension with embrowned cells

(0) absent

(1) present

Comments. All species of the *brunfelsiae* species group have opaquely embrowned cells in the subcostal extension as do some species of *Leptopharsa*. The cells are opaquely embrowned. There are no embrowned cells in the subcostal extensions of the *nigrinervis* or *patricia* species groups, nor in *Astrictus*.

23. Costal area with embrowned cells

(0) absent (Fig. 87)

(1) present (Fig. 77)

Comments. All species of the *brunfelsiae* species group except *G. munda* and *G. paula* have embrowned cells present in the costal area. Some species of *Leptopharsa* share this character state. No species of the *nigrinervis*, *patricia* species groups or of *Astrictus* have embrowned cells in the costal area.

24. Sutural area with embrowned cells

(0) absent (Fig. 91)

(1) present (Fig 79)

Comments. All species of the *brunfelsiae* species group except *G. obliqua* have opaquely embrowned cells present in the sutural area. Some species of *Leptopharsa* share this character state. No species of the *nigrinervis* or *patricia* species groups, nor species of *Astrictus* share this character state.

25. Sutural area cells

(0) not twice the size of costal area cells (Fig 95)

(1) twice the size of costal area cells (Fig. 76)

Comments. Character state (1) occurs only within the *brunfelsiae* species group, although it does not occur in all members of the group.

26. Metasternal laminae

(0) open anteriorly (Fig. 18)

(1) closed anteriorly (Fig. 19)

Comments. Character state (1) was the single autapomorphy uniting the former *Gargaphia*. In the current analysis, it occurs in the *brunfelsiae* species group with the single exception of *G. schulzei*, and in all members of the *nigrinervis*, *patricia* species groups and in *Astrictus*. Those species of *Leptopharsa* with a partial anterior metasternal lamina are being moved from *Leptopharsa* to the appropriate genus or species group.

27. Paranota greatest width

(0) anterior to middle (Fig. 86)

(1) middle or behind (Fig. 80)

Comments. The plesiomorphic state for this character is state (0)

Results

Of the 108 equally parsimonious trees, 41 were completely resolved, 49 were fully resolved with the exception of one trifurcation, and 18 were completely resolved with the exception of two trifurcations. The cladogram presented (Appendix B, Fig. 110) is a strict consensus of 108 equally parsimonious trees, all of length 59, CI = .525, RI = .641.

Results of this analysis support a division of the former *Gargaphia* into four groups. One taxon at the basal node of the former *Gargaphia* is described as the new

genus *Astrictus*. Three new species groups are described and represent the elements of *Gargaphia (s.s.)*. *Astrictus*, the sister group to *Gargaphia (s.s.)*, represents 15 species as characterized in the next section of this document. *Gargaphia (s.s.)* includes the *patricia, nigrinervis,* and *brunfelsiae* species groups. At the basal node of *Gargaphia (s.s.)* is the *patricia* species group which is characterized in the following section and includes nine species. The *nigrinervis* species group, the sister group to the *brunfelsiae* species group, consists of 24 species, as revised in this document. The *brunfelsiae* species group consists of 14 species as revised in this document.

Monophyly of the ingroup (*Gargaphia s.l.*) is supported by eight characters in this analysis. However, each of these characters changes again at some point on the tree. The node that unites *Gargaphia (s.l.)* is supported by the pronotum being obviously setose. Species of *Leptopharsa* do not have the pronotum obviously setose. The metasternal laminae are open posteriorly in *Gargaphia (s.l.)* this character is variable in other genera of Tingidae and the laminae are generally closed posteriorly in *Leptopharsa*. The subcostal extension with nervures not darkened supports *Gargaphia (s.l.)* although it changes again at node 20; many species of *Leptopharsa* have darkened nervures. *Gargaphia (s.l.)* is supported by the absence of embrowned cells in the costal and sutural areas and in the subcostal extension, a reversal of this character occurs in the *brunfelsiae* species group. Some species of *Leptopharsa* have embrowned cells in the hemelytra and embrowned cells are found scattered in a number of other genera of Tingidae. The metasternal laminae of *Gargaphia (s.l.)* are

closed anteriorly, this character state is not found in other genera of Tingidae. The paranota of *Gargaphia (s.l.)* are expanded widest at the middle or behind, species of *Leptopharsa* generally have the paranota expanded anterior to middle.

Support for the node of *Gargaphia (s.s.) (patricia + nigrinervis + brunfelsiae* species groups) consists of six characters including two that change at only one place on the tree. The hood is elevated in *Gargaphia (s.s.)*, species of *Astrictus* have the hood as wide or wider than high. The median spine extends beyond all others in *Gargaphia (s.s.)*. The paranota are widely expanded in *Gargaphia (s.s.)* with the exception of *G. patria*; members of *Astrictus* do not have the paranota widely expanded. The node uniting *Gargaphia (s.s.)* is supported by the costal area having three rows of cells adjacent the anterior one-half of the discoidal area in comparison to two or fewer cells in the same area of *Astrictus*. The costal area of *Gargaphia (s.s.)* is also wider than the sutural area, in *Astrictus* the costal area is narrower than the sutural area. The hemelytra do not overlap for the entire length of the sutural area in *Gargaphia (s.s.)* as they do in *Astrictus*.

Characters supporting the sister grouping of *nigrinervis + brunfelsiae* species groups include three characters, one of which doesn't change elsewhere on the tree. The median carinal cells increase in height on the posterior pronotal projection in species of the *nigrinervis* and *brunfelsiae* species groups. The subcostal extension nervures are darkened in these two species groups, a reversal from the generalized *Gargaphia (s.s.)* condition. The subcostal extension widens toward the apex of the

hemelytron in members of these species groups, this character state is not found elsewhere in the analysis.

The genus *Astrictus* is supported by one autapomorphy, the presence of a shiny black vertex, this character state is not found in any other taxa represented in this analysis.

The *patricia* species group is supported by a single autapomorphy of long head spines, this character is also found in three species of the *brunfelsiae* species group.

The *nigrinervis* species group is supported by a single autapomorphy of four rows of cells adjacent the anterior discoidal area, this character state is not found in other species of *Gargaphia (s.l.)*.

Monophyly of the *brunfelsiae* species group is supported by five autapomorphies and an additional two characters are present in all but one species of the genus. The species of the *brunfelsiae* species group have the hood higher than the median carina. The shape and modifications of the hood serve as important characters in tingids. There are a number of variations within the *brunfelsiae* species group, but all are higher than the median carina. Air-dried specimens of this group have an abundance of wax in the pronotum. This character state serves to alter the color pattern on their body and obscures a portion of the darkened pronotum. Further studies on the physiological processes involved in this secretion of wax are indicated. These investigations might serve to further resolve the species relationships among species of the *brunfelsiae* species group. Some members of the genus also have

embrowned cells in the costal area. This character occurs in a number of other genera of Tingidae and has probably arisen more than once. This coloration in combination with the light or transparent areas on the hemelytra serves to create an illusion of body outline that is not coincident with the insect's actual hemelytra.

Eight of the 27 characters change only once on the tree. Character 2, bucculae not extending anteriorly, and Character 10, diameter of occipital spines reduced, are autapomorphies for *G. patria*. Character 5, hood elevated, supports the grouping of the *patricia, nigrinervis,* and *brunfelsiae* species groups. Character 9, median spine extending beyond all others, and Character 12, wax on thorax abundant, and Character 25, sutural area cells twice the size of costal area cells, all support the monophyly of the *brunfelsiae* species group. Character 15, median carina with tree rows of cells at the apex is an autapomorphy for *G. inca*. Character 21, subcostal extension widens toward the apex, supports the *nigrinervis* species group as the sister group of the *brunfelsiae* species group.

Conclusions

Resolution among most species of the *brunfelsiae* species group was lost in formation of the consensus tree. However, each of the 108 cladograms retained the grouping with the resolution of four species of the *brunfelsiae* species group *(G. acmonis, G. lunulata, G. paula, G. schulzei)*. The rate of evolution in these species may be faster than that of other species in the genus, or there may be some biological or host effect in place helping to determine body size. Current host information is

missing for *G. paula* and *G. schulzei*, so conclusions about linkage with a particular taxon of plants would be premature at this time. The additional information contained within this portion of the tree presents an opportunity for focused investigations on these species. With species level relationships resolved, concentrated efforts for collecting these species and the potential for additional biological information is present in a more natural unit. Concentration on hosts and a search for evidence of coevolution might provide evidence of host plant phylogenies and serve to further resolve those relationships. Known hosts of these *brunfelsiae* group species should be collected for possible additional collections of the other species within this group. In addition, those plants most closely related to the known hosts should be investigated for possible new species in the *brunfelsiae* species group. Previous concern about the possible overlap of species in the *brunfelsiae* species group with species of *Leptopharsa* is dispelled by the evidence of monophyly of the *brunfelsiae* species group.

Homoplasy is evident in a number of characters investigated here. Each of the characters supporting monophyly of *Gargaphia* revert to the plesiomorphic state at some point on the tree. The current status of Tingidae causes one to be cautious with designation of new genera because of the proliferation of monobasic genera and very large "catch-all" genera. Previously the great majority of work in Tingidae has been primarily descriptive without subsequent revisionary or comparative work. The evidence used in this analysis supports the division of *Gargaphia (s.l.)* into four

groups. One of these groups has been designated as the new genus *Astrictus*. These species are compact in appearance with neither the hemelytra nor the paranota expanded. The remaining three groups are designated as species groups at this time, those are the *patricia, nigrinervis,* and *brunfelsiae* species groups.

Further investigations within the Tingidae are necessary to establish monophyly of other genera and to establish a framework for sister-group relationships among the genera. With the difficulties encountered in delimiting *Leptopharsa* and other genera, it is obvious that phylogenetic consideration of tingid genera are overdue. It is the author's goal to become more familiar with other genera within Tingidae and to confirm the generic limits as natural groups before placing nomenclatural changes into taxonomic status. This initial investigation into the phylogenetic relationships within Tingidae will establish a basis upon which to build cohesive investigations at the generic and eventually the tribal level.

REVISION OF *GARGAPHIA* Stål *(sensu lato)*

Those specimens keying out to *Gargaphia* in Blatchley (1926), Froeschner (1944), Hurd (1946), and Slater and Baranowski (1978) may be identified to genus with the following key.

Key to Genera of *Gargaphia (sensu lato)*

1. Wings overlapping for entire sutural area, right posterior wing margin meeting subcostal extension of left wing . . . . . *Astrictus* Smith (p. 28)
1' Wings not overlapping entire sutural area, right posterior wing margin not meeting subcostal extension of left wing . . . . . *Gargaphia* Stål (p. 30)

Astrictus Smith NEW GENUS

Distribution. Six species are found exclusively in the United States, three are in the United States and Mexico, two species are reported exclusively from Mexico, two exclusively from South America and one species is reported from Costa Rica and Cuba.

Diagnosis. *Astrictus* may be recognized by the combination of the hood no higher than wide (Fig. 107), antennal segment I short (Fig. 107, compare Fig 77), costal area more narrow than sutural area (Fig. 107), R+M+Cu straight or nearly so, not flaring out (i.e. subcostal extension not expanded laterad of discoidal area) (Fig. 107, compare Fig 92), vertex black and shiny, the sutural areas completely overlapping (Fig. 107, compare Fig. 108), paranota not widely expanded (Fig. 107), and costal area at base of subcostal extension narrower than widest distance between lateral carinae.

Astrictus may be distinguished from *Gargaphia* by the straight subcostal area (it is S-shaped in *Gargaphia*); by the black vertex (fuscous in *Gargaphia*); by the sutural areas overlapping for their entire length (diverging posteriorly in *Gargaphia*) and by the less expanded costal area of the hemelytra. Also the costal area at base of subcostal extension narrower than widest distance between lateral carinae will distinguish *Astrictus* from all species of *Gargaphia* except *G. acmonis* and *G. patria*.

Description

Head. Eyes black; vertex shiny and black, usually no wax present. Five cephalic spines, occipital spines may be reduced to setae-like projections. Bucculae meeting anteriorly, produced ventrally. Antennal segment II shortest; III longest, setae may or may not be visible on segment III at 12x. Antennal IV has a dense coat of short setae and scattered longer setae. Rostrum not surpassing transverse metasternal laminae.

Thorax. Hood with little variation, usually about as wide or wider than high. Median carina bearing one row of cells and closely following outline of the pronotum. Paranota slightly expanded with most species having two rows of cells throughout. metasternum with an anterior transverse lamina meeting medially, without a posterior transverse lamina. Prothorax sometimes with a thick coat of wax dorsally. Some portion of the tarsus usually darker than the remainder of the leg.

Hemelytron. Costal area only slightly expanded, most species with one to three rows of cells, not expanded far beyond body posteriorly. Subcostal area with two

to four rows of cells; subcostal area and subcostal extension straight or nearly so, not diverging apically, females often have one more row of cells than males. Discoidal area variously modified, delimited by a raised carina, usually angulate posteriorly, females often have one more row of cells than males. Sutural area cells not enlarged compared to costal area cells. Sutural areas of hemelytra overlapping completely so that the posterior wing margin of each wing meets the subcostal extension of the other wing. Sutural areas remain overlapping to the apex of the hemelytra. The hypocosta has one row of cells. No cells of the hemelytra are embrowned.

Etymology. *Astrictus* is Latin for drawn together, narrow or close and refers to the compact appearance of these species caused by the hemelytra overlapping for the entire length of the sutural areas.

Type species. *Astrictus albescens* (Drake). This species has been chosen as the type species of *Astrictus* because of it's marked representation of the diagnostic characters.

Included taxa. *albescens* (Drake) **NEW COMBINATION**, *arizonica* (Drake and Carvalho) **NEW COMBINATION**, *balli* (Drake and Carvalho) **NEW COMBINATION**, *bimaculata* (Parshley) **NEW COMBINATION**, *condensa* (Gibson) **NEW COMBINATION**, *gentilis* (Van Duzee) **NEW COMBINATION**, *insularis* (Van Duzee) **NEW COMBINATION**, *iridescens* (Champion) **NEW COMBINATION**, *lanei* (Monte) **NEW COMBINATION**, *opacula* (Uhler) **NEW COMBINATION**, *oregona* (Drake and Hurd) **NEW COMBINATION**, *subpilosa*

(Berg) **NEW COMBINATION**, *tuthilli* (Drake and Carvalho) **NEW COMBINATION**, *vanduzeei* (Gibson) **NEW COMBINATION**.

Gargaphia Stål

Monanthia (Gargaphia) Stål 1862: 324

Gargaphia: Stål 1873:119,124. Uhler 1886:22. Letheirry and Severin 1896:13. Champion 1897:9, key. Banks 1910:56. Van Duzee 1916:25, 1917:217. Osborn and Drake 1916:233, key. Drake 1917:227-228, key. Gibson 1919:187-201, key. Blatchley 1926:472, key. Costa Lima 1936:126. Monte 1939:69, 1941c:95. Hurd 1946:479. Drake and Ruhoff 1960:58, 1965:221.

Type species. *Gargaphia patricia* (Stål)

Diagnosis. *Gargaphia* may be distinguished from *Leptopharsa* by the paranotal expanded widest at or behind humeri (*Leptopharsa* has the paranota expanded widest anterior to humeri) and the surface of the discoidal area being flat or nearly so (*Leptopharsa* often has a longitudinal depression).

Gargaphia may be distinguished from *Astrictus* by the fuscous vertex (*Astrictus* has a shiny black vertex); extension of the hemelytra for one-third the body length beyond the tip of the abdomen (*Astrictus* has comparatively short wings); the S-shaped curve of the subcostal area (*Astrictus* has the subcostal area nearly straight); and by the wings divercating before the apex (except *G. patria*) (*Astrictus* has the wings overlapping for the entire sutural area).

Description

Head. Eyes fuscous or black; vertex fuscous, with or without wax. Five cephalic spines, occipital spines reduced in some species and obscured by the hood. Bucculae meeting anteriorly, produced anterolaterally. Antennal segment III longest, usually also lightest, segment IV darkest with a dense coat of short setae and scattered longer setae; segment I with or without setae; segment II shortest also with or without setae. Rostrum not surpassing metasternal lamina.

Thorax. Hood always present, variously modified, expanded higher than wide. Median carina in lateral view with one row of cells (except *G. inca* with three rows at apex), closely following the pronotum; and increasing or remaining consistent in height on posterior pronotal projection. Paranotum variously expanded, widest at apex or beyond. Metasternum with an anterior transverse lamina meeting or approaching medially; posterior margin of metasternal laminae present or absent. Femur and tibia of leg unicolorous, tarsus may be partially or wholly darkened.

Hemelytron. Costal area variously expanded, unicolorous or with darkened nervures in a scattered or aggregated pattern. Subcostal area two to six rows wide forming dorsal or lateral margin of suprasomatic area; females usually with at least one more row of cells than males; S-shaped so that the apex of subcostal extension of one wing does not meet the posterior margin of the other wing for the entire sutural area. Wings diverging before their apices (except *G. patria*). Discoidal area variable but not wider than width between lateral carinae; delimited by a raised carina (*G. costalimai*

has no posterior margin delimited); females usually have at least one more row of cells than males; coloration either unicolorous, darkened at apex only, darkened at base and apex, or darkened for entire area except lateral margins. Hypocosta with one row of cells. Sutural area cells subequal to costal area cells or enlarged up to twice the size of costal area cells. All cells of hemelytra clear or with a few cells embrowned.

Key to the species groups of *Gargaphia (sensu stricto)*

1. Cell membranes in apical half of hemelytron embrowned . . . . . *Gargaphia, brunfelsiae* species group (p.38)
1' Cell membranes in apical half of hemelytron not embrowned 2

2. Subcostal extension expanded far laterad of discoidal area. Wings divercating, overlapping at most 2/3 the length of sutural area . . . . . *Gargaphia, nigrinervis* species group (p.81)
2' Subcostal extension not or only slightly expanded laterad of discoidal area. Wings overlapping 3/4 to complete length of discoidal area . . . . . *Gargaphia, patricia* species group (p.36)

Gargaphia, patricia Species Group

The following characters are shared by species of the *patricia* species group those marked with an asterisk are autapomorphies found only in this species group:

1) Costal area expanded wider than sutural area

* 2) Sinuate lateral carinae

* 3) Wings overlapping for two-thirds of the sutural area (Fig. 108)

4) Subcostal extension expanded laterad of discoidal area (Fig. 1)

5) Setose paranota

Distribution. North, Central, and South America

Description

Head. Eyes fuscous to black; vertex fuscous with or without wax. Five cephalic spines, the occipital spines are sometimes obscured by the hood. Bucculae meeting anteriorly and produced anteroventrally. Antennal segments I and II often light, always lighter than vertex, sometimes as light as antennal III; segment II shortest, III longest, segment IV dark to fuscous with dense coat of short setae and scattered long setae; setae on segment I and II may or may not be visible at 12x, setae on III and IV visible at 12x. Rostrum not surpassing transverse metasternal lamina.

Thorax. Hood variously modified, expanded higher than wide. Median carina bearing one row of cells, closely following the pronotum and remaining consistent on posterior pronotal projections. Paranota variously expanded, often four or more cells wide at widest point. Metasternum with an anterior transverse lamina meeting contiguously, no posterior transverse lamina. Prothorax obviously setose. Apical one-fourth to one-third of tarsus darkened.

Hemelytron. Costal area variously expanded with at least three rows of cells. Subcostal area and extension S-shaped though not diverging greatly. Discoidal area delimited by a raised carinae, angulate posterior margin, variously colored. Sutural area cells subequal to costal area cells; overlapping approximately two-thirds of their length, but not all the way to apex of hemelytra. Hypocosta with one row of cells. No embrowned cells present.

Included taxa. *amorphae* (Walsh), *angulata* Heidemann, *mexicana* Drake, *mirabilis* Monte, *patricia* (Stål), *socorrona* Drake, *solani* Heidemann, *tiliae* (Walsh), *torresi* Costa Lima.

Gargaphia, brunfelsiae Species Group

The following characters are shared by species of the *brunfelsiae* species group, those marked with an asterisk are unique to this species group:

1) Hood higher than median carina (as seen in lateral view)

* 2) abundance of wax on pronotum (in properly preserved specimens) (Fig. 76)

3) nervures of subcostal extension darkened (Fig. 84)

* 4) Subcostal extension with embrowned cells (Fig. 76)

* 5) Sutural area with embrowned cells

* 6) Sutural area cells twice the size of costal area cells (Fig. 77)

* 7) Subcostal extension expanded laterad of discoidal area (except *patria*)

8) Median spine extending beyond all others (Fig. 79)

9) Diameter of occipital spines equal to that of median spine (except *patria*)

10) Subcostal extension widens toward apex (Fig. 84)

11) Explanate margin of hemelytra with cells enlarged compared to suprasomatic area. (Fig. 81)

Distribution. South America

Description

Head. Eyes fuscous; vertex fuscous, with or without wax. Five cephalic spines, median spine surpassing all others and usually quite long. Bucculae meeting anteriorly produced anterolaterally. Antennal segment I or segments I and II darker than III, segment IV with apical 3/4 darkened; at 12x setae visible on only segment IV. Rostrum not surpassing transverse metasternal lamina.

Thorax. Hood variously modified, base obscured by wax. Collar covered with wax posteriorly to anterior margin of lateral carinae. Median carina in lateral view with one row of cells (except *G. inca* with three at highest point), closely following pronotum; and slightly increasing in height on apex of posterior pronotal projection. Paranotum variously expanded, cells larger than suprasomatic cells but smaller than costal area cells. Metasternum with an anterior transverse lamina contiguous medially (except *G. schulzei*), with or without a posterior transverse lamina. Prothorax with wax ventral to paranota. Apex of tarsal segment II darkened, tarsal claws may or may not be darkened as well.

Hemelytron. Subcostal area generally at least three rows of cells wide and forming part of the dorsal suprasomatic area of the hemelytron. Discoidal area long and narrow, in males, width approximately equal to width between median and lateral carinae; in some females slightly wider than width between lateral and median carinae; may be unicolorous, darkened at apex only, darkened at base and apex, or darkened for entire area except lateral margins. Sutural area cells two times size of costal area cells,

enlarged cells not embrowned. Subcostal extension cells very small and vertically oriented at base, widening and flattening out toward apex. Hypocosta with one row of cells. Embrowned cells opaque.

Key to species of *Gargaphia, brunfelsiae* Species Group

1. Wings overlapping in sutural area all the way to apex of hemelytra . . . . . *patria* (Drake and Hambleton), (Fig. 86)
1' Wings diverging before reaching apex of hemelytra 2

2. Median carina with three rows of cells at apex . . . . . *inca* (Monte), (Fig. 82)
2' Median carina with one row of cells at apex 3

3. Incurved ends of metasternal laminae not meeting medially . . . . . *schulzei* (Drake), (Fig. 88)
3' Incurved ends of metasternal laminae contiguous medially 4

4. Hood with darkened, transverse carina at apex . . . . . *ephamillosa* Smith, (Fig. 80)
4' Hood without transverse carina at apex 5

5. R-M vein elevated above Cu vein (in lateral view) 6
5' R-M vein level with Cu vein (in lateral view) 7

6. Highest point of R-M vein acute in lateral view . . . . . *differitas* Drake, (Fig. 79)
6' Highest point of R-M vein rounded in lateral view . . . . *brunfelsiae* Monte, (Fig.77)

7. R-M vein straight, parallel to Cu vein 8
7' R-M vein curving, not parallel to Cu vein 11

8. Costal area adjacent to basal one-third discoidal area with one row of cells . . . . . *acmonis* Drake and Hambleton, (Fig. 76)
8' Costal area adjacent to basal one-third discoidal area with two or more rows of cells 9

9. Costal area adjacent to basal one-third discoidal area with two rows of cells 10
9' Costal area adjacent to basal one-third discoidal area with three rows of cells . . . . . *serjaniae* Drake and Hambleton, (fig. 89)

10. Costal, subcostal and discoidal areas unicolorous . . . . . *flexuosa* (Stål), (Fig. 81)
10' Costal, area may have some nervures darkened; discoidal area with darkened area near apex and base . . . . . *lunulata* (Mayr), (Fig. 83)

11. Hood in lateral view with highest point anterior-most . . . . *paula* Drake, (Fig. 87)
11' Hood in lateral view with highest point near middle 12

12. Paranotum concave anterolaterally . . . . . *obliqua* Stål, (Fig 85)
12' Paranotum convex anterolaterally 13

13. Discoidal and subcostal areas unicolorous . . . . . *contubernala* Smith, (Fig 78)
13' Discoidal area with a darkened base and vertical mid section; subcostal area dark basally . . . . . *munda* (Stål), (Fig 84)

Gargaphia acmonis Drake and Hambleton

Figures 20–21, 76.

Gargaphia acmonis Drake and Hambleton 1945:366, Peru, Colombia. Drake and Ruhoff 1965:221,467, catalog, Surinam, *Hibiscus esculentus*.

Diagnosis. *G. acmonis* may be recognized by the "torpedo-shaped" hood in combination with one row of cells in the costal area opposite the basal half of the discoidal area, and two rows of cells in most of the paranotum reduced to one row behind the humeri. This species often has an abundance of wax anterior to the pronotal disk.

Comparisons. *G. acmonis* may be distinguished from *G. lunulata* by the single row of cells in the anterior costal area (*G. lunulata* has two rows), and the absence of a posterior elevation of the median carina.

Distribution. Colombia, Peru, Surinam.

Host plants. *Hibiscus esculentus* L.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood not extended to anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point anterior-most. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with one or two rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area without embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with one row of cells, opposite midlength of discoidal area also with one row of cells, widest apical to discoidal area at base of subcostal extension, there with two or three rows of cells. Subcostal area with three rows of cells. Discoidal area with three rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 20; paramere as in Fig. 21.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with four rows of cells.

Holotype. ♂, "Tingo Maria, Peru IX-10-'44, E.J. Hambleton" "Type, *Gargaphia acmonis*, D. & H." "CJ Drake, Coll. 1956" (DRAKE).

Allotype. ♀, Same data as holotype (DRAKE).

Paratypes. Same data as holotype (DRAKE 3♂); No. 1, (DRAKE 3♀); **PERU, Rio Rimac**, 193? (sic) (DRAKE 1♀); **COLOMBIA**, San Jose, XI-11−1944, E.J. Hambleton, (DRAKE 2♀).

Other material examined. Seven specimens. See Appendix C for label data.

Gargaphia brunfelsiae Monte

Figures 22−23, 77.

Gargaphia brunfelsiae Monte 1938c:64, Brazil, *Brunfelsia*. Monte 1938d:389, Argentina, *Brunfelsia hopeana*. Monte 1940c:193, Fig. Monte 1940d:295, compare *G. munda*. Drake and Hambleton 1944:127, confirmation of specimen identification. Drake and Poor 1942:301,302, compared with *G. venosa*. Singh 1953:118, list. Drake and Ruhoff 1965:223, catalog.

Gargaphia venosa Drake and Poor 1942:301−302, Argentina. Drake and Ruhoff 1965:223, catalog. **NEW SYNONYMY**.

Diagnosis. *G. brunfelsiae* may be recognized by the gently sloping elevation of the R+M vein as seen in lateral view, this elevation causes the subcostal area to widen posterior to the center of the discoidal area.

Comparisons. *G. brunfelsiae* is the most heavily pigmented species of *Gargaphia*. In comparison to *G. munda*, *G. brunfelsiae* has an overall appearance that

is more robust and more darkly pigmented, *G. brunfelsiae* is short, has three rows of cells in the paranota (*G. munda* has two rows), the hood protrudes further forward surpassing the anterior margin of the head, and the basal expansion of the hemelytron is almost as wide as the apical expansion (*G. munda* widens from base to apex).

Distribution. Argentina, Brazil, Paraguay.

Host plants. *Brunfelsia hopeana* L.; *Brunfelsia* sp.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines parallel with top of head, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae sinuate. Paranotum unicolorous, with three or more rows of cells, evenly expanded, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin smooth, portion

adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Subcostal area with three rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein equal to or higher than Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 22; paramere as in Fig. 23.

Female. Similar to male except discoidal area with six rows of cells and subcostal area with three rows of cells.

Holotype. ♂, Belo Horizonte, **BRAZIL**; (MONTE). (Not examined).

Holotype of *Gargaphia venosa*: ♂, Resistencia, Chaco, Argentina (Argentina Mus.) (Not examined).

Allotype. ♀, same data as holotype. (Not examined). Allotype of *Gargaphia venosa*: Resistencia, Chaco, Argentina (Argentina Mus.) (Not examined).

Paratypes. BRAZIL, **Minas Gerais**, Belo Horizonte, no date, O. Monte, 649. (NMNH 1♂, DRAKE 1♀); **BRAZIL**, Belo Horizonte, no date, O. Monte, (DRAKE 1♀); **BRAZIL**, Belo Horizonte, 1937, 231. (DRAKE 1♀)

Paratypes of *Gargaphia venosa*: **ARGENTINA**, Chaco, Resistencia, 10-XII-1936, J.B. Daguerre; (DRAKE 3♂).

Remarks. Identification of *G. brunfelsiae* species is based on the paratypes as well as a number of figures from the literature. Specimens of *G. venosa* and *G. brunfelsiae* cannot be clearly delimited. *G. brunfelsiae* tends to be larger than *G. venosa*, but paratypes of both species overlap within the same size range and cannot be distinguished by any other characters, therefore I am synonymizing them here.

Other material examined. 16 specimens. See Appendix C for label data.

Gargaphia contubernala Smith **NEW SPECIES**

Figures 24–25, 78.

Diagnosis. This species may be recognized by a combination of the following characters: the A-shaped outline of the hemelytra, the rectangular genital capsule of the male, four rows of cells in the discoidal area, and the ventor predominantly light fuscous.

Comparisons. *G. contubernala* may be distinguished by its dark appearance and similarities to *G. munda*, however the discoidal and costal areas are unicolorous (*G. munda* has the discoidal area darkened at the base and through the vertical midsection, and the subcostal area is darkened basally). *G. contubernala* has embrowned cells in the costal area (*G. munda* has no embrowned cells in the costal area).

Distribution. Brazil.

Host plants. Unknown.

Description Male. Head. Vertex fuscous, not shiny. Occipital spines parallel with top of head, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood surpassing anterior margin of eyes; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with three or more rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Subcostal area with five rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 24; paramere as in Fig. 25.

Female. Similar to male except discoidal area with five rows of cells and subcostal area with four rows of cells.

Holotype. ♂, "Vicosa, BRAZIL Minas Geraes 6-V-34 E.J. Hambleton" "103" "CJ Drake Coll 1956" Type deposited in the Drake Collection.

Allotype. ♀, same data as holotype. Deposited in the Drake Collection.

Paratypes. 5♂, 7♀ same data as holotype. Deposited in the Drake collection.

Remarks. Holotype, allotype and all paratypes are from the same series of specimens collected by E.J. Hambleton with an identical lot number (103.) on each pin.

Etymology. Taken from "contubernalis", Latin for companion or mate. Named for the close resemblance to *G. munda*.

Gargaphia differitas Drake

Figures 26–27, 79.

Drake 1935:19, Paraguay. Monte 1939:70, Brazil. Silva 1956:30, *Dalechampia ficifolia*. Drake and Ruhoff 1965:224, 459, catalog.

Diagnosis. *B. differitas* is easily recognized by the acute elevation in the R-M vein and the presence of long head spines.

Comparisons. In comparison to *G. flexuosa, G. differitas* has three rows of cells in the paranota (*G. flexuosa* has two rows), the base of the costal area is wider

(similar to *G. brunfelsiae*), in general the nervures are thinner than those of *G. flexuosa*, the head spines are much longer with the median spine reaching the apex of antennal I, the metasternal lamina is open behind (closed behind in *G. flexuosa*), and the hood is more compressed anterobasally than in *G. flexuosa*.

Distribution. Brazil, Paraguay.

Host plants. *Dalechampia ficifolia* L.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood surpassing anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Paranotum unicolorous, with three or more rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row

of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Subcostal area with four rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein equal to or higher than Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 26; paramere as in Fig. 27.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with three rows of cells.

Holotype. ♂, **PARAGUAY**, **S. Bernardina**; (Vienna Museum) (Not examined).

Allotype. ♀, same data as holotype. (Vienna Museum) (Not examined).

Paratypes. PARAGUAY , **San Bernardino**, no date, Fiebrig, (DRAKE 2♀).

Remarks. I examined several specimens of *G. differitas* determined by Drake. These specimens along with the paratypes were used as the basis for identification of *G. differitas*. In addition, a number of figures available in the literature and the very distinctive character of the acutely elevated R-M vein allow this species to be recognized easily.

Other material examined. 65 specimens. See Appendix C for label data.

Gargaphia ephamillosa Smith **NEW SPECIES**

Figures 28–29, 80.

Diagnosis. This species is recognized easily by the transverse carina at the apex of the bulbous hood. This character is not found in any other species of *Gargaphia (sensu lato)*.

Comparisons. *G. ephamillosa* has a closer resemblance to *Leptopharsa* species than any species of *Gargaphia (sensu stricto)*. It may be distinguished from the superficially similar species of *Leptopharsa* by the presence of the anterior transverse carinae of the metasternal laminae.

Distribution. Mexico.

Host plants. Unrecorded.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood surpassing anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height greater than that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous,

expanded greatest at or behind midpoint, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly narrower at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Not delimited by elevated veins, apical margin angular. R-M vein level with Cu. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 28; paramere as in Fig. 29.

Holotype. ♂, "Mexico: Jalisco 16 km. n. Autlan July 12−14, 1983 Kovarik, Harrison, Schaffner" Type deposited in the Drake Collection.

Allotype. ♀, same data as holotype. Deposited in the Drake Collection.

Paratypes. 15♂, 27♀ same data as holotype. 5♂, 9♀ deposited in the Drake collection; 5♂, 9♀ deposited in the USNM collection; 5♂, 9♀ deposited in the TAMU collection.

Remarks. In addition to the transverse carina at the apex of the hood, *G. ephamillosa* has widely expanded paranota and a very narrow subcostal extension.

Etymology. Taken from the Greek "ephamillos" meaning equaling, matching or rivaling. Name for the superficial resemblance to some species of *Leptopharsa*, yet with the transverse metasternal laminae characteristic of *Gargaphia* and *Astrictus*.

Gargaphia flexuosa (Stål)

Figures 30–31, 81.

Monanthia (Phyllontocheila) flexuosa Stål 1858:61 Brazil.

Monanthia (Gargaphia) flexuosa: Stål 1862:324 new subgenus.

Monanthia flexuosa: Walker 1873:192.

Gargaphia flexuosa: Stål 1873:124, redescription. Gibson 1919:200, key. Drake and Hambleton 1934:450, *Cissampelos glaberrima, Cissampelos tamoides*. Drake and Poor 1937:309, Fig. Silva 1956:30 Fig., *Aristolochia*. Drake and Ruhoff 1965:224–225, 450, 468, catalog.

Gargaphia flexulosa: Drake and Hambleton 1934:450, incorrect spelling, Menispermaceae, *Cissampelos glaberrima*, *C. tamoides*.

Diagnosis. *G. flexuosa* may be recognized by the following combination of characters: widely divercating wings with the hemelytra meeting 1/2 the distance from the apex of the subcostal extension; thickened cell margins in the suprasomatic area; three rows of cells in the paranota; and the narrow, parallel-sided discoidal area.

Comparisons. *G. flexuosa* may be distinguished from *G. differitas* by more thickened nervures, a flat R-M vein (with an acute elevation in *G. differitas*), two rows of cells in the paranota (*G. differitas* has three rows), more narrowed base of the costal area, shorter cephalic spines, and the metasternal laminae closed behind (open behind in *G. differitas*). In comparison to *G. lunulata*, *G. flexuosa* has more cells embrowned in the sutural area, whereas *G. lunulata* has more cells embrowned in the sutural area than the costal area. Also *G. flexuosa* has widely divercating hemelytra (*G. lunulata* has the outer margins of the hemelytra parallel or only slightly widening at the apex).

Distribution. Brazil, Paraguay.

Host plants. *Aristolochia sp.; Cissampelos tamoides* L. (?); *Cissampelos glaberrima* L.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood surpassing anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Paranotum

unicolorous, with three or more rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area without embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension. Subcostal area with four rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, without darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 30; paramere as in Fig. 31.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with three rows of cells.

Holotype. ♂, **BRAZIL**; (Stockholm Mus.) (Not examined).

Allotype. None designated.

Paratypes. None designated.

Remarks. I have seen several specimens determined by Drake and there are a number of figures available in the literature that facilitate identification of this species.

Other material examined. 60 specimens. See Appendix C for label data.

Gargaphia inca Monte **REVIVED STATUS**

Figures 32–33, 82.

Gargaphia inca Monte 1943a:105, Fig. Monte 1947b:232, Fig. Drake and Hambleton 1945:365, *Canavalia ensiformis*, synonymized with *Gargaphia opima*.

Diagnosis. *G. inca* has extremely long cephalic spines and a median carina with an elevation at apex of pronotal disk (often three cells deep there).

Comparisons. In addition to the diagnostic characters, *G. inca* has the paranota widest anterior to humeri, it has two transverse bands of embrowned cells on the hemelytra. It may be distinguished from *G. lunulata* by three rows of cells in the basal costal area (*G. lunulata* has two rows of cells), the more highly elevated median carina, the hood more bulbous than compressed (*G. lunulata* is more compressed), and the wings more rounded at the apex. *G. inca* may be distinguished from *G. acmonis* by three rows of cells in the costal area as compared to only one row in *G. acmonis*, hood that protrudes further anteriorly than in *G. acmonis*, the metasternal lamina is closed behind (*G. acmonis* is open behind), and the hood is more bulbous than that of *G. acmonis*.

Distribution. Peru.

Host plants. *Canavalia ensiformis* (L.) DC.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines declivent, reaching or surpassing apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood rounded, surpassing anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point anterior-most. Median carinal height greater than that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest anterior to midpoint, margin serrate. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension. Delimited by elevated veins, apical margin open. R-M vein level with Cu. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 32; paramere as in Fig. 33. Exposed posterior margi of clasper with angular projection absent.

Holotype. ♂, Satipo, **PERU**, April 1942, P. Paprzycki; (MONTE) (Not examined).

Allotype. ♀ same data as holotype. (MONTE) (Not examined).

Paratypes. Seven specimens, same data as holotype.

Remarks. This species was synonymized for no apparent reason. The figure presented in the original description clearly shows this species to be very distinct from other species of *Gargaphia*. Most notably there are three rows of cells at the apex of the median carina, unlike any other species of *Gargaphia*. The species is in the *brunfelsia* species group whereas *G. opima* is in the *nigrinervis* species group. I have not seen the holotype, but a good series of eleven specimens in the Drake collection match the figure.

Other material examined. 11 specimens. See Appendix C for label data.

Gargaphia lunulata (Mayr)

Figures 34–35, 83.

Monanthia lunulata Mayr 1865:441, Brazil. Mayr 1866:163–164, Fig. Walker 1873:193, catalog.

Gargaphia lunulata: Stål, 1873:124 redescription. Berg 1884:190, Argentina, *Passiflora caerulea*. Gibson 1919:190,200, key. Pennington 1921:20, list. Drake and Hambleton 1934:450, *Canavalia ensiformis, Phaseolus vulgaris, Hibiscus esculentus,*

Glycine max, Passiflora violacea, Ricinus communis, Pyrus communis, Gossypium arboreum, Stigmaphyllum sp., Cassia fistula, Urena lobata, Manihot utilissima, Chorisia speciosa. Drake 1935:19, Paraguay. Costa Lima 1936:127, *Canavalia ensiformis*, *Dolichos lablab, Phaseolus lunatus, Phaseolus vulgaris, Cassia imperialis, Psidium, Gossypium arboreum*, "Rosa", "mandioca". Bosq 1937:128–129, Uruguay. Monte 1937:36, 41, Fig. Monte 1938b:131, list. Monte 1938d:388, list. Drake and Poor 1938:109, Monte Video, Brazil; Cordoba, Argentina. Drake and Hambleton 1945:366, similar to *G. acmonis*. Drake 1954:77–78, compared with *G. schulzei*. Araujo Mendonca 1949:183–187, Figs. Silva 1956:32, Fig., *Rosa, Abelmoschus esculentus, Euphorbia heterophylla, Zornia diphylla, Cnidoscolus, Meibomia adscendens*. Drake and Ruhoff 1965:227, 452, 459, 464, 466, 467, 468, 469, 472, 473, catalog. Ochoa 1989:417, *Passiflora edulis* var. *flavicarpa*, 486, *Passiflora spp.* Stonedahl, Dolling and duHeaume 1992:446, *Cassia, Glycine, Phaseolus*, *Gossypium*, *Hibiscus*, *Urena*, *Euphorbia, Manihot, Ricinus*.

Gargaphia lasciva Gibson 1919:190–191, 198–199, key. Drake and Hambleton 1934:450, *G. lasciva* synonymized with *G. lunulata*. Fiuza 1946:338, 340, 341, 343, legumes. Drake and Ruhoff 1965:227, catalog.

Diagnosis. *G. lunulata* may be recognized by the following combination of characters: two rows of cells in the basal costal area and a posterior elevation of the median carina.

Comparisons. *G. lunulata* closely resembles *G. acmonis* and may be distinguished most readily by the presence of two rows of cells in the basal costal area (*G. acmonis* has only one row of cells). *G. lunulata* has a posterior elevation of the median carina, (*G. acmonis* does not). *G. lunulata* may be distinguished from *G. paula* by the median spine much longer than occipital spines (*G. paula* has the occipital and median spines of approximately equal lengths), the genital capsule of *G. lunulata* is rounded (parallel-sided in *G. paula*), the first antennal segment is darkened in *G.lunulata* (the first two antennal segments are darkened in *G. paula*). A median indention is present in the hemelytra of *G. lunulata* (the hemelytra of *G. paula* are parallel-sided). *G. lunulata* may be distinguished from *G. flexuosa* by more embrowned cells in the sutural area than costal area (*G. flexuosa* has more embrowned cells in the costal area than sutural area), the outer margins of the hemelytra are parallel or only slightly widening at the apex (*G. flexuosa* has widely divercating hemelytra.).

Distribution. Argentina, Brazil, Colombia, Paraguay, Peru, Uruguay.

Host plants. *Abelmoschus esculentus* (L.) Moench, *Canavalia ensiformis* (L.) DC, *Cassia fistula* L., *Cassia imperialis* L., *Chorisia speciosa* A.St.-Hil., *Cnidoscolus*

sp., *Dolichos lablab* L., *Euphorbia heterophylla* L., *Glycine max* (L.) Merr., *Gossypium arboreum* L., *Hibiscus esculentus* L., *Manihot utilissima* Cruntz., *Desmodium adsendens* (L.) DC, *Passiflora caerulea* L., *Passiflora edulis* var. *flavicarpa* L., *Passiflora violacea* L., *Phaseolus lunatus* L., *Phaseolus vulgaris* L., *Psidium sp.*, *Pyrus communis* L., *Ricinus communis* L., *Rosa sp.*, *Stigmaphyllon sp.*, *Urena lobata* L., *Zornia diphylla* J.F. Gmel.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood surpassing anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point anterior-most. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with one or two rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite

midlength of discoidal area with two rows of cells, widest apical to discoidal area at base of subcostal extension, there with two or three rows of cells. Subcostal area with five rows of cells. Discoidal area with three rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 34; paramere as in Fig. 35.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with four rows of cells.

Holotype. BRAZIL, Rio de Janeiro; sex and deposition of type unknown.

Allotype. None designated.

Paratypes. None designated.

Remarks. Drake and Ruhoff (1965) report that the sex and deposition of type is unknown, however there is a specimen in the Drake collection that is labeled "compared with type" this specimen was used for determination of *G. lunulata* specimens. In addition the concept of this species in the literature is stable.

Other material examined. 160 specimens. See Appendix C for label data.

Gargaphia munda (Stål)

Figures 36–37, 84.

Monanthia (Phyllontocheila) munda Stål 1858:60 Brazil.

Monanthia (Gargaphia) munda: Stål 1862:324, new subgenus.

Monanthia munda: Walker 1873:192,194.

Gargaphia munda: Stål 1873:124. Distant 1888:83, list. Gibson 1919:200, key. Pennington 1921:20, Argentina. Drake 1935:20, Rio Grande do Sul, Brazil. Drake and Hambleton 1934:450, Vicosa, *Brunfelsia, Solanum*. Drake and Hambleton 1944:127, confirmation of specimen identification. Araujo Silva 1936:7, list. Costa Lima 1836:128 *Brunfelsia, Solanum*. Bosq 1937:129, *Brunfelsia hopeana*, Buenos Aires, Chaco, Brazil. Drake and Poor 1937:310, Fig., Brazil, Peru, *Brunfelsiae, Solanum*. Drake and Poor 1938:109, list. Drake and Poor 1942:301, comparison with *G. venosa*. Monte 1940c:295 (erroneous citation due to misidentification, should be *Gargaphia munda*, see Drake and Hambleton, 1944 for explanation). Monte 1944:466, correction for 1940c paper. Drake and Ruhoff 1965:228,475, catalog.

Monanthia lineifera Walker 1873:194.

Leptostyla lineifera: Champion 1898:60. Distant 1902:356. Drake 1922:41, synonymized with *G. munda*.

Gargaphia magna Gibson 1919:194, Paraguay. Drake 1922:41. Drake and Poor 1937:310 synonymized with *G. munda*.

Gargaphia oreades Drake 1928:75, Argentina, description. Drake 1935:20, Rio Grando Sul, Brazil. Drake 1936:700. Bosq 1937:129, *Solanum nigrum*, *Solanum*

capiscastrum. Monte 1938d:388. Drake and Poor 1942:301, compared with *G. venosa*. **NEW SYNONYMY** .

Diagnosis. *G. munda* may be recognized by the following combination of characters: the embrowned cells are translucent rather than opaque; all five head spines are short; the subcostal area has four rows of cells in males and five to six rows of cells in females; the pronotum is usually shiny black.

Comparisons. *G. munda* may be distinguished from *G. brunfelsiae* by an overall appearance that is more elongate and more lightly pigmented. *G. munda* has two rows of cells in the paranota (*G. brunfelsiae* has three rows), the hood of *G. munda* does not surpass the anterior margin of the eyes (the hood of *G. brunfelsiae* surpasses the anterior margin of the head), the abdomen is often black (often reddish in *G. brunfelsiae*), and the hemelytra widen from base to apex. *G. munda* may be distinguished from *G. contubernala* by the discoidal area darkened at the base and through the vertical midsection (*G. contubernala* has the discoidal and costal areas unicolorous). *G. munda* has no embrowned cells in the costal area (*G. contubernala* has embrowned cells in the costal area). In addition, the legs of *G. munda* lighten in color toward the joints (*G. contubernala* has uniformly colored legs).

Distribution. Argentina, Brazil, Paraguay, Peru.

Host plants. *Brunfelsia hopeana* L., *Brunfelsia sp.*, *Solanum sp.*, *Solanum capsicastrum* Link ex Schauer, *Solanum nigrum*. L.

Description Male. Head. Vertex fuscous, not shiny. Occipital spines parallel with top of head, not reaching apex of median spine, not exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood not extended to anterior margin of eyes; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with one or two rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with four or more rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Subcostal area with five rows of cells. Discoidal area with six rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with

darkened area on posterior half. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 36; paramere as in Fig. 37.

Female. Similar to male except discoidal area with seven rows of cells and subcostal area with five rows of cells.

Holotype. ♀, Brazil; (Stockholm Museum) (Not examined).

Holotype of *Gargaphia magna*: "S. Bernardino, Paraguay" "K. Fiebrig, Collector" "*Gargaphia, magna* Gib., ♂ Det. E.H. Gibson" "Type, 22139, U.S.N.M." (USNM)

Holotype of *Gargaphia oreades*: "Buenos Ayres, Bellavista" "Type *Gargaphia oreades* Drake" "CJDrake, Coll. 1956". (USNM).

Allotype. None designated.

Paratypes. None designated.

Remarks. Since the holotype of *G. munda* was unavailable for examination, I based identifications on the holotype of *G. magna*, a synonym of *G. munda*. I compared the holotype of *G. magna* and the holotype of *G. oreades* and found no differences between the species, therefore I am placing them in synonymy here.

Other material examined. 185 specimens. See Appendix C for label data.

Gargaphia obliqua Stål

Figures 38–39, 85.

Gargaphia obliqua Stål 1873:124, Brazil. Drake 1931:514, compared to *G. decoris*. Drake and Hambleton 1934:450, Vicosa, Pedro Leopoldo, *Serjania*. Drake 1936:700, Argentina. Drake and Poor 1937:310, Fig., Rio Janeiro, Chapada, Vicosa, Pedro Leopoldo. Drake and Hambleton 1938b:57, compare *G. serjaniae*. Monte 1947:236. Drake and Davis 1960, Fig. Drake and Ruhoff 1965:229,474, catalog.

Gargaphia stigma Monte 1946:284–285. Monte 1947b:236, Synonymized with *G. obliqua*.

Diagnosis. *G. obliqua* may be recognized by the shape of the paranota (Fig. 85).

Comparisons. In comparison with *G. serjaniae*, *G. obliqua* is longer, a majority of the embrowned cells are located in the costal area (*G. serjanie* has no embrowned cells in the costal area), the hood is more elevated and more compressed than that of *G. serjaniae*, the hood is lower than the highest point of the median carina (hood higher than highest point of median carina in *G. serjaniae*), the metasternal lamina is closed behind (open behind in *G. serjaniae*), antennal segment III is obviously setose, and the occipital spines are short (occipital spines long in *G. serjaniae*).

Distribution. Argentina, Brazil.

Host plants. *Serjania sp.*

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood not extended to anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point near middle. Median carinal height greater than that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum darkened behind, with three or more rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Subcostal area with four rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 38; paramere as in Fig. 39.

Female. Similar to male except discoidal area with five rows of cells and subcostal area with three rows of cells.

Holotype. ♂,**BRAZIL**, Rio de Janeiro; (Stockholm Mus.) (Not examined)

Holotype of *Gargaphia stigma*: ♀, Sao Paulo; (MONTE) (Not examined).

Allotype. None designated.

Allotype of *Gargaphia stigma*: ♂, Minas Gerais, Juatuba; (MONTE) (Not examined).

Paratypes. None designated.

Remarks. A specimen in the Drake collection is labelled as follows and seems to indicate the specimen Drake used for comparisons of *G. obliqua*. "Bresil (sic), Prov. Rio Janeiro, Lagune de Sacuaresma, P. Germain, Aout. Sept. 1884" "C J Drake, Coll. 1956" "Gargaphia, oblique Stal, by Drake".

Other material examined. 181 specimens. See Appendix C for label data.

Gargaphia patria (Drake and Hambleton)

Figures 40−41, 86.

Leptopharsa patria Drake and Hambleton 1938a:58, Brazil; *Bathysa stipulata*.

Gargaphia patria: Drake 1942:1. Silva 1956:34, *Sickingia tinctoria*. Drake and Ruhoff 1965:230, 449, 473, catalog.

Leptopharsa bondari Drake and Poor 1939a:33, Brazil. **NEW SYNONYMY.**

Diagnosis. *G. patria* is the only species of *Gargaphia* with embrowned cells arranged in an inverted Y pattern in which the sutural areas overlap completely and the subcostal extensions do not divercate. It is easily distinguished from all other members of the genus by these two characters.

Comparisons. In comparison to *G. inca*, *G. patria* has much shorter cephalic spines, parallel-sided hemelytra, the first antennal segment is shorter, the bucculae are not produced anteriorly, the paranota are expanded evenly throughout, the median carina is very low, often without one row of cells distinguishable.

Distribution. Brazil.

Host plants. *Bathysa stipulata* C. Presl., *Simira tinctoria* Aubl.

Description Male. Head. Antennal segment I and II concolorous, darker than III. Vertex fuscous, not shiny. Occipital spines declivent, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood surpassing anterior margin of eyes, bulbous, convex; in lateral view, even with median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Paranotum unicolorous,

with one or two rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly narrower at their apices than at apex of posterior pronotal projection. Costal area without embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with two rows of cells, widest anterior to base of subcostal extension, there with two or three rows of cells. Subcostal area with six rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, without darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 40; paramere as in Fig. 41.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with five rows of cells.

Holotype. ♂, "Sao Paulo, BRASIL, 7 Set., 1934, E.J. Hambleton" "130." "*Leptopharsa, patria*, HOLOTYPE" "C J Drake, Coll. 1956" "*Gargaphia, patria*, Drake '65" (DRAKE).

Holotype of *Leptopharsa bondari* ♂, Bahia, **BRASIL** (DRAKE).

Allotype. ♀, "**BRASIL**, **Sao Paulo**; 7 Sept., 1934, E.J. Hambleton, 136" "Allotype *Leptopharsa patria*" (DRAKE).

Paratypes. Ponte Nova, **BRASIL**, **Minas Gerais**, April 32, 1934, E.J. Hambleton, 88; (DRAKE 17 ♂, 18 ♀).

Remarks. *Leptopharsa bondari* has an anterior transverse metasternal lamina and therefore is a member of the genus *Gargaphia*. *Leptopharsa bondari* is conspecific with *Gargaphia patria*, they are easily distinguished from other species of *Gargaphia* by having a combination of embrowned cells in the hemelytra and the sutural areas overlapping to the apex of the hemelytra.

Other material examined. 14 specimens. See Appendix C for label data.

Gargaphia paula Drake

Figures 42–43, 87.

Gargaphia paula Drake 1939:68, Canal Zone. Drake and Hambleton 1945:366, Peru. Hurd 1946:480, list. Drake and Ruhoff 1965:231, catalog.

Diagnosis. *G. paula* may be recognized by the parallel-sided hemelytra, and the milky appearance of cells in the sutural area.

Comparisons. It may be distinguished from *G. lunulata* by the occipital and median spines of approximately the same lengths (in *G. lunulata* the median spine is much longer than the occipital spines), the genital capsule is parallel-sided (rounded in *G. lunulata*), the first two antennal segments are generally darkened (only the first segment darkened in *G. lunulata*), the apex of the hemelytra is acutely rounded in *G.*

paula and more broadly rounded in *G. lunulata*, *G. paula* usually has three cells at the widest point of the costal area (*G. lunulata* usually has two cells at the widest point of the costal area).

Distribution. Brazil, Costa Rica, Ecuador, Panama (Canal Zone), Peru.

Host plants. Unrecorded.

Description Male. Head. Antennal segment I and II concolorous, darker than III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood surpassing anterior margin of eyes, strongly compressed, concave; in lateral view, even with median carina, and with highest point anterior-most. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with one or two rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly narrower at their apices than at apex of posterior pronotal projection. Costal area without embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with two rows of cells, widest apical to discoidal area at

base of subcostal extension, there with two or three rows of cells. Subcostal area with three rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, without darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 42; paramere as in Fig. 43.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with four rows of cells.

Holotype. ♂, "Panama C.Z., Baro (sic) Colorado, C J Drake 1939" "HOLOTYPE, B C.J. Drake, *Gargaphia, paula*" "CJ Drake, Coll. 1956". (DRAKE).

Allotype. None designated.

Paratypes. None designated.

Other material examined. 33 specimens. See Appendix C for label data.

Gargaphia schulzei Drake

Figures 44–45, 88.

Gargaphia schulzei Drake 1954:76–77, Paraguay. Drake and Ruhoff 1965:231, catalog.

Diagnosis. *G. schulzei* is recognized by the transverse laminae not contiguous medially and the very narrow subcostal extension. In some specimens the rostrum

extends onto the metasternum, no other species of *Gargaphia* nor *Astrictus* have the rostrum extending this far.

Comparisons. The only other species of *Gargaphia* with a narrowed subcostal extension is *G. ephamillosa* from which *G. schulzei* may easily be distinguished by the cells of the explanate area of the hemelytra greater than twice the size of cells in the suprasomatic area (*G. ephamillosa* has the cells in those two areas about the same size). Also, *G. ephamillosa* has greatly expanded paranota in comparison to this species.

Distribution. Paraguay.

Host plants. Unrecorded.

Description Male. Head. Antennal segment I and II concolorous, darker than III. Vertex fuscous, not shiny. Occipital spines obliquely elevated, reaching or surpassing apex of median spine, exceeding anterior margin of eyes. Median spine surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood surpassing anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point anterior-most. Cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with three or more rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, not meeting medially, open posteriorly.

Hemelytron. Wings slightly narrower at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with two rows of cells, there with two or three rows of cells. Subcostal area with three rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. Without darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 44; paramere as in Fig. 45.

Female. Similar to male except discoidal area with four rows of cells and subcostal area with three rows of cells.

Holotype. ♂,"Asuncion, Para, Nov. Dec. 1944, A. Schulze" "HOLOTYPE, *Gargaphia, schulzei*, ♂ Drake" "CJ Drake, Coll. 1956" (DRAKE).

Allotype. "Asuncion, Para, Nov. Dec. 1944, A. Schulze" "ALLOTYPE, *Gargaphia, schulzei*, ♀ Drake" "CJ Drake, Coll. 1956". (DRAKE).

Paratypes. 11 specimens, Asunction, **PARAGUAY**, A. Schulte. (DRAKE).

Remarks. No other specimens were available for study except the type material.

Other material examined. Specimens. See Appendix C for label data.

Gargaphia serjaniae Drake and Hambleton

Figures 46–47, 89.

Gargaphia serjaniae Drake and Hambleton 1938b:57, Fig., Brazil, *Serjania*. Drake and Hambleton 1945:365. Drake and Ruhoff 1965:231,474, catalog.

Gargaphia seorsa Drake and Hambleton 1945:365, Peru, similar to *G. serjaniae*. Drake and Ruhoff 1965:231, catalog. **NEW SYNONYMY**.

Diagnosis. *G. serjanie* may be recognized by the lateral carinae ending abruptly at the highest point of the pronotal disk. In addition, the occipital and median spines are long with the median spine extending beyond the apex of antennal segment I, and the hood constricted anteriorly.

Comparisons. *G. serjaniae* may be distinguished from *G. obliqua* by the embrowned cells in the sutural area, the subcostal extension, the lack of embrowned cells in the costal area, the hood is elevated higher than that of *G. obliqua*, and the hood is also higher than the highest point of the median carina (*G. obliqua* has the hood lower than the highest point of the median carina), the metasternal lamina is open behind (closed in *G. obliqua*), antennal segment III is not obviously setose, and the occipital spines are long, whereas the occipital spines are long in *G. obliqua*.

Distribution. Brazil, Peru.

Host plants. *Serjania sp*.

Description Male. Head. Antennal segment I darker than II or III. Vertex fuscous, shiny. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood surpassing anterior margin of eyes, strongly compressed, concave; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Paranotum unicolorous, with three or more rows of cells, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area without embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Subcostal area with four rows of cells. Discoidal area with three rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 46; paramere as in Fig. 47.

Female. Similar to male except discoidal area with three rows of cells and subcostal area with three rows of cells.

Holotype. ♂, "P. Leopolda, Braz. I-23−34" "*Gargaphia, serjamiae*, HOLOTYPE" "CJ Drake, Coll. 1956" (DRAKE).

Holotype of *G. seorsa* "Aquaytia, Peru, Sept. 6, 1944, E.J. Hambleton" "3." "Type, *Gargaphia, sesarsa*, D&H" "CJ Drake, Coll. 1956" (DRAKE).

Allotype. ♀, same data as Holotype. (DRAKE).

Paratypes. BRASIL, Sao Paulo, 9 Set. 1934, E.J. Hambleton; (DRAKE 2♂). **BRASIL, Sao Paulo**, Campinas 10-III-1936, E.J. Hambleton; (DRAKE 1♂, 2♀).

Paratypes of *G. seorsa*: **PERU, Aguaytia,** Sept. 6, 1944, E.J. Hambleton; (USNM 1♂). **PERU, Pucallpa**, Sept. 5, 1944, E.J. Hambleton; (USNM 1♂) (DRAKE 1♂, 2♀).

Remarks. The type specimens of *G. seorsa* are teneral specimens of *G. serjaniae*, otherwise the variablility found in specimens of *G. seorsa* is encompassed within the variability of specimens of *G. serjaniae*. Therefore I treat *G. seorsa* as a junior synonym of *G. serjaniae*. Type specimens of *G. serjaniae* are labelled as "*Gargaphia serjamiae*". Type specimens of *G. seorsa* are labelled as "*Gargaphia sesarsa*".

Other material examined. 30 specimens. See Appendix C for label data.

Gargaphia, nigrinervis Species Group

The following characters are shared by species of the *nigrinervis* species group, those marked with an asterisk are autapomorphies found only in this species group:

1) Subcostal extension expanded laterad of discoidal area

2) Subcostal extension nervures darkened

3) Costal area wider than sutural area

4) Wings with a deep divercation (Fig. 92)

* 5) Paranota mostly triangulate (Fig. 101)

* 6) Parallel lateral carinae

Distribution. South America

Description

Head. Eyes fuscous to black, vertex fuscous, with or without wax. Five cephalic spines of various lengths. Bucculae meeting anteriorly and produced anteroventrally. Antennal segment II shortest, III longest; antennal IV with a dense coat of short setae and scattered long setae. Apical three-fourths or more darkened. Setae visible on all antennal segments at 12x. Rostrum not extending beyond transverse metasternal lamina.

Thorax. Hood variously modified, higher than wide. Median carina bearing one row of cells, following pronotum closely, in some species the height of the cells increases on the posterior pronotal projection. Paranota variously expanded, may be angulate or broadly rounded. Metasternum with an anterior transverse lamina; without

a posterior transverse lamina. Prothorax may have a thin coat of wax dorsally. Often entire tarsus is darkened.

Hemelytron. Costal area variously expanded and often quite wide, some transverse nervures darkened. Subcostal area S-shaped, divercating widely at apex of wings. In some species the female has one extra row of cells, in other species there is no difference between males and females both often having two rows of cells. Discoidal area variously shaped; delimited by a raised carina (except *G. costalimai* which has no posterior margin). Sutural area overlapping slightly, but hemelytra with a deep divercation. Subcostal extension with embrowned nervures. Hypocosta with one row of cells. No embrowned cells present.

Key to the species of *Gargaphia, nigrinervis* Species Group

1. Discoidal area delimited posteriorly by an elevated carina 2
1' Discoidal area not delimited posteriorly by an elevated carina . . . . . *costalimai* Monte, (Fig. 92)

2. Paranota with a definite anterior margin and separate lateral margin . . . . . *crotonae* Drake and Hambleton, (Fig.93)
2' Paranota with a single anterolateral margin rather than two separate margins 3

3. Cells of median carina increasing in height on posterior pronotal projection 4
3' Cells of median carina consistent in height on posterior pronotal projection 6

4. Incurved anterior portion of metasternal laminae not meeting medially . . . . . *deceptiva* (Drake and Bruner), (Fig. 94)
4' Incurved anterior portion of metasternal laminae contiguous medially 5

5. Posterior margin of hood shallow, depth less than one-half that of anterior margin, posterior margin of discoidal area rectangular and not covered with wax . . . . . *manni* Drake and Hurd, (Fig. 98)

5' Posterior margin of hood deep, depth at least one-half that of anterior margin, posterior margin of discoidal area angular, or if rectangular, then covered with wax . . . . . *nigrinervis* Stål, (Fig 101)

6. Hood, in lateral view, with dorsal margin angled 7

6' Hood, in lateral view, with dorsal margin broadly rounded 9

7. Hemelytra bordered on all sides by regularly spaced, stiff setae (if undamaged); hemelytra A-shaped, broader posteriorly than anteriorly 8

7' Hemelytra not bordered on all sides by setae; hemelytra parallel-sided . . . . . *jucunda* Drake and Hambleton, (Fig. 97)

8. One row of cells between posterior marginal row of cells and subcostal extension; paranota angulate . . . . . *neivei* Drake and Poor, (Fig. 99)

8' Two rows of cells between posterior marginal row of cells and subcostal extension; paranota widely rounded . . . . . *paraguayensis* Drake and Poor, (Fig. 104)

9. Two rows of cells in paranota, or occasionally with a single extra cell at the lateral apex 10

9' Three or four rows of cells in paranota, if three rows, then middle row at least two or more cells long 12

10. One row of cells between posterior marginal row of cells and subcostal extension . . . . . *opima* Drake, (Fig. 103)

10' Two rows of cells between posterior marginal row of cells and subcostal extension 11

11. Metasternal laminae with a wide indentation, indentation at least one-half depth of metasternal laminae . . . . . *implicata* Drake and Hambleton, (Fig. 96)

11' Metasternal laminae with a narrow indentation, indentation one-third to one-fourth depth of metasternal laminae . . . . . *comosa* Monte, (Fig. 90)

12. Paranota with four rows of cells, broadly rounded 13

12' Paranota with three rows of cells, angulate 15

13. Three rows of cells in costal area adjacent to basal one-half of discoidal area; very dark species, venter nearly black . . . . . *sororia* Hussey, (Fig. 106)
13' Four or more rows of cells in costal area adjacent to basal one-half of discoidal area; light tan or bronze to fuscous species 14

14. Cells of paranota smaller than those at base of hemelytra; hemelytra light tan; cells irregularly placed between subcostal extension and posterior marginal row of cells; disk of pronotum lighter than anterior to disk . . . . . *decoris* Drake, (Fig. 95)
14' Cells of paranota subequal to those at base of hemelytra; hemelytra bronze colored, antennae, and legs; cells aligned in two rows between subcostal extension and posterior marginal row of cells; disk of pronotum darker than anterior to disk . . . . . *nexilis* Drake and Hambleton, (Fig. 100)

15. Antennal I and II much darker than III, nearly as dark as antennal IV; male with angulate projection on parameres . . . . . *penningtoni* Drake, (Fig. 105)
15' Antennal I, II, and III unicolorous or nearly so; antennal I, II, and III lighter than IV; male without an angulate projection on parameres 16

16. Apex of median carina located posterior to apex of pronotal disk; cells of median carina anterior to carinal apex shortened . . . . . *concursa* Drake, (Fig. 91)
16' Apex of median carina located in line with apex of pronotal disk; cells of median carina anterior to carinal apex subequal in height to those at the apex . . . . . *nociva* Drake and Hambleton, (Fig.102)

Gargaphia comosa Monte

Figures 48–49, 90.

Gargaphia comosa Monte 1941a:374, Fig., Brazil. Drake and Ruhoff 1965:223, catalog.

Diagnosis. *G. comosa* may be recognized by the median carina in which the apex is more posterior than normal, the apex of this species occurs on the posterior prontoal projection.

Comparisons. *G. comosa* is very similar to *G. implicata*, but *G. comosa* has the male genital capsule tapered posteriorly as compared to *G. implicata* in which the genital capsule is nearly parallel-sided. In addition the metasternal lamina of *G. comosa* has a more narrow indentation than *G. implicata*.

Distribution. Brazil.

Host plants. Unrecorded.

Description Male. Head. Antennal segment I and II concolorous, darker than III. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, not exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes; in lateral view, even with median carina, and with

highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with six rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 48; paramere as in Fig. 49.

Female. Similar to male except discoidal area with seven rows of cells and subcostal area with three rows of cells.

Holotype. BRAZIL, **Sao Paulo**, Cantanduva; (Museu Nacional). (Not examined).

Allotype. ♀, same data as holotype. (Museu Nacional). (Not examined).

Paratypes. Same data as holotype. (Not examined).

Remarks. Specimen identifications were based on a detailed drawing published with the original description. In addition, there is one specimen determined by Reece Sailer available for examination.

Other material examined. Five specimens. See appendix C for label data.

Gargaphia concursa Drake

Figures 50–51, 91.

Gargaphia concursa Drake 1930:25–26. Monte 1939b:69, *Croton*. Drake and Hambleton 1940:535, compare *G. concursa* var. *implicata*. Drake and Hambleton 1944:127, compare *G. implicata*. Silva 1956:30. Drake and Ruhoff 1965:223, catalog.

Gargaphia concusa: Drake 1947:2, incorrect spelling.

Diagnosis. This species may be recognized by the following combination of characters: the cells of the median carina increase in height on the posterior pronotal projection, the hood is compressed anterior to middle, and the paranota are nearly pointed at the apex. In addition, the pronotal disk is black or noticeably very dark. Females have the subcostal area oblique or nearly horizontal.

Comparisons. In comparison to *G. nigrinervis*, *G. consursa* has short head spines. For at least some portion of the subcostal area there are three rows of cells in *G. concursa* (*G. nigrinervis* consistently has two row of cells in the subcostal area).

Distribution. Brazil.

Host plants. *Croton* sp., Annonaceae.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point near middle. Median carinal height greater than that of lateral carinae, cells increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with four or more rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with five rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, without darkened area on posterior half. Sutural area

nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 50; paramere as in Fig. 51. Male, exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except discoidal area with six rows of cells and subcostal area with three rows of cells.

Holotype. ♂ "Bahia, Brazil" "Bondar, 1066" "HOLOTYPE, *Gargaphia, concursa*, Drake" "CJ Drake, Coll. 1956". (DRAKE).

Allotype. ♀, same data as holotype. (DRAKE).

Paratypes. Same data as holotype (DRAKE 1♂, 5♀) (USNM, No. 50955, 1♂).

Remarks. There is variation in the angle of the paranota from sharply angled to nearly rounded in the series of paratypes.

Other material examined. Four specimens. See Appendix C for label data.

Gargaphia costalimai Monte

Figures 52−53, 92.

Gargaphia costalimai Monte 1938b:130, Fig., (Brazil). Drake and Ruhoff 1965:223, catalog.

Diagnosis. This species is most easily recognized by the absence of a raised carina on the posterior margin of the discoidal area. The shape of the paranotum is as

in Fig. 1. In addition, the occipital spines and median spine are nearly as long as antennal segment I.

Comparisons. The cells of the hemelytra in *G. costalimai* and *G. manni* appear somewhat similar, but the two species may be distinguished by the absence of a hind margin on the discoidal area in *G. costalimai* (present in *G. manni*). In addition, cells of the median carina remain consistent in height on the posterior pronotal projection in *G. costalimai* while they increase in height in *G. manni*.

Distribution. Bolivia, Brazil, Peru.

Host plants. *Croton* sp.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes; in lateral view, even with median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with four or more rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with five rows of cells, not delimited by elevated veins, apical margin open. R-M vein level with Cu, without darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 52; paramere as in Fig. 53.

Holotype. ♂; **BRAZIL**, **Belo Horizonte**, (MONTE) (Not examined).

Allotype. Same data as holotype. (MONTE) (Not examined).

Specimens marked "**Cotype**": **BRASIL, Minas Geraes**, B. Horizonte, O. Monte, 889. (USNM No. 53501, 2♂, 3♀).

Paratypes. BRASIL, Minas Geraes, B. Horizonte, 10-XI-'37, O. Monte, 30. (DRAKE 1♀).

Remarks. The specimens marked "Cotype" were used for comparisons since the holotype was not examined. The original description indicates a holotype, an allotype and 40 paratypes all from the same locality. The cotypes have the same locality

data as the type material, it is unclean whether these specimens are part of the paratype series or represent additional specimens.

Other material examined. Seven specimens. See Appendix C for label data.

Gargaphia crotonae Drake and Hambleton

Figures 54–55, 93.

Gargaphia crotonae Drake and Hambleton 1938:66. Monte 1946:285, comparison *G. stigma*. Drake and Ruhoff 1965:224, catalog.

Diagnosis. This species may be recognized by the shape of the paranota (Fig. 93), and the metasternal laminae being closed behind.

Comparisons. In *G. crotonae* the cells in the outer row of the paranota are smaller than the basal cells of the costal area, this is in contrast to *G. costalimai* where the cells in the outer row of the paranota are larger than the basal cells of the costal area. *G. crotonae* has a raised carina delimiting the hind margin of the discoidal area (*G. costalimai* has no delimitation of the hind margin of the discoidal area).

Distribution. Brazil.

Host plants. *Croton urucurana* Michx., *Solanum* sp.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood wider than high, not extended to anterior margin of eyes, strongly compressed, concave; in lateral view, lower than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae sinuate. Paranotum darkened behind, with three or more rows of cells, evenly expanded, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, closed posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with six rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures clear. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 54; paramere as in Fig. 55; exposed posterior margin of clasper with angular projection absent.

Holotype. ♂ "Atibaia, S.Paulo, Brasil, 28-V-1936, E.J. Hambleton" "178" "*G., crotonae*, HOLOTYPE" "CJ Drake, 1956". (DRAKE).

Allotype. Same data as holotype. (Not examined).

Paratypes. BRASIL, S. Paulo, Passa Tres, 3-VIII-1939, E.J. Hamb.eton, 178. (DRAKE 1♂, 1♀).

Remarks. The original description indicates the allotype is in the Drake Collection, however I was unable to locate it.

Other material examined. Four specimens. See Appendix C for label data.

Gargaphia deceptiva (Drake and Bruner)

Figures 56–57, 94.

Gelchossa deceptiva Drake and Bruner 1924:150.

Leptopharsa deceptiva: Monte 1942:95, *Ipomea*.

Gargaphia deceptiva: Drake and Hambleton 1944:127. Hurd 1946:480, list. Drake and Ruhoff 1965:224, catalog.

Diagnosis. This species may be recognized by the metasternal laminae not meeting in the center, the rostrum is only partially interrupted. The median carina increases in height on the posterior pronotal projection. In addition, the paranotum is expanded as in Fig. 94, the apex of the subcostal extension is at the outer margin of the hemelytron, and the antennae are darker than the legs.

Comparisons. The metasternal laminae of *G. deceptiva* do not meet medially, those of *G. manni* are contiguous medially. In comparison to *G. manni*, *G. deceptiva*

has a more pointed hood (*G. manni* more obtuse angle on dorsal margin of hood), a deeper hind margin of the hood (in *G. manni* the hood and median carina meet at a level above that of the anterior margin of the hood). *G. deceptiva* usually has five rows of cells at the widest point of the paranota (*G. manni* has four rows of cells).

Distribution. Colombia, British Guiana, Trinidad, Venezuela.

Host plants. *Ipomoea* sp.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, even with median carina, and with highest point near middle. Median carinal height greater than that of lateral carinae, cells increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin smooth. Metasternal laminae with anterior ends incurved, not meeting medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row

of cells, opposite midlength of discoidal area with four or more rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin rectangular. R-M vein equal to or higher than Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 56; paramere as in Fig. 57. Male, exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except discoidal area with six rows of cells.

Holotype. ♀, "type" "Demerara R., Brit. Guiana, March 1913" "Type, *Gelchossa deceptiva*, Drake" "CJ Drake, Coll. 1956" (DRAKE).

Allotype. "Trinidad, San Fernando Hill A-798, Oct. 20, 1918, H. Morrison" "C.J. Drake Coll. 1956". (DRAKE).

Paratypes. Same data as holotype (DRAKE 2♀). Same data as allotype (DRAKE 1♂, 4♀) (USNM No. 27298, 5♂, 2♀). **COLOMBIA, Rio Frio**, April 2, 1926 (AMNH 1♀). **TRINIDAD ISL.**, Sept. '02, (DRAKE 1♂). **TRINIDAD, B.W.I.A**, Oct. 27–29, 1938, C. Drake (DRAKE 1♂). **COLOMBIA, Rio Frio,** April 2, 1926, (DRAKE 2♀).

Remarks. The last two localities listed as paratypes represent specimens labeled "*Gargaphia disparis*" by Drake, however, this names was not published. These specimens are conspecific with *G. deceptiva*.

Other material examined. 19 specimens. See Appendix C for label data.

Gargaphia decoris Drake

Figures 58–59, 95.

Gargaphia decoris Drake 1931:514. Drake and Hambleton 1938a:66, comparison to *G. crotonae*. Drake and Poor 1939b:98, Argentina. Monte 1939:69. Monte 1940a:376. Drake and Ruhoff 1965:224, catalog.

Gargaphia decorie: Monte 1938b:131 incorrect spelling.

Diagnosis. This species is recognized by a broadly rounded paranota in which the cells are smaller than those at the base of the hemelytra.

Comparisons. In comparison, *G. nexilis* has cells of the paranota the same size as those at the base of the hemelytra. *G. decoris* has few nervures that are darkened in the costal area of the hemelytra. In addition the female has three rows of cells in the subcostal area in comparison to the female of *G. nexilis* which has two rows of cells in the subcostal area.

Distribution. Argentina, Brazil.

Host plants. *Croton urucurana* Michx., *Solanum* sp. (probably "*auricalatum*").

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point near middle. Median carinal height greater than that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with four or more rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures

embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 58; paramere as in Fig. 59.

Female. Similar to male except discoidal area with five rows of cells and subcostal area with three rows of cells.

Holotype. ♂, **BRAZIL, Minas Gerais**, B. Horizonte (Cornell Univ.) (Not examined).

Allotype. ♀, "Bello Horizonte, M. Geraes, BRAZIL, 1−6 Nov. '19, Cornell University Expedit." "Allotype *Gargaphia decoris*" "C.J. Drake Coll. 1956". (DRAKE).

Paratypes. Same data as allotype (DRAKE 3♂, 4♀) (USNM No. 52248, 1♂).

Remarks. The allotype was used for identification of specimens since the holotype was not examined.

Other material examined. 154 specimens. See Appendix C for label data.

Gargaphia dissortis Drake

Figures 109.

Gargaphia dissortis Drake 1930a:3. Monte 1942:94. Drake and Ruhoff 1965:224, catalog.

Diagnosis. *G. dissortis* may be recognized by the abundant setae on the pronotum and the cells in the explanate portion of the hemelytra are subequal to those of the suprasomatic area.

Comparisons. *G. dissortis* has an extra cell at the widest point of the paranotum so that it has three rows of cells at widest (*G. opima* has two rows of cells throughout the paranotum). In *G. dissortis*, the hood projects to the anterior margin of the eyes (in *G. opima* the hood does not reach the anterior margin of the eyes).

Distribution. Argentina, Brazil.

Host plants. Unrecorded.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, not extended to anterior margin of eyes, bulbous, convex; in lateral view, even with median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly narrower at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with six rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. With so few specimens availabe for examination, I did not remove the male genitalia for illustrating. Male, exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except subcostal area with three rows of cells.

Holotype. ♂, **BRAZIL, Chapada**; (AMNH) (Not examined).

Allotype. ♀, same data as holotype. (Not examined).

Paratypes. BRAZIL, Corumba, Highland, March (USNM 1♂, 1♀) (DRAKE 1♂, 1♀).

Remarks. The paratypes were used for comparison of specimens since the holotype was available for examination.

Other material examined. One specimen. See Appendix C for label data.

Gargaphia implicata Drake and Hambleton

Figures 60–61.

Gargaphia concursa var. *implicata* Drake and Hambleton 1940:535. Drake and Hambleton 1944:127, elevated to species status.

Gargaphia implicata: Drake and Ruhoff 1965:225–226, catalog.

Diagnosis. This species is recognized by the two rows of cells in the paranota, occasionally with one extra cell at the lateral apex, and by the metasternal laminae with a wide indentation. The female has three rows of cells in the subcostal area for at least a small section. In addition there are two rows of cells between the subcostal extension and the posterior marginal row of cells.

Comparisons. In comparison to *G. opima*, *G. implicata* has longer head speines and a more bulbous hood (*G. opima* has the hood constricted posteriorly). The setae on the pronotum of *G. implicata* are about twice the length of setae on the pronotum of *G. opima*.

Distribution. Brazil.

Host plants. Unknown.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood wider than high, surpassing anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with one or two rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 60; paramere as in Fig. 61. Male, exposed posterior margin of clasper with angular projection absent.

Holotype. ♂, "Vicosa, BRAZIL, Minas Geraes, 21−4-'34, E.J. Hambleton" "HOLOTYPE, *Gargaphia, concursa, implicata*, D & H" "95." "CJ Drake, Coll. 1956" "implicata, Drake 65". (DRAKE).

Allotype. Same data as holotype. (DRAKE).

Paratypes. BRAZIL, Minas Geraes, Vicosa 21-IV-'34, E.J. Hambleton, 95. (DRAKE 6♂, 14♀).

Remarks. The holotype is filed under *Gargaphia concursa implicata* Drake and Hambleton 1940 in the Drake collection, holotype cabinet.

Other material examined. 24 specimens. See Appendix C for label data.

Gargaphia jucunda Drake and Hambleton

Figures 97.

Gargaphia jucunda Drake and Hambleton 1942:80−81. Hurd 1946:480, list. Drake and Ruhoff 1965:226, catalog.

Diagnosis. *G. jucunda* had an angulate apex on the hood and median carina, the discoidal area is unicolorous, and the occipital spines are short and hidden by the hood. This species has three rows of cells in the paranota, and two rows of cells between the subcostal extension and the posterior marginal row of cells.

Comparisons. The occipital spines of this species are hidden beneath the hood, in contrast with *G. sororia* where the head spines are long and exposed. *G. jucunda* has three rows of cell in the paranota (*G. sororia* has four rows of cells). In addition *G. jucunda* has a very light color except for the darkened nervures (*G. sororia* is a darker color).

Distribution. Panama.

Host plants. Unrecorded.

Description Male. Head. Vertex fuscous. Occipital spines declivent, not reaching apex of median spine, not exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, even with median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Costal area with embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite

midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with two or three rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, without darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. This species is known from only one specimen, the holotype, so the genital capsule is not figured. Male, exposed posterior margin of clasper with angular projection absent.

Holotype. ♂, "Panama City, Pan, February 1939, Carl J. Drake" "*Gargaphia, jucunda*, ALLOTYPE" "CJ Drake, Coll. 1956" (DRAKE).

Allotype. None designated.

Paratypes. None designated.

Remarks. The holotype for *G. jucunda* is listed in Drake and Hambleton's descriptions as a male. In the Drake type collection where the specimen should be I found a pin with the label "see type collection", but no specimen. The specimen labeled "allotype" was found in the Drake collection, but it is a male. I believe that this specimen is actually the holotype, but was mislabeled as the allotype. The original description does not mention an allotype and does not indicate any variation among

the species so that *G. jucunda* appears to have been described by a single specimen. The label data for the holotype as recorded above is taken from the specimen labelled "allotype".

Gargaphia manni Drake and Hurd

Figures 62–63, 98.

Gargaphia manni Drake and Hurd 1945:130–132. Drake and Ruhoff 1965:227, catalog.

Diagnosis. This species is recognized by the following combination of characters: the posterior margin of the discoidal area is rectangular or straight as in Fig. 98, not angled; the median carina increases in height on the posterior pronotal projection; antennal segment III fades in color from base to apex.

Comparisons. In comparison to *G. deceptiva*, *G. manni* has a shallow hood in which the margin of the hood posterior to the apex is only 1/2 as deep as the margin anterior to the apex.

Distribution. Bolivia, El Salvador.

Host plants. Unrecorded.

Description Male. Head. Vertex fuscous. Occipital spines parallel with top of head, not reaching apex of median spine, not exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, not extended to anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point near middle. Median carinal height greater than that of lateral carinae, cells increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with four or more rows of cells, widest anterior to base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin rectangular. R-M vein level with Cu, without darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 62; paramere as in fig 63. Exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except discoidal area with five rows of cells and subcostal area with four rows of cells.

Holotype. ♂, "Wuachi, Bolivia" "W.M. Mann, Collector" "Mulford, Biol Expl. 1921−22" "Type *Gargaphia, manni*, Drake" "Type No., 57236, U.S.N.M." (USNM).

Allotype. ♀, same data as holotype. (USNM).

Paratypes. BOLIVIA, Wuachi, Mulford Biol. Exp. 1921−22, W. Mann (USNM No. 37236, 7♂, 7♀) (DRAKE 3♂, 2♀).

Other material examined. One specimen. See Appendix C for label data.

Gargaphia neivai Drake and Poor

Figures 64−65, 99.

Gargaphia neivai Drake and Poor 1940:227−228. Drake and Hambleton 1940:536, comparison with *G. nociva*. Drake and Hambleton 1945:365, Eduador. Drake and Ruhoff 1965:228, catalog.

Gargaphia valeriori Drake 1941:144. Hurd 1946:480, list. Drake and Ruhoff 1965:234, catalog. **NEW SYNONYMY** .

Diagnosis. This species is recognized by a combination of setose, angulate paranota; an angulate dorsal margin of the hood; setae surrounding the margin of the

hemelytra; long setae attached to nervures of the discoidal area and one row of cells between the subcostal extension and posterior marginal row of cells.

Comparisons. In comparison to *G. paraguayensis*, *G. neivai* has uniform cells in a single row between the subcostal extension and posterior margin row of cells (*G. paraguayensis* has a scattered pattern of cells in this same area). *G. neivai* has four rows of cells in the paranota (*G. paraguayensis* has six rows of cells in the paranota).

Distribution. Costa Rica, Ecuador, Paraguay.

Host plants. Unrecorded.

Description Male. Head. Not shiny. Occipital spines parallel with top of head, not reaching apex of median spine, not exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, not extended to anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin rectangular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 64; paramere as in Fig. 65. Exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except discoidal area with five rows of cells.

Holotype. ♂, "Paraguay, Horqueta, 1938, Alberto Schulze" "*Gargaphia neivai*, Drake & Poor, HOLOTYPE" "CJ Drake, Coll. 1956". (DRAKE).

Holotype of *Gargaphia valeriori*: ♂, "LaGloria, Costa Rica, alt. 900m: "M. Valerio, coll. CII-31" "HOLOTYPE By C.J. Drake, *Gargaphia valderioi*" "*Gargaphia valderioi* Drake" "type No. 55138 U.S.N.M.". (USNM).

Allotype. ♀, same data as holotype. (DRAKE).

Allotype of *Gargaphia valeriori*: ♀, same data as holotype. (USNM No. 55138).

Paratypes. PARAGUAY, Horqueta, 1938, A. Schulze (USNM No. 56423, 1♀) (USNM No. 55135, 1♂) (DRAKE 5♂, 4♀).

Paratype of *Gargaphia valeriori*: same data as allotype (DRAKE 1♀).

Remarks. The variation within the paratype of *G. neivai* and *G. valeriori* overlap each other, therefore I am placing them in synonymy here. The type material for *G. valeriori* is labeled as "*G. valderioi*" which was apparently changed before publication.

Other material examined. 14 specimens. See Appendix C for label data.

Gargaphia nexilis Drake and Hambleton

Figures 66–67, 100.

Gargaphia nexilis Drake and Hambleton 1940:537. Drake and Ruhoff 1965:228, catalog.

Diagnosis. This species is recognized by the short, nublike head spines in which the occipital spines are obscured by the hood and the median spine is shorter than the width of antennal segment I, and bronze colored antennae and legs. The pronotum is quite dark, but may have a thin coat of wax on it. Both males and females have two rows of cells in the subcostal area.

Comparisons. The cells in the paranota are approximately the same size as those at the base of the hemelytra, this is in contrast to *G. decoris* whose paranotal cells are smaller than those at the base of the hemelytra.

Distribution. Brazil.

Host plants. Unrecorded.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum darkened behind, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly narrower at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with four or more rows of cells, widest apical to discoidal

area at base of subcostal extension, there with four or more rows of cells. Discoidal area with five rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 66; paramere as in Fig. 67.

Female. Similar to male except discoidal area with seven rows of cells.

Holotype. ♀, "Campinas, Sao, Paulo, BRASIL, 10-XI-1936, E.J. Hambleton" "210" "*Gargaphia, nexilis*, HOLOTYPE" "CJ Drake Coll. 1956". (DRAKE).

Allotype. ♂, same data as holotype. (DRAKE).

Paratypes. Same data as holotype. (DRAKE 3♂, 4♀).

Other material examined. Six specimens. See Appendix C for label data.

Gargaphia nigrinervis Stål

Figures 68–69, 101.

Gargaphia nigrinervis Stål 1873:125. Berg 1879:43, comparison to *G. subpilosa*. Heidemann 1899:302, comparison to *G. angulata*. Osborn and Drake 1915b:536, Guatemala. Drake and Bruner 1924:144–154, similar to *Gelchossa deceptiva*. Drake 1926:378, list. Drake 1932:100. Monte 1940:302,305, *Solanum*. Drake and Hambleton 1944:127. Drake and Hambleton 1945:365. Drake and Hurd

1945:131, compare *G. manni*. Hurd 1946:480, list. Drake and Cobben 1960:87−88, Fig. Froeschner 1972:59, compare *G. sanchezi*. Drake and Ruhoff 1965:228, catalog.

Diagnosis. *G. nigrinervis* has antennal segments I, II and basal one-third of segment III unicolorous, anterior 2/3 of segment III fades to very light (about the same color as the tibiae). The lateral apex of the paranotum is pointed and many specimens have the outer margins of the paranotum and hemelytron darkened.

Comparisons. The metasternal laminae have a deeper indentation than *G. concursa* or *G. penningtoni*. *G. nigrinervis* has the wings strongly diverging and has two rows of cells between the subcostal extension and posterior marginal row of cells.

Distribution. Colombia, Guatemala, Netherlands Antilles (Aruba; Curacao; Bonaire), Panama, Peru, Venezuela.

Host plants. *Jatropha urens* L., *Solanum* sp.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood wider than high, surpassing anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells increasing in height on posterior pronotal projection. Lateral

carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin rectangular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 68; paramere as in Fig. 69. Male, exposed posterior margin of clasper with angular projection absent.

Holotype. ♂, **COLOMBIA**, **Bogota**; (Stockholm Museum) (Not examined).

Allotype. None designated.

Paratypes. None designated.

Remarks. There are several specimens determined by Drake for comparisons of this specimen. Also there are several figures available for reference.

Other material examined. 111 specimens examined. See Appendix C for label data.

Gargaphia nociva Drake and Hambleton

Figures 102.

Gargaphia nociva Drake and Hambleton 1940:536. Drake and Ruhoff 1965:229, catalog.

Diagnosis. *G. nociva* is recognized by the following combination of characters: the occipital and median spines are long, there are three rows of cells in the paranota, females have two rows of cells in the subcostal area, there are two rows of cells between the subcostal extension and posterior marginal row of cells.

Comparisons. The male genital capsule is similar to that of *G. implicata*, but the metasternal laminae do not have a wide indentation as in *G. implicata*. Two rows of cells in the subcostal area of the female contrasts with three rows in the female of *G. comosa*.

Distribution. Brazil.

Host plants. Unrecorded.

Description Male. Head. Antennal segment I and II concolorous, darker than III. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median

spine, exceeding anterior margin of eyes. Median spine surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures clear. Sutural area cells not attaining two times size of costal area cells.

Genitalia. With only two males specimens available for examination, the male genital capsule was not removed for illustration.

Female. Similar to male except discoidal area with five rows of cells.

Holotype. ♂, "Vicosa, Brazil, Minas, Geraes, 23-IV-33, E.J. Hambleton" "18." "HOLOTYPE, *Gargaphia, novica*, D & H" "CJ Drake, Coll. 1956". (DRAKE).

Allotype. ♀, same data as holotype (DRAKE).

Paratypes. Same data as holotype. (DRAKE 1♂, 3♀).

Remarks. The holotpye, allotype and paratypes are labelled "*novica*" rather than "*nociva*".

Gargaphia opima Drake

Figures 70−71, 103.

Gargaphia opima Drake 1931:513−514. Drake and Hambleton 1945:365, synonymized *Gargaphia inca*. Drake and Ruhoff 1965:229, catalog.

Gargaphia inca Monte 1943a:105−106.

Diagnosis. *G. opima* has two rows of cells throughout the paranota. The male genital capsule possesses two laterally raised pyramid-like structures on the dorsal surface. This species has one row of cells between the subcostal extension and the posterior marginal row of cells.

Comparisons. *G. opima* has a narrow and shallow indentation of the metasternal laminae as compared to *G. implicata*'s wide indentation.

Host plants. *Canavalia ensiformis* (L.) DC.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, not extended to anterior margin of eyes, bulbous, convex; in lateral view, lower than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral carinae not sinuate. Paranotum unicolorous, evenly expanded, margin smooth. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells two times size of costal area cells.

Genitalia. Male genital capsule as in fig 70; paramere as in Fig. 71. Male, exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except discoidal area with five rows of cells and subcostal area with three rows of cells.

Holotype. ♂, **PERU, Cam. del Pichis**, Miriatiriani, (Cornell Univ.) (Not examined).

Allotype. ♀, same data as holotype. (Not examined).

Paratypes. Same data as holotype. (DRAKE 1♂, 1♀).

Remarks. The paratypes were used for specimen identification.

Other material examined. 13 specimens. See Appendix C for label data.

Gargaphia paraguayensis Drake and Poor

Figures 72−73, 104.

Gargaphia paraguayensis Drake and Poor 1940a:229−230. Zikan and Wygodzinsky 1948:18. Drake and Ruhoff 1965:230, catalog.

Diagnosis. This species may be recognized by setose margins of the hemelytra; broadly expanded, setose paranota (as in Fig. 104); setose rostral laminae and ventral abdominal segments; setose antennae appearing nearly spinose.

Comparisons. *G. paraguayensis* has six rows of cell in the paranota (*G. neivai* has four). *G. paraguayensis* has a scattered pattern of cells between the subcostal extension and the posterior marginal row of cells in comparison to *G. neivai* in which the cell are uniform and in a single row.

Distribution. Paraguay.

Host plants. Unrecorded.

Description Male. Head. I short. Vertex fuscous. Occipital spines parallel with top of head, not reaching apex of median spine, not exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with one row of cells ventrally. Hood higher than wide, not extended to anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. With three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with four rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area

nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsule as in Fig. 72; paramere as in Fig. 73. Male, exposed posterior margin of clasper with angular projection absent.

Female. Similar to male except discoidal area with five rows of cells and subcostal area with three rows of cells.

Holotype. ♂, "Paraguay, Horgueta, 1938, Alberto Schulze" *Gargaphia, paraguayensis*, Drake & Poor, HOLOTYPE" "CJ Drake, Coll. 1956" (DRAKE).

Allotype. ♀, same data as holotype. (DRAKE).

Paratypes. Same data as holotype (DRAKE 12♂, 8♀) (USNM No. 55137, 2♂, 2♀) (USNM No. 58623 1♀).

Other material examined. See Appendix C for label data.

Gargaphia penningtoni Drake

Figures 74–75, 105.

Gargaphia penningtoni Drake 1928b:74–76. Drake and Hambleton 1934:450, *Sida acuta ?, Abutilium* sp, *Acalypha* sp. Bosq 1937:129, list. Drake and Poor 1939b:98, Argentina. Drake and Ruhoff 1965:231, catalog.

Gargaphia sanchezi Froeschner 1972:59–60. **NEW SYNONYMY**.

Diagnosis. The most easily recognized character in this species is the angulate projection on the male paramere (Fig. 75). In addition, antennal segments I and II are darker than III. Males have two rows of cells in the subcostal area, females have three rows of cells. There are three to four rows of cells in the paranotum.

Comparisons. In comparison to *G. manni*, *G. penningtoni* has three rows of cells in the paranota (*G. manni* has four), and the cells of the median carina rematin consistent in height on the posterior pronotal projection (in *G. manni* the cells increase in height).

Distribution. Argentina, Brazil, Paraguay.

Host plants. *Abutilum sp.*, *Acalypha*, *Cajanus indicus* (L.) Millsp., *Croton lobatus* L., *Phaseolus* sp., *Sida acuta* Burm., *Sida sp.*, *Wissadula sp.*.

Description Male. Head. Antennal segment I and II concolorous, darker than III. Vertex fuscous. Occipital spines obliquely elevated, reaching or surpassing apex of median spine, exceeding anterior margin of eyes. Median spine surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, higher than median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Lateral

carinae not sinuate. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Wings slightly wider at their apices than at apex of posterior pronotal projection. Costal area with embrowned nervures, margin with spines or raised setal bases, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with six rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. Male genital capsules as in Fig. 74; paramere as in Fig. 75., exposed posterior margin of clasper with angular projection present.

Female. Similar to male except discoidal area with six rows of cells.

Holotype. ♂, "B. Aries" "HOLOTYPE, *Gargaphia, penningtoni*, Drake" "CJ Drake, Coll. 1956". (DRAKE).

Holotype for *Gargaphia sanchezi*: "COLOMBIA Bello, Ant., Aug. 17, 1970, G. Sanchez G." "from beans" "HOLOTYPE, *Gargaphia sanchezi* Froeschner" (USNM).

Allotype. ♀, same data as holotype. (DRAKE).

Allotype for *Gargaphia sanchezi*: None designated.

Paratypes. Same data as holotype (DRAKE 2♀). **ARGENTINA, Buenos Aires**, 190-, C. Bruch (DRAKE 2♂, 2♀).

Paratypes of *G. sanchezi*: **COLOMBIA, Bello Antioquia**, Aug 17, 1970, G. Sanchez (USNM 1♂, 9♀).

Remarks. The angulate paramers of the males occur in no other species of *Gargaphia*. Because of this characteristic and the overlap of the paratypes of these two species, I am placing them in synonymy here.

Other material examined. 129 specimens. See Appendix C for label data.

Gargaphia sororia Hussey

Figures 107.

Gargaphia sororia Hussey 1957:175–176. Drake and Ruhoff 1965:232, catalog.

Diagnosis. This is the darkest species of the *G. nigrinervis* species group. The abdomen and venter are nearly black, nervures of the hemelytron and pronotum are

dark. There is an identifiable highest point on the median carina and there are four rows of cells in the paranota.

Comparisons. The head spines of this species are longer than those of *G. jucunda* which are hidden beneath the hood. There are four rows of cell in the paranota as compared with three rows in *G. jucunda*. The coloration of *G. sororia* is dark as compared to the light coloration of *G. jucunda*.

Distribution. United States (Florida).

Host plants. Unrecorded.

Description Male. Head. Vertex fuscous. Occipital spines obliquely elevated, not reaching apex of median spine, exceeding anterior margin of eyes. Median spine not surpassing apex of antennal segment I.

Thorax. Collar with two rows of cells ventrally. Hood higher than wide, surpassing anterior margin of eyes, bulbous, convex; in lateral view, even with median carina, and with highest point near middle. Median carinal height subequal to that of lateral carinae, cells not increasing in height on posterior pronotal projection. Paranotum unicolorous, with three or more rows of cells, expanded greatest at or behind midpoint, margin with hairs. Metasternal laminae with anterior ends incurved, contiguous medially, open posteriorly.

Hemelytron. Costal area with embrowned nervures, margin smooth, portion adjacent to anterior half of discoidal area with more than one row of cells, opposite midlength of discoidal area with three rows of cells, widest apical to discoidal area at base of subcostal extension, there with four or more rows of cells. Discoidal area with five rows of cells, delimited by elevated veins, apical margin angular. R-M vein level with Cu, with darkened area on posterior half. Sutural area nervures embrowned with an inverted Y pattern. Sutural area cells not attaining two times size of costal area cells.

Genitalia. There was only one male specimen available for examinations, therefore I did not remove the genitalia for illustration. Male, exposed posterior margin of clasper with angular projection absent.

Holotype. UNITED STATES, Florida, Gadsden County; Florida Univ. (Not examined).

Allotype. None designated.

Paratypes. Same data as holotype, (FSCA 1♂).

Remarks. This specimen is described from only two specimens, both males. A single paratype was the only specimen I saw and I found no other specimens which were conspecific with it.

CONCLUSIONS

Prior to this work, the presence of an anterior transverse metasternal lamina was the determining factor for placing species in the genus *Gargaphia (sensu lato)*. In my classification those species with an anterior transverse metasternal lamina that also have the subcostal area and extension straight or nearly so are now placed in the new genus *Astrictus*. In addition to the two characters listed, several other autapomorphies tie this genus together. Moreover, the majority of the species of *Astrictus* are found in North America. *Gargaphia* as redefined here includes those species previously in the genus that have the combination of an anterior transverse metasternal laminae and an S-shaped subcostal area and subcostal extension.

Because the elaborate ornamentations of Tingidae are not adequately described with words alone, illustrations are necessary to grasp the full meaning of descriptive terms. This study encompassed a series of experiments to determine the most favorable conditions for illustrating Tingidae. The eight separate methods of photographing or otherwise illustrating lacebugs proved that each had its limitations and problems due to the difficult nature of the subject. Environmental Scanning Electron Microscopy proved suitable for illustrating portions of the insect, but even the lowest magnification required a series of eight shots which were later compiled into one image through software applications. As memory capacities increase and high resolution printers become more affordable, this might prove to be the best method in the future. With those limitations in mind, microphotography was found to be the

most suitable current method, though it is not without its limitations. The techniques that work well for the explanate portions of the hemelytra are not suitable for the suprasomatic area. The transparent hemelytra of the lacebugs in contrast to the translucent body cause one to compromise the ideal photograph.

Another technique that worked quite well for me was color photographs of the insects that allowed general comparison and sorting of species without the mental comparisons necessary due to the slow transition of physically placing each specimen under the microscope. This technique also allowed me to try numerous groupings of the species and visually compare characters of the hemelytra across the entire genus.

Use of DELTA for descriptions proved to have many advantages, however I think it is best used when character systems are previously worked out rather than in an initial investigation into a group.

Initially the genitalia were thought to be quite promising for differentiating between species, but this did not turn out to be the case. Very delicate techniques are necessary for dissecting the genitalia and inflation does not occur by osmosis. I was able to successfully inflate the aedeagus, but was unable to keep it inflated long enough to illustrate the structures. After a series of different techniques to keep the aedeagus inflated, I finally found that immersing the structure in warm gelatin immediately after inflation and then quickly cooking the gelatin worked quite well. The membranes stayed inflated as supported by the congealed gelatin for weeks at a time and colored gelatin helps to make the membranes more visible. If placed in a depression slide, the

structure can later be placed on a compound microscope where the gelatin quickly liquifies under the heat of illumination, thus illustration is once again a problem. I was able to examine several exemplars from each of the species groups of *Gargaphia* and from *Astrictus* and found that internal genital structures did not provide additional characters for species group relationships. Some species are distinguishable by internal genitalia, but the species distinctions are much easier seen by external characters that are more generally available to investigators.

Based on the phylogenetic analysis, *Gargaphia* was separated into three species groups: *G. brunfelsiae, G. nigrinervis* and *G. patricia*. I believe that with further investigation these species groups will prove to be genera. The distribution of species in the three groups of *Gargaphia* and *Astrictus* indicates that these phylogenetic relationships may reflect some underlying biogeographic history. The *brunfelsiae* and *nigrinervis* species groups are found in South America, the *patricia* species group is found in North, Central, and South America, and *Astrictus* is found in North America. This suggest that the *brunfelsiae* and *nigrinervis* species groups originated in South America, with the *patricia* group providing the transition to North America where *Astrictus* has flourished. Further investigation will determine if this pattern encompasses *Leptopharsa* as well.

This progress into the phylogenetic relationships within the family will proceed slowly because of the lack of previous investigations and papers consolidating information on genera. The great majority of work in Tingidae has been descriptive

only and species descriptions are scattered throughout the literature without subsequent review and production of keys. Since phylogenetic methods have not previously been applied within Tingidae, the initial challenge was to identify character systems suitable for such studies. This initial investigation of Tingidae has established a framework from which to further pursue the phylogenetic relationships of members of the family.

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APPENDIX A

FIGURES

Fig. 1. (a). Morphological features

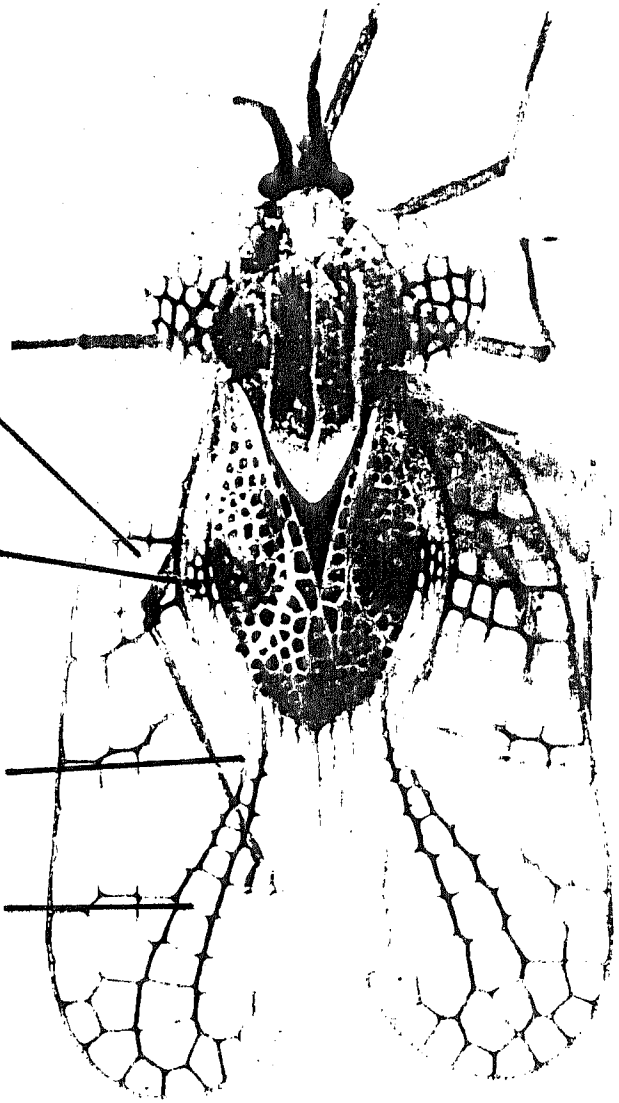


Fig. 1. (b). Morphological features

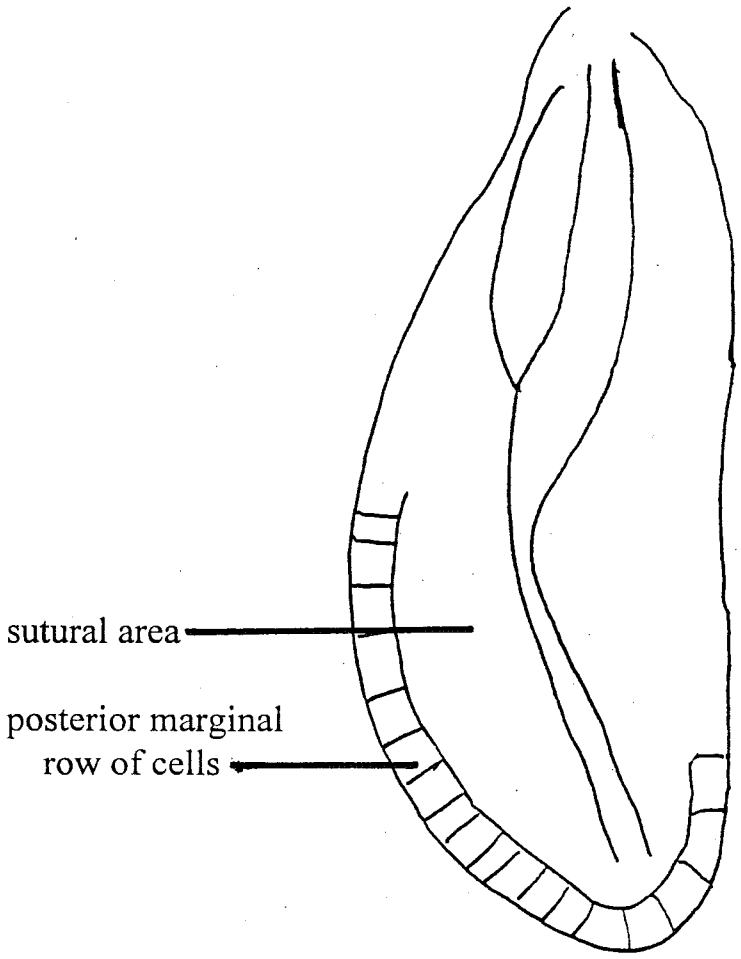
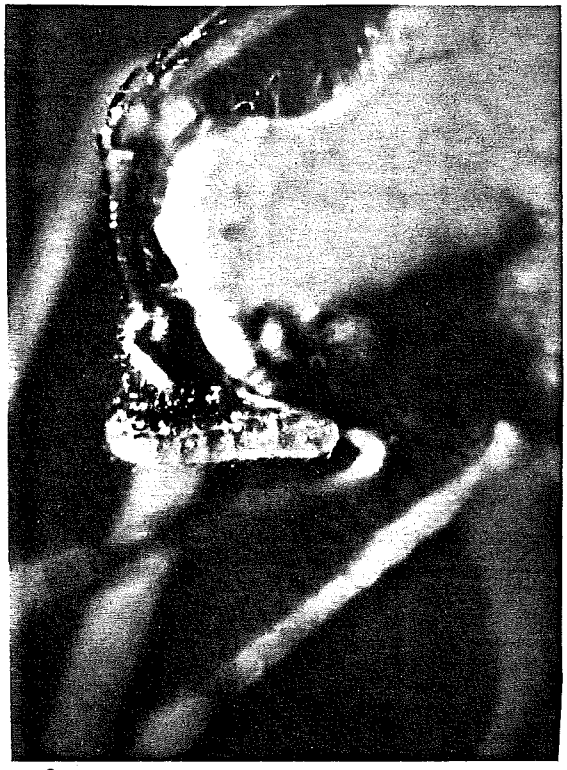


Fig. 2. Morphological features of sutural area.



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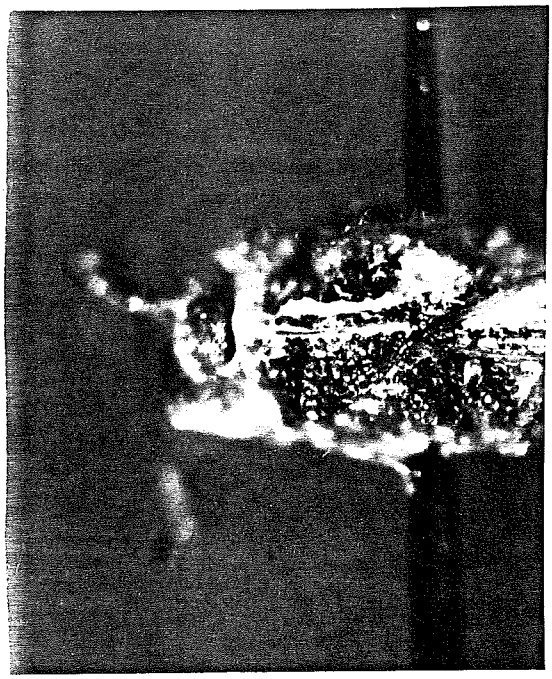

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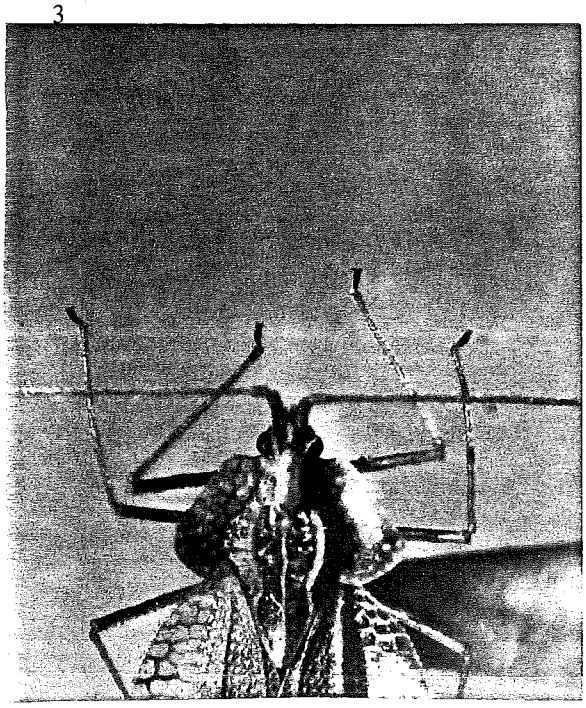

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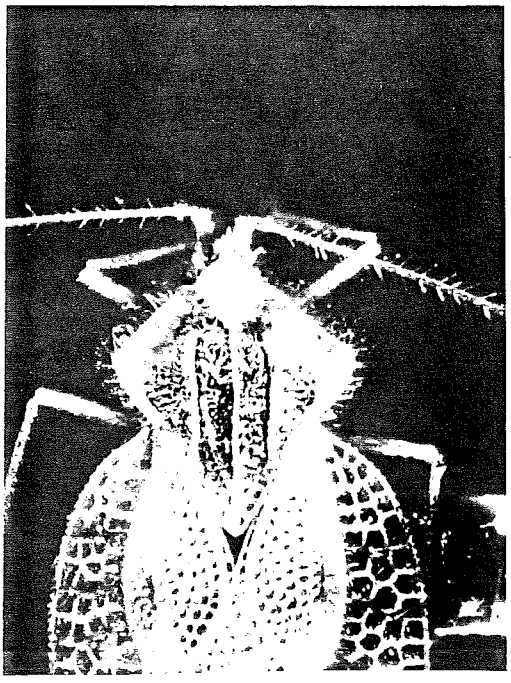

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Fig. 3. Bucculae projecting forward. **4.** Bucculae not projecting forward. **5.** Hood not extending beyond anterior margin of head. **6.** Hood extending beyond anterior margin of head.

7

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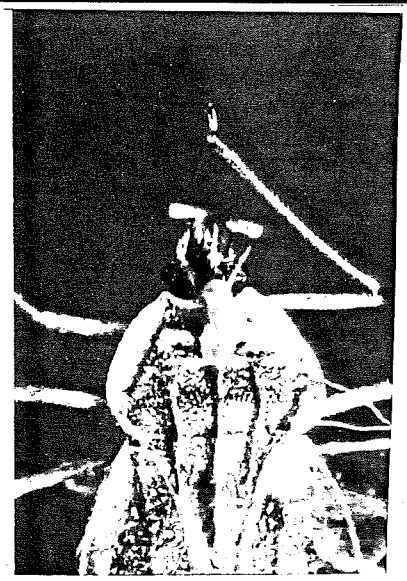

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Fig. 7. Highest point of hood anterior-most. **8.** Highest point of hood median. **9.** Hood concave laterally. **10.** Hood bulbous, not concave.

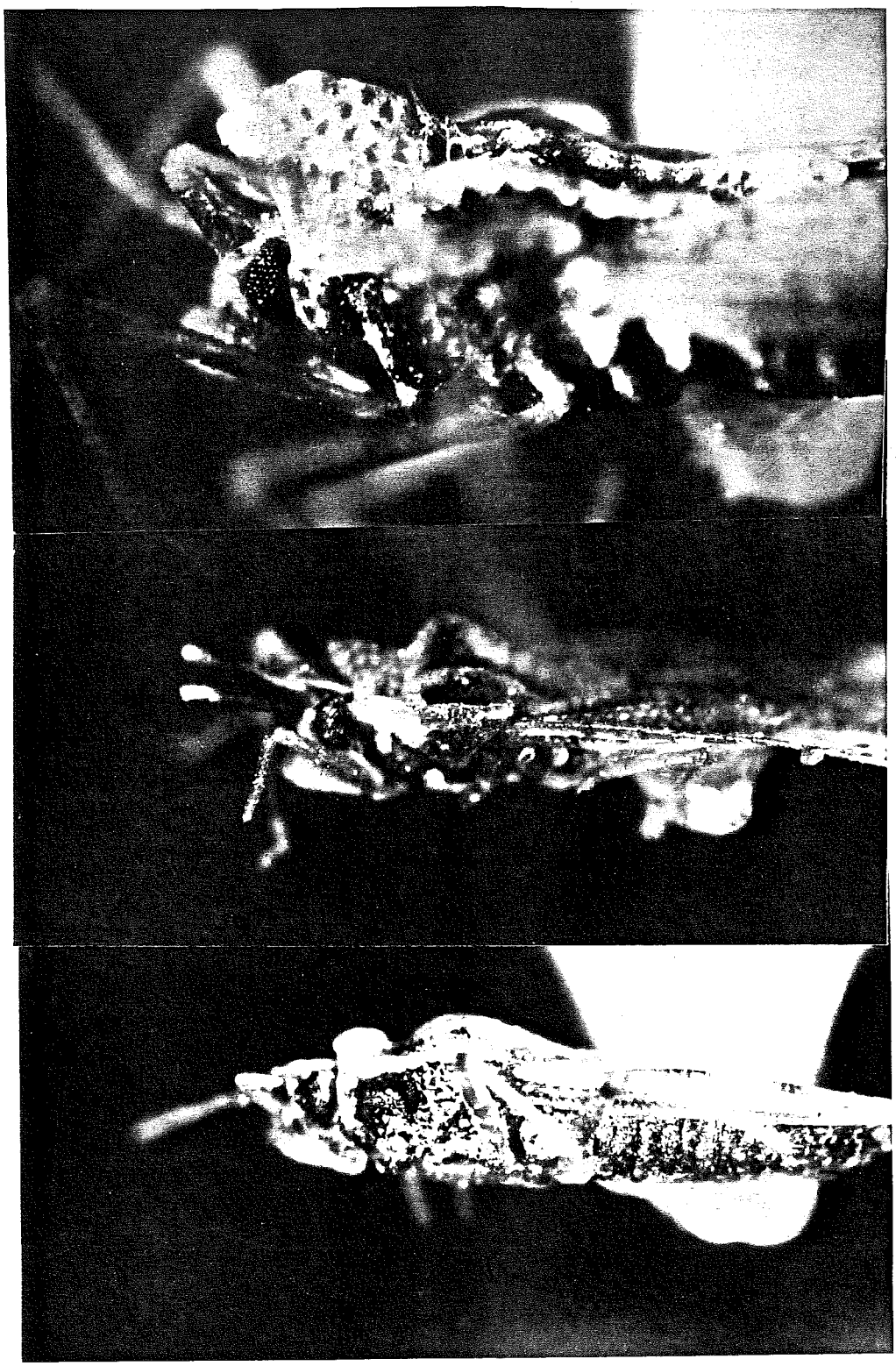

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Fig. 11. Hood higher than median carina. **12.** Hood lower than median carina. **13.** Hood even with median carina.

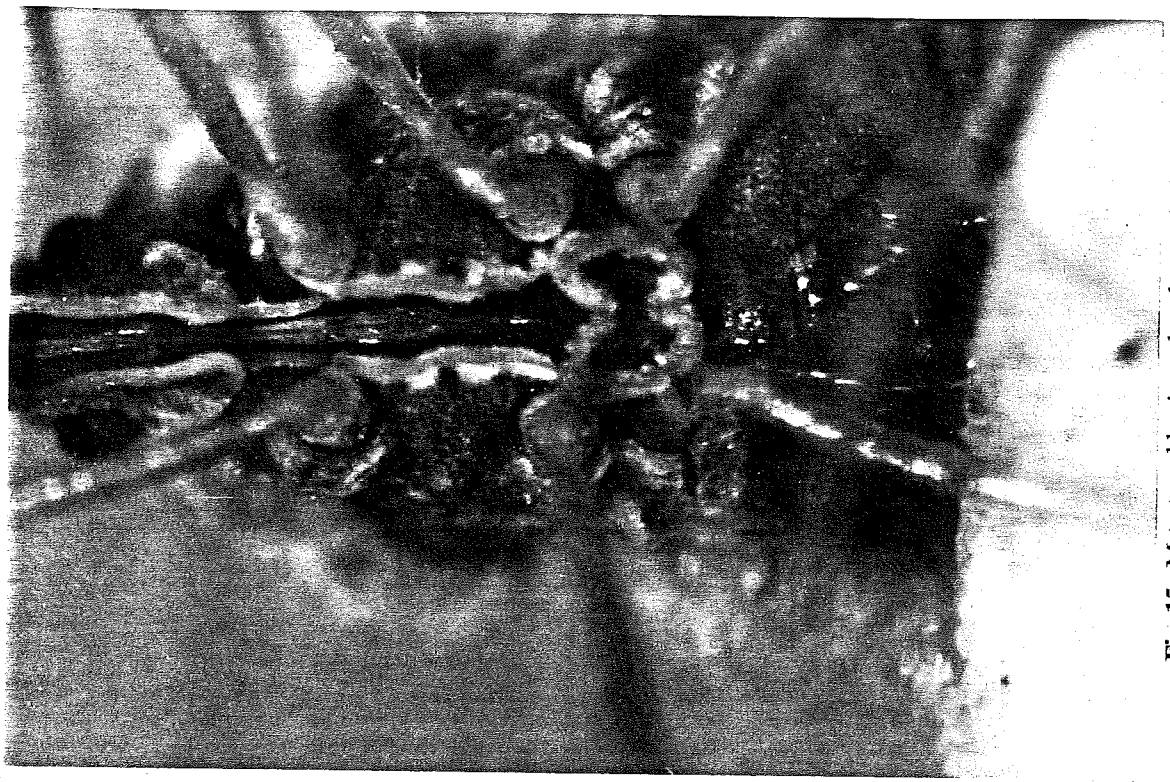


Fig. 15. Metasternal laminae closed posteriorly.

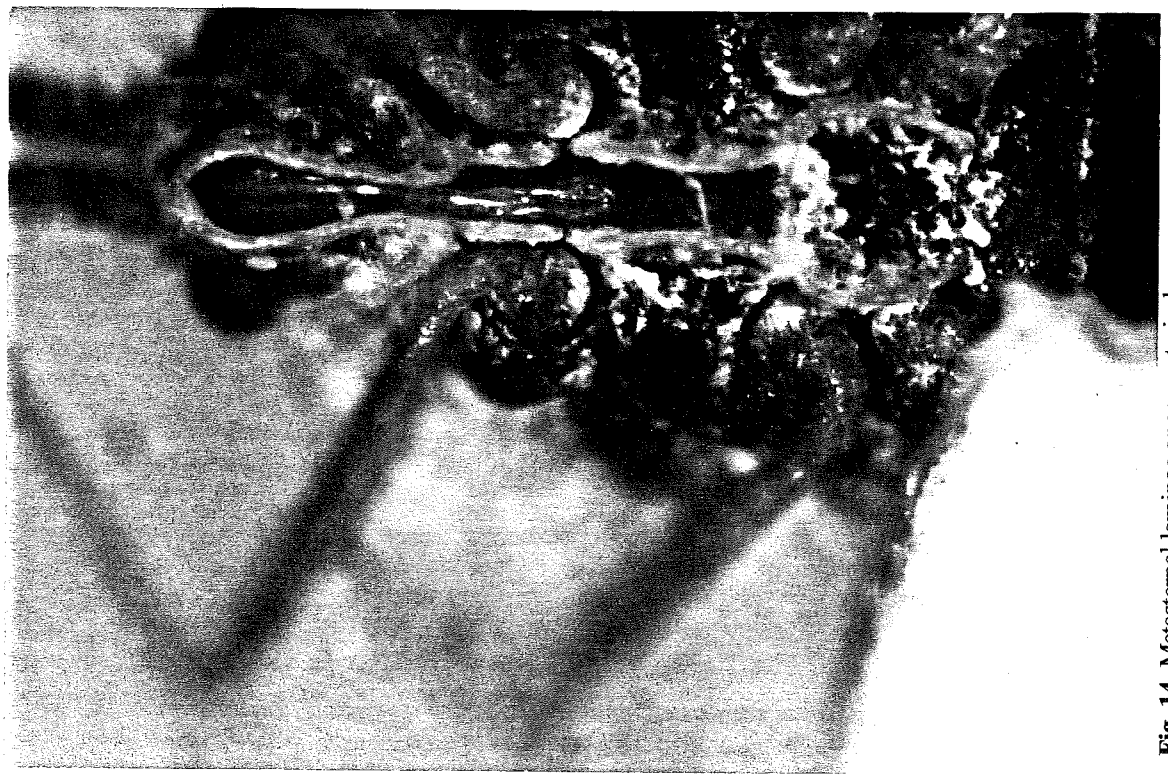
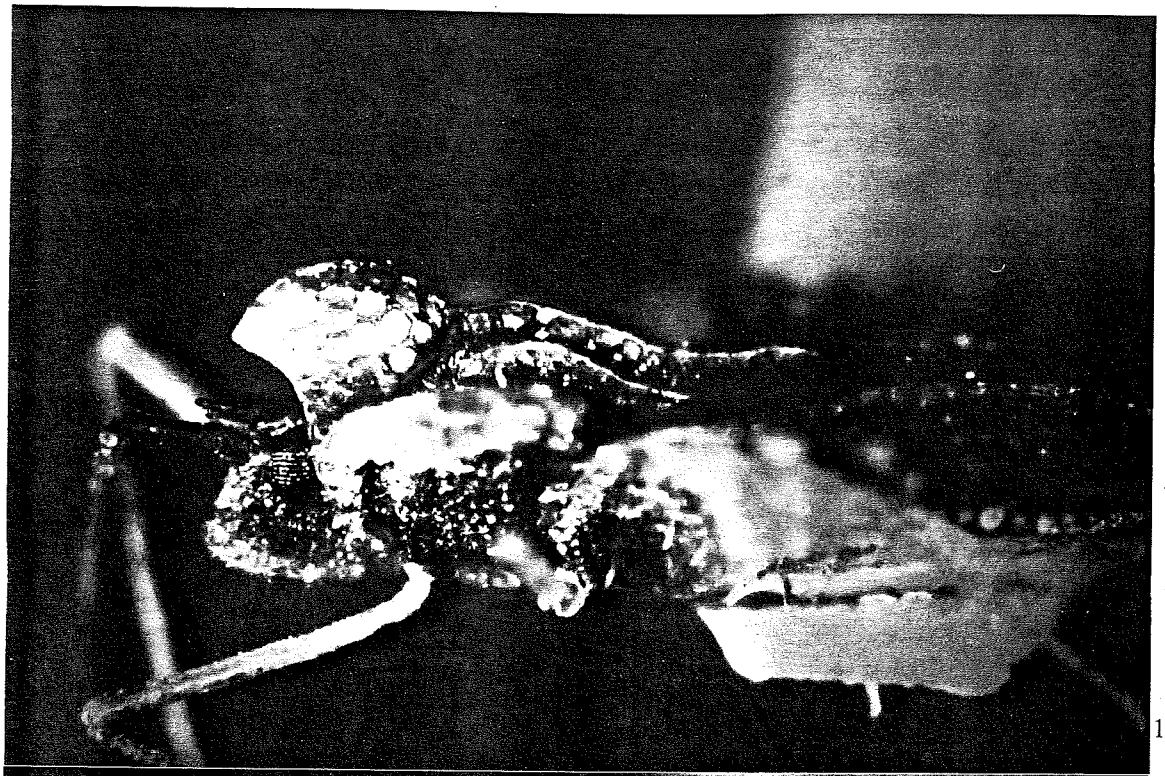


Fig. 14. Metasternal laminae open posteriorly.



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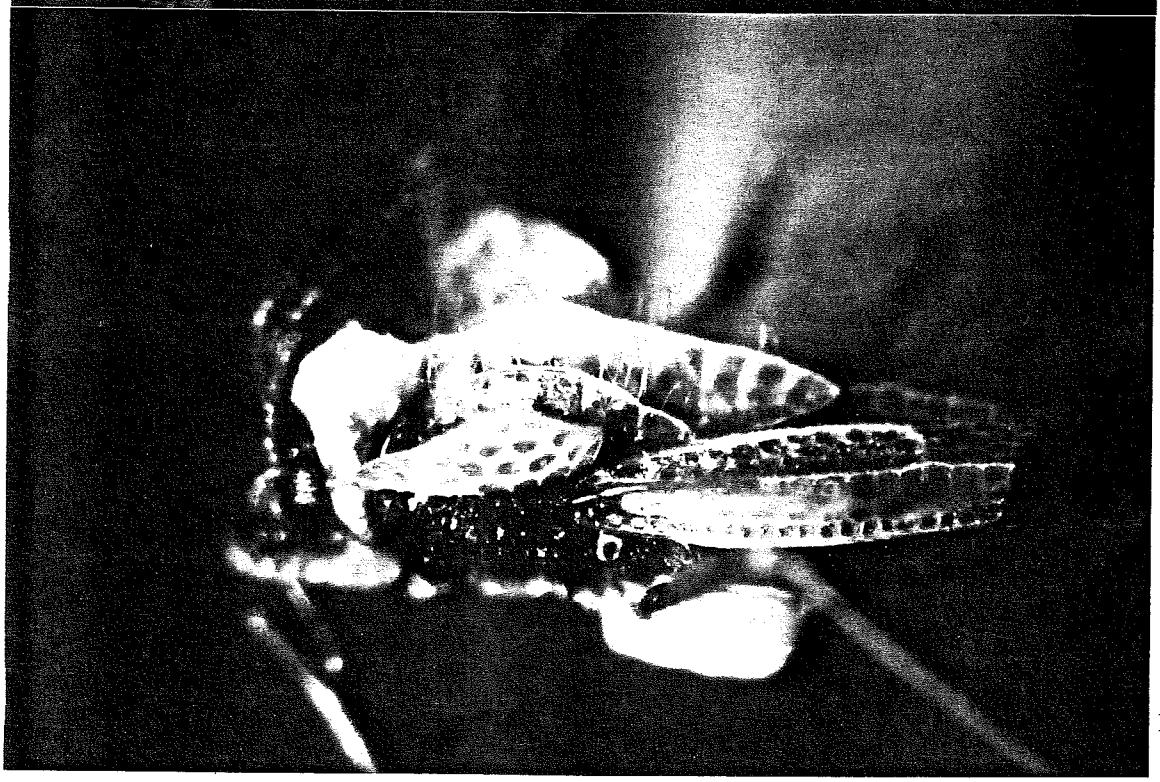
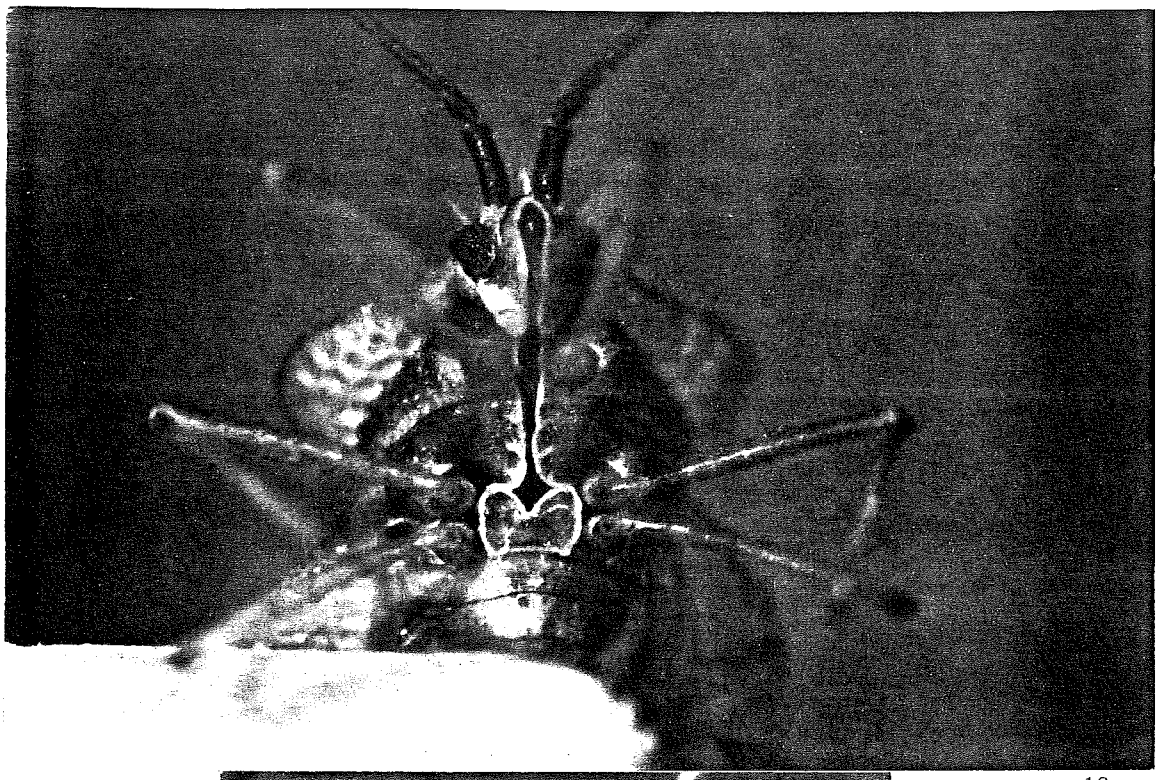


17

Fig. 16. Cells of median carina remaining consistent on posterior pronotal projection. **17.** Cells of median carina increasing in height on posterior pronotal projection.



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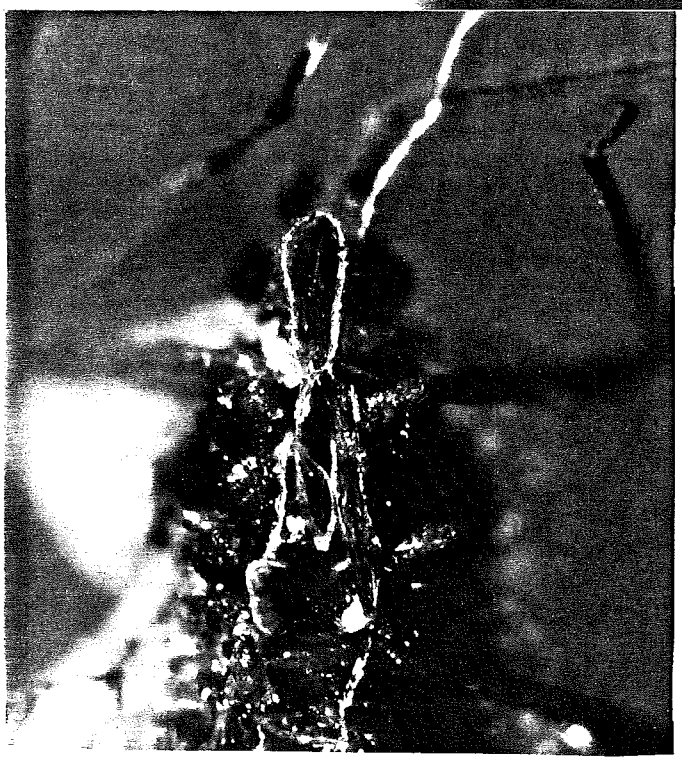
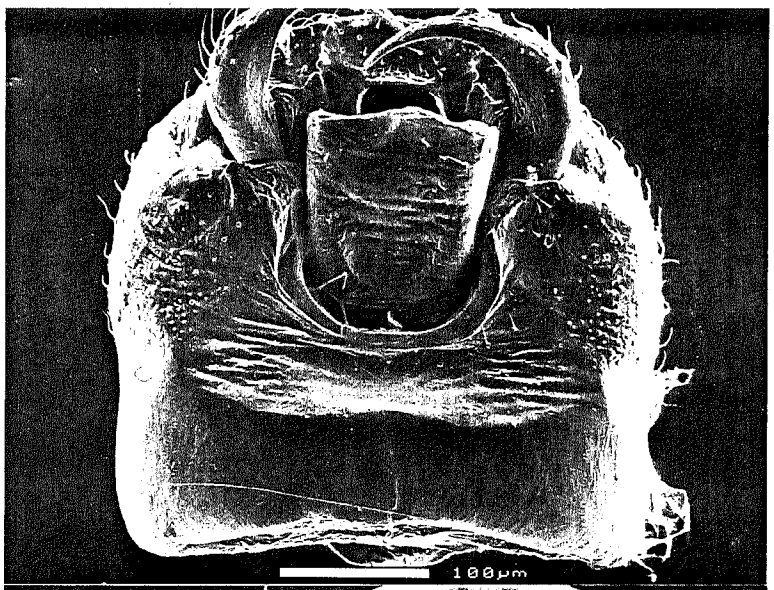


19

Fig. 18. Metasternal laminae contiguous anteriorly. **19.** Metasternal laminae not meeting anteriorly.



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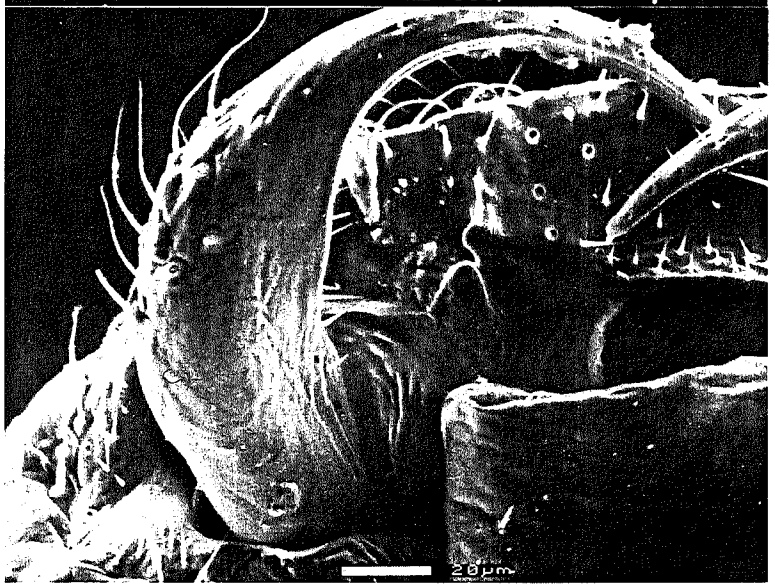
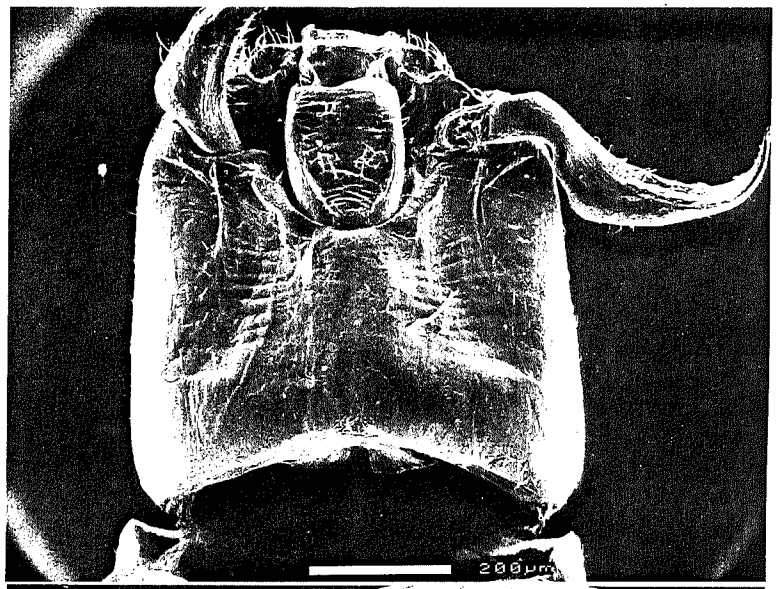


21

Fig. 20-21 *Gargaphia acmonis* (20) genital capsule, (21) paramere.



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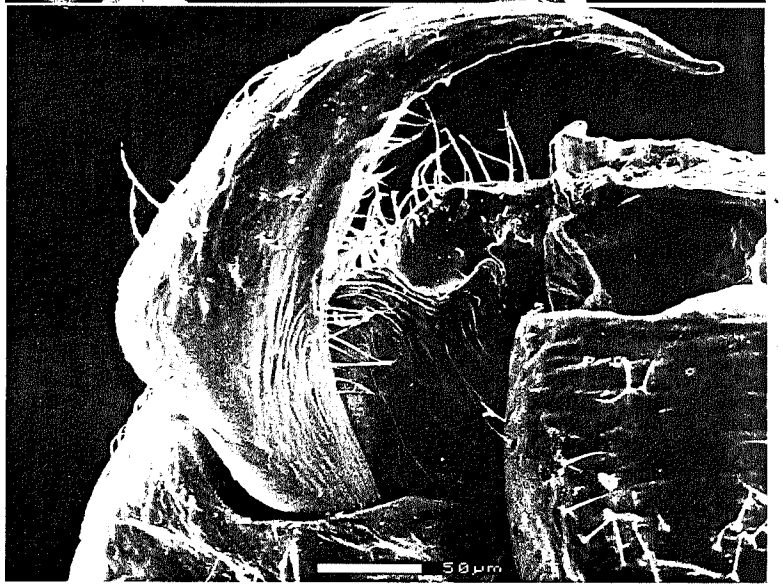

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Fig.22-23 *Gargaphia brunfelsiae* (22) genital capsule, (23) paramere.

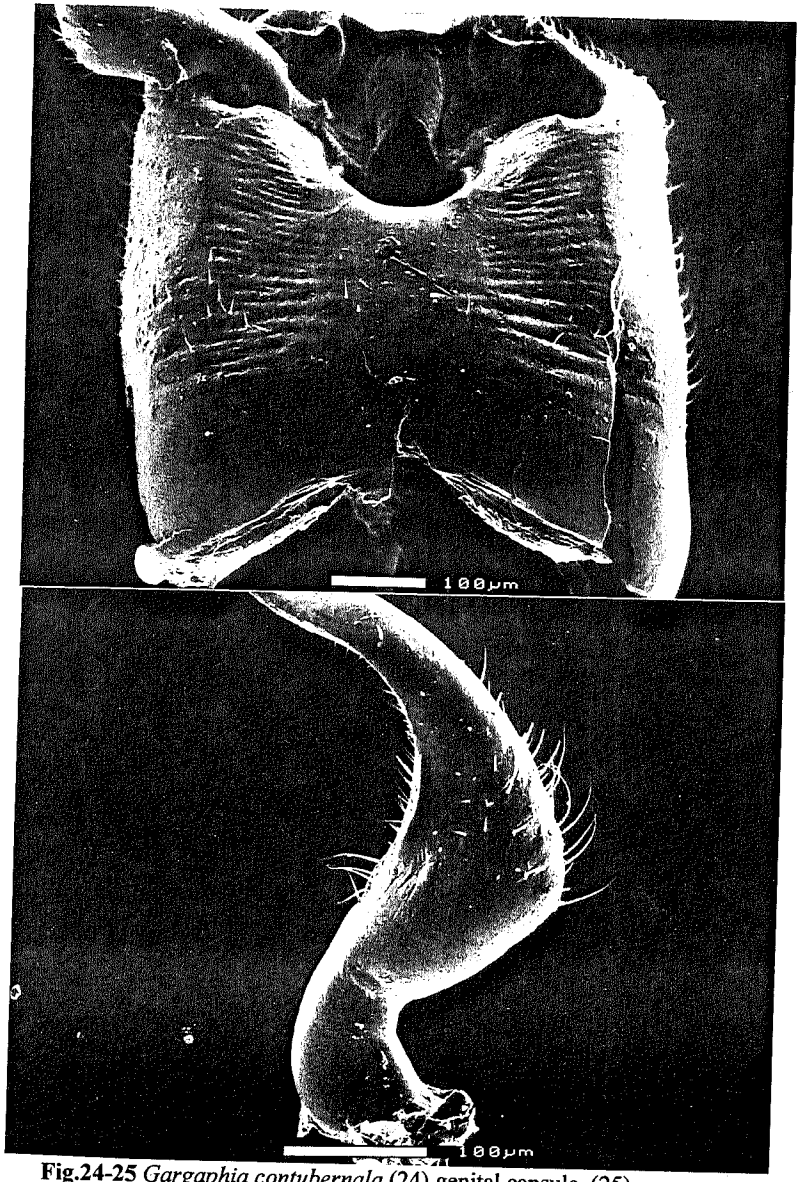

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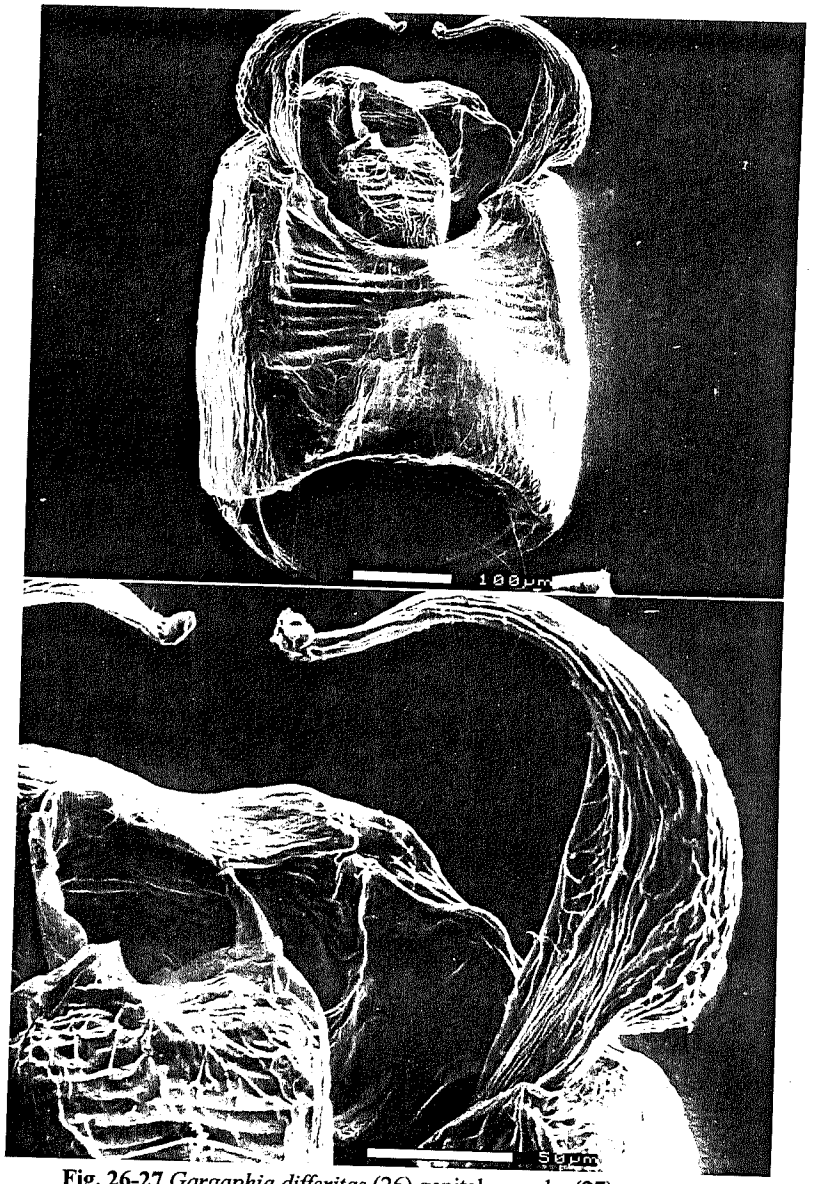
Fig.24-25 *Gargaphia contubernala* (24) genital capsule, (25) paramere.



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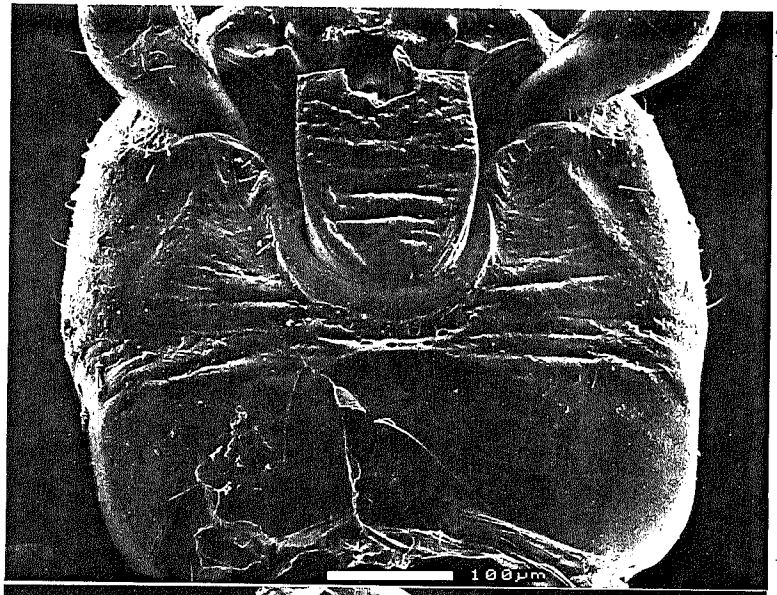
27

Fig. 26-27 *Gargaphia differitas* (26) genital capsule, (27) paramere.



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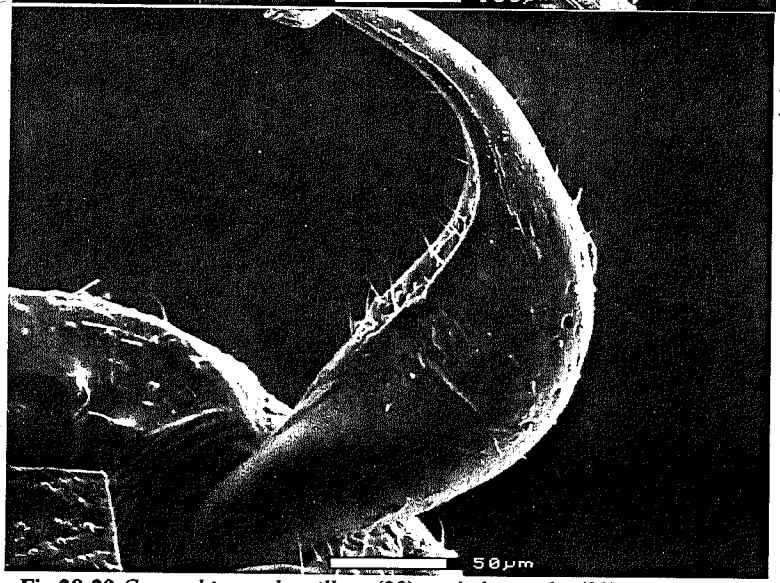

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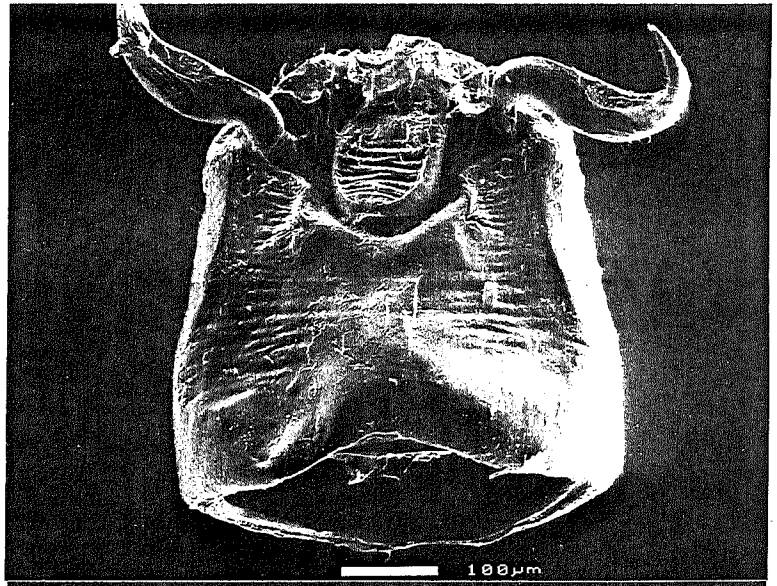
Fig.28-29 *Gargaphia emphamillosa* (28) genital capsule, (29) paramere.



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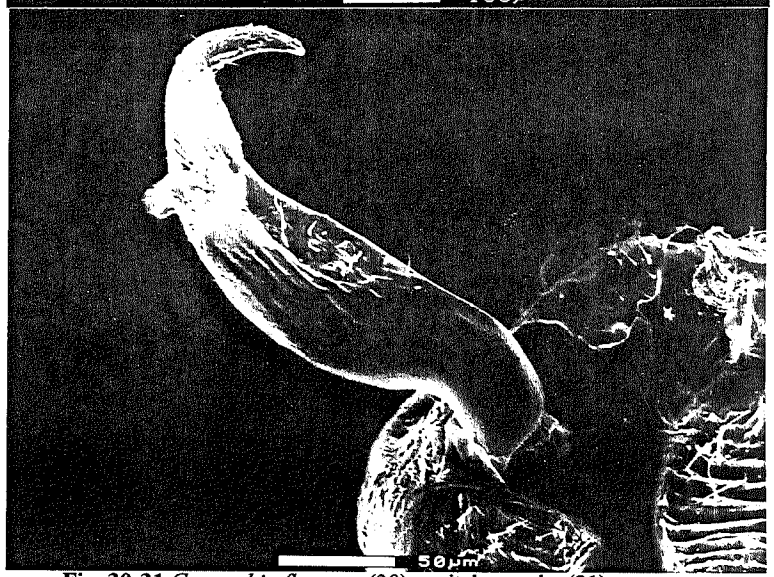
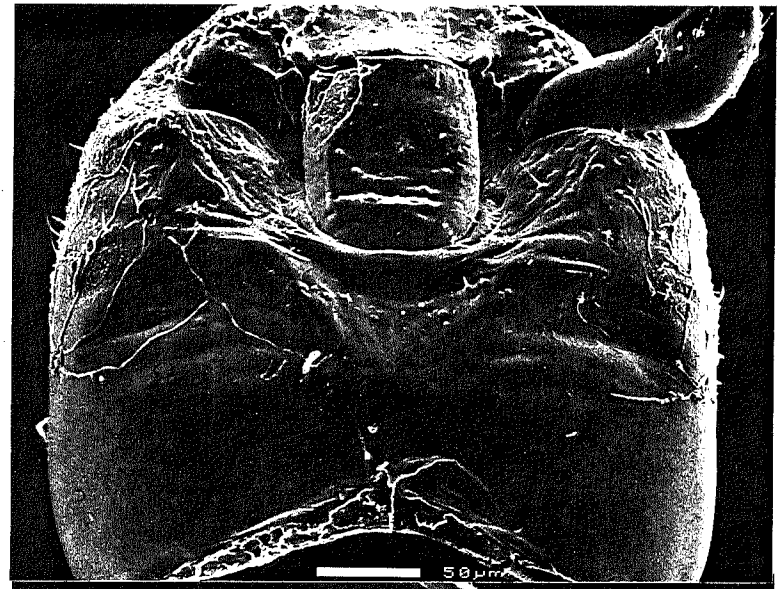


31

Fig. 30-31 *Gargaphia flexuosa* (30) genital capsule, (31) paramere.



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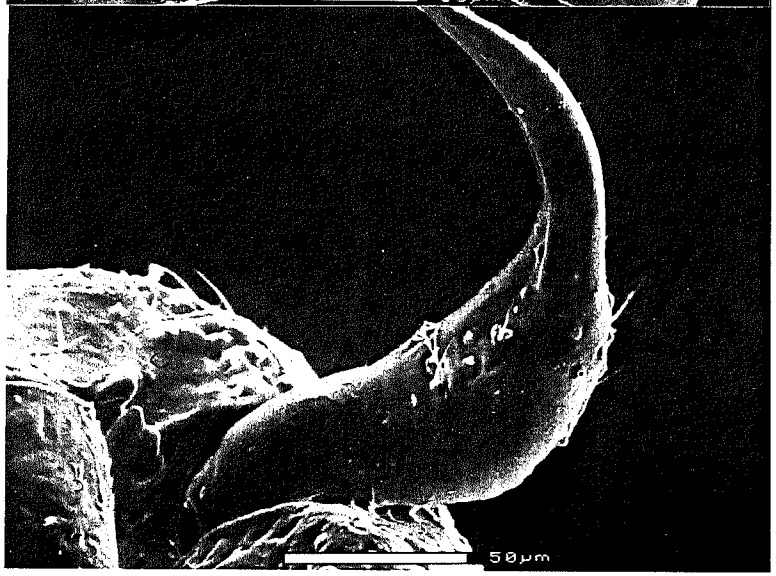

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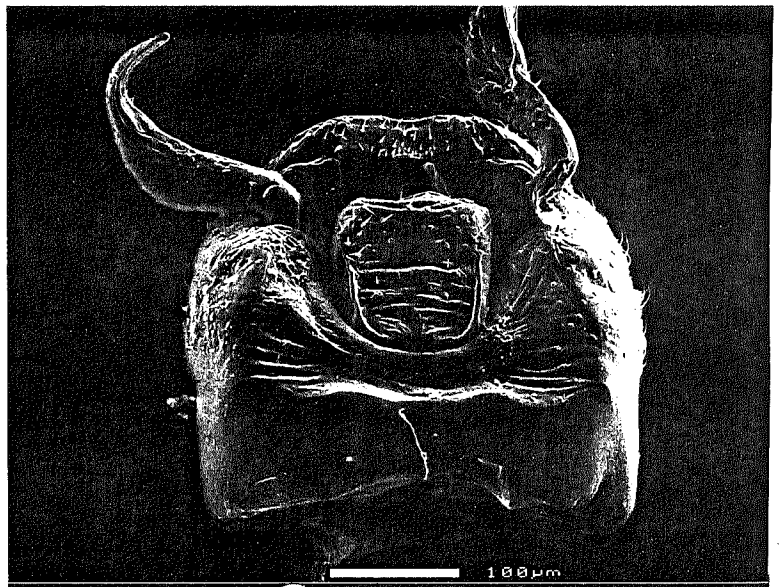
Fig. 32-33 *Gargaphia inca* (32) genital capsule, (33) paramere.



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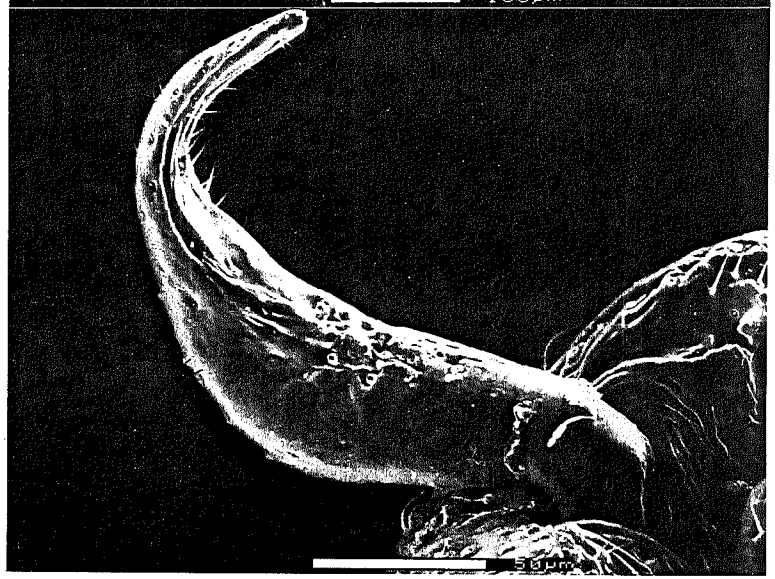

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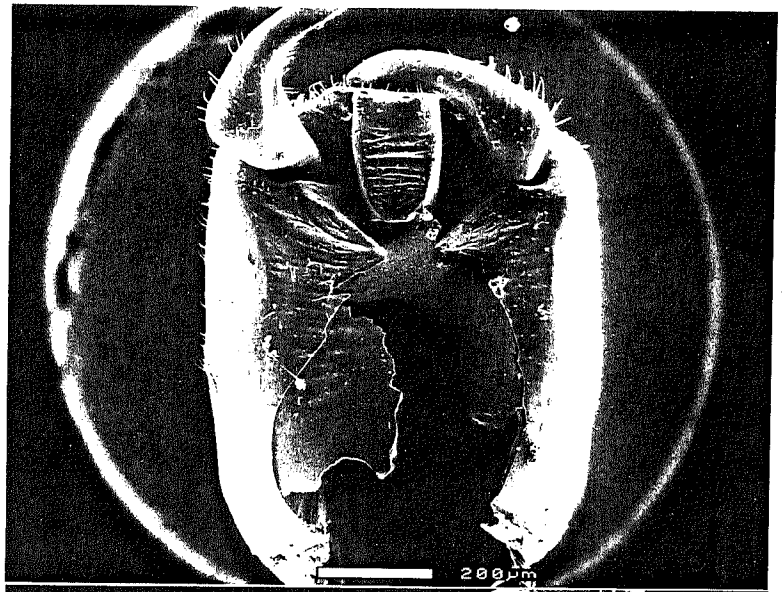
Fig. 34-35 *Gargaphia lunulata* (34) genital capsule, (35) paramere.



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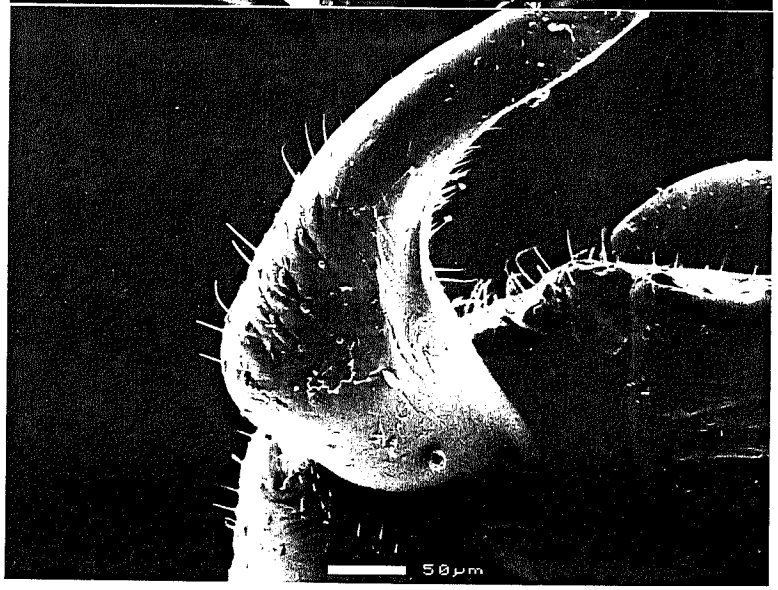

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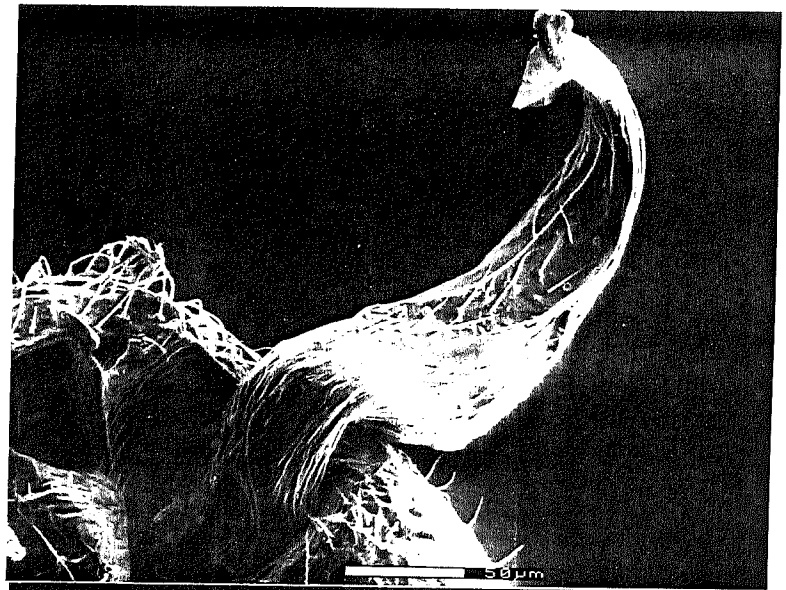
Fig. 36-37 *Gargaphia munda* (36) genital capsule, (37) paramere.



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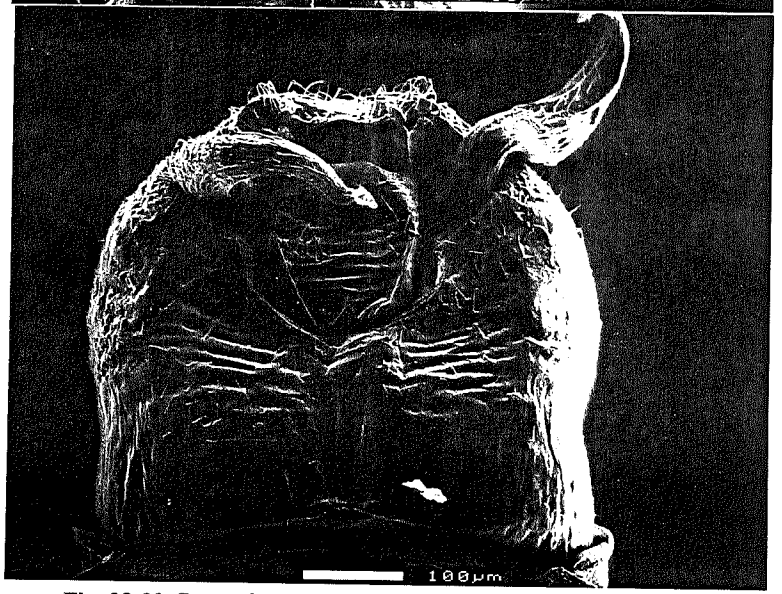

39

Fig. 38-39 *Gargaphia obliqua*(38) genital capsule, (39) paramere.

40

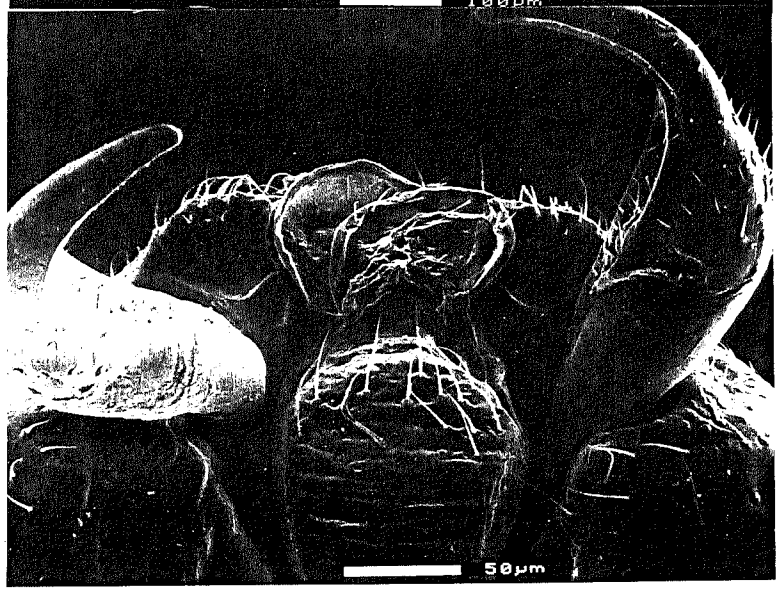

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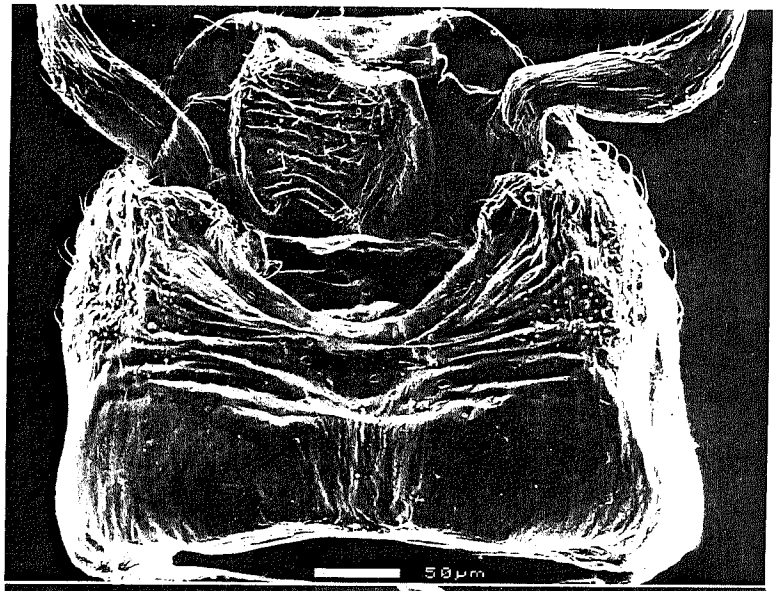
Fig. 40-41 *Gargaphia patria* (40) genital capsule, (41) paramere.



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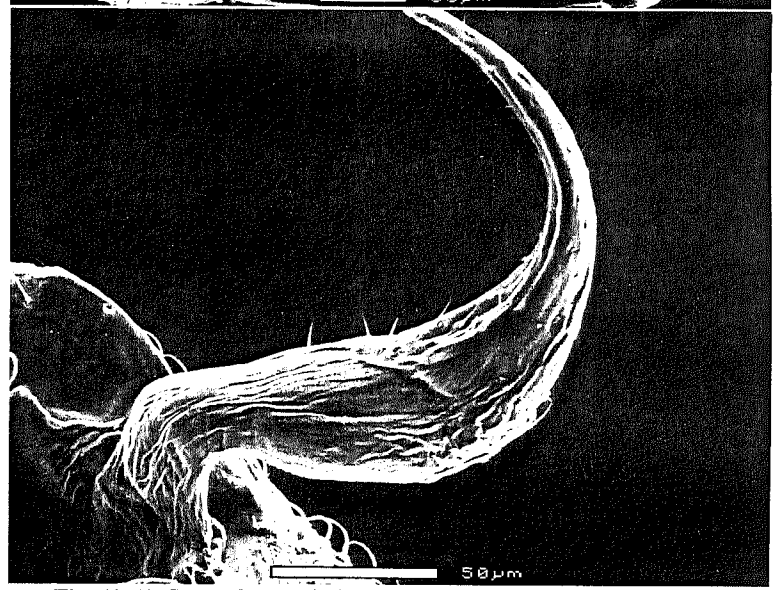
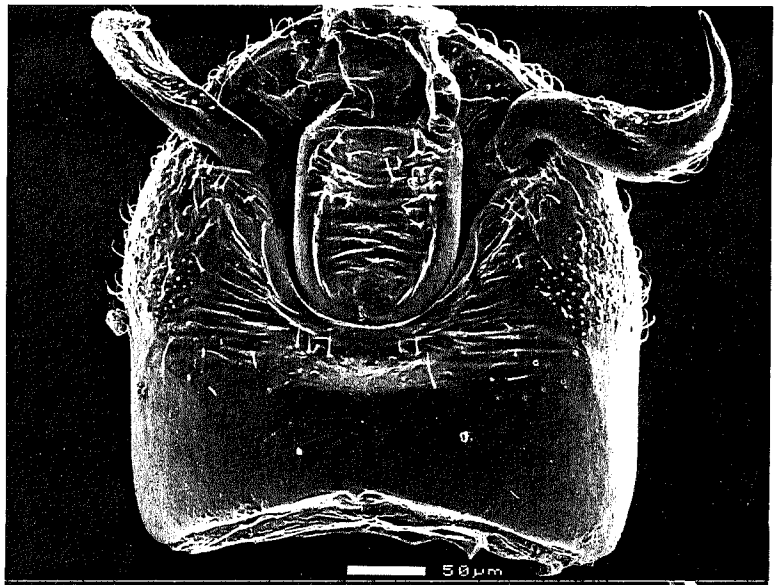


43

Fig. 42-43 *Gargaphia paula* (42) genital capsule, (43) paramere.



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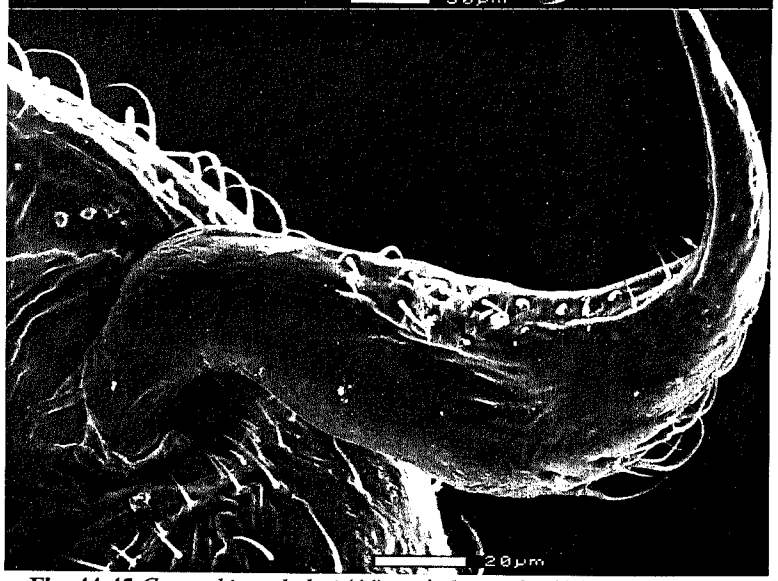
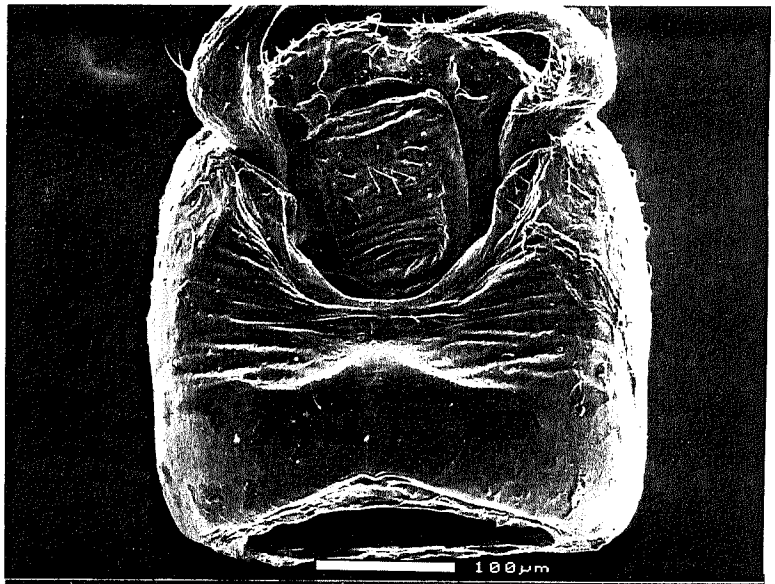


45

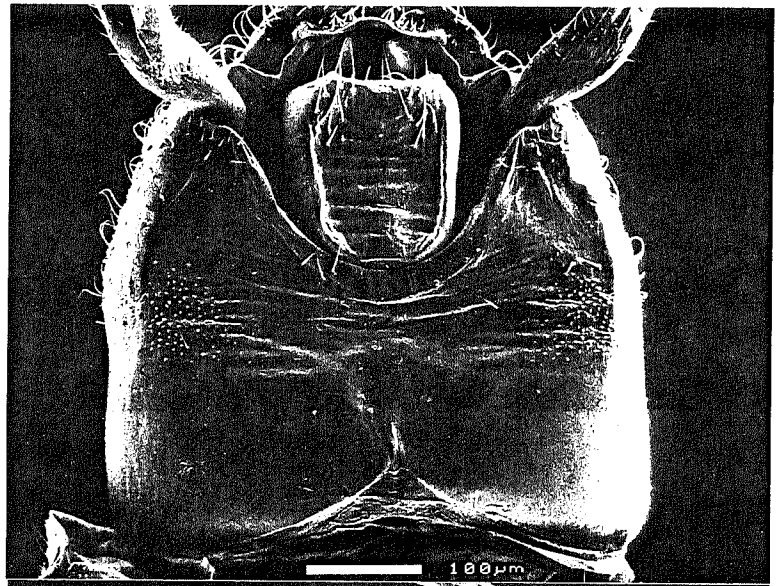
Fig. 44-45 *Gargaphia schulzei* (44) genital capsule, (45) paramere.



46

47

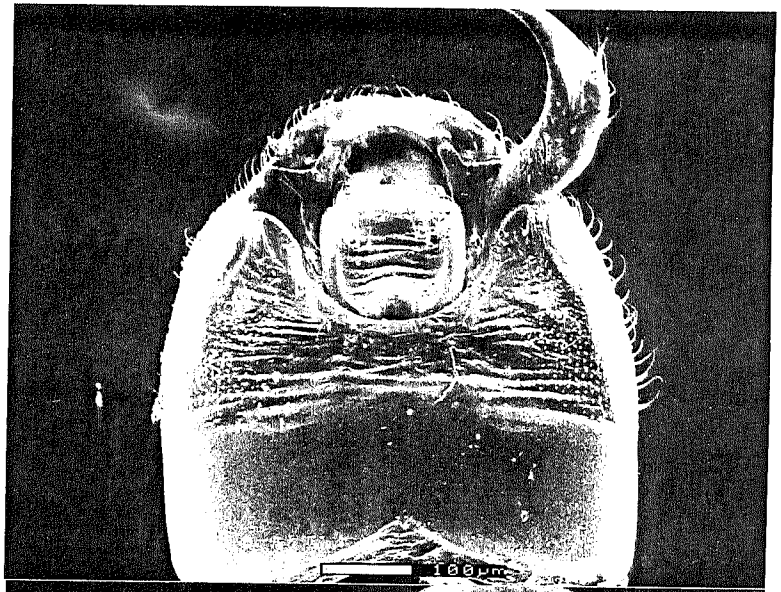
Fig. 46-47 *Gargaphia serjaniae* (46) genital capsule, (47) paramere.



48

49

Fig. 48-49 *Gargaphia comosa* (48) genital capsule, (49) paramere.



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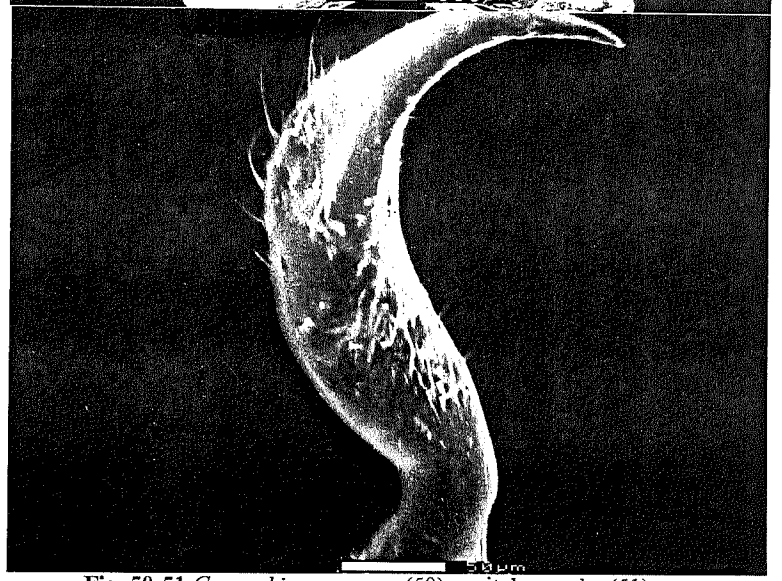
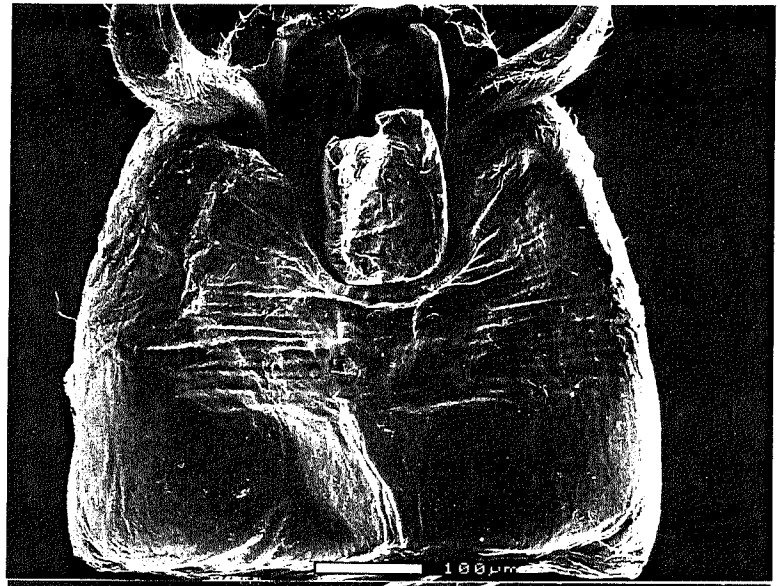


51

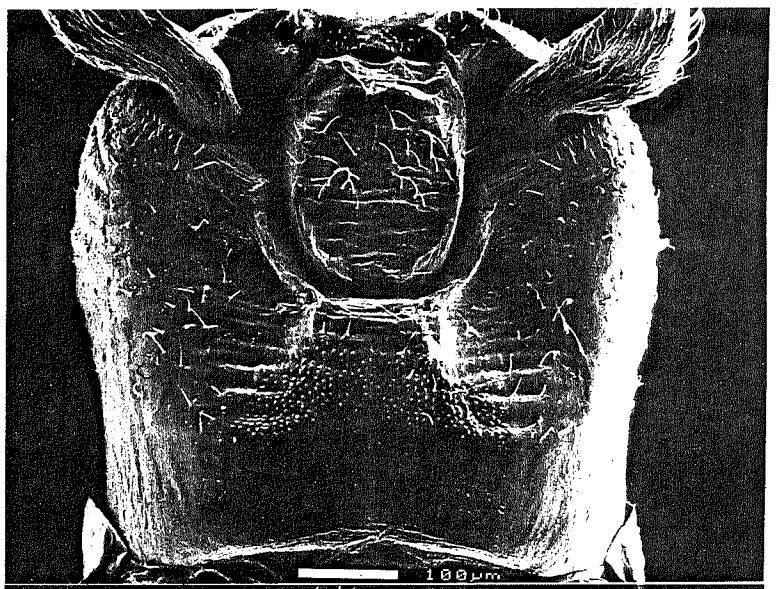
Fig. 50-51 *Gargaphia concursa* (50) genital capsule, (51) paramere.



52

53

Fig. 52-53 *Gargaphia costalimai* (52) genital capsule, (53) paramere.



54

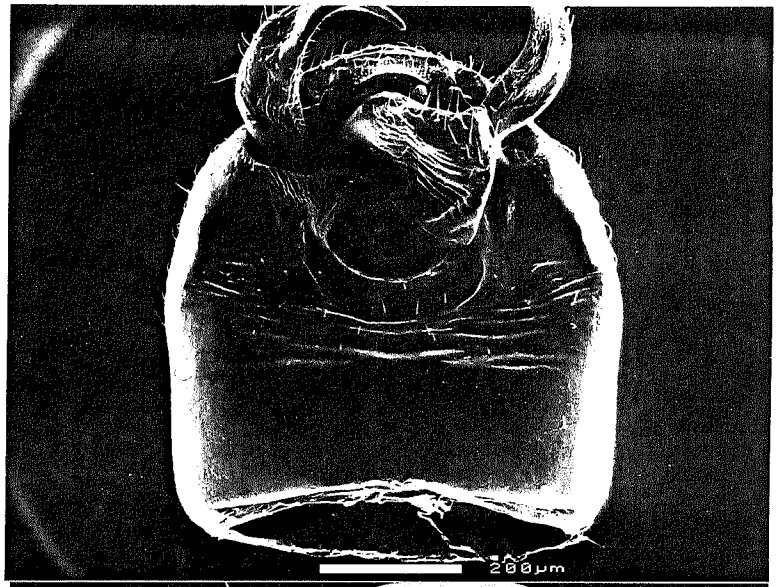
55

Fig. 54-55 *Gargaphia crotonae* (54) genital capsule, (55) paramere.

56

57

Fig. 56-57 *Gargaphia deceptiva* (56) genital capsule, (57) paramere.



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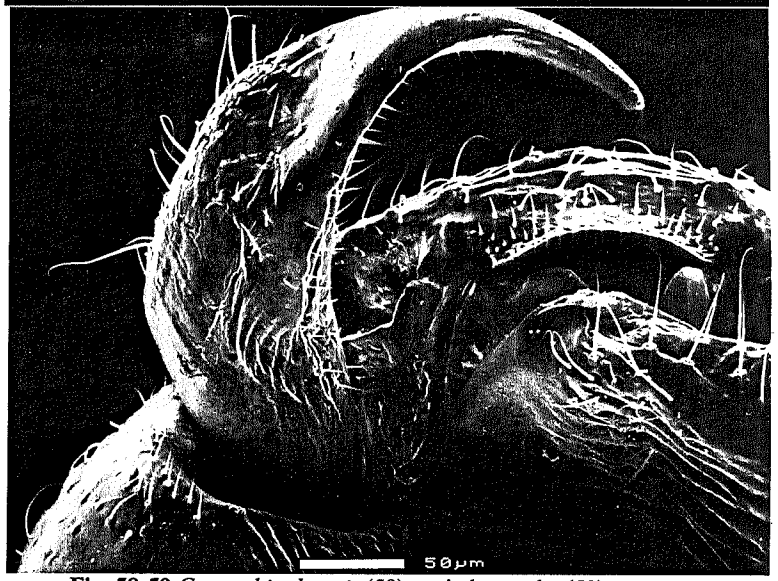
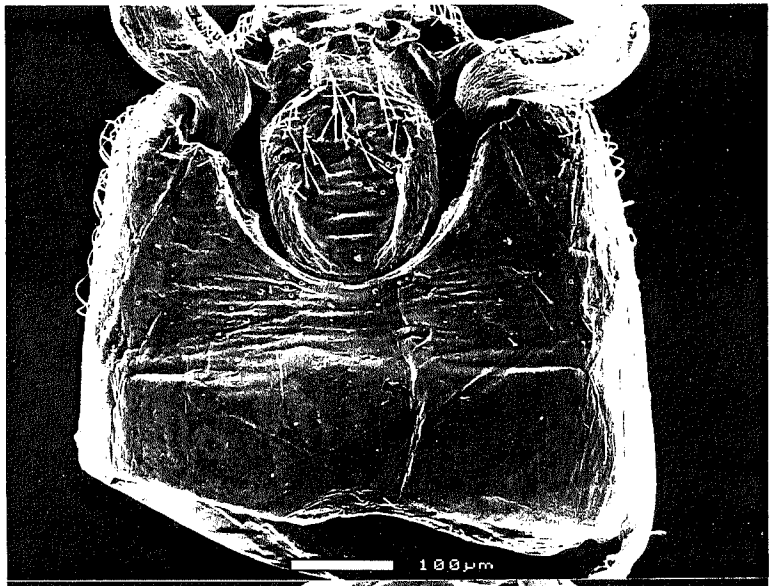


59

Fig. 58-59 *Gargaphia decoris* (58) genital capsule, (59) paramere.



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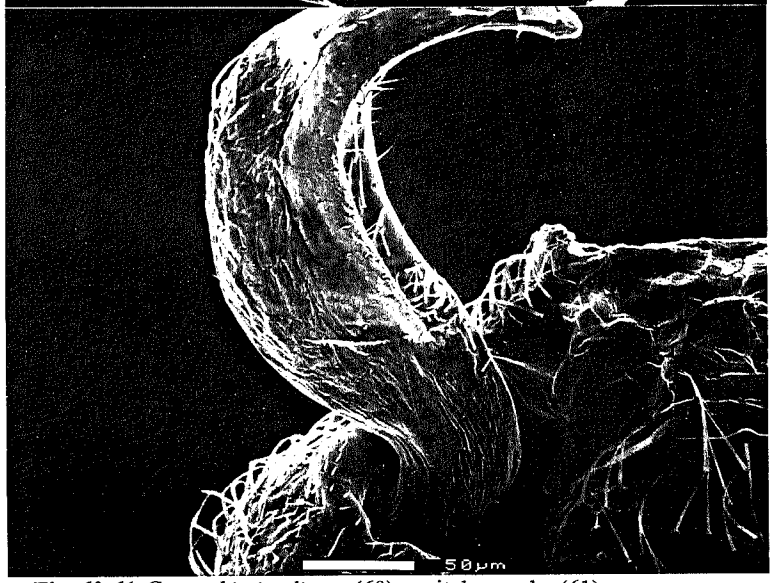
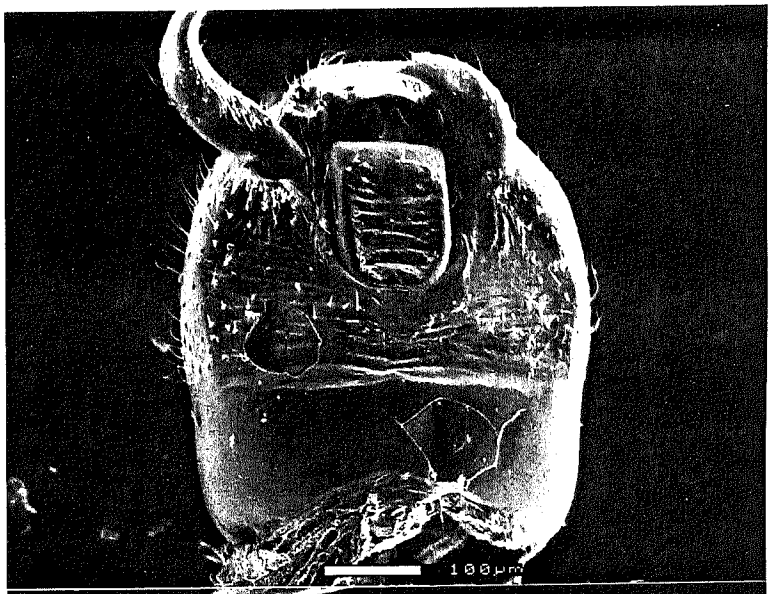


61

Fig. 60-61 *Gargaphia implicata* (60) genital capsule, (61) paramere.



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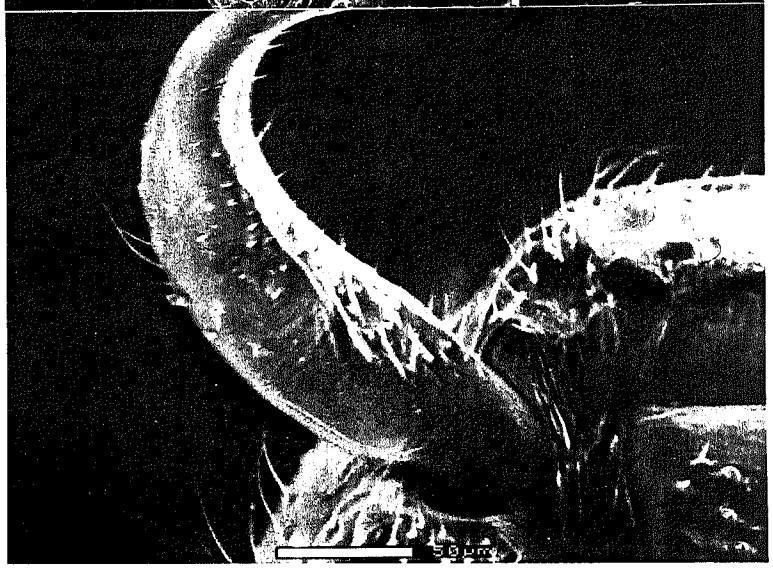


63

Fig. 62-63 *Gargaphia manni* (62) genital capsule, (63) paramere.

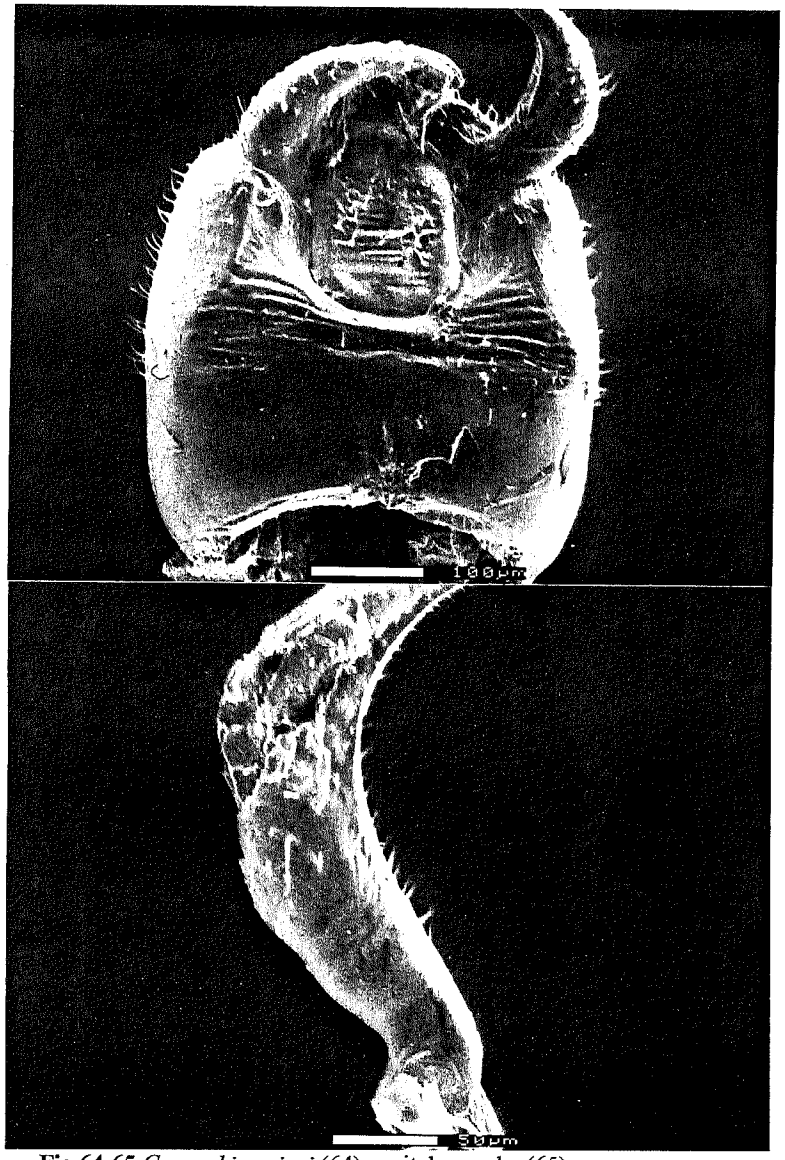


Fig.64-65 *Gargaphia neivai* (64) genital capsule, (65) paramere.

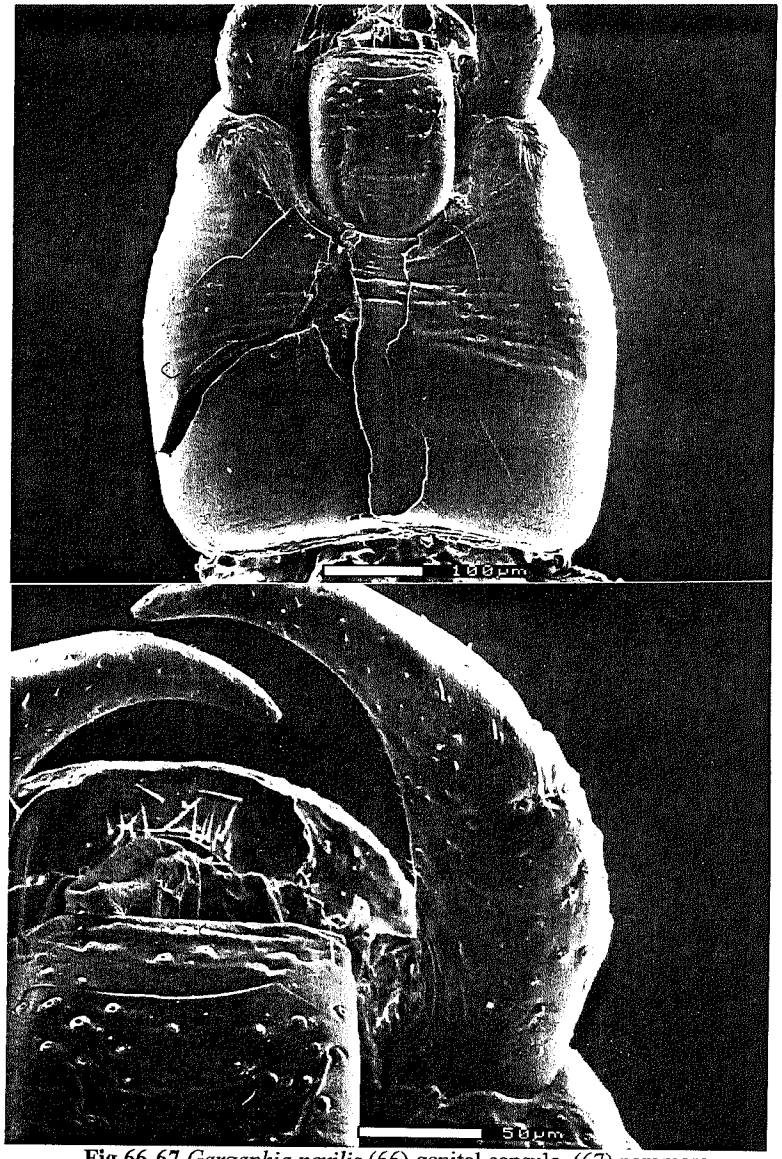


Fig.66-67 *Gargaphia nexilis* (66) genital capsule, (67) paramere.

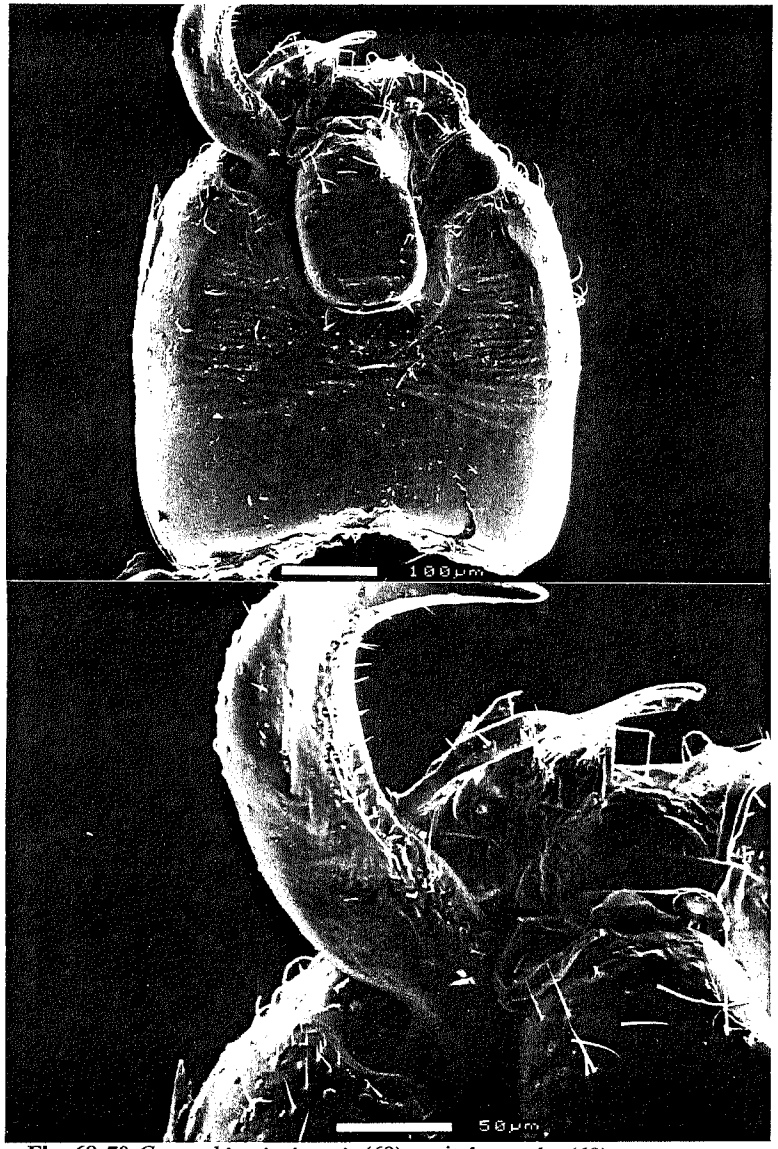


Fig. 68-70 *Gargaphia nigrinervis* (68) genital capsule, (69) paramere.

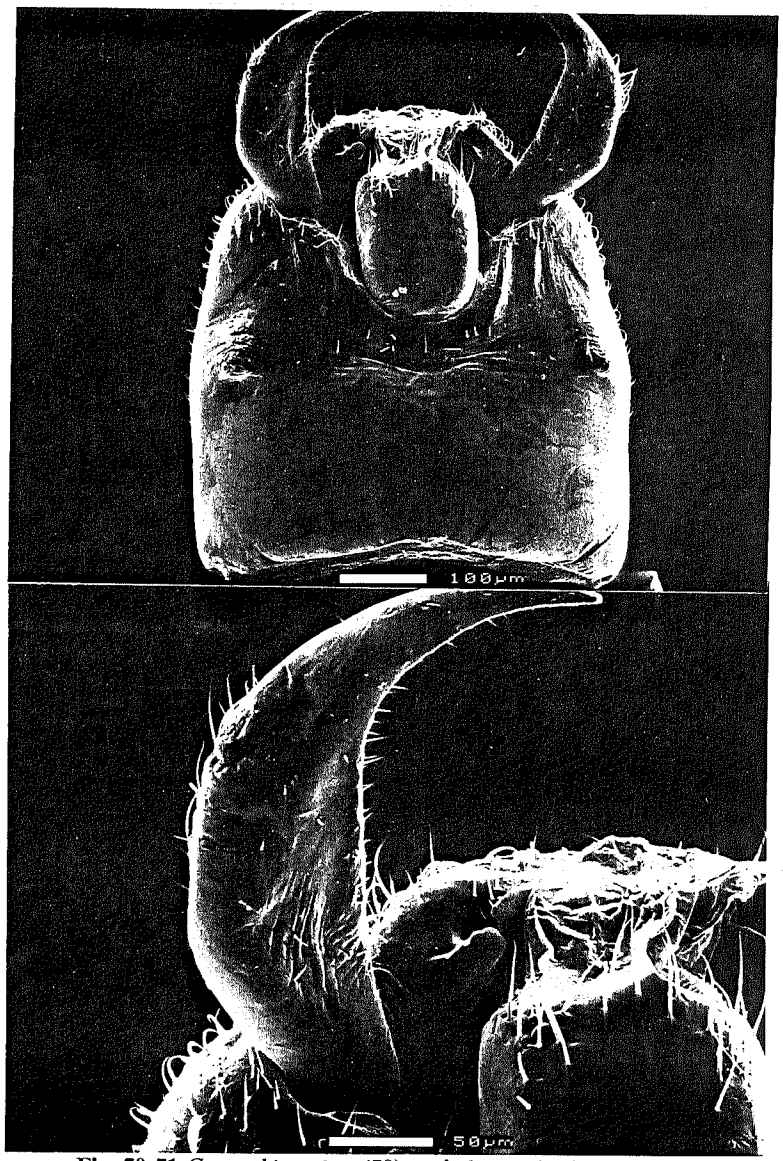
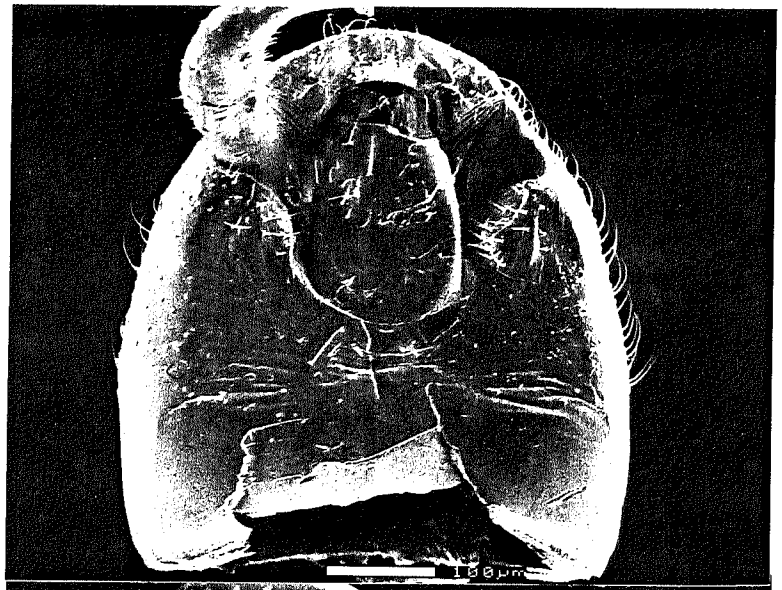
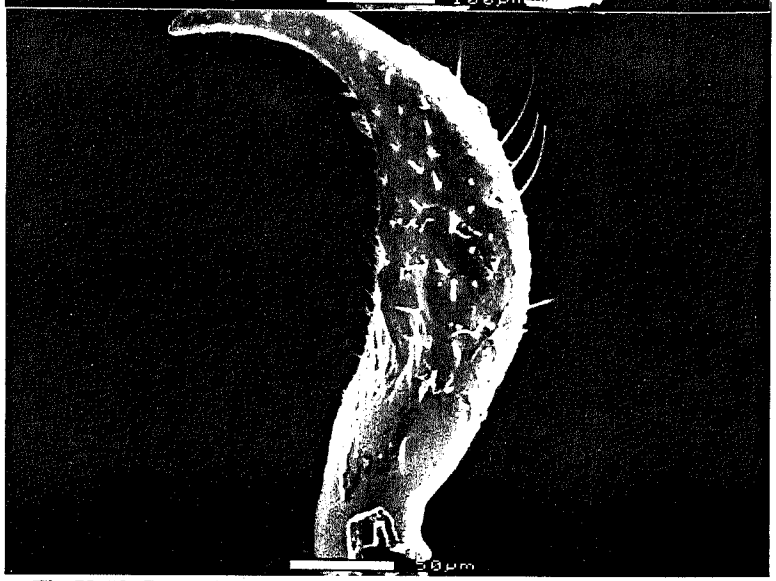


Fig. 70-71 *Gargaphia opima* (70) genital capsule, (71) paramere.

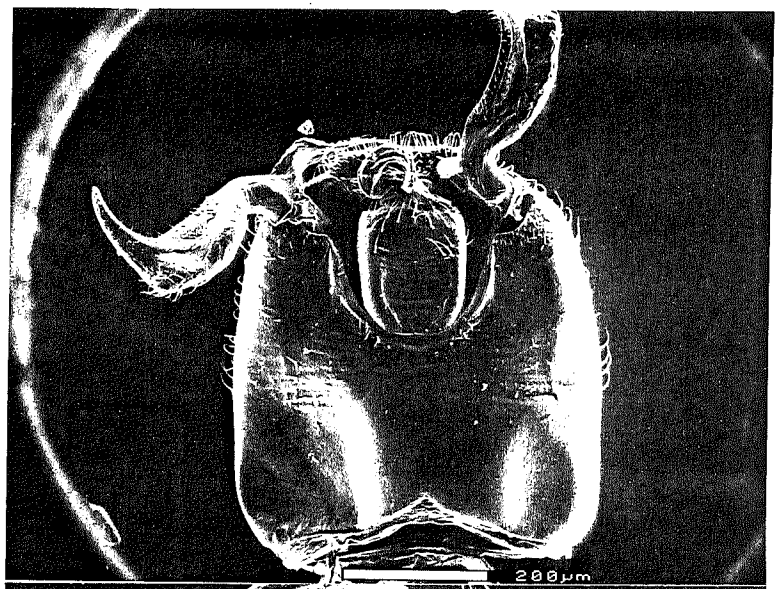


72

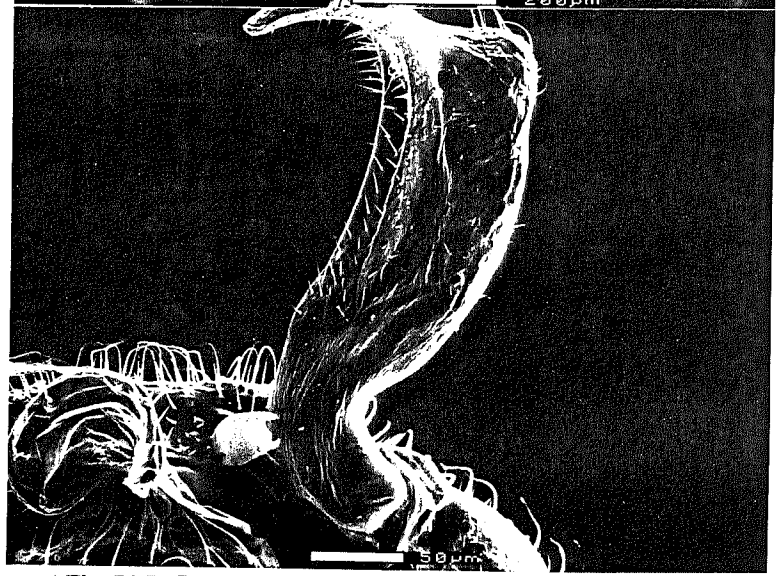


73

Fig.72-73 *Gargaphia paraguayensis* (72) genital capsule, (73) paramere.



74



75

Fig. 74-75*Gargaphia penningtoni* (74) genital capsule,(75) paramere.

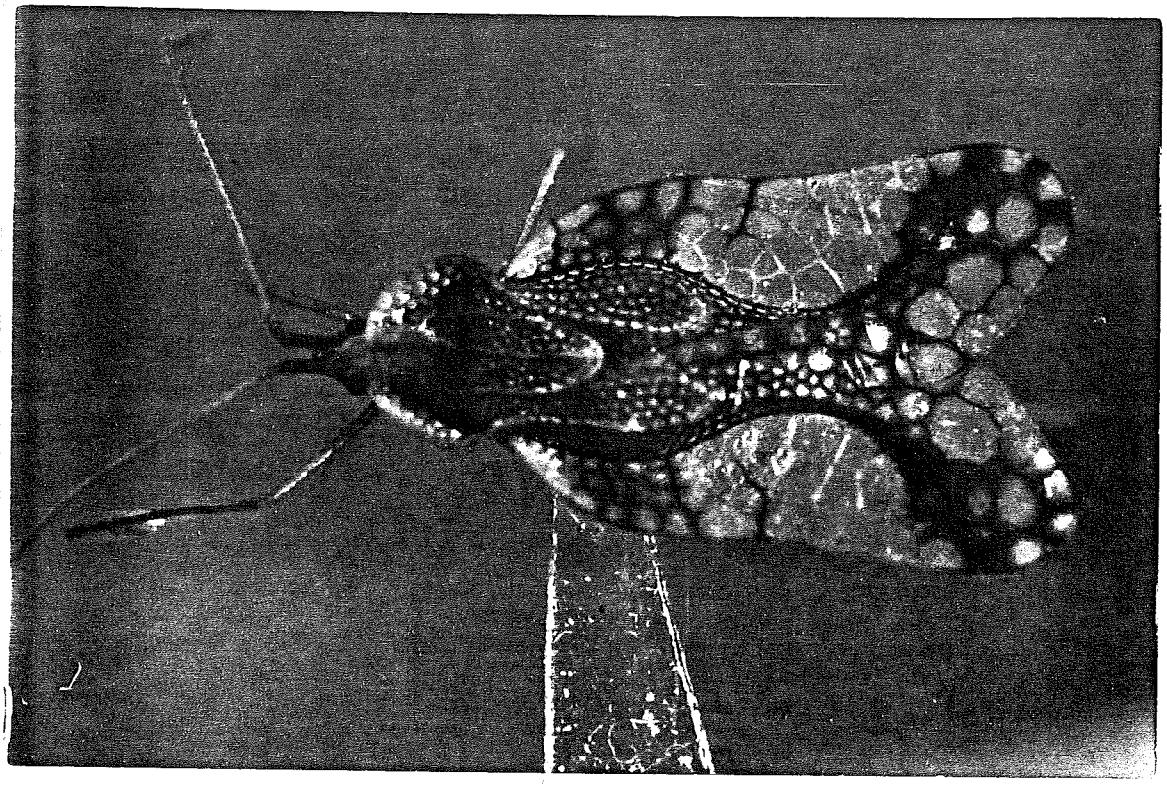


Fig. 77. *Gargaphia brunfelsiae.*

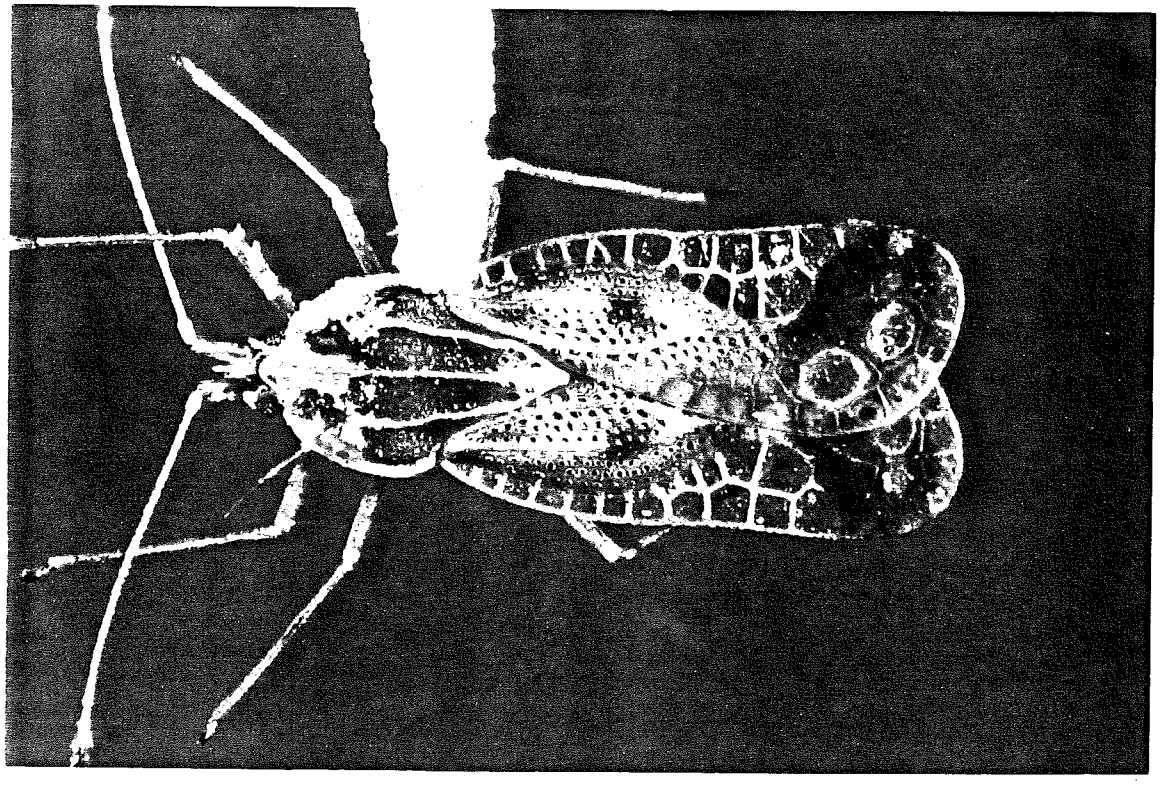


Fig. 76. *Gargaphia acmonis.*

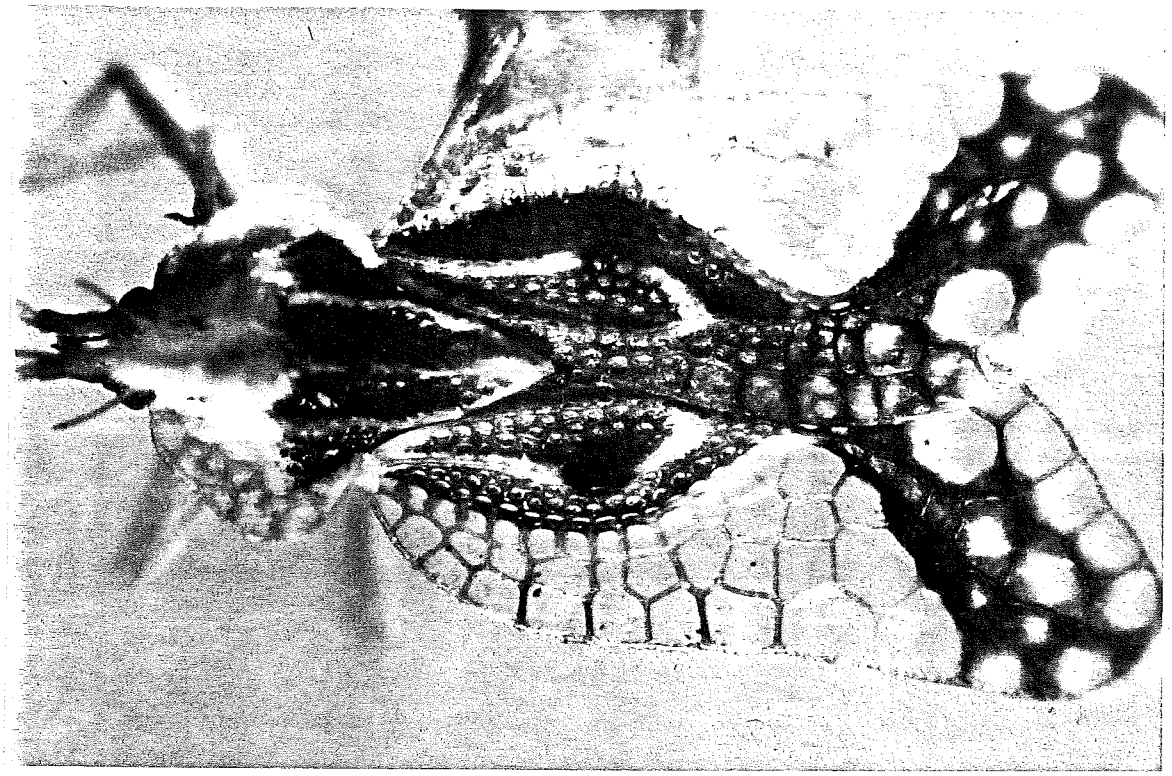


Fig. 79. *Gargaphia differitas.*

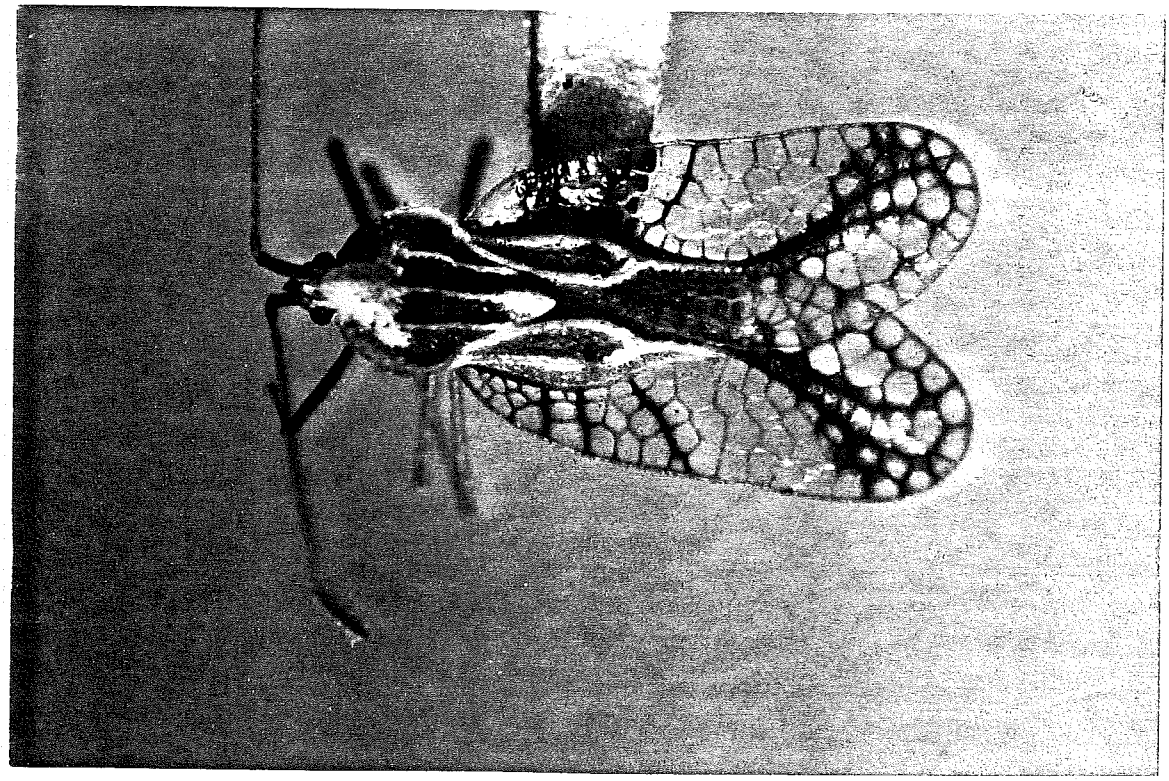


Fig. 78. *Gargaphia contubernala.*

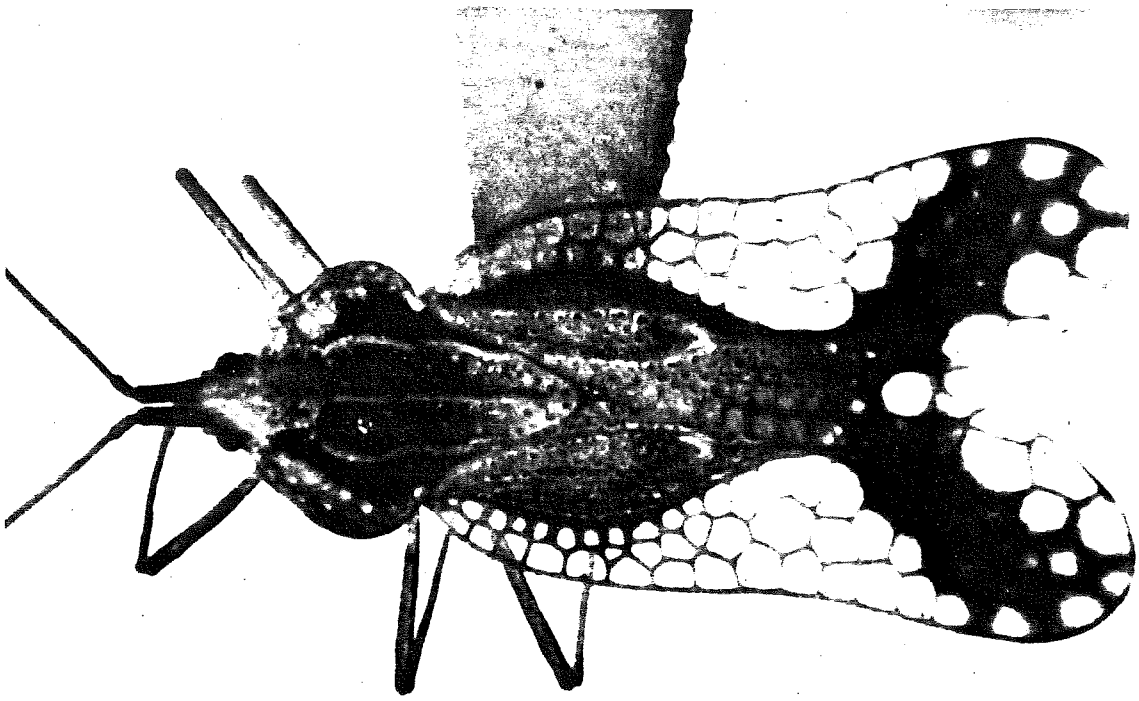


Fig. 81. *Gargaphia flexuosa.*

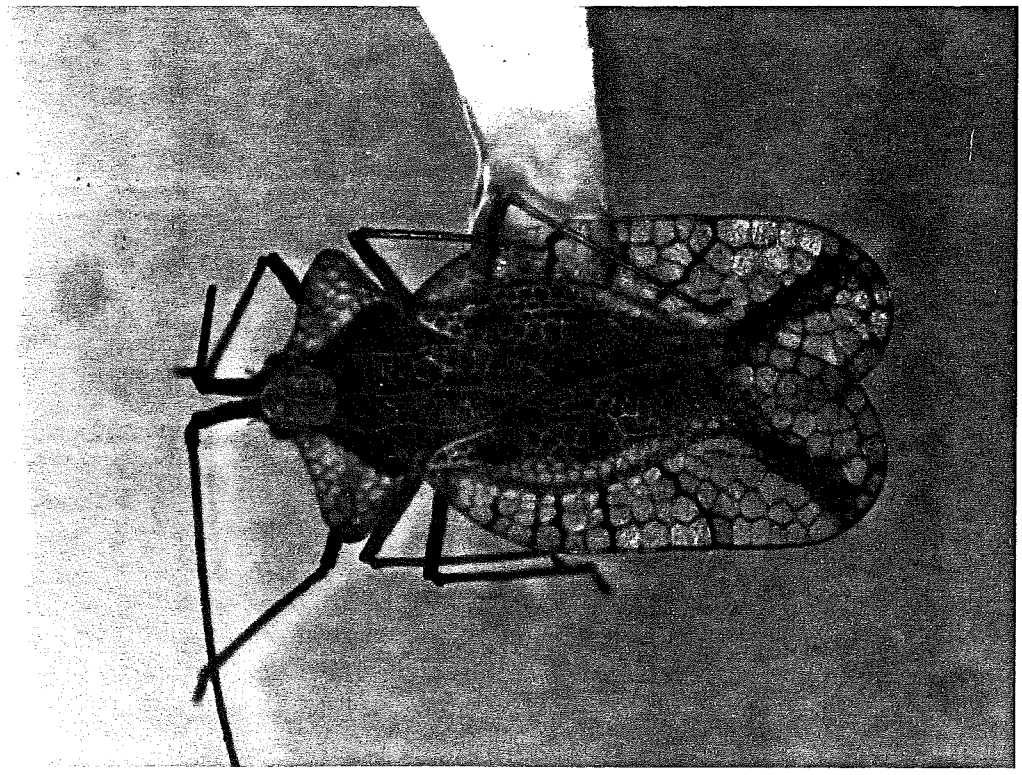


Fig. 80. *Gargaphia emphamillosa.*

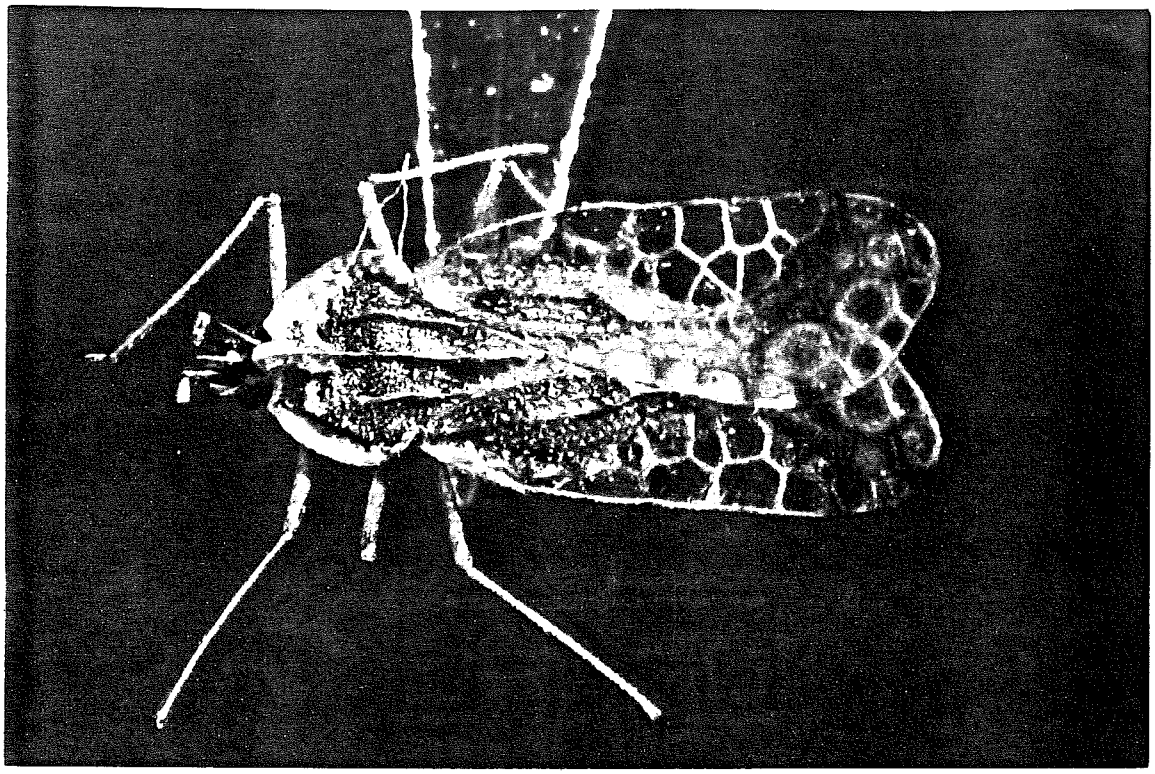


Fig. 83. *Gargaphia lunulata* .

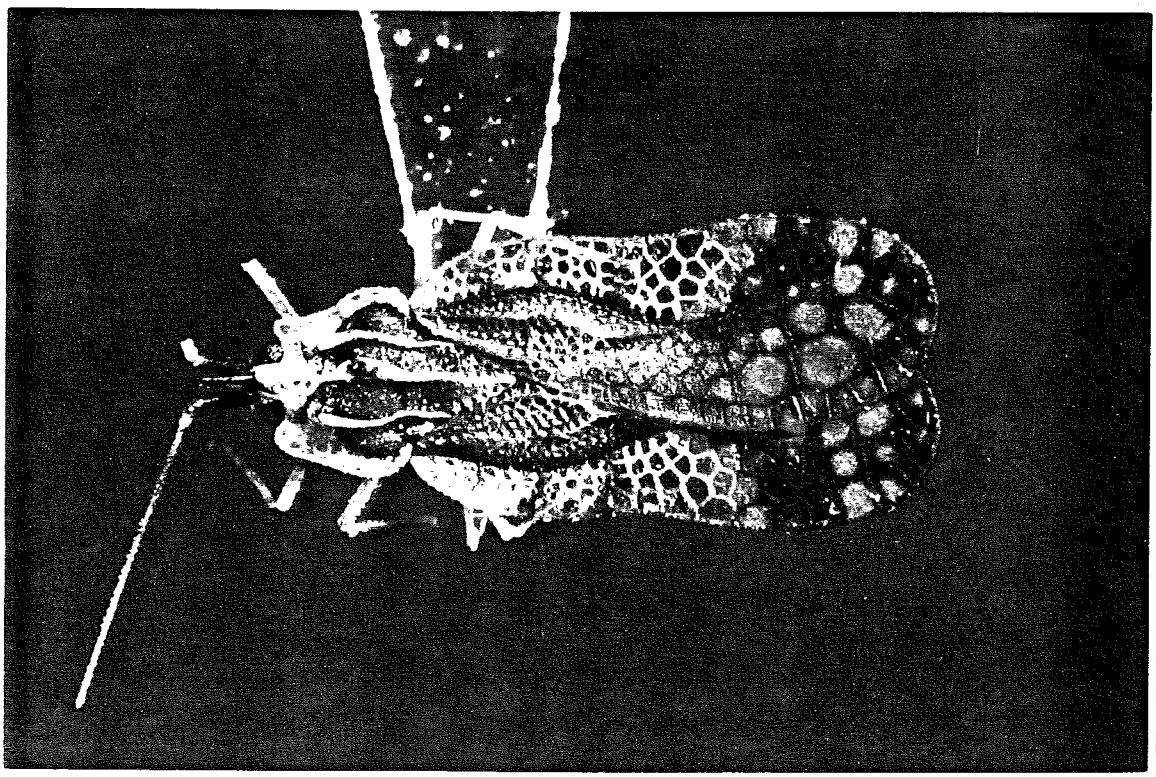


Fig. 82. *Gargaphia inca.*

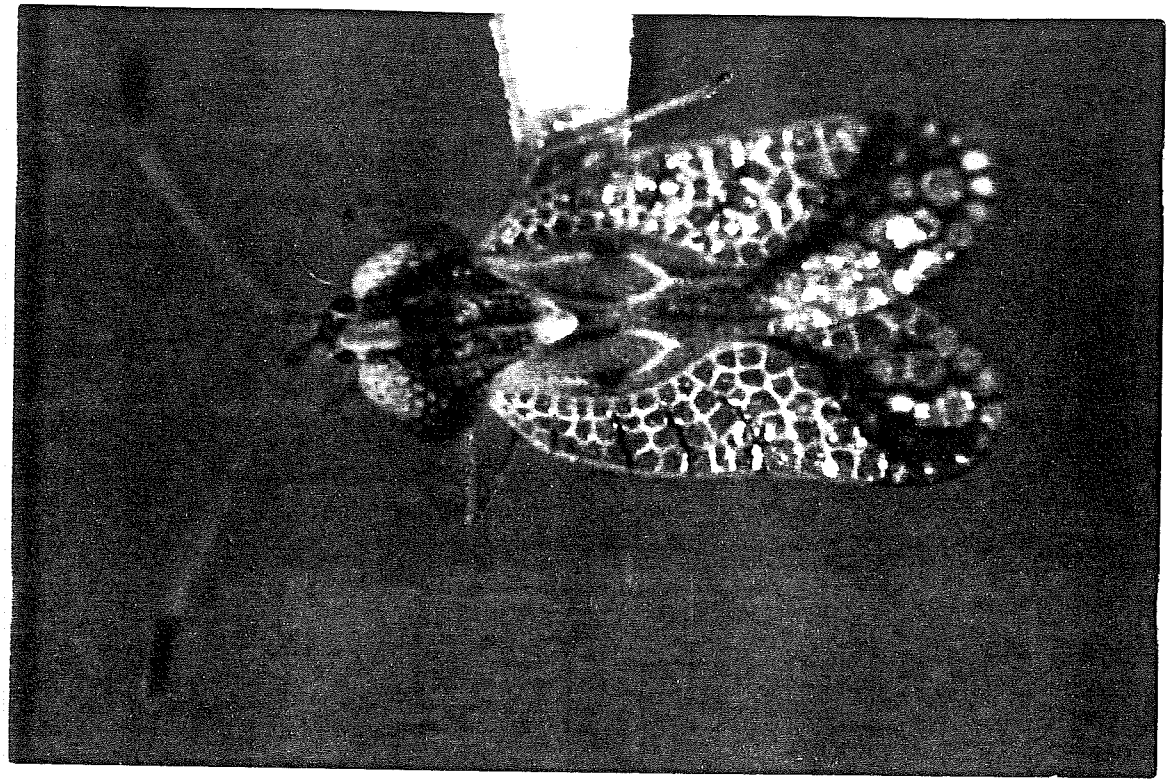


Fig. 85. *Gargaphia obliqua.*

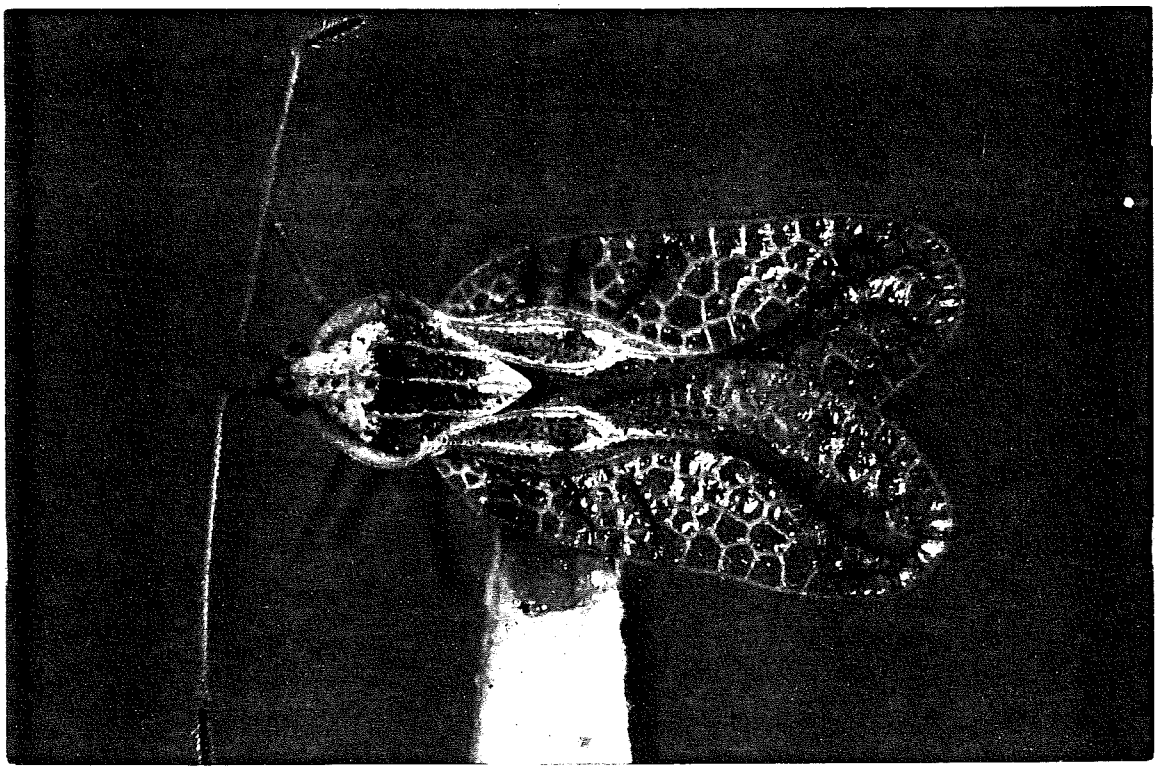


Fig. 84. *Gargaphia munda.*

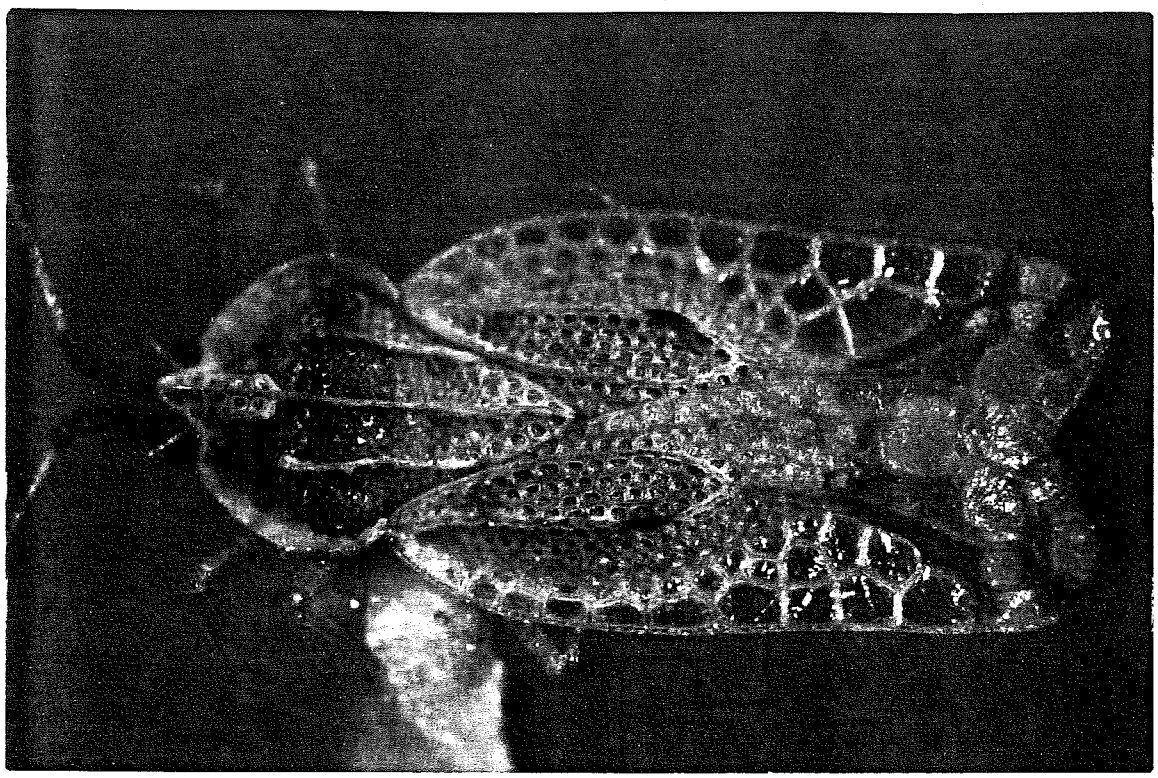


Fig. 87. *Gargaphia paula.*

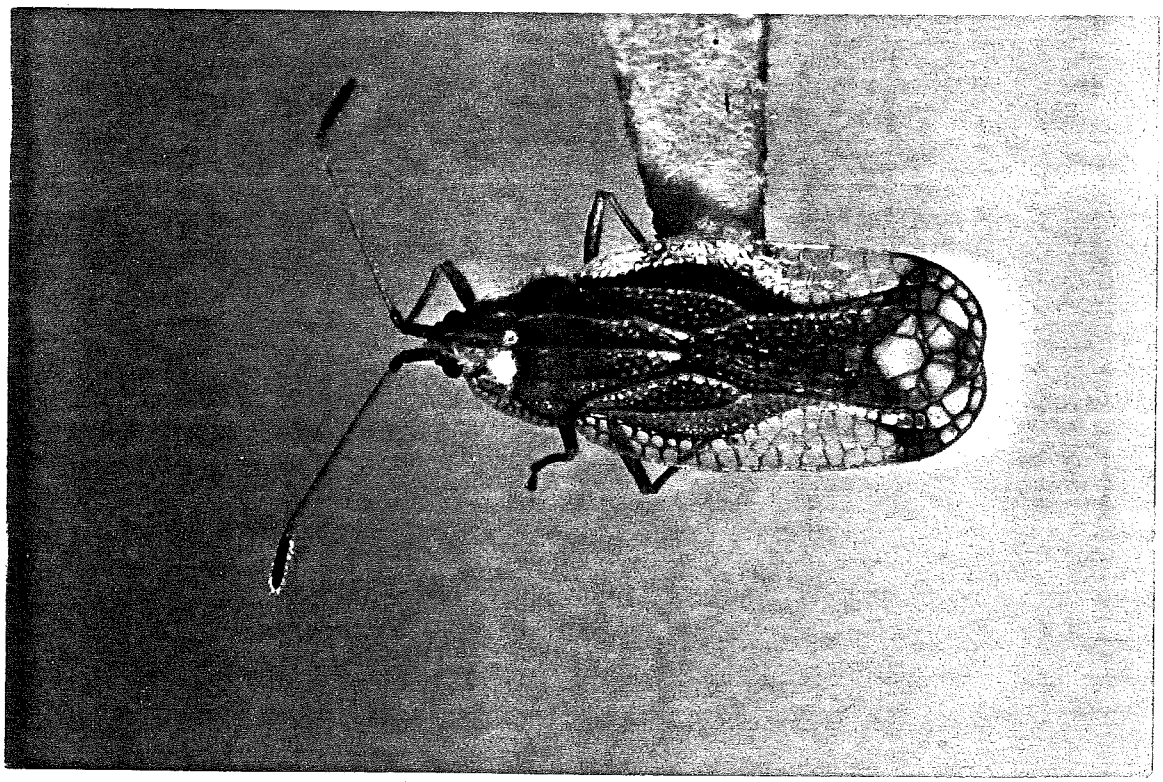


Fig. 86. *Gargaphia patria.*

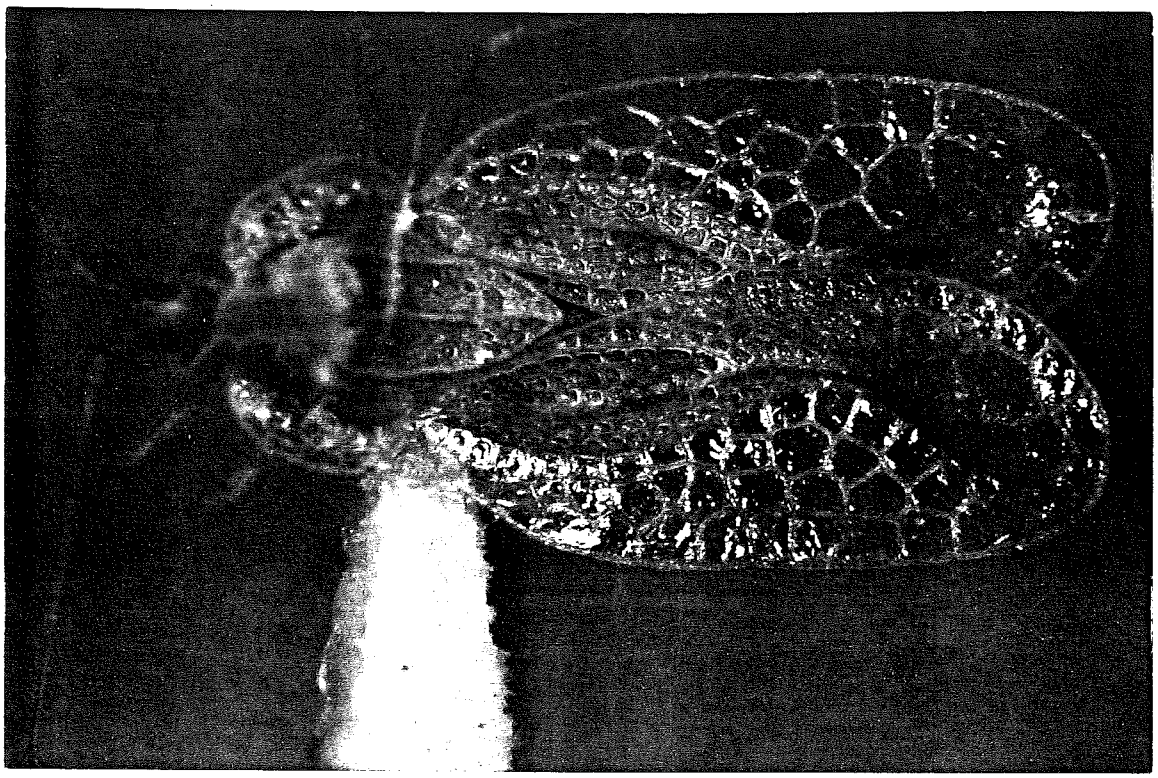


Fig. 89. *Gargaphia serjaniae.*

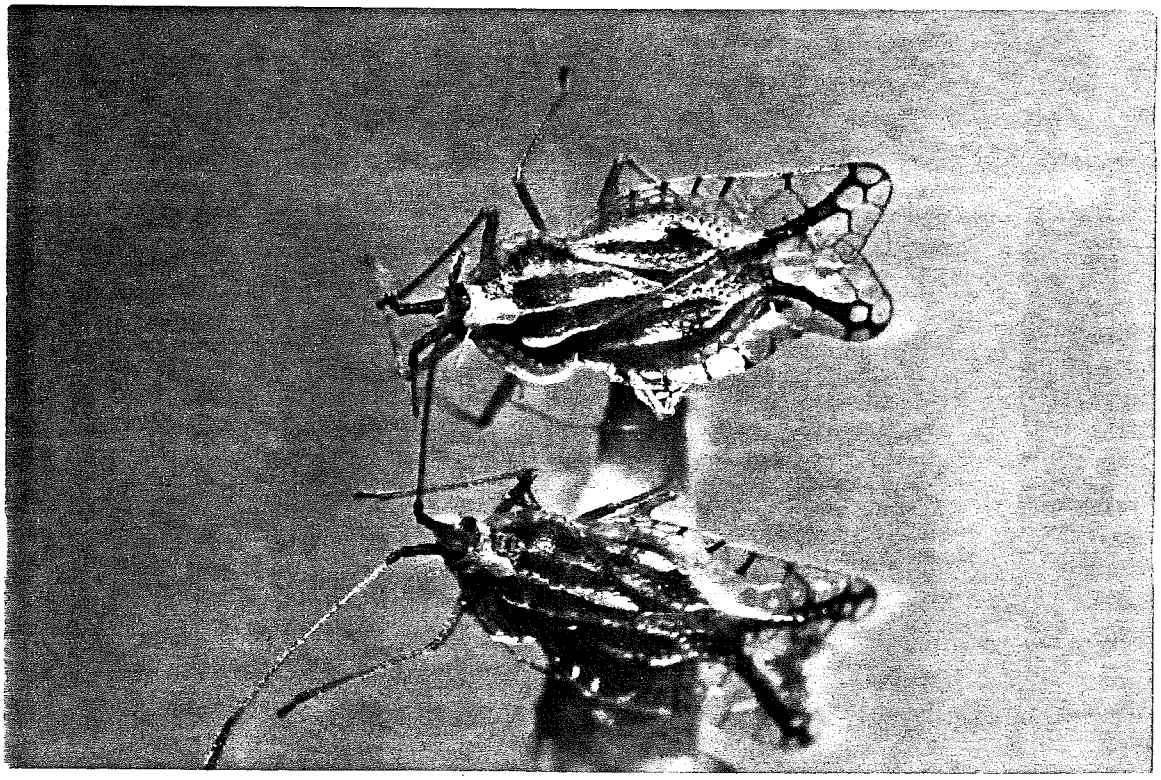


Fig .88. *Gargaphia schulzei.*

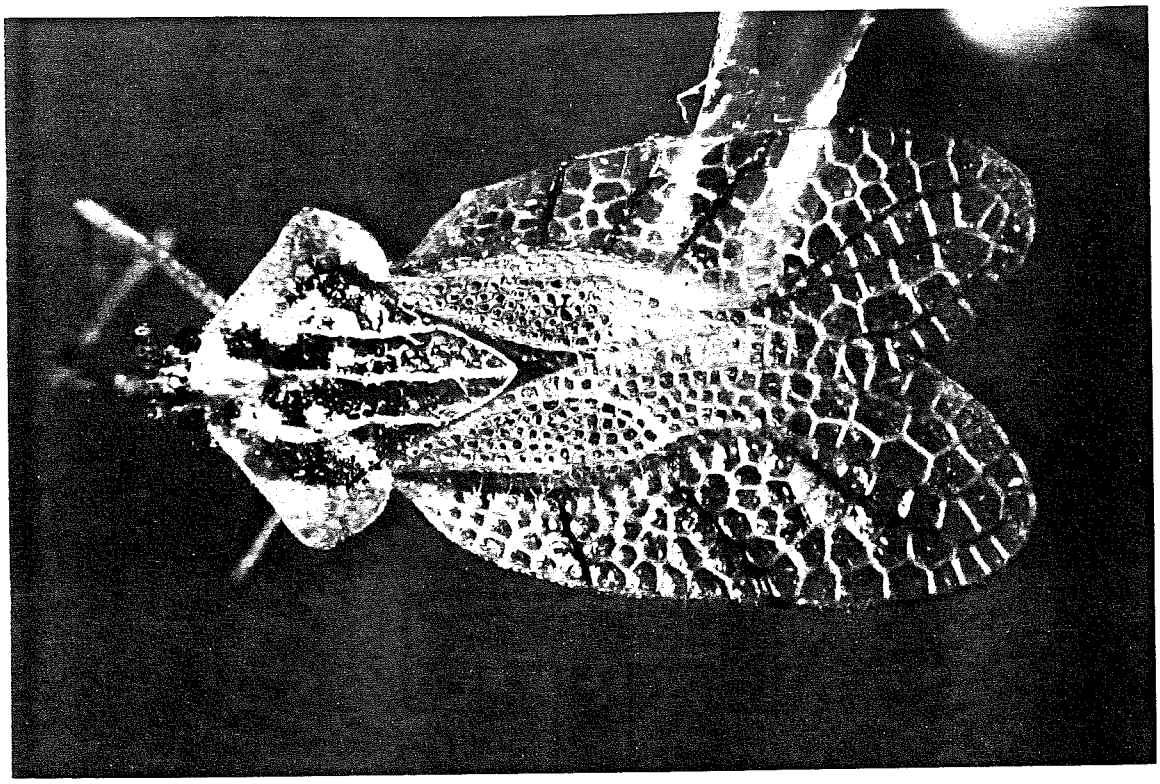


Fig. 91. *Gargaphia concursa.*

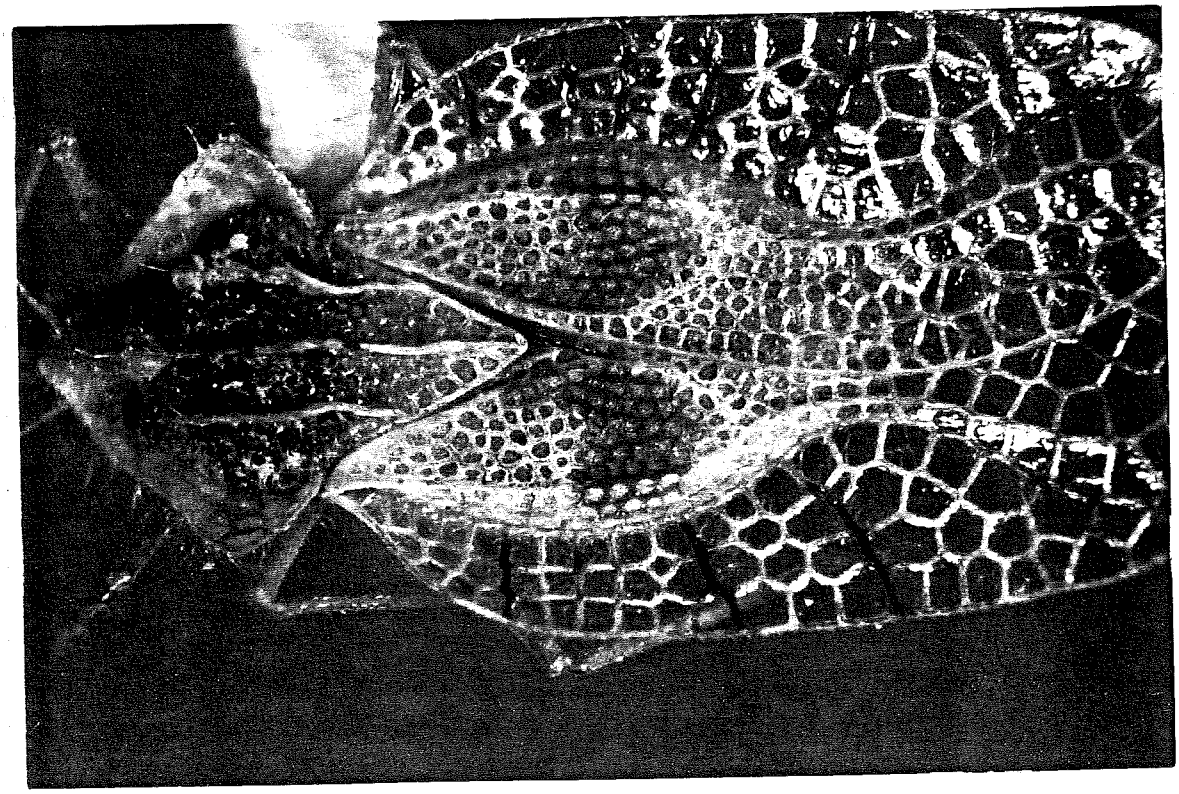


Fig. 90. *Gargaphia comosa.*

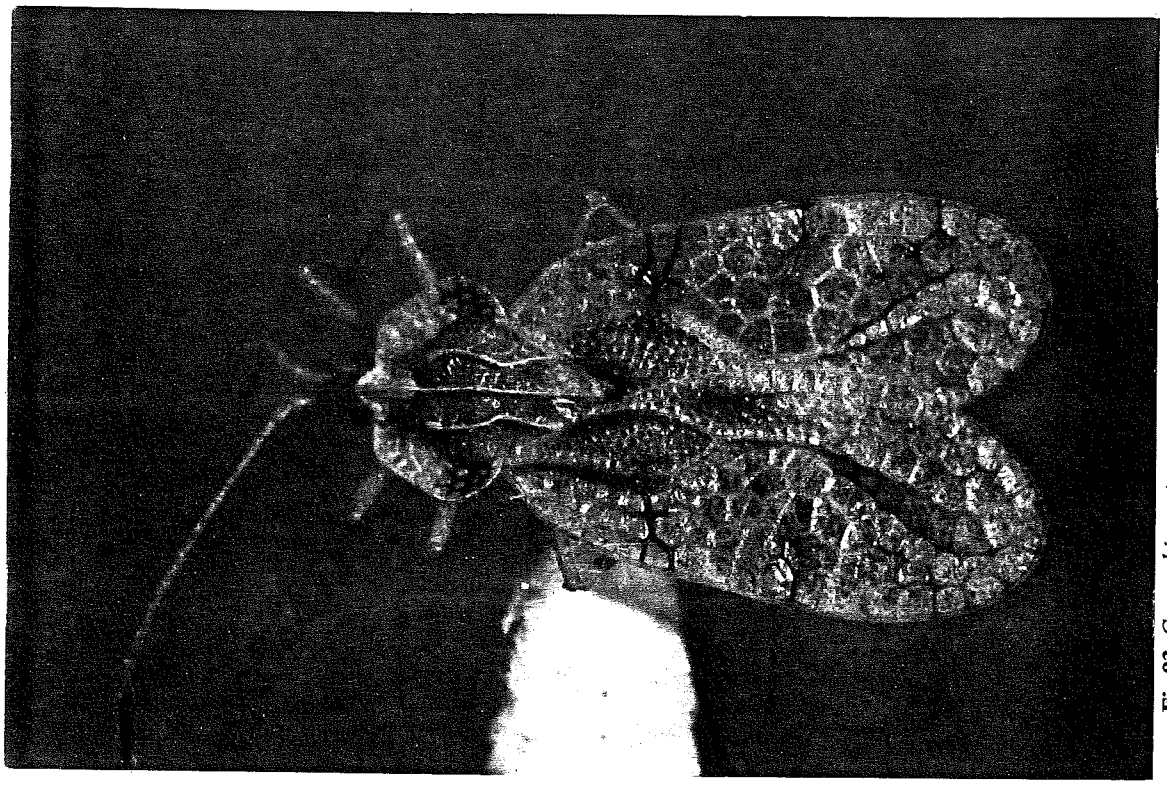


Fig.93. *Gargaphia crotonae.*

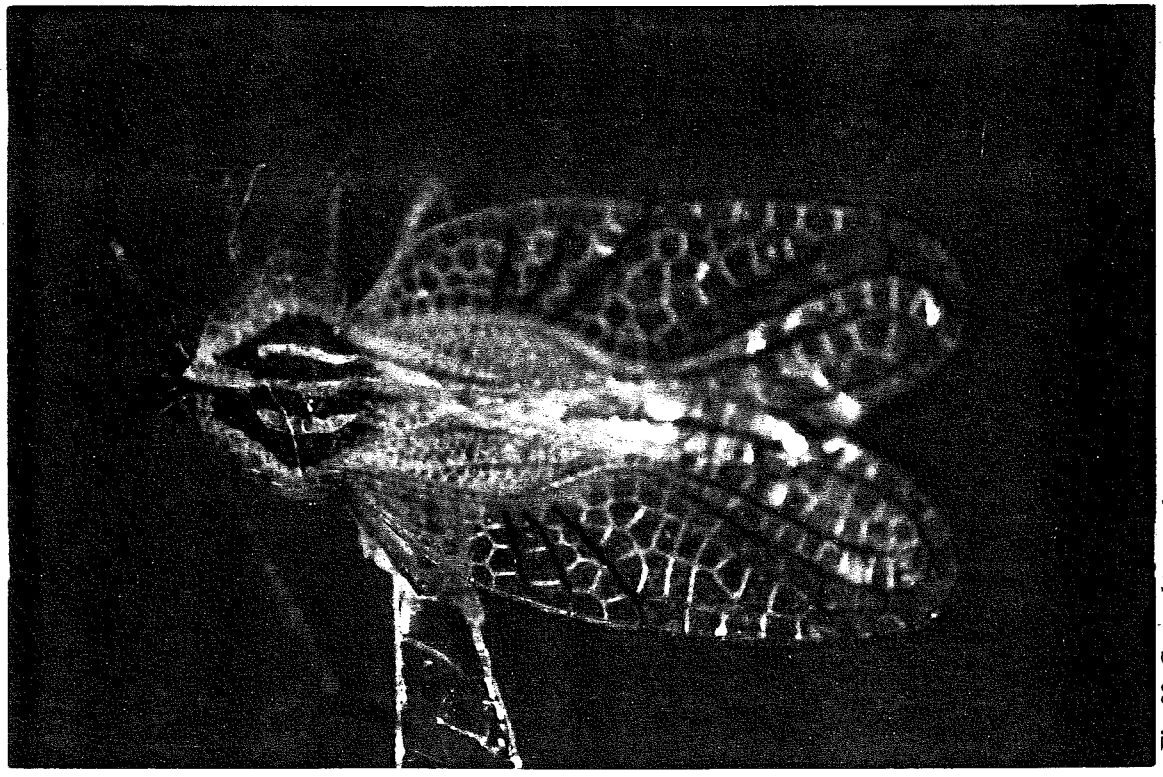


Fig. 92. *Gargaphia costalimai.*

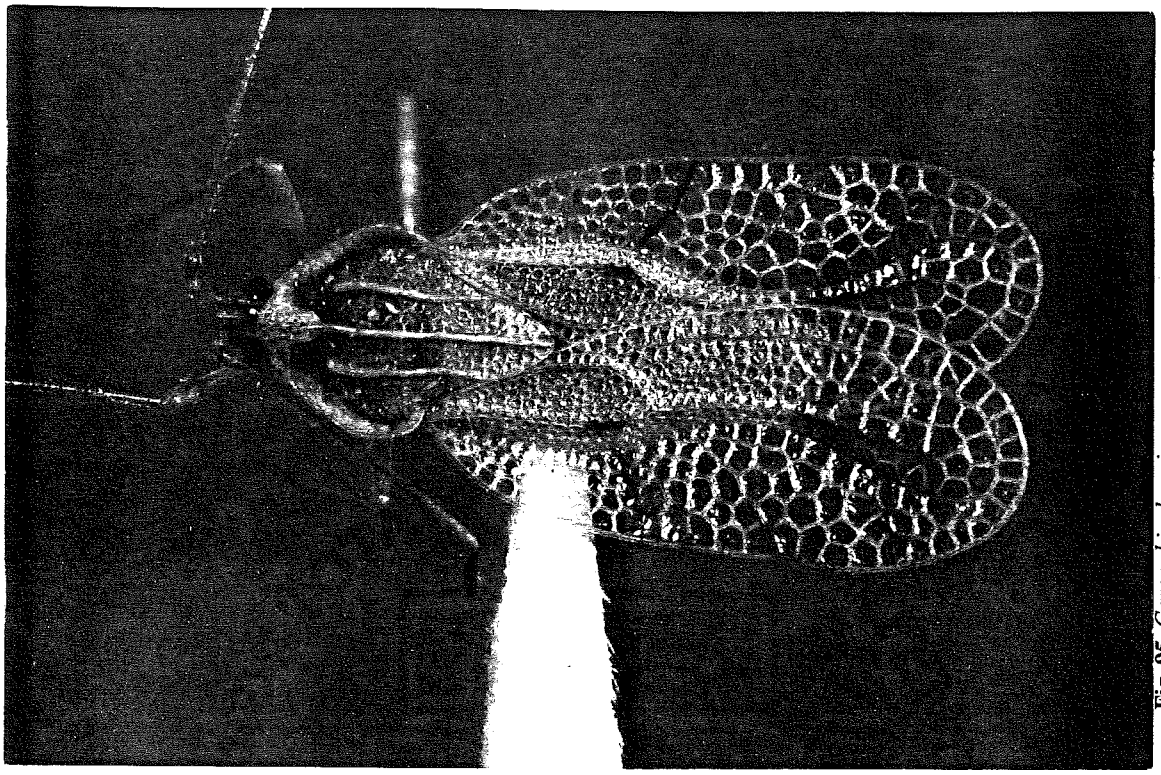


Fig. 95. *Gargaphia decoris.*

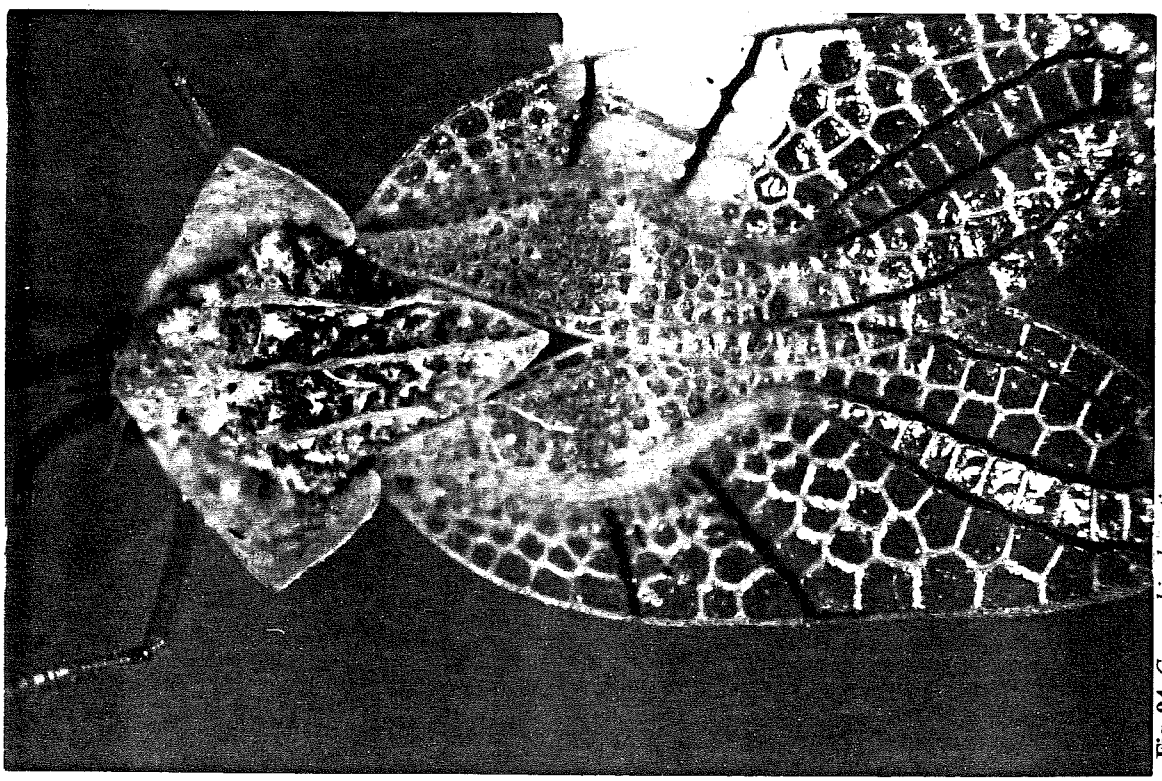


Fig. 94. *Gargaphia deceptiva.*

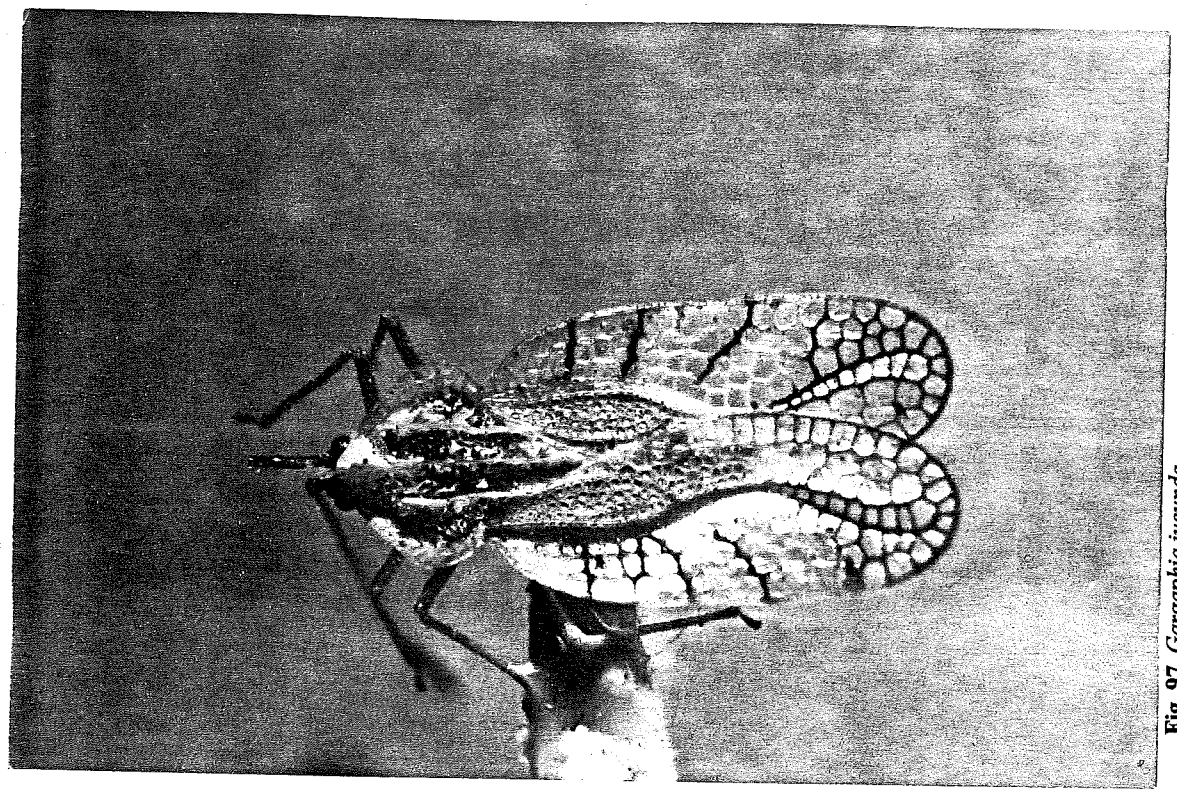


Fig. 97. *Gargaphia jucunda.*

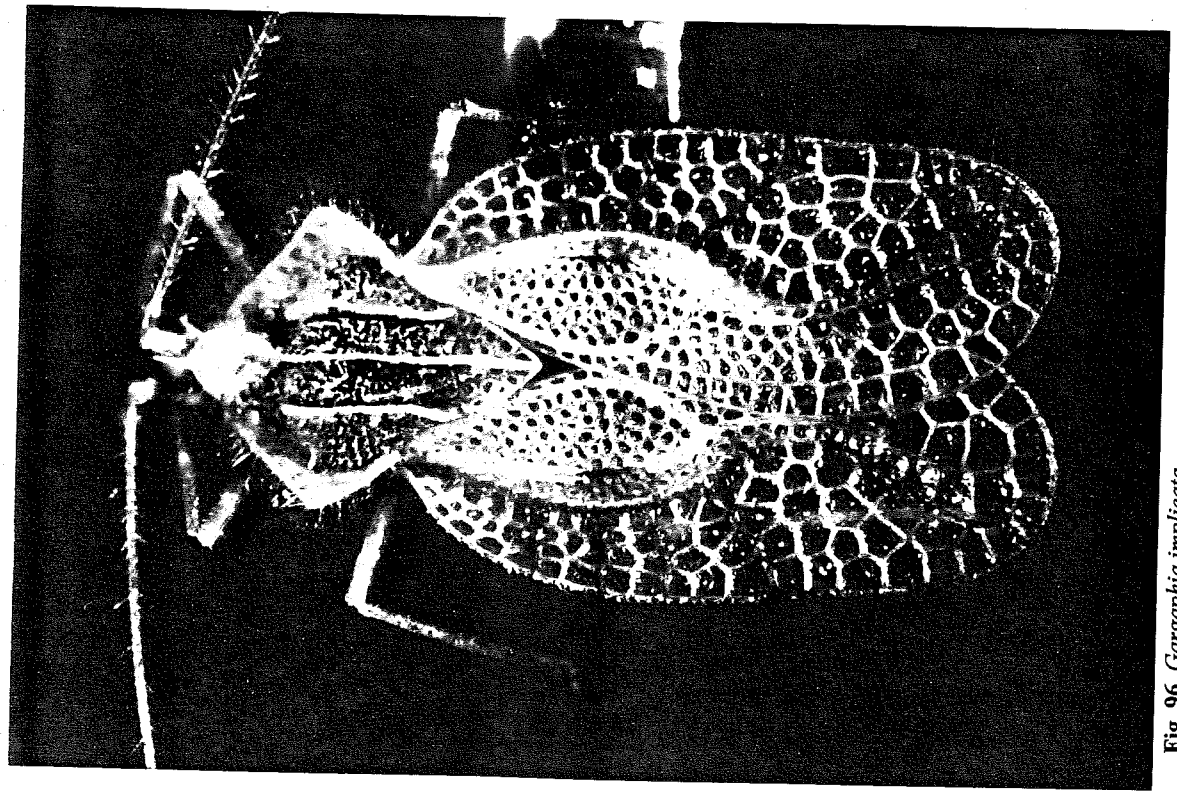


Fig. 96. *Gargaphia implicata.*

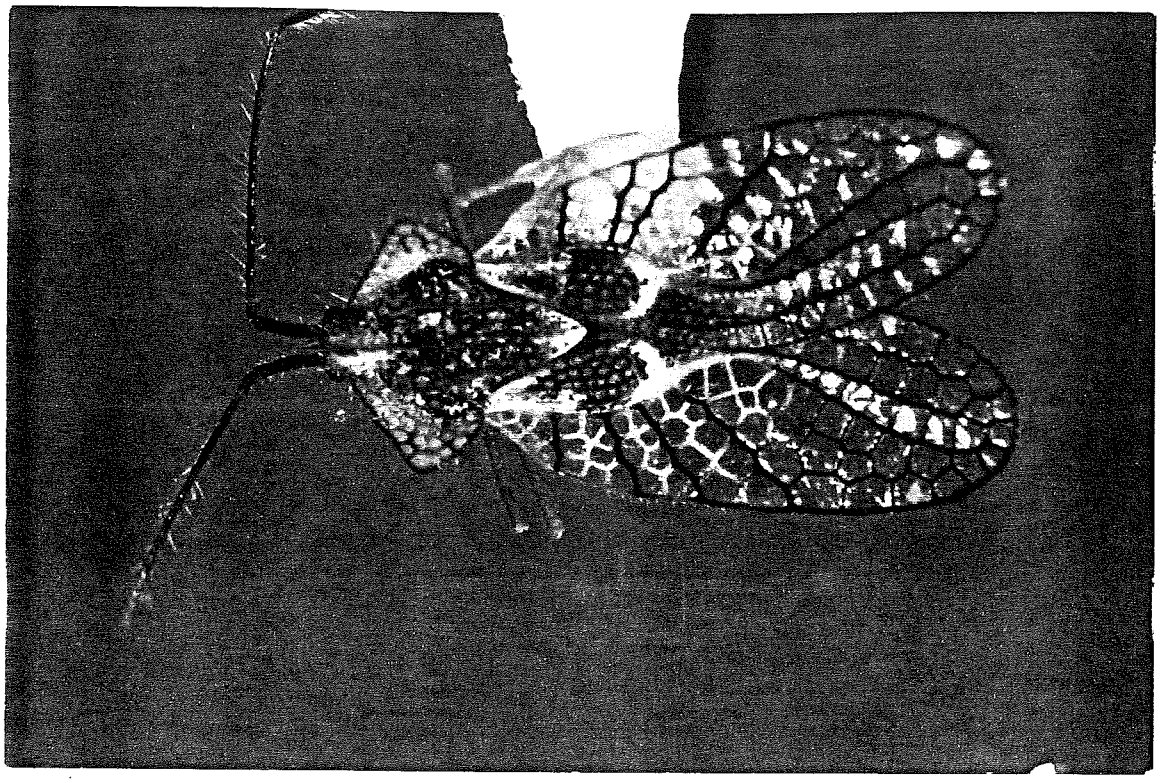


Fig. 99. *Gargaphia neivai.*

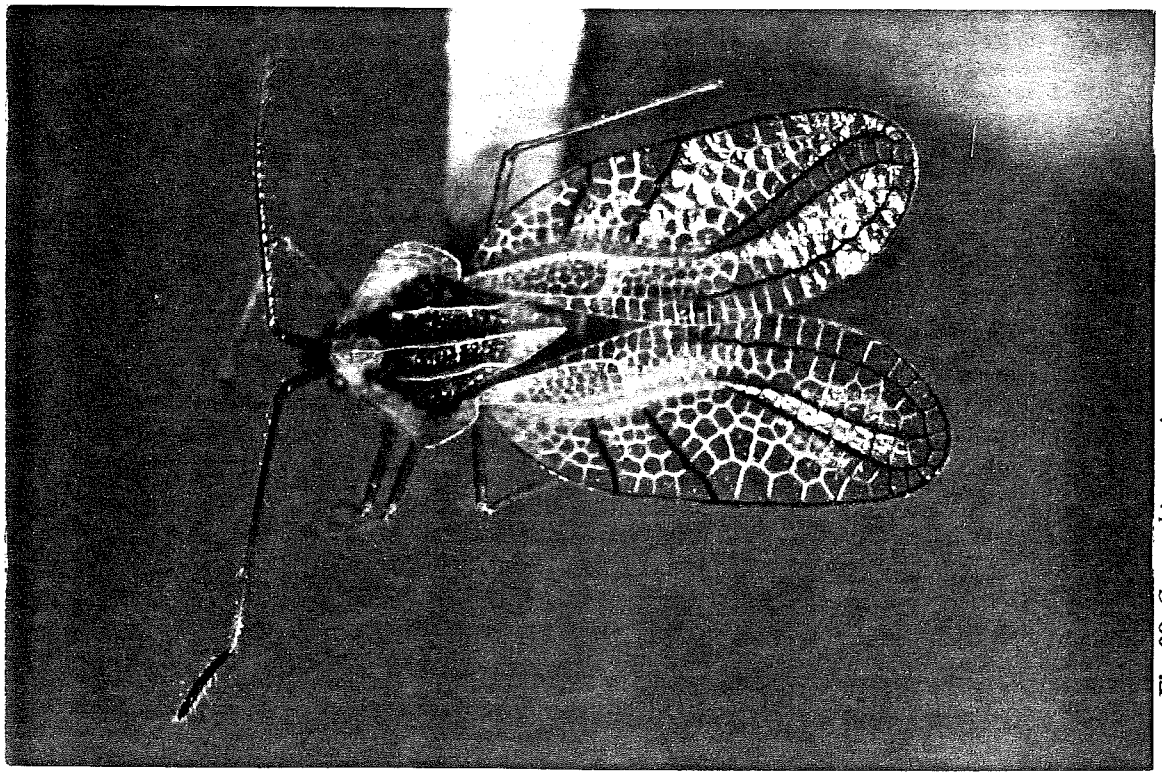


Fig. 98. *Gargaphia manni.*

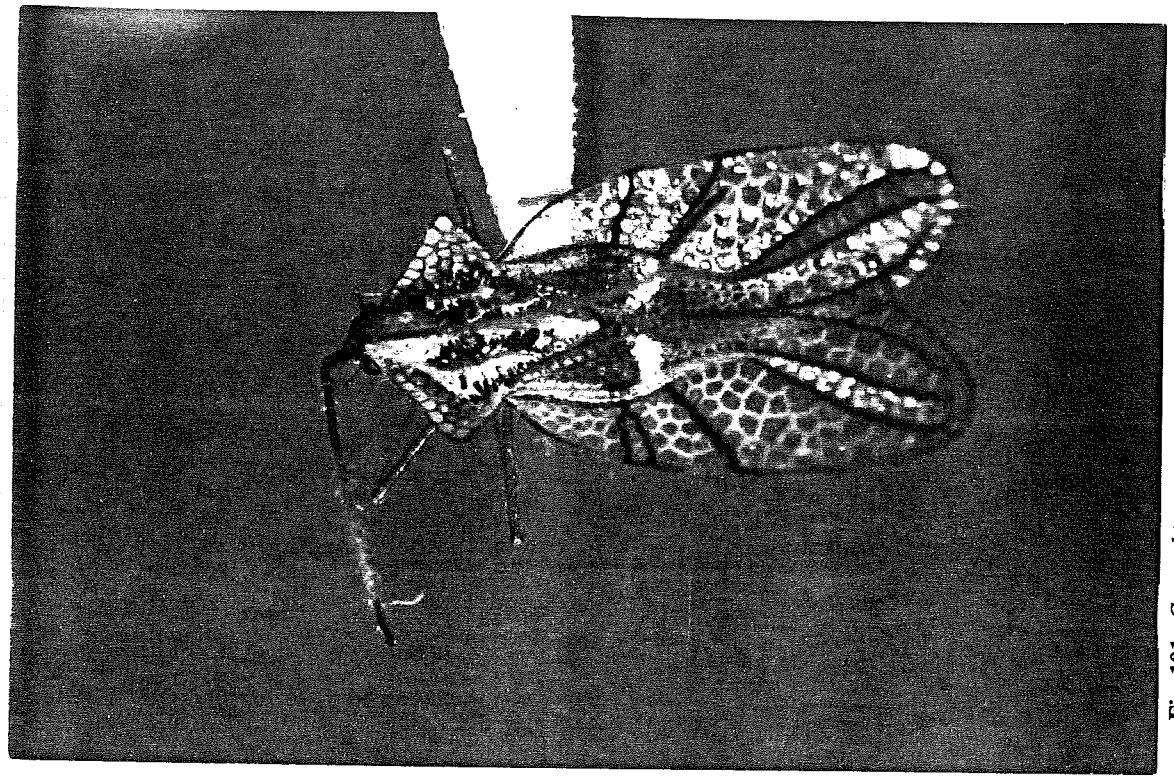


Fig. 101. *Gargaphia nigrinervis.*

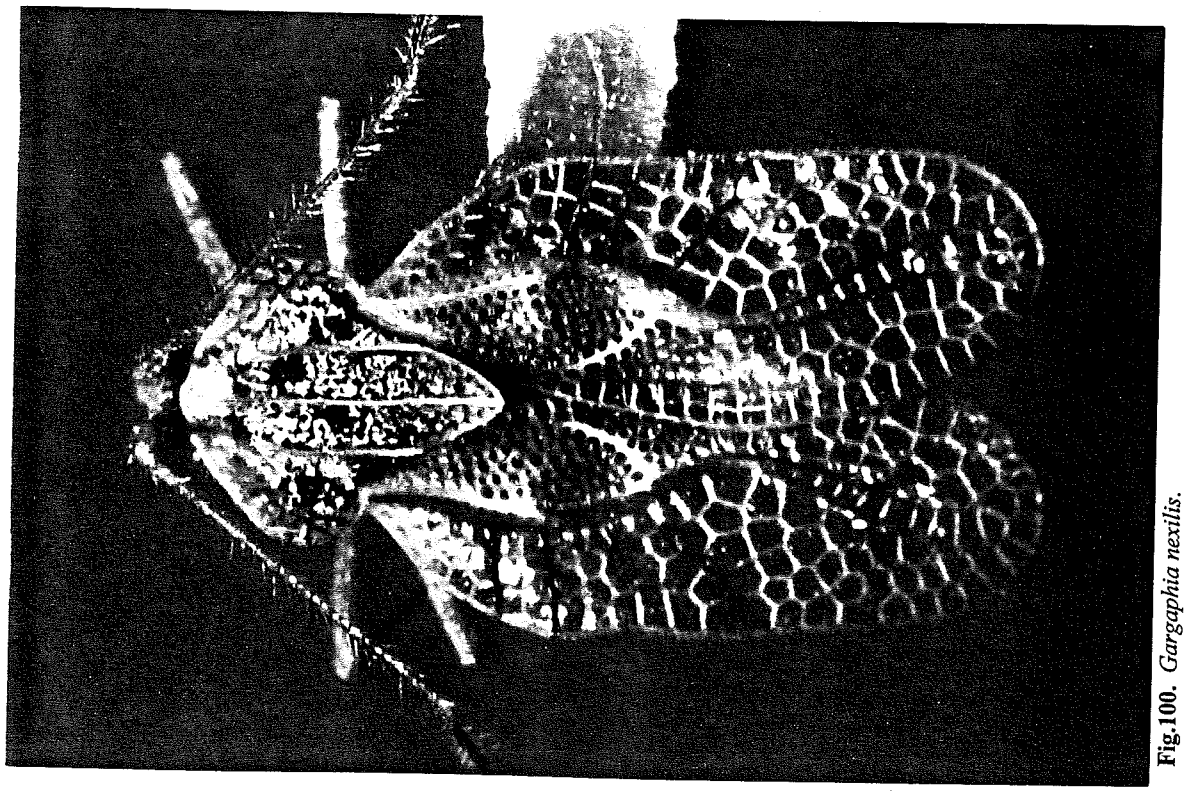


Fig.100. *Gargaphia nexilis.*

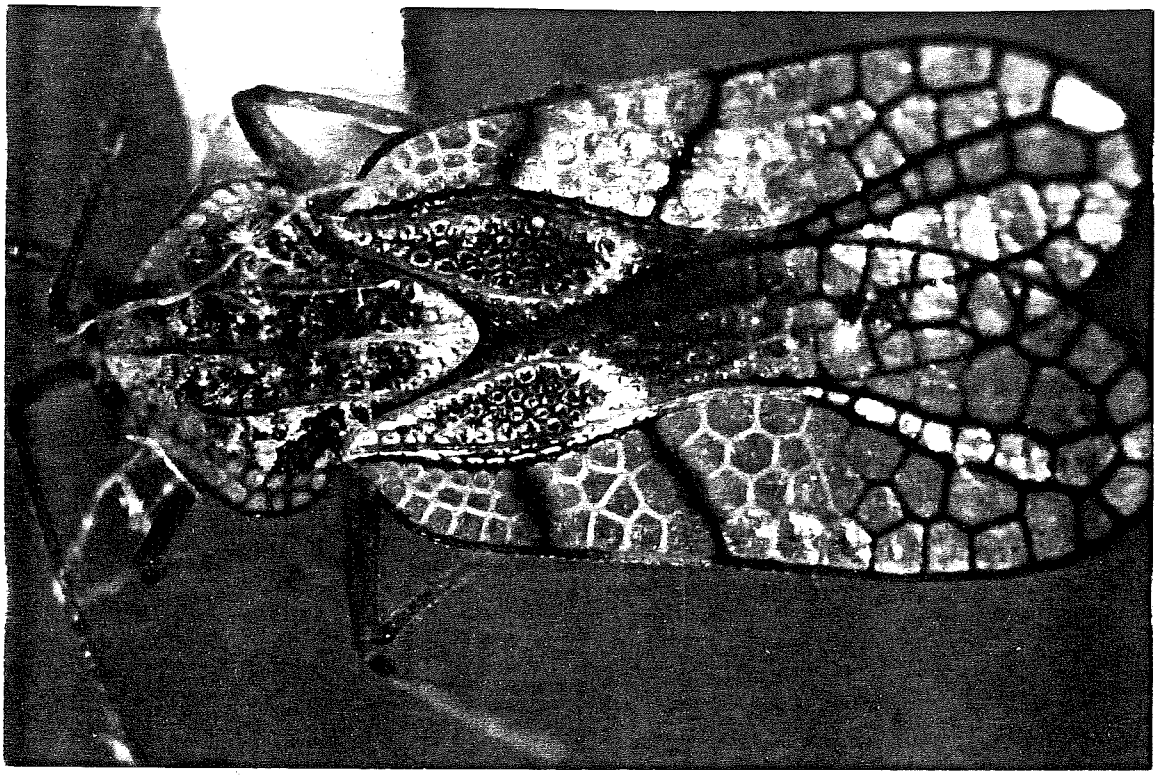


Fig.103. *Gargaphia opima.*

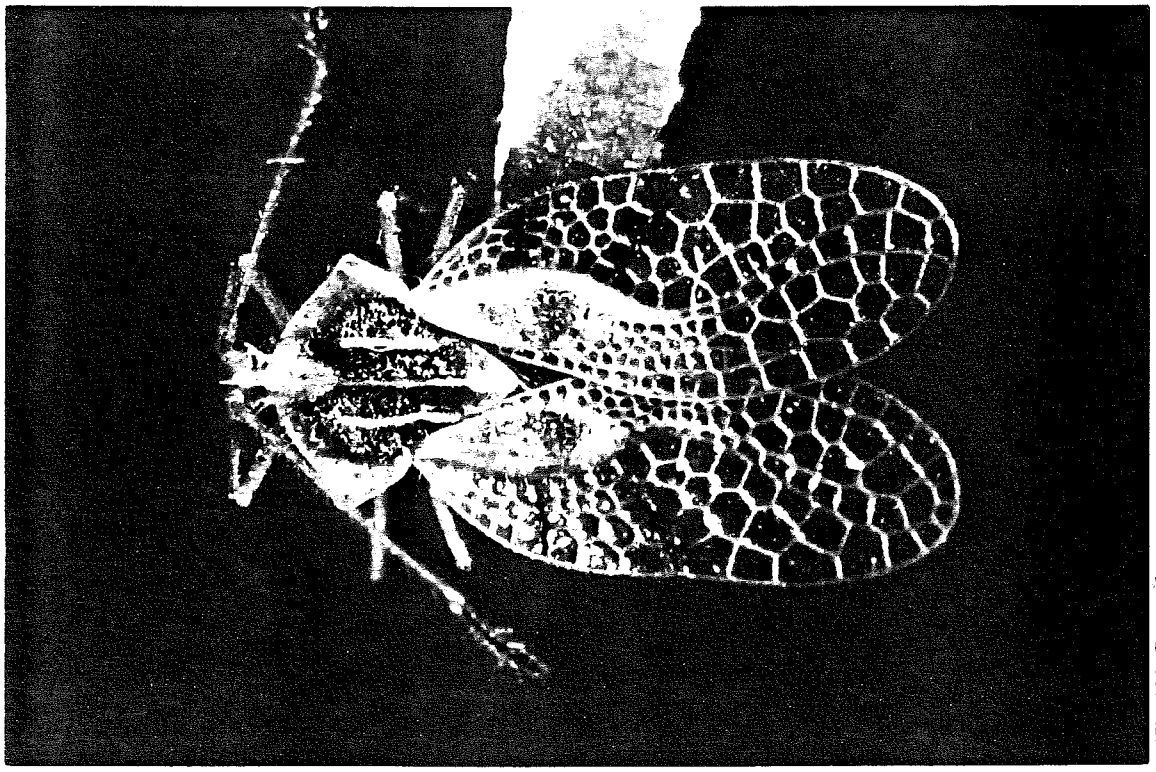


Fig.102 *Gargaphia nociva.*

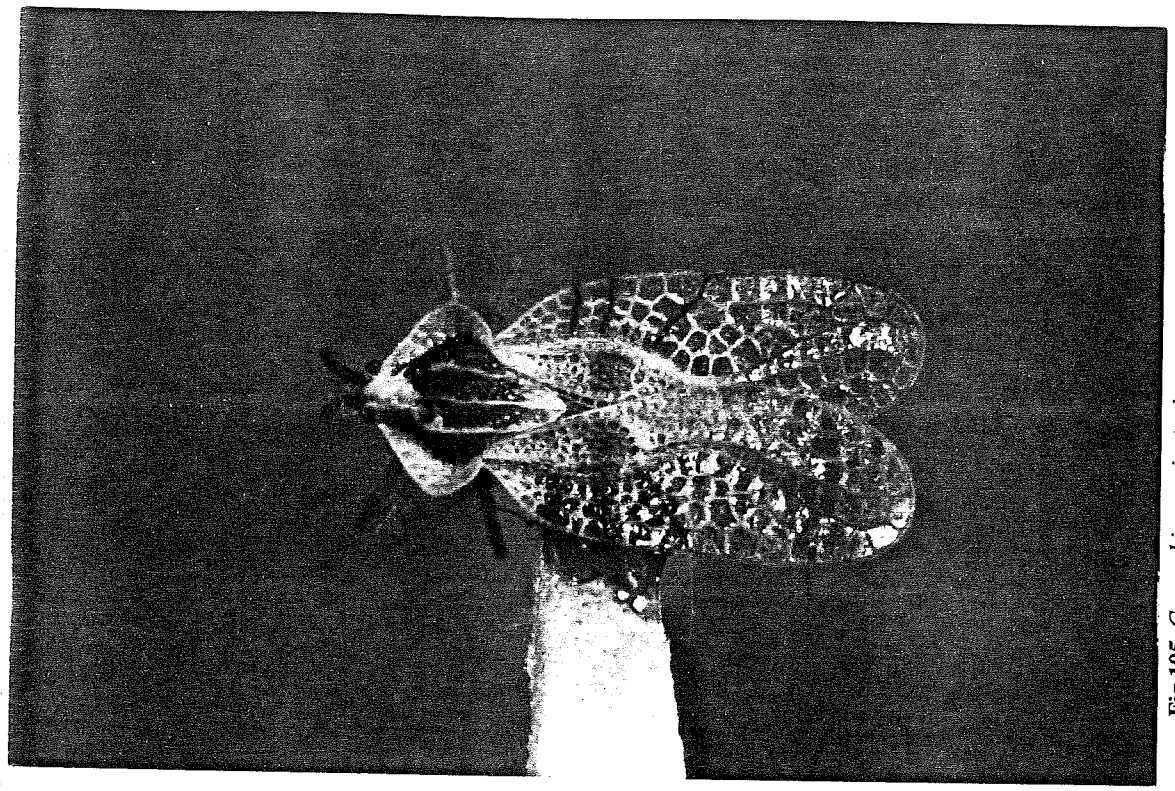


Fig.105. *Gargaphia penningtoni.*

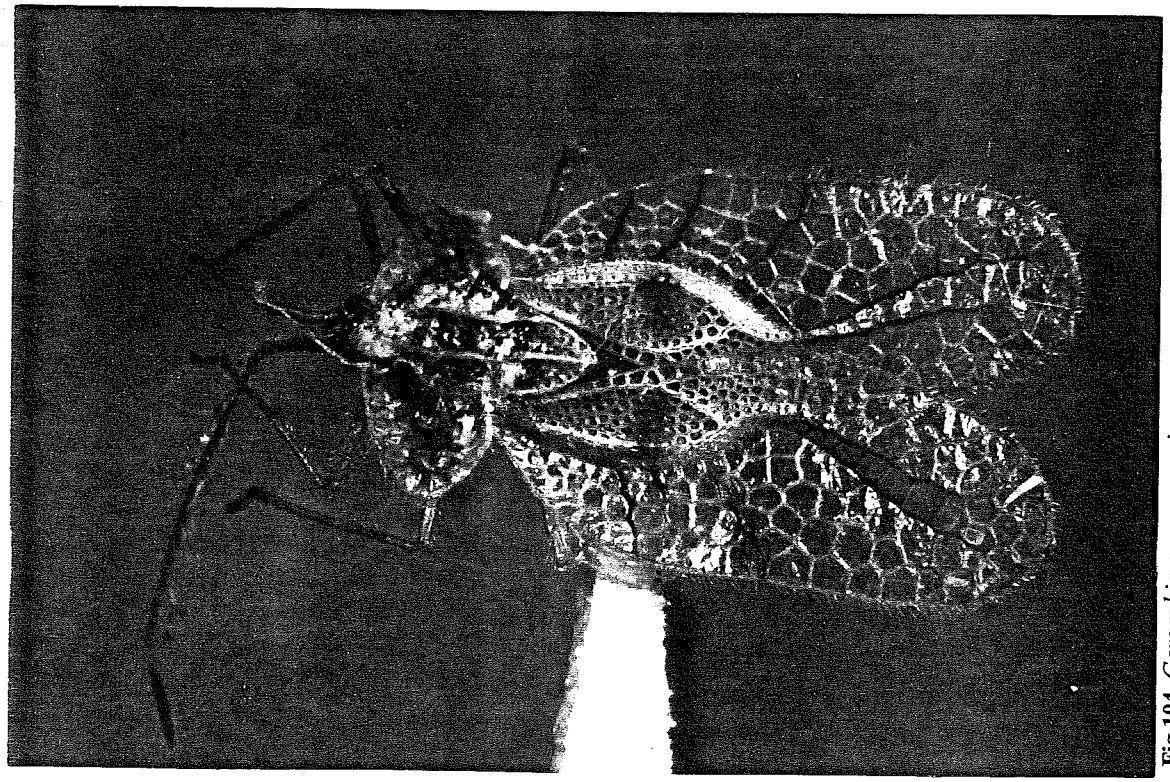


Fig.104. *Gargaphia paraguayensis.*

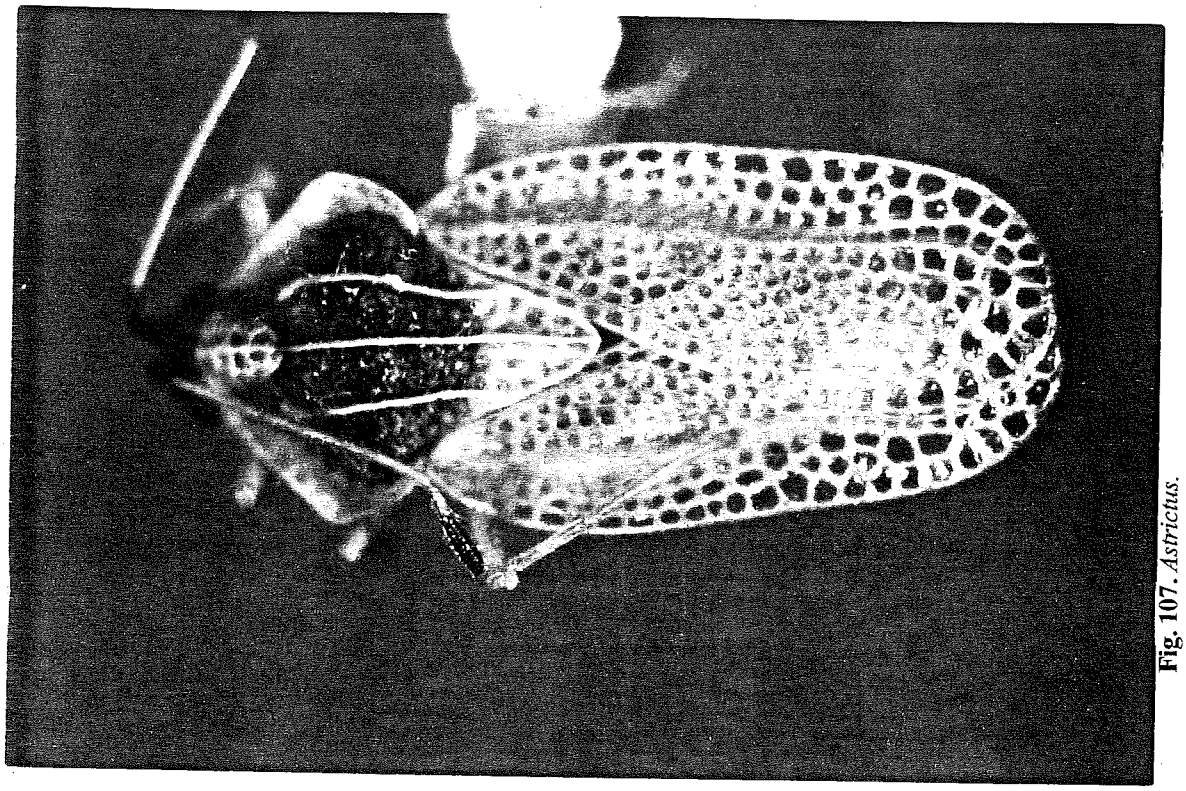


Fig. 107. *Astrictus.*

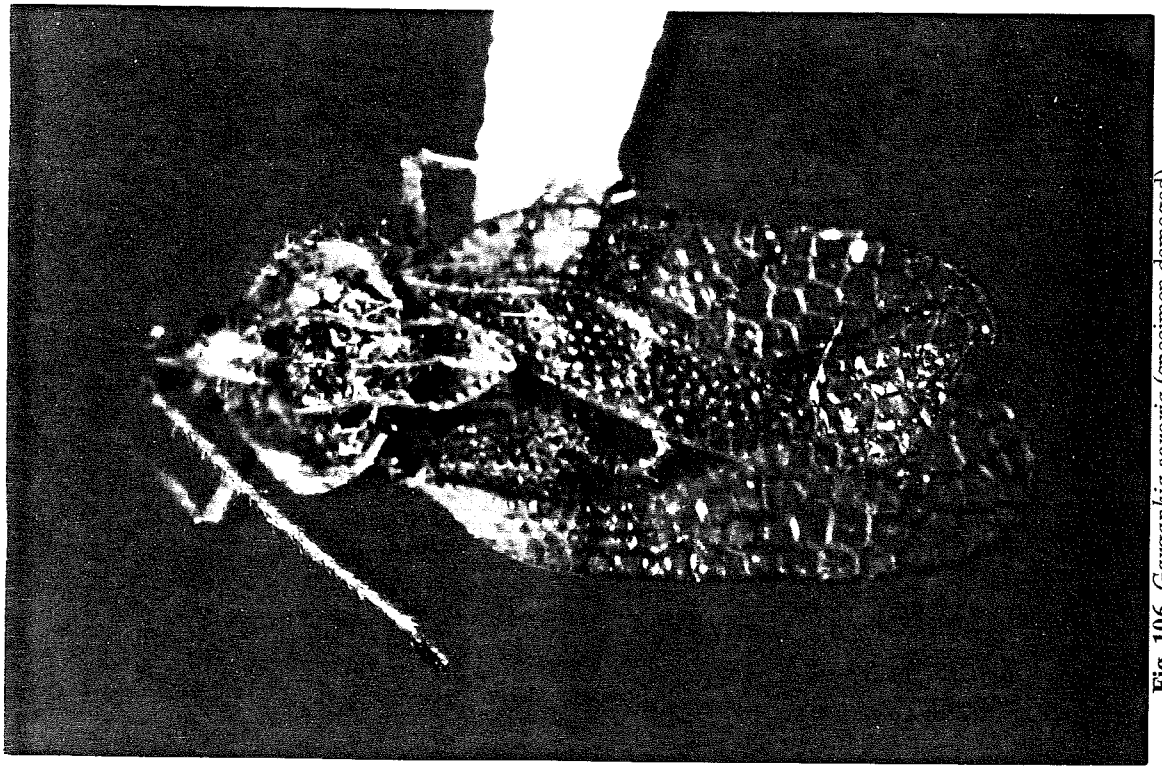


Fig. 106. *Gargaphia sororia* (specimen damaged).

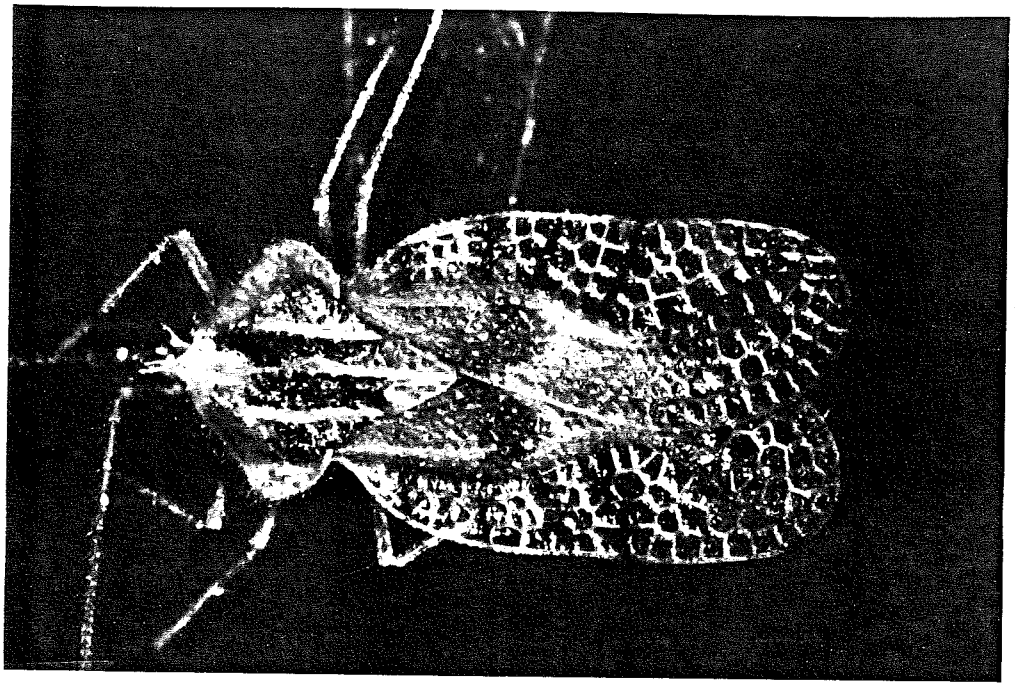


Fig. 109. *Gargaphia dissortis.*

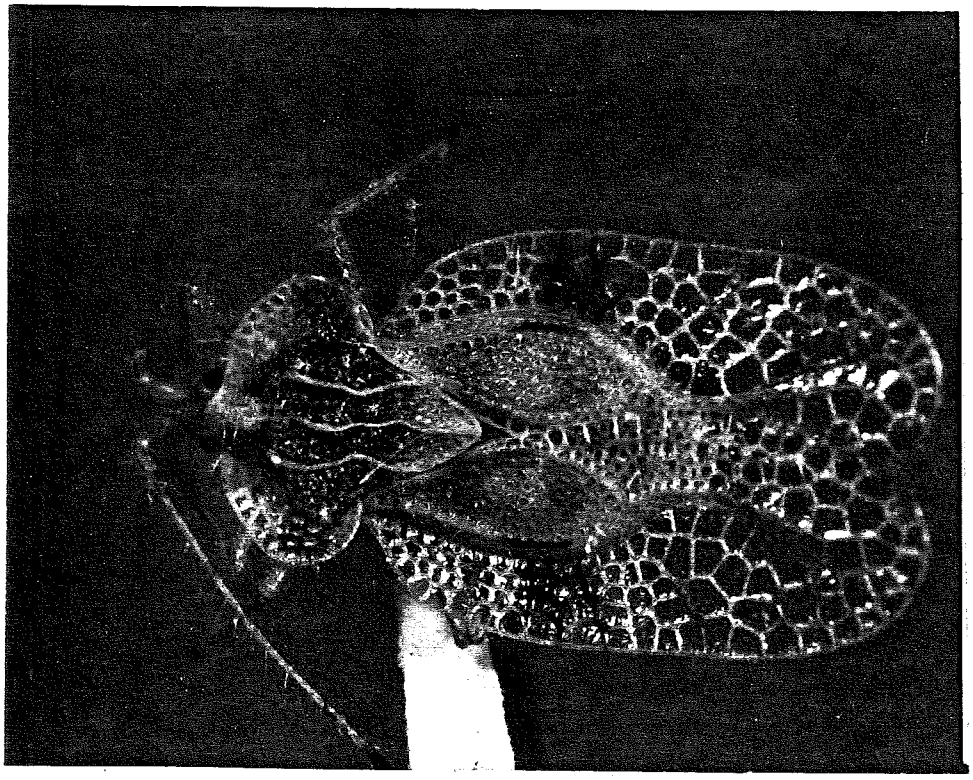


Fig. 108. *Gargaphia patricia* species group.

APPENDIX B

FIGURES FROM PHYLOGENETIC ANALYSIS

Table 1. Data Matrix

Taxon	Character Number
	1 1111111112 2222222
	1234567890 1234567890 1234567
Gargaphia acmonis	1001010010 1100000210 1111?11
Gargaphia brunfelsiae	10100000?? 0101002010 1111111
Gargaphia contubernala	1000000010 ?101012010 1111?11
Gargaphia differitas	1010010110 010?002010 1111111
Gargaphia ephamillosa	1000000010 0100012010 1111011
Gargaphia flexuosa	1010010010 1101001010 1111111
Gargaphia inca	1001001170 ?101102010 1111110
Gargaphia lunulata	1001010010 1100011210 1111111
Gargaphia munda	1000000010 1100012010 1101?11
Gargaphia obliqua	1000010010 0101002010 1110111
Gargaphia patria	1100?02011 1101001200 1111111
Gargaphia paula	1001012010 1100011210 1101111
Gargaphia schulzei	1001010170 1100011210 1101101
Gargaphia serjaniae	1000010110 0100012010 1111?11
Gargaphia, patricia gr.	100000?110 0010002011 0000011
Gargaphia, nigrivervis gr.	1000001??? 00100?3011 0000011
Astrictus	000010100? 10100 01101 0000011
Leptopharsa	1000101000 1001001100 0111000

List of species represented by OTU's in Appendix B, Fig. 1 and Fig. 2.

Astrictus

- *Astrictus albescens* (Drake)
- *Astrictus arizonica* (Drake and Carvalho)
- *Astrictus balli* (Drake and Carvalho)
- *Astrictus bimaculata* (Parshley)
- *Astrictus condensa* (Gibson)
- *Astrictus gentilis* (Van Duzee)
- *Astrictus insularis* (Van Duzee)
- *Astrictus iridescens* (Champion)
- *Astrictus lanei* (Monte)
- *Astrictus opacula* (Uhler)
- *Astrictus oregona* (Drake and Hurd)
- *Astrictus subpilosa* (Berg)
- *Astrictus tuthilli* (Drake and Carvalho)
- *Astrictus vanduzeei* (Gibson)

Gargaphia patricia species group

- *Gargaphia amorphae* (Walsh)
- *Gargaphia angulata* Heidemann
- *Gargaphia mexicana* Drake
- *Gargaphia mirabilis* Monte
- *Gargaphia patricia* (Stål)
- *Gargaphia socorrona* Drake
- *Gargaphia solani* Heidemann
- *Gargaphia tiliae* (Walsh)
- *Gargaphia torresi* Costa Lima

Gargaphia nigrinervis species group

- *Gargaphia comosa* Monte
- *Gargaphia concursa* Drake
- *Gargaphia costalimai* Monte
- *Gargaphia crotonae* Drake and Hambleton
- *Gargaphia deceptiva* (Drake and Bruner)
- *Gargaphia decoris* Drake
- *Gargaphia dissortis* Drake
- *Gargaphia jucunda* Drake and Hambleton
- *Gargaphia manni* Drake and Hurd
- *Gargaphia neivai* Drake and Poor
- *Gargaphia nexilis* Drake and Hambleton
- *Gargaphia nigrinervis* Stål
- *Gargaphia nociva* Drake and Hambleton
- *Gargaphia opima* Drake
- *Gargaphia paraguayensis* Drake and Poor
- *Gargaphia penningtoni* Drake
- *Gargaphia sororia* Hussey

Gargaphia brunfelsiae species group
- *Gargaphia acmonis* Drake and Hambleton
- *Gargaphia brunfelsiae* Monte
- *Gargaphia contubernala* Smith
- *Gargaphia differitas* Drake
- *Gargaphia ephamillosa* Smith
- *Gargaphia flexuosa* (Stål)
- *Gargaphia inca* Monte
- *Gargaphia lunulata* (Mayr)
- *Gargaphia munda* (Stål)
- *Gargaphia obliqua* Stål
- *Gargaphia patria* (Drake and Hambleton)
- *Gargaphia paula* Drake
- *Gargaphia schulzei* Drake
- *Gargaphia serjaniae* Drake and Hambleton

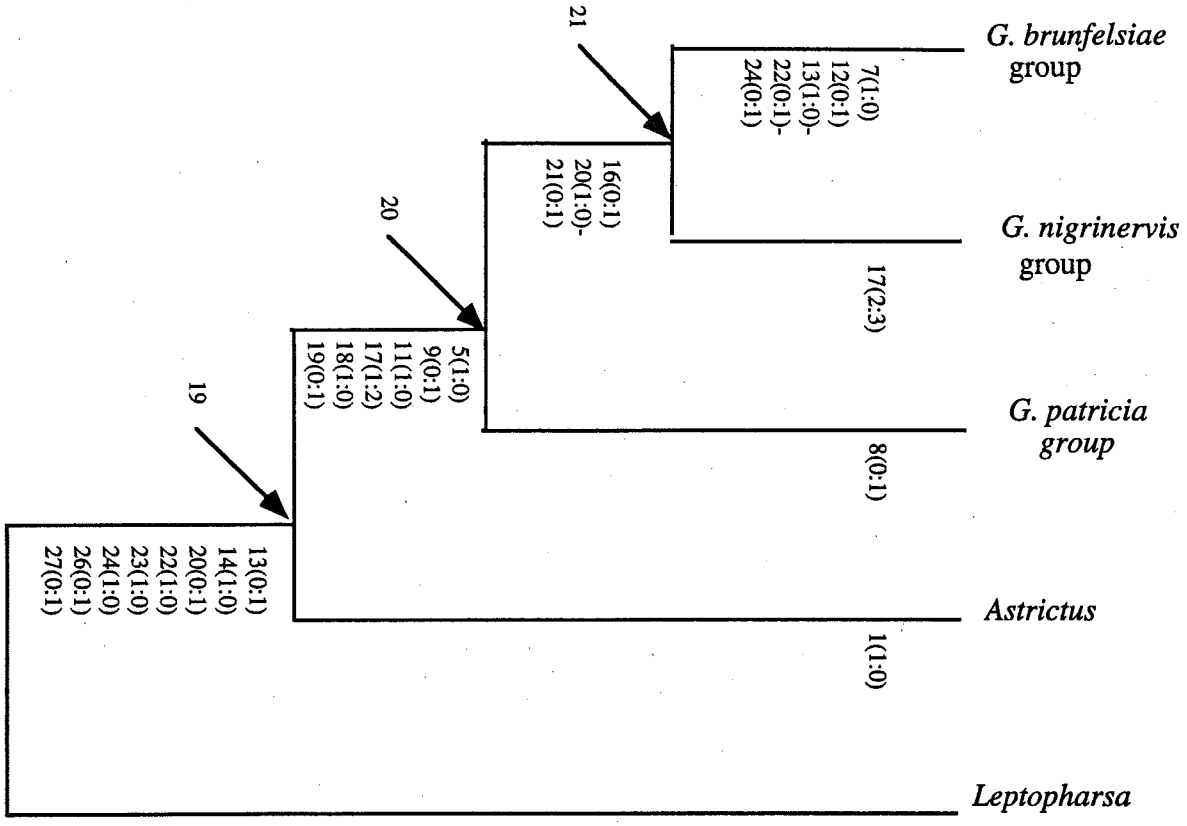


Fig. 110. Strict consensus of 108 equally parsimonious trees. Support for nodes indicated with state changes in parenthesis (- indicates reversal).

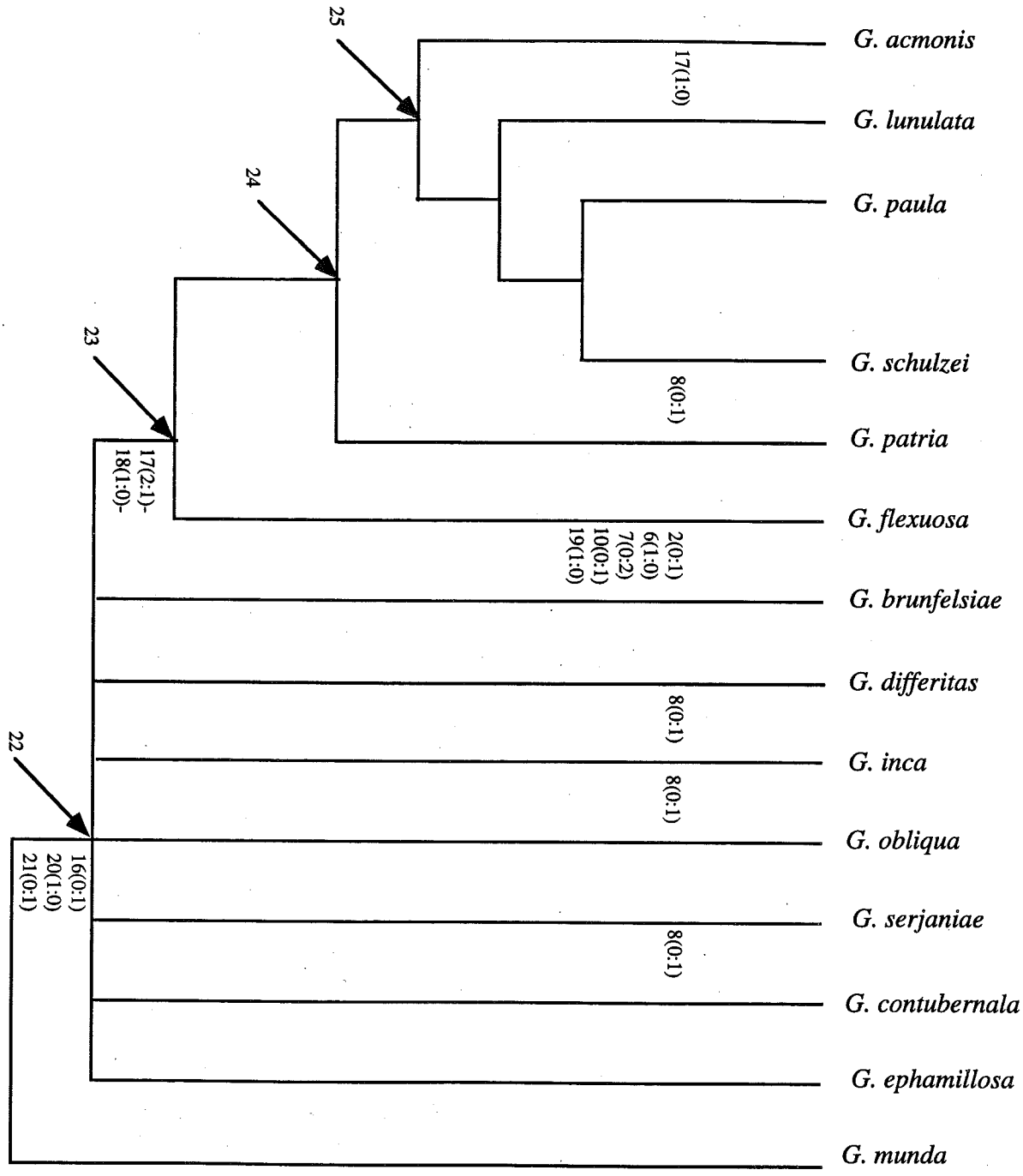


Fig. 111. Extension of Cladogram 1, resolution of species within the *brunfelsiae* species group. Support for major nodes indicated with state changes in parenthesis (-indicates reversal).

APPENDIX C

LABEL DATA

Gargaphia acmonis Drake and Hambleton

PERU					
Tingo Maria					
Rio Huallaga, 700m	IX-1944	Weyrauch	DRAKE	2♂	
SURINAM					
Paramaribo					
		P.H.v.Doesburg, Jr.	DRAKE	3	2♀

Gargaphia brunfelsiae Monte

ARGENTINA					
Chaco					
Dep. Resistencia	X-XII-1935	J.B. Daguerre	DRAKE	2♂	
				1 unknown (missing abd.)	
BRAZIL					
Minas Gerais					
Belo Horizonte		O. Monte, 649.	FSCA		2♀
Rio Grande do Sul		J. Backer	DRAKE	1	1
Vicosa	14-IV-1933	E.J. Hambleton	DRAKE	3	3

Gargaphia differitas Drake

BRAZIL					
Minas Gerais					
Ponte Nova	22-IV-1934		DRAKE	23♂	12♀
Ponte Nova	22-IV-1934				1
Vicosa	5-II-1934	E.J. Hambleton, 80.	DRAKE		1
Vicosa	29-IV-1934	E.J. Hambleton	DRAKE	4	2
Vicosa	13-X to 1-XI-1985	T.J. Henry &S.P. Fiuza F.	TAMU	2	
Vicosa	20-II-1934	.	DRAKE	1	2
Santa Catarina					
Nova Teutonia 27°11B52°23L 3-500m	7-V-1938		DRAKE		1
Nova Teutonia 27°11B52°23L 3-500m	8-VIII-1948	F. Plaumann, XVI.2	USNM		1
Nova Teutonia 27°11B52°23L 3-500m	9-VIII-1948	F. Plaumann	USNM	1	1
Nova Teutonia 27°11B52°23L 3-500m	9-IX-1949		DRAKE	1	
Nova Teutonia 27°11B52°23L 3-500m	22-XII-1952		DRAKE	1	
Nova Teutonia 27°11B52°23L 3-500m	8-I-1953		DRAKE		1
Nova Teutonia	21-VIII-1948	F. Plaumann	USNM		1
Nova Teutonia	9-XII-1952		DRAKE	1	
Nova Teutonia	27-XII-1952		DRAKE		2
Nova Teutonia	5-I-1953		DRAKE		1
Nova Teutonia	8-I-1953		DRAKE		1
Nova Teutonia	29-I-1953		DRAKE		1
PERU					
Colonia					
Perene, Rio Perene 18 mi NE La Merced	3-I-1955	E. Schlinger &E. Ross	DRAKE		1

Gargaphia ephamillosa Smith

MEXICO					
Jalisco					
16 km. N. Autlan	12-14-VIII-1983	Kovarik, Harrison, Schaffner	TAMU	37♂	44♀
7 mi NE. Autlan	13-VII-1983	Schaffner, Kovarik Harrison	TAMU	15	12
6 mi N. Autlan	7-VII-1984	Schaffner, Woolley, Carroll, Friedlander	TAMU		1
Puebla					
16 mi. NW Acatlan	14-VII-1974	Clark, Murray, Ashe, Schaffner	TAMU		1
14.5 mi SE Acatlan	21-VII-1981	Bogar, Schaffner, Friedlander	TAMU	10	11
14.5 mi SE Acatlan	21-VII-1981	J.C. Schaffner	TAMU	5	5
6 mi. SW Tehuacan	8-VII-1981	Bogar, Schaffner Friedlander	TAMU	2	2
7.3 mi SW Izucar de Matamoros	20-VII-1984	Bogar, Schaffner Friedlander	TAMU		2
5 mi. SE Izucar de Matamoros	20-VII01984	Carrol, Schaffner Friedlander	TAMU		1
Sinaloa					
30 mi. N Mazatlan	18-VII-1964	H. Burke & J. Apperson	TAMU		1

Gargaphia flexuosa (Stål)

BRAZIL					
Sao Paulo	10-II-1935	E.J. Hambleton	DRAKE	6♂	21♀
Sao Paulo Taquarctinga	III-1939	E.J. Hambleton	DRAKE	1	
Minas Gerais					
B. Horizonte	25-VI-1939	O. Monte, 29.	MNMH	2	1
Vicosa	4-VI-1933	E.J. Hanbleton, 52.	DRAKE	1	1
Vicosa	4-VI-1933	E.J. Hambleton	DRAKE	1	
Vicosa	29-IV-1934	E.J. Hambleton	DRAKE	5	3
Vicosa	3-VI-1934	E.J. Hambleton, 837.	FIUZA	1	
Vicosa	6-V-1934	E.J. Hambleton, 104	DRAKE	11	5
Vicosa	10-VI-1934	E.J. Hambleton, 837	FIUZA	1	

Gargaphia inca Monte

PERU					
Satipo					
	14-VI-1941	P. Paprzycki	USNM		1♀
	9-VIII-1941	P. Paprzycki	USNM	1♂	1
	9-VIII-1941	P. Paprzycki, 392	USNM		1
	10-VIII-1941	P. Paprzycki, 392	USNM	1	
	10-VIII-1941	P. Paprzycki	USNM	4	1
	23-VIII-1941	P. Paprzycki, 397	USNM	1	

Gargaphia lunulata (Mayr)

ARGENTINA					
Aguas Blancas					
Oran, Salta	14-XI-1949	P. Wygodzinsky	USNM	1♂	
Calilegua de Jujuy					
	6-V-1927	Max Kisluik, 545	USNM	3	1♀ Feeding on Castor
BRAZIL					
Bahia					
	1922	G. Bondar	USNM		2
	11-IX-1938	Peditro Silva	USNM	2	
Agua Preta	21-VIII-1938	O. Monte, 28.	USNM	1	
Corumba					
lowland	III	Acc. No. 2966	DRAKE		1
Minas Gerais					
B. Horizonte		O. Monte, 39	DRAKE		3
Rio de Janeiro					
Paqueta I	VII-1954	NLH Krauss	USNM		1
So. Amer. Par Labo No. 1413	25-III-1946		USNM	6	2
Country ? S. Luiz, Maranhao	X- 1938	E.J. Hambleton	DRAKE		2
COLOMBIA					
Amazonas					
Puerto Narina, P. Redondo	20-III-1991	J.M. Guerrero	USNM		1 Ex. *Manihot esculenta*
PARAGUAY					
Aregua					
	IV- 1943	Alberto Schulze	DRAKE	9	4
PERU					
Satipo					
	26-IV-1941	P. Paprzycki	USNM	34	36
	8-V-1941	P. Paprzycki	USNM	6	6
	4-VIII-1941	P. Paprzycki, 391	USNM		1
Iquitos					
	III-IV-1931	P.C. Shannon	USNM		1
URUGUAY					
Montevideo					
S.A. Par. Lab, 1413	25-III-1946	P.A. Berry	USNM	19	17 MorningGlory 2 imm. Castor Bean

Gargaphia munda (Stål)

ARGENTINA					
Buenos Aires					
	No date	J.B. Daguerre	USNM	1♂	3♀
	No date	J. Bosco	DRAKE	1	
Bella Vista	No date	No coll.	DRAKE		1 Allotype *oreades*
Bella Vista	No date	No coll.	DRAKE	3	1 Paratypes *oreades*
Dique Luzan	20-XI-1962	J.B.Daguerre	USNM		1
Isla Martin Garcia	IV-1937	M.J. Viana, 47434	DRAKE		1
Punta Lara	I-1958	J.B. Daguerre	USNM	3	5
Punta Lara	4-I-1941		DRAKE	2	4
Punta Lara	30-III-1941		DRAKE		1
San Fernando	XII-1957	J.B. Daguerre	USNM		1
San Fernando	1958	J.B. Daguerre	USNM	2	4
Tigre	XII-1951	M.J. Viana	DRAKE	1	
Tigre	15-IV-1937	O. Monte, 33	USNM	1	2
Tigre	20-XI-1938	C.J. Drake	DRAKE	1	2
Misiones					
	5-X-1939	J. Bosq	DRAKE	1	1
Loreto	30-I-1933	A. Ogloblin	DRAKE	1	

Loreto	No date	A. Ogloblin	DRAKE	1	
Est. Exp Loreto	5-I-1937	A. Ogloblin	DRAKE	1	
BRAZIL					
Cuiaba to Cacera					
	20-VII-1988	Salinas	DRAKE		1
Est. Rio					
Therezopolis	V-1939	FCC	DRAKE		3
Haquaquecetaba					
	XII-1941to I-1942	H.L. Parker	DRAKE	7	3
Minas Gerais					
Vicosa	13-X to 1-XI-1985	T.J. Henry & S.P. Fiuza F.	TAMU		1
Vicosa	29-IV-1934	E.J. Hambleton	DRAKE	1	2
Vicosa	10-V-1934	E.J. Hambleton	DRAKE	5	4
Vicosa	10-V-1934	E.J. Hambleton, 107	DRAKE	13	10
Vicosa	6-V-1934	E.J. Hambleton, 103	DRAKE	10	9
Rio Cauif de Fozales					
	12-II-1952	W. Wittmier	DRAKE	1	
Rio Grande do Sul					
Vila Oliva	15-II-1949	P. Wygodzinsky	USNM	1	4
Rio de Jan.					
		Acc. No. 2966	USNM	1	
Sao Paulo Capital					
	14-II-1938	O. Monte, 31	USNM		2
	26-III-1940	O. Monte	USNM		1
Sao Paulo					
	No date		DRAKE	1	
	III-1954	NLH Krauss	USNM	3	7
PARAGUAY					
S.E. Naranjal					
Alto Parana	VIII-1988	L.E. Pena G.	DRAKE	11	14
				4 immatures	
Alto Parana	VIII-1988		DRAKE	1	1
				1 immature	
South America					
Montevideo, Paras. Lab No. 942	30-V-1943	Berry	USNM	7	6
Montevideo Paras. Lab, No. 933	18-*-1944	Berry	USNM	4	3

Gargaphia obliqua Stål

ARGENTINA					
Misiones					
Loreto	no date	N. Kormilev	DRAKE	1♂	1♀
Loreto	12-III-1936	J. Bosq	DRAKE	2	
Loreto	no date	D.A. Ogloblin	DRAKE		1
Pto. Bemberg	XI-1945	Prosen	DRAKE	5	2
BRAZIL					
Minas Geraes					
Carmo do Rio Claro	I-1978	Carvalho & Schaffner	TAMU	8	4
Vicosa	6-V-1934	E.J. Hambleton, 103	DRAKE	1	
Vicosa	29-IV-1934	E.J. Hambleton	DRAKE	8	2
Nickeroi					
Est do Rio	31-VII-1934	E.J. Hambleton, 258	DRAKE		2
Nova Teutonia					
27°11B-52°23L 300-500m	195?	F. Plaumann	DRAKE	2	
St. Catarina	6-I-1953	F. Plaumann	DRAKE		2
St. Catarina	8-I-1953	F. Plaumann	DRAKE	1	1
St. Catarina	27-I-1953	F. Plaumann	DRAKE		1
St. Catarina	30-XI-1956	F. Plaumann	DRAKE	2	

St. Catarina	VI-1957	F. Plaumann	DRAKE	2	2
St. Carina	24-V-1945	F. Plaumann	USNM		2
Parana					
58km. S. Curitiba, Sao Jose dos Pinhais	24-XI-1985	T.J. Henry	TAMU		4
Rio Janeiro					
Lagune de Sacua esma	IX-1884	P. Germain	DRAKE	1	
Rio G. Do Sul					
Alloioda Septima	31-XII-1948	J. Backer	DRAKE	2	3
Sao Paulo					
	7-XI-1934	E.J. Hambleton, 150	DRAKE	5	3
			FSCA	1	
	10-III-1935	E.J. Hambleton, 148	DRAKE	44	33
			FSCA	1	1
Atibaia	28-V-1936	E.J. Hambleton 150	DRAKE	1	
Campinas	VI-1937	E.J. Hambleton	DRAKE	8	
Campinas	16-V-1937	E.J. Hambleton, 148	DRAKE	2	
S. Do Estado	7-XI-1934	E.J. Hambleton	DRAKE	1	
S. Do Estado	7-XI-1934	E.J. Hambleton, 150	DRAKE	8	5
PARAGUAY					
S.E. Naranjal					
Alt. Parana	VIII-1988	L.E. Pena	DRAKE	1	
VILLARRICA DISTR.					
Col. Independencia	29-x-1931	R.F. Hussey	??		1
Col. Independencia	9-XI-1951	J. Foerster		1	
Coaguatu					
Paso Yobai	13-II-1957	J. Foerster	??	1	2

Gargaphia patria Drake and Hambleton

BRAZIL					
Minas Gerais					
Ponte Nova	21-IV-1934	E.J. Hambleton, 88	DRAKE	7♂	4♀
Sao Paulo (Cap)					
	13-V-1940	O. Monte, 12	USNM	2	1 host Eucalyptus, USNM 169753 45-4220

Gargaphia paula Drake

BRAZIL					
Minas Gerais					
Vicosa	4-VI-1933	E.J. Hambleton, 142	DRAKE		1♀
ECUADOR					
Pichilingue					
	1-2-X-1944	E.J. Hambleton	DRAKE	1♂	1
Zam.-Chin. Prov.					
Cumbaratza	12-VI-1976	A. Langley	USNM		2 Eduador Peace Corps Smiths. Inst. Aquatic Insect Survey
PERU					
Tingo Maria					
	10-IX-1944	E.J. Hambleton	DRAKE	2	2
	14-IX-1944	E.J. Hambleton	DRAKE	2	
	7-IX-1944	E.J. Hambleton	DRAKE	1	1
	V-1946	E.J. Hambleton	DRAKE	12	8

Gargaphia serjanie Drake and Hambleton

BRAZIL					
Minas Gerais					
Vicosa	13-X to 1-XI- 1985	T.J. Henry & S.P. Fiuza F.	USNM	5♂	2♀
Carma do Rio Claro	I-1958	J. Becker	DRAKE		1
PERU					
Aguaytia					
	6-IX-1944	E.J. Hambleton, 3.	DRAKE		1 *G. seorsa* paratype
	6-IX-1944	E.J. Hambleton	DRAKE		5 *G. seorsa* paratype
			USNM	1	2 *G. seorsa* paratype
Loreto					
Requena	14-VI-1992	S. Couturier	DRAKE	1	1Host *Passiflora coccinea*
Pucallpa					
	5-IX-1944	E.J. Hambleton, 2	DRAKE	3	4 G. *seorsa* paratypes
			USNM	1	1 G. *seorsa* paratype
	5-IX-1944	E.J. Hambleton	USNM	1	*G. seorsa* paratype
Satipo					
	9-VIII-1941	P. Paprzycki	DRAKE		1

Gargaphia comosa Monte

ARGENTINA					
Resistoncia					
So. A. P.L. lab	No date	H.L. Parker	DRAKE	4♂	1♀ Malvaceae

Gargaphia concursa Drake

PARAGUAY					
Horqueta					
45 mi. E. Par. Riv.	24-VI-1933	A. Schulze	USNM	2♂	
45 mi. E. Par. Riv.	27-VI-1935	A. Schulze	USNM	2	

Gargaphia costalimai Monte

BOLIVIA					
Santa Cruz					
Buena Vista	No date	A. Psosea	DRAKE	1♂	1♀
Buena Vista	XI-1919	A. Martinez	DRAKE	1	1
Entre Warnes y Montero	27-28-I-1958	Wygodzinsky	DRAKE		1
Banegas					
1500 m.	18-XII	Martinez	DRAKE	1	
PERU					
Marcapata	No date	No coll.	DRAKE	1	

Gargaphia crotonae Drake and Hambleton

BRAZIL					
Minas Geraes					
B. Horizonte	No date	O. Mone	USNM	3♂	1♀

Gargaphia deceptiva (Drake and Bruner)

TRINIDAD					
San Fernando Hill	20-X-1918	H. Morrison	USNM	10♂	2♀
VENEZUELA					
Akukiman	20-X-1940	P. Andzee	DRAKE	4	1
Surukun	XI-1940	P. Anduzee	DRAKE		2

Gargaphia decoris Drake

ARGENTINA					
Misiones					
	23-24-XI-1941	H.Parker	DRAKE	1♂	
Dosde Mayo	XI-1989	No coll.	USNM	5	8♀
Loreto	5-III-1936	J. Bosq	DRAKE		2
Loreto	No date	A. Ogloblin	DRAKE	8	7
Ext. Exp. Loreto	3-I-1936	A. Ogloblin	DRAKE	2	
P.T.O. Iguazu	XI-1987	No coll.	DRAKE	1	1
P. Rica	No date	Kunz	DRAKE	1	
San Autonia	X-1951	A. Martinez	DRAKE	1	2
BRAZIL					
Haquaquecetaba	XII-I-1941-1942	H.L. Parker	DRAKE		1
Mara					
Viana	16-X-1950	No coll.	DRAKE	17	8
Marcellino					
Ramos	18-VII-1942	H.L. Parker	USNM	8	11 *Solanum auriculatum*
Minas Geraes					
Vicosa	29-IV-1934	E.J. Hambleton	DRAKE	6	3
Nova Teutonia					
	16-IX-1948	F. Plaumann	DRAKE		1
	22-VII-1948	F. Plaumann	DRAKE	1	
	16-IV-1951	F. Plaumann	USNM	2	
Rio Grande do Sul					
	No date	J. Backer	DRAKE	1	2
	20-I-1948	J. Eacker	DRAKE		1
P. Alegre	20-IV-1938	O. Monte, 27	DRAKE		1
Sao Paulo					
	22-VIII-1934	E.J. Hambleton	AMNH	1	
	22-VIII-1934	E.J. Hambleton, 118a	DRAKE	2	7
	29-VII-1934	E.J. Hambleton ,118	DRAKE	10	5
Campinas	19-III-1939	E.J. Hambleton, 118a	DRAKE	5	11
Campinas	II-1937	E.J. Hambleton, 118	DRAKE	2	2
Capital	29-VII-1934	E.J. Hambleton, 118	DRAKE	1	
Marilia	9-I-1937	E.J. Hambleton, 209	DRAKE	1	1
Taquritinga	III-1939	E.J. Hambleton	DRAKE	1	
PARAGUAY					
Craquet	13-II-1951	J. Foczitez	DRAKE	1	
Judopcutcia	9-II-1951	J. Foczitez	DRAKE	1	1

Gargaphia dissortis Drake

PARAGUAY					
Horqueta					
45 mi. E. Par. Riv.	22-XI-1933	A. Schulze	USNM	1♂	

Gargaphia implicata Drake and Hambleton

BRAZIL						
Minas Geraes						
Ponte Nova	21-IV-1934	E.J. Hambleton	DRAKE	10♂	8♀	
Vicosa	29-IV-1934	E.J. Hambleton	DRAKE	2		
Sao Paulo						
Campinas	II-1933	E.J. Hambleton	DRAKE	2	2	

Gargaphia manni Drake and Hurd

EL SALVADOR						
Ilopanao	21-XII-1928	K. Salman	USNM	1♂		

Gargaphia neivai Drake and Poor

ECUADOR					1♀	
Bucay	6-X-1922	F. Williams	DRAKE			
Pichilinque	15-X-1944	E.J. Hambleton, 7	DRAKE	1♂	3	
San Jose do Minas	13-III-1954	No coll.	DRAKE	1	1	
Tandapi	17-VI-1965	L. Pena	USNM	5	1	
PARAGUAY						
Horqueta	1938	A. Schulze	DRAKE		1	

Gargaphia nexilis Drake and Hambleton

COLOMBIA						
Anolaima	10-IX-1965	J. Ramos	USNM	2♂	4♀	

Gargaphia nigrinervis Stål

ARGENTINA						
Misiones						
Posadas	III-1940	No coll.	DRAKE	2♂	2♀	
BOLIVIA						
Rio Coroica						
La Paz., 1200 m.	24-26-XI-1984	L. Pena	DRAKE	1	1	
BRAZIL						
Piracicaba						
SP E.S.A.L.Q.	5-III-1940	No coll.	DRAKE	40	42	
COLOMBIA						
Anapoima	8-X-1965	J. Ramos	USNM		2	
Cauca			DRAKE	*2*		*Centrosema sp.*
Santandei de Quilichao	10-II-1988	C. Cardoza	USNM	1	1	
El Triunfo	11-XII-1965	J. Ramos	USNM	1		
Fusagasuga	5-VI-1965	J. Ramos	USNM	1		
Girardot	8-VIII-1965	J. Ramos	USNM	1	4	
Girardot	11-XII-1965	J. Ramos	USNM		2	
La Mesa	14-VIII-1965	J. Ramos	USNM	1		
Manizales	22-25-VI-1965	J. Ramos	USNM	1	1	
Melgar	11-XI-1965	J. Ramos	USNM	1		
Viota	11-XII-1965	J. Ramos				
VENEZUELA						
Lara						
12 km N Cubrio 800m.	27-XII-1985	P. Kovarik, R. Jones	TAMU	1		2 *Acacia* and sec. growth
1 km E Baraquisimento	27-XII-1985	P. Kovarik, R. Jones	TAMU	1		

Gargaphia opima Drake

COLOMBIA					
Restrepo	2-X-1965	J. Ramos	USNM	2♂	
Pachiaquiari					
Peralonso	4-IX-1965	J. Ramos	USNM	1	
ECUADOR					
Pichincha Prov.					
Tinalandia	11-17-V-1986	J. Eger	USNM	9	10♀
Zam-Chin Prov.					
Zamora	1-5-VI-1976	A. Langley et al	USNM	1	

Gargaphia penningtoni Drake

SOUTH AMERICA					
Montevideo to Salto	6-14-III-1940	H. Parker	USNM	1♂	
ARGENTINA					
	24-III-1927	M. Kisliuk	USNM	2	1♀
Guaymallen de Mendoza	25-II-1927	M. Kisliuk	DRAKE	2	Okra
Guaymallen de Mendoza	25-II-1927	M. Kisliuk	USNM	8	7 Okra
Tucuman					
	15-XII-1940	No coll.	USNM	1	7
Ciudad Universitaria	17-II-1959	J. Clark	USNM	3	5
Ciudad Universitaria	18-II-1959	J. Clark	USNM	2	
Ciudad Universitaria	19-II-1959	J. Clark	USNM	1	1
BRAZIL					
San Lorenza					
Salta	I-1951	T. Ramirez	USNM	1	
Minas Geraes					
B. Horizonte		O. Monte, 960	DRAKE	2	2
B. Horizonte		O. Monte	DRAKE	1	1
COLOMBIA					
Anolaima	10-IX-1965	J. Ramos	USNM	10	3
Belo Ant.	17-VIII-1970	G. sanchez	USNM	1	9 beans
La Mesa	14-VIII-1965	J. Ramos	USNM	1	7
Palmira	22-III-1973	A. Melendez	USNM	1	3 *Phaseolus vulgaris*
Valle Darien	21-II-1989	S. Alcaraz	USNM	1	*Phaseolus vulgaris*
ECUADOR					
Pichilingue	IV-1946	E.J. Hambleton	USNM	11	8
PERU					
Huanuca					
Huan., 1900 m	XI-1946	W. Weyrauch	AMNH	1	
Lugar	27-IV-1975	P. Alcala	USNM		2 bean
Huaneabamba					
S.A. Par. Lab 1312	11-VIII-1945	P. Berry	USNM	1	1
Mantanya	VII-1926	C. Townsend	USNM	13	8

VITA

Robin Michele Smith was born in Benton, Arkansas. She graduated from Jacksonville High School and gained an appreciation for biology during that time, taking as many biology courses as possible. Robin obtained her BSE in Biology from Arkansas Sate University, December 1985. During her last year as an undergraduate, Robin became interested in entomology because of a challenging general entomology course. Through a special problems course Robin was introduced to Heteroptera and decided to attend graduate school, obtaining an MS degree in Biology from Arkansas State University, December 1988. Her Master's thesis is entitled: Coeroidea of Northeastern Arkansas with notes on the biology of *Liorhyssus hyalinus* (Heteroptera: Rhopalidae).

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