

CONSPECTUS OF AEPTINI STÅL, 1871 (HEMIPTERA: HETEROPTERA:
PENTATOMIDAE: PENTATOMINAE)

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Title

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North Dakota State University's regulations and meets the accepted standards
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DOCTOR OF PHILOSOPHY

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ABSTRACT

The Pentatominae tribe Aeptini is revised. A key to the known genera is provided, together with redescription and figures. The genus *Paramenestheus* is revised, including a key to the species and figures to all the included taxa. Two new genera and eight new species are discovered and described. A phylogenetic analysis is included for the Aeptini, with two approaches, cladistic and maximum likelihood, both morphologically based. After these analysis it is concluded that it is a monophyletic tribe and has to be split into two subtribes: Aeptina (including *Aeptus* and *Eribotes*) and Menesthina (including *Aeliosoma*, *Hillieria*, *Menestheus*, *Paramenestheus*, *Pseudaelia*, New Genus 1, New Genus 2.). Diagnoses for both subtribes are included. Biogeographically it is hypothesized that the Aeptini have a Gondwanian origin which explains its current disjunct distribution in Africa and Australia.

The importance of the findings on this dissertation, as well as the relationships among Aeptini and other Pentatominae groups is commented and discussed. Special reference is made to the importance of the presence of a mesosternal sulcus as a major character that may lead to a reclassification of the Pentatominae, having the Aeptini as one of the basal groups.

After all the changes proposed on this dissertation the Aeptini is now comprised of two subtribes, nine genera and 30 species.

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DEDICATION

I dedicate this dissertation to my wife Mariom A. Carvajal, for all the support she gave me during the extensive workdays during my Ph.D. studies. To my adviser David A. Rider, for his support and in recognition to his contribution to the knowledge of pentatomoids. To my mother

Ines Peña for her constant support during my whole education time. To my former adviser Vicente Pérez D'Angello for motivate me to continue working in taxonomy and systematics.

Finally, I dedicate this dissertation to the memory of Carl W. Schaefer, who passed away in April 29th of 2015; who was a friend, a mentor, and a source of inspiration for studying the true bugs.

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LIST OF ABBREVIATIONS

[AMCA]	Australian Museum Collection
[AMNH]	American Museum of Natural History
[CASC]	California Academy of Sciences
[CI]	Consistency index
[ML]	Maximum likelihood
[Mya]	Million years ago
[QMCA]	Queensland Museum Collection
[RI]	Retention index
[SAMC]	South Australian Museum Collection
[USNM]	United States National Museum of Natural History

INTRODUCTION AND METHODOLOGY

Introduction

The Pentatomidae is a family of heteropterans commonly called stink bugs, which contains 4722 species classified into 896 genera (Rider 2014). Many pentatomids are well known as economically important species (Schaefer & Pannizi 2000). Several are considered to be pests that damage crops; on the other hand, species belonging to the subfamily Asopinae are insect predators, and are considered to be beneficial as pest control agents. The Pentatominae is the largest subfamily of Pentatomidae (i.e. about 3350 species in 621 genera), and all of its included members are phytophages. The Aeptini is one of over 40 tribes of Pentatominae, and currently contains 19 species in 8 genera. The Aeptini has a disjunct distribution, being present in the African and the Australian continents. This tribe had been little studied and various workers have different points of view about the species and genera that should be included in its membership.

The Aeptini was first established by Stål (1871) originally to include four genera: *Aeptus* Dallas, *Dymantis* Stål, *Eribotes* Stål, and *Menestheus* Stål. He placed this group close to the tribe Myrocheini. Stål's later (1876) listing of this group of four genera was the last reference to the group for many years. Kirkaldy (1909), in his world catalog of the Pentatomidae, made the first expansion in the concept of this group by including the following nine genera: *Aeptus*, *Belopis* Distant, *Dorpius* Distant, *Dymantis*, *Eribotes*, *Halyabbas* Distant, *Menestheus*, *Paramenestheus* Breddin, and *Pretorius* Distant. In this work, he made some morphological comments further defining the group. Bergroth (1920) removed *Halyabbas*, *Belopis*, *Dymantis* and *Pretorius* from the Aeptini based on various morphological traits and discussed the decision of other contemporary authors (e.g. Kirkaldy and Distant). Gross (1975), in his work on South Australian

Pentatomidae, placed together as the “*Menestheus* group” the genera *Eribotes*, *Hillieria* Distant, *Menestheus*, *Paramenestheus*, and *Pseudaelia* Distant.

As a result of the research conducted herein, I am including one more genus in the Aeptini: *Aeliosoma* Baehr (which Baehr, in his 1985 original description, wrote that this genus was probably related to *Pseudaelia*). In addition *Caridillus* Bergroth (which Bergroth, in his 1909 original description, placed near *Aeptus*) is placed on *insertae sedis* until more data is available. As a result, the Aeptini currently is comprised of the genera *Aeptus*, *Aeliosoma*, *Eribotes*, *Hillieria*, *Menestheus*, *Paramenestheus* and *Pseudaelia*.

Taxonomic works and catalogs related to the species of Aeptini

One of the earliest works in the taxonomy related to this tribe is the one of Bergroth (1912). In that paper he made some comments on the identity of the genus *Menestheus*. He discussed the type species situation within the genus. According to Bergroth, Stål based his new genus, *Menestheus*, on a misidentified species. Apparently, because of this, the type species of this genus is either *Menestheus cuneatus* Distant, or an undescribed species related to *M. cuneatus*.

Linnavuori (1982) gave illustrations, descriptive notes, and distributional records for the genus *Aeptus*.

Gross (1975, 1976) wrote the most important comprehensive work on the Australian genera and species of this group. He gave some distribution records as well as descriptive notes and illustrations. Taxonomically, the most remarkable actions made by Gross (1975) were several synonymies within the genus *Paramenestheus* and the description of two new species of *Pseudaelia*; in this study, I report additional new species belonging in both genera.

Finally, there are several catalogs and/or similar works that include the species of this tribe and sometimes they provide distributional and biological data useful for biogeographic analyses; these include Lethierry & Severin (1893), Bergroth (1908), Kirkaldy (1909), Distant (1910), Gaedike (1971) and Cassis & Gross (2002).

Cladistic Analyses in Pentatomomorphans

Modern phylogenetic studies on pentatomorphans have become more common in recent years. Several groups have been thoroughly reviewed, revised, and reorganized, with several new taxa being described. For this type of study, various cladistic analyses provide a strong tool, which has nearly become an obligate part of any revisionary work. One of the best examples of how a cladistic analysis can completely change the classification of a taxon is the work of Henry (1997); in this work, as a result of his analysis, Henry split the Lygaeidae *sensu lato* (Heteroptera) into many different families. Henry's new classification has been accepted by many recent workers. Another important work on the classification of Heteroptera is the analysis made by Wheeler *et al.* (1993). In this study, they provided some basis for the selection of characters, and they introduced the use molecular analyses to the group.

Concerning the higher classification of the Pentatomoidea, the most important cladistic analysis is the recent study by Grazia *et al.* (2008); this paper included both molecular and morphological traits, which has become the most accepted methodology for phylogenetic analyses. Additionally, for a phylogenetic analysis to produce meaningful results, it is not only important to select a good phylogenetic methodology, it is also important to select good characters for the analyses. For example, the recent work of Memon *et al.* (2011) on the south Asian Halyini genera was strongly criticized by Barão *et al.* (2012) because of the character selection. Thus I have selected a set of classical morphological works on Heteroptera as a

morphological guide: Pendergrast (1957), McDonald (1966), Schaefer (1968, 1975, 1993), Rolston & McDonald (1979), Schuh & Slater (1995).

The present dissertation is divided into two chapters, the first includes the generic conspectus of Aeptini, and the associated alpha taxonomic treatment, and the second includes the phylogenetic (cladistic) analysis. Therefore, the following are the objectives of this study:

- 1) To describe additional new taxa (genera, species, and subspecies) in the Aeptini.

In a preliminary review of material from various collections, I found several new taxa belonging to this group, including new genera, species and subspecies.

- 2) To conduct a taxonomic revision of the genus *Paramenestheus* (Pentatominae: Aeptini).

Paramenestheus is an endemic genus occurring only in Australia; it currently contains only two described species. Very little is known about the biology and systematics of this genus. At this point, there are five available names (i.e. two valid species and three synonyms) within this genus; however, after a preliminary review of material, I have determined that there are at least seven different species. Therefore, several species will be resurrected, and others will be described as new. A taxonomic review of this genus is needed in order to establish the generic concept of *Paramenestheus*, match the taxa we have in collections with the names available in the literature, as well as describe those new species currently lacking names.

- 3) To conduct a phylogenetic analysis of the tribe Aeptini Stål, 1871.

At this point, the tribe Aeptini has never been reviewed. Therefore, the relationships of the genera within the tribe are not clear, and some genera may even need to be removed from this tribe. A comprehensive phylogenetic analysis is needed in order to define this taxon and understand its higher relationships. I will therefore test the monophyly of this tribe and determine the relationships among the included genera.

- 4) To determine the biogeographical relationships among members of the Aeptini

The members of the Aeptini currently exhibit a disjunct distribution (i.e. it is distributed in the Afrotropical Region and the Australasian Region). Biogeographically, this pattern is often associated with Gondwanian relationships; however, when this occurs, the taxa are usually also represented in South America. Thus, there are two hypotheses regarding the distribution of the genera within the Aeptini: the first is that this tribe has a Gondwanian origin and the South American representatives have evolved much differently. The second is that the African members of the Aeptini are different from the Australasian genera and should be placed in a different tribe. I will address this question with a review of the zoogeographical data from the material examined, the results of the phylogenetic analysis, and comparisons with South American fauna.

Methodology

The present dissertation is divided into two chapters, the first includes the generic conspectus of Aeptini, and the associated alpha taxonomic treatment, and the second includes the phylogenetic (cladistic) analysis. In systematics I follow Rider (2017). For the description of new taxa and the development of keys, I follow standardized modern descriptions of pentatomoids (e.g. Rolston & McDonald 1984, Rider 2000, Schwertner & Grazia 2006, and Faúndez 2014). Measurements are in millimeters including the media for specimens examined in a given taxon; for new species descriptions, the value in parentheses is that of the holotype. For the dissections and terminology of genitalia, I follow McDonald (1966).

Nearly 500 specimens were examined which were borrowed from the following collections (acronyms are those used in the text):

AMCA – Australian Museum Collection, Sydney, Australia,

AMNH – American Museum of Natural History, New York, USA.

CASC – California Academy of Sciences, Honolulu, USA.

QMCA – Queensland Museum Collection, Brisbane, Australia.

SAMC – South Australian Museum Collection, Adelaide, Australia.

USNM – U.S. National Museum of Natural History, Washington, D.C., USA.

For the cladistic analysis, I have followed some of the procedures of Grazia *et al.* (2008), plus the recommendations of Barão *et al.* (2012), however with new software use for the analysis. Two different approaches have been taken, including parsimony and a maximum likelihood analysis.

A list of 36 characters was elaborated including pentatomine generic level characters according to Rolston & McDonald (1979, 1984), and validated by modern phylogenetic analysis (Grazia *et al.* 2008); additionally, three family level characters were included to help polarize the outgroups. The regional biogeography was coded as a single character. The parsimony analysis was run in Mesquite v. 3.10 ®; whereas, the maximum likelihood was run in IQ-TREE (Trifinopoulos *et al.* 2016). For the biogeographical analysis and geological times, I follow Lomolino *et al.* (2006) and Morrone (2001).

CHAPTER I. GENERIC CONSPECTUS OF AEPTINI

Introduction

As mentioned previously, the treatment of the Aeptini has been poor over the years and many of the descriptions and data known from the taxa is outdated or even nonexistent. In this chapter, a generic conspectus of the Aeptini is presented, including redescriptions, new records, new genera and species, and the correction of several nomenclatural issues. Also, a species-level revision of the genus *Paramenestheus* is treated including the revalidation of taxa and the description of new species. In addition, an updated key for the identification of all the Aeptini genera is included.

Key to the genera of Aeptini

1	Scutellum spatulate, apex broadly rounded (<i>Aeptina</i>).....	2
-	Scutellum triangular, apex narrowly rounded (<i>Menesthina</i>)	3
2(1)	Base of abdomen sulcate.....	<i>Aeptus</i>
-	Base of abdomen not sulcate.....	<i>Eribotes</i>
3(1)	Antennae 4-segmented.....	<i>Aeliosoma</i>
-	Antennae 5-segmented.....	4
4(3)	Superior or outer surface of tibiae flattened or rounded, not longitudinally sulcate	
	New Genus.....	1
-	Superior or outer surface of tibiae longitudinally sulcate	5
5(4)	Base of abdomen sulcate.....	6
-	Base of abdomen not sulcate.....	7
6(5)	Paraclypei contiguous, meeting anterior to anteclypeus.....	New Genus 2
-	Paraclypei not contiguous, separate anterior to anteclypeus	<i>Pseudaelia</i>

- 7(5) Each anterior angle of pronotum produced cephalad into a distinct spinose tooth*Hillieria*
- Each anterior angle of pronotum rounded or acute, but not produced cephalad as a spinose tooth 8
- 8(7) Body shape narrowly elongate, paraclypei extend greatly beyond apex of anteclypeus *Menestheus*
- Body shape more broadly elongate, paraclypei not greatly extended beyond apex of anteclypeus*Paramenestheus*

Taxonomic treatment

Aeliosoma Baehr, 1985

(Fig. 1)

Type species: *Aeliosoma weberi* Baehr, 1985, by original designation.

1985 *Aeliosoma* Baehr, *Spixiana* 8(2):138.

2002 *Aeliosoma*: Cassis & Gross, *Zool. Cat. Australia* 27(3B):448. (catalog)

Description: General body features: Elongate body (about 2 times longer than wider) (Fig. 1A), dorsal coloration dark brown to ochraceous, with a distinct medial, longitudinal pale line extending from apex of clypeus to apex of scutellum. Dorsal surface finely and densely punctate, with black or dark brown punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface.

Head: Elongate apically, longer than wide, paraclypei slightly longer than clypeus, not contiguous anteriorly, with very acute apex (Figs.1); eyes prominent. Antenniferal tubercles elongate, each with a large, acute tooth; antennae 4-segmented (antennomeres 2 and 3 fused),

relatively thick (Fig. 1B). Bucculae flattened dorsoventrally, evanescent posteriorly; rostrum 4-segmented, apex reaching metacoxae.

Thorax: Pronotum trapezoid with a small spinose cleft in each humeral angle. Thoracic sterna longitudinally sulcate, with lateral carinae, prosternal carina with a rudimentary tooth at base. Scutellum isosceles triangular, submarginal fovea in each basal angle, contiguous with lateral ivory callus, and an elongate, longitudinal ivory band medially. Ostiolar peritremes short, auriculate; evaporatoria small, obscure, each not reaching halfway to lateral margin of metapleuron, ostiolar plates narrow, convex, slightly darker than evaporatoria. Legs with strong spine like setae; superior surface of each tibia not sulcate; tarsi 3-segmented.

Abdomen: Connexiva nearly obscurely serrate, each segment darkened laterally; base of abdomen lacking tubercle or spine. **Genitalia:** Female unknown. Posterior margin of male pygophore subrectangular in ventral view, with large rectangular medial emargination (Fig. 1C), a truncate posterior projection on each side of medial emargination, posterolateral angles rounded, posterior rim bilobulate and wide in dorsal view. Parameres elongate, each tapering to a narrowly rounded apex, more robust basally.

Material examined: *A. weberi*: South Australia, Mt. Lindsay, 15-X-1976, 11♂♂ (SAMC); Western Australia, Gill Pinnacle, 5-IX-1966, Aitken & Tindale leg. 3♂♂ (SAMC); Western Australia, Flora Valley, 12-X-1953, Tindale leg. 2♂♂ (SAMC)

Included species: *Aeliosoma weberi* Baehr, 1985.

Distribution: Previously known only from Northern Territories, Australia, herein I provide records which extend its distribution into neighboring areas in South Australia and Western Australia.

Comments: This genus is closely related to New Genus 1. It can be easily recognized from all the other Aeptini by having only four antennal segments.

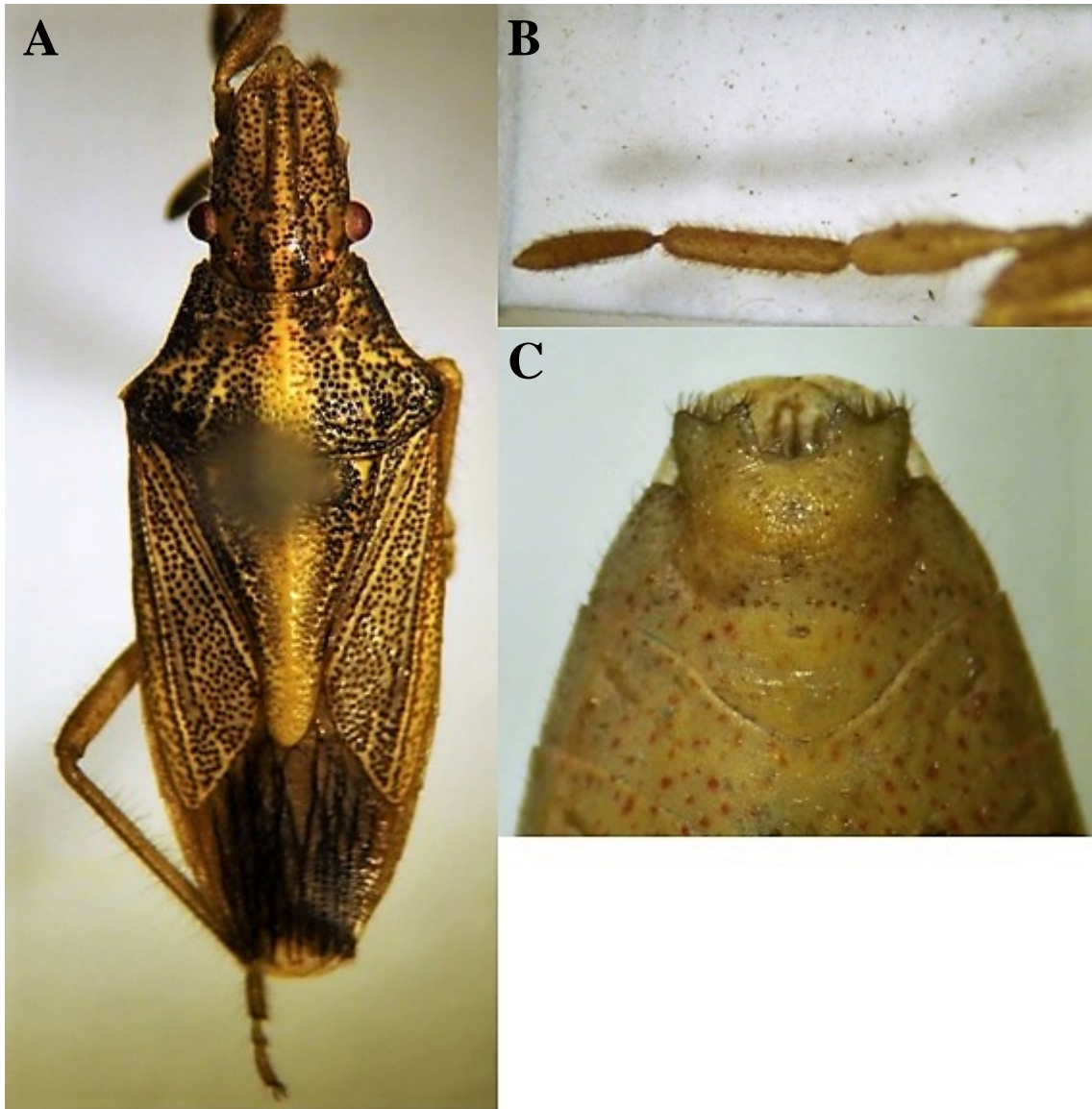


Fig. 1. *Aeliosoma weberi*. A, habitus; B, antenna; C, male pygophore, ventral view.

Aeptus Dallas, 1851

(Fig. 2)

Type species: *Aeptus singularis* Dallas, 1851, by monotypy.

1851 *Aëptus* Dallas, List Hem. 1:131, 145.

1859 *Aëptus*: Dohrn, Cat. Hem. 1859:10. (catalog)

1867 *Æptus*: Walker, Cat. Hem. Het. Brit. Mus. 1:182. (list)

1876 *Aeptus*: Stål, Sv. Vet. Ak. Handl. 14(4):51. (key)

1893 *Aeptus*: Lethierry & Severin, Cat. Gén. Hém. 1:109. (catalog)

1909 *Aëptus*: Bergroth, Deut. Ent. Zeitschr. 1909:331. (taxonomy)

1909 *Aeptus*: Kirkaldy, Cat. Hem. 1:182. (catalog)

1910 *Æptus*: Distant, Ann. Mag. Nat. Hist. (8)6:84. (list)

Description: General body features: Short, compact body (Fig. 2A), dorsal coloration yellowish-cream to brownish and ochraceous. Dorsal surface finely, densely punctate, with black or dark brown punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface.

Head: Triangular, elongate apically, longer than wide, paraclypei much longer than clypeus, contiguous anteriorly; eyes prominent. Antenniferal tubercles short, tubular; antennae 5-segmented. Bucculae nearly straight ventrally, truncate posteriorly; rostrum 4-segmented, apex reaching base of abdomen.

Thorax: Pronotum trapezoid to rectangular. Thoracic sterna longitudinally sulcate, with lateral carinae. Scutellum reduced, U-shaped, reaching to middle of abdomen. Hemelytra micropterous, without membranes, reaching to about $\frac{3}{4}$ of length of scutellum (one specimen has

nearly vestigial membrane). Metathoracic scent gland nearly vestigial (Fig. 2B). Legs with strong spine like setae; superior surface of each tibia sulcate; tarsi 3-segmented.

Abdomen: Posterolateral angles of connexiva rounded, each segment with a distinct medial line of dark punctation. Base of abdomen with median sulcus. Genitalia: Female paratergites straight, first and second gonocoxae with posterior margins rounded, surface convex posteriorly, mesial margins straight (Fig. 2D). Spermathecal bulb ovate, distal flange of pump discoidal, sclerotized rod straight with apex expanded, pointed (Fig. 2E). Posterior margin of male pygophore subrectangular in ventral view, with very deep truncate medial emargination, a rounded posterior projection on each side of medial emargination (Fig. 2C), posterolateral angles rounded, slightly produced, prominent, posterior rim bilobulate, parameres bilobate and opposed, parandria absent.

Material examined: *A. singularis*: South Africa, Pongoola Poort Nat. Res. 13-14-XI-1990, I. M. Miller leg. 2♂♂1♀; South Africa, Boodeplast, 21-II1988 I, M. Miller leg 2 ♂♂. South Africa, rest illegible 2♂♂3♀♀ (Pretoria).

Included species: *Aeptus singularis* Dallas, 1851.

Distribution: Afrotropical.

Comments: This genus is closely related to *Eribotes* from which it can be easily differentiated by the shape of hemelytra, the sulcate base of the abdomen, and the less developed ostiolar peritreme. This genus is currently under review (Faúndez, Kment & Rider, in preparation), and there are at least two undescribed species. This is the only genus in the Aeptini without signs of parandria.

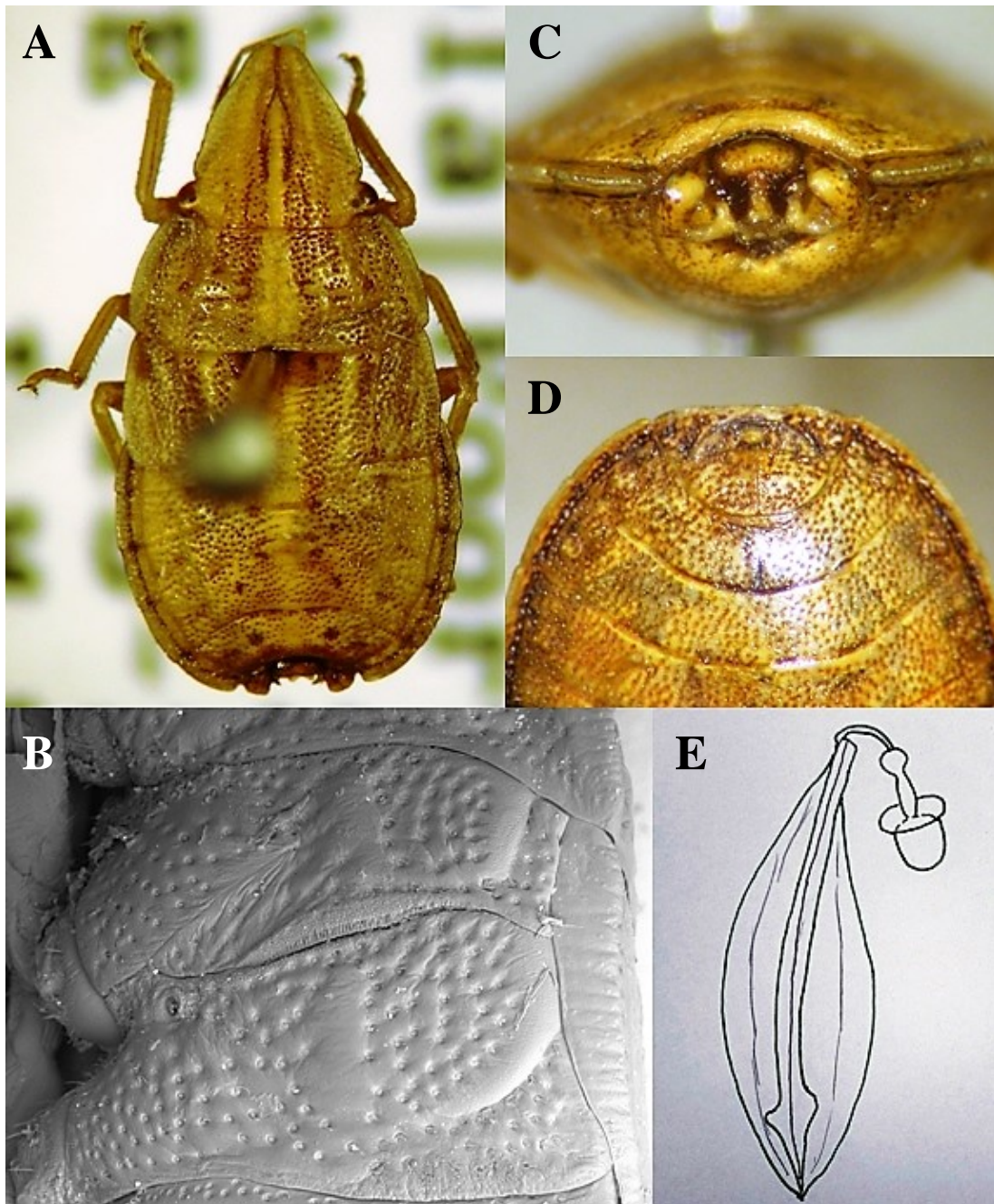


Fig. 2. *Aeptus singularis*. A, habitus; B, meso- and metapleurae (photo by Petr Kment); C, male pygophore, caudal view; D, female genitalia, ventral view; E, spermatheca.

Eribotes Stål, 1868

(Fig. 3)

Type species: *Eribotes* Stål, 1868: *Sciocoris australis* Dallas, 1852, by monotypy.

Neomenestheus Distant, 1911: *Neomenestheus walkeri* Distant, 1911 (= *Menestheus doddi* Distant, 1910), by monotypy.

1868 *Eribotes* Stål, Öfv. Vet. Akad. Förh. 24(7)[1867]:504.

1876 *Eribotes*: Stål, Sv. Vet. Akad. Handl. 14(4):51. (Key)

1893 *Eribotes*: Lethierry & Severin, Cat. Gén. Hém. 1:109. (catalog)

1909 *Eribotes*: Kirkaldy, Cat. Hem. 1:182. (catalog)

1910 *Eribotes*: Distant, Ann. Mag. Nat. Hist. (8)6:470. (type species)

1911 *Neomenestheus* Distant, Ann. Mag. Nat. Hist. (8)7:342-343. (syn. by Cassis & Gross, 2002)

1975 *Neomenestheus*: Gross, S. Austral. Het. 1:177, 178. (description)

1975 *Eribotes*: Gross, S. Austral. Het. 1:178, 182-183. (description, key)

2002 *Eribotes*: Cassis & Gross, Zool. Cat. Australia 27(3B):448-449. (catalog, synonymy)

Description: General body features: Ovate, compact body (Fig. 3A), dorsal coloration yellowish-cream to ochraceous, with a distinct medial, longitudinal pale line extending from apex of clypeus to basal disc of pronotum. Dorsal surface strongly, densely punctate with black or dark brown punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface, some distinctly darkened, forming a dark band.

Head: Widened, about as long as wide, paraclypei much longer than clypeus, contiguous or nearly contiguous anteriorly, with sides forming a small sulcus apically; eyes prominent.

Antenniferal tubercles compact, each with a rounded tooth; antennae 5-segmented, antennomeres

progressively increasing in size, with constant thickness. Bucculae slightly concave ventrally, nearly evanescent posteriorly; rostrum 4-segmented, apex reaching base of abdomen.

Thorax: Pronotum trapezoid with obtuse humeral angles. Thoracic sterna longitudinally sulcate medially, with lateral carinae; prosternum with a tooth oriented anteriorly. Scutellum U-shaped, spatulate, submarginal ivory patch along each side of the basal foveae, scutellar disk elevated. Hemelytra without distinct carinate veins. Ostiolar peritremes short, each reaching one-third the distance to lateral margin of metapleuron, straight (Fig. 3B); evaporatoria small, obscure, each not reaching halfway to lateral margin of metapleuron, a small portion of each evaporatorium continuing onto adjacent mesopleuron; ostiolar plates narrow and convex, slightly darker than evaporatoria. Legs with strong spine like setae; superior surface of each tibia sulcate; tarsi 3-segmented.

Abdomen: Connexiva slightly serrate, each segment bicolored. Base of abdomen lacking tubercle or spine. Genitalia: Female paratergites apically rounded, compact; fist and second gonocoxae rounded, convex posteriorly, mesial margins straight. Spermathecal bulb broad, rounded, distal flange of pump elongate, sclerotized rod thick, funnel shaped (Fig. 3C). Posterior margin of male pygophore subrectangular in ventral view, with small V-shaped medial emargination, posterolateral angles rounded, slightly produced, prominent, a faint, arcuate carina between the two posterolateral angles, posterior rim nearly bilobulate and wide in dorsal view. Parameres wide, each tapering to a narrowly acute apex, more robust basally with a truncate process.

Material examined: *E. australis*: Australia, rest illegible, 1♂ 2♀♀ (QMCA); *E. doddi*: Australia, New South Wales Bundjulong, Black Rocks, 15-XI-1993, 2♂♂ 2♀♀ G. Cassis leg. (AUMC); Sydney, without more data, 1♂ (AUMC). *E. hobartensis*: Australia, South Australia, 1

mile north of Melrose, I-IX-1966, G. Gross leg. 8♂♂ 11♀♀ (SAMC); South Australia, Salt Creek, III-1994 1♂ (SAMC); *E. reconditus*: Australia, South Australia, Gum Lagoon, 24-III-1962, Matthews & Forrest leg. 3♂♂ 4♀♀ (SAMC); South Australia, Railway Cutting, 360 South, 31-I-1969, on *Atriplex levadulosa*, Cooper leg. 4♂ 2♀♀ (SAMC), South Australia, rest illegible, 2♂♂ 2♀♀ (QMCA).

Included species: *Eribotes australis* (Dallas, 1852); *Eribotes bicuspis* Bergroth, 1920; *Eribotes delitescens* Bergroth, 1920; *Eribotes doddi* (Distant, 1910) = *Eribotes challengerii* Distant 1910 and *Neomenestheus affinis* Schouteden, 1912, both syn. by Cassis & Gross (2002); *Eribotes hobartensis* Distant, 1910; *Eribotes indicator* (Walker, 1868); *Eribotes leana* Distant, 1910; *Eribotes reconditus* Bergroth, 1920; *Eribotes subsinuatus* Bergroth, 1920.

Distribution: Australia: Northern Territories, Queensland, New South Wales, South Australia, Tasmania, Western Australia.

Comments: This genus is closely related to *Aeptus* from which it can be easily differentiated by the characters discussed previously. This is the most diversified genus within the tribe, however it requires revision to clarify species concepts, as many types are lost. Additionally, a cladistic analysis may be useful to test the monophyly of the genus.

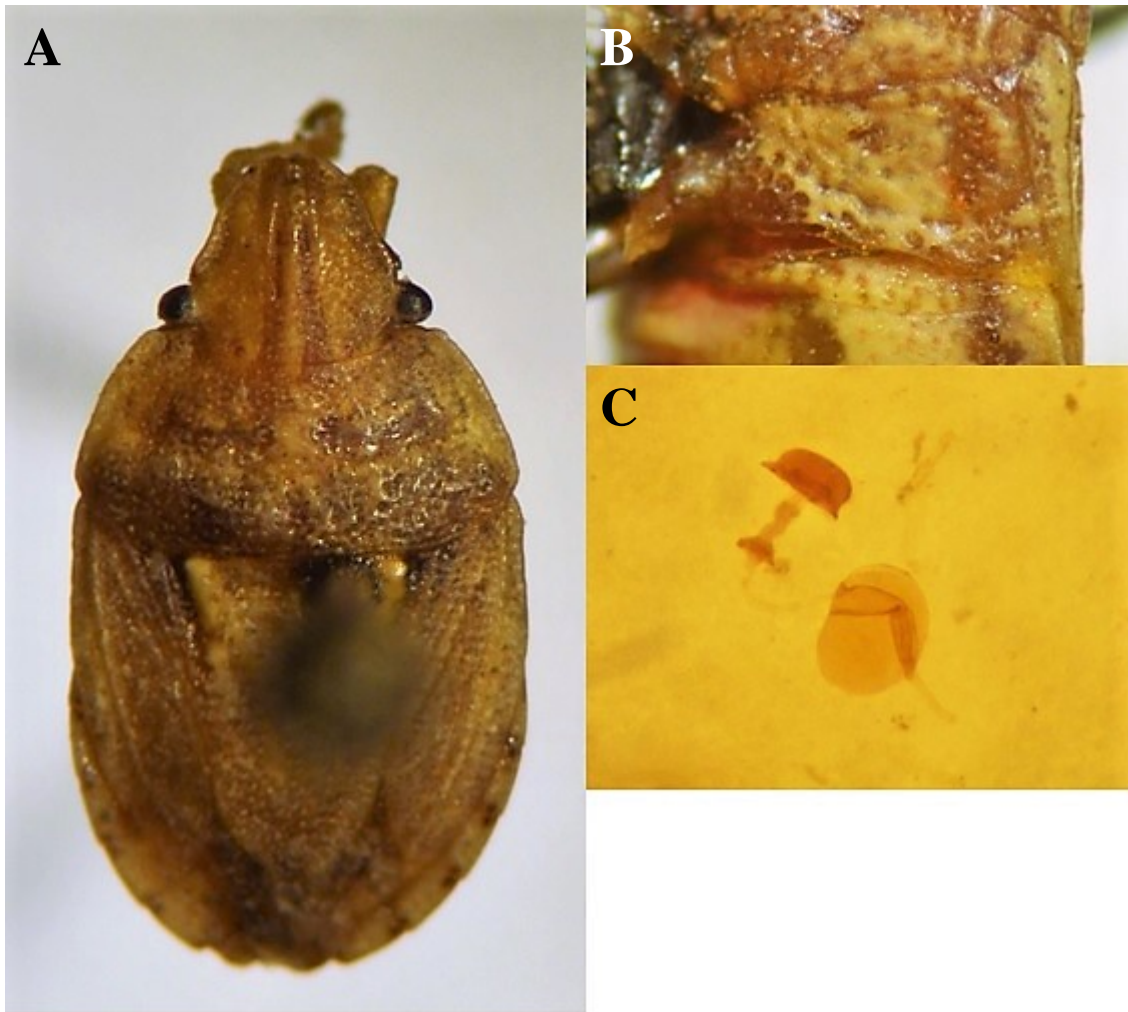


Fig. 3. *Eribotes* spp. A, *Eribotes australis*, habitus; B, *Eribotes australis*, metapleuron, C. *Eribotes hobartensis*, spermatheca.

Hillieria Distant, 1910

(Fig. 4)

Type species: *Hillieria acuminata* Distant, 1910, by monotypy.

1910 *Hillieria* Distant, Ann. Mag. Nat. Hist. (8)6:477-478.

1975 *Hillieria*: Gross, S. Austral. Het. 1:178, 189. (description, key)

2002 *Hillieria*: Cassis & Gross, Zool. Cat. Australia 27(3B):450. (catalog)

Description: General body features: Body, elongate, pointed anteriorly (Fig. 4A), dorsal coloration yellowish-cream to ochraceous. Dorsal surface finely, densely punctate, with concolorous punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface.

Head: Extremely elongate apically, clearly longer than wide, paraclypei much longer than clypeus, may or may not be contiguous anteriorly; eyes prominent. Antenniferal tubercles elongate, each with a very short, acute tooth; antennae 5-segmented, shorter than head. Bucculae straight, thin ventrally, subtruncate posteriorly; rostrum 4-segmented, apex reaching abdomen.

Thorax: Pronotum subtriangular, with a small cleft in each humeral angle; each anterior angle with a very sharp spine oriented anteriorly, surpassing adjacent eye. Thoracic sterna longitudinally sulcate, with lateral carinae; prosternum with a rounded tooth oriented posteriorly. Scutellum nearly isosceles triangular, without carinae; two basal foveae present, one on each side of the mesial pale band; apex narrowly rounded. Carinae on each hemelytron along lateral margin of radial vein. Ostiolar peritremes short, nearly vestigial (Fig. 4B); evaporatoria small, opaque, not reaching halfway to lateral margin of metapleuron; ostiolar plates narrow, convex, slightly darker than evaporatoria. Legs with strong dark setae; superior surface of each tibia sulcate; tarsi 3-segmented.

Abdomen: Connexiva rounded, each segment unicolored; base of abdomen lacking tubercle or spine. Genitalia: Female paratergites apically rounded; first and second gonocoxae rounded, convex posteriorly, mesial margins nearly straight (Fig. 4D). Spermathecal bulb ovate, distal flange of pump discoidal, sclerotized rod straight with apex dilated, pointed (Fig. 4E). Posterior margin of male pygophore subrectangular in ventral view, with small v-shaped medial emargination (Fig. 4C), a subtriangular posterior projection on each side of medial emargination,

posterolateral angles rounded, slightly produced, prominent, posterior rim bilobulate, wide in dorsal view. Parameres elongate, each tapering to a narrowly rounded apex, more robust basally.

Material examined: *H. acuminata*: South Australia, Lake Lyre, N. Madigan Gulf, at light, 6-XI-1966, G. F. Gross leg. 3♂♂ 4♀♀ (SAMC); South Australia, Lake Palankarina, 3-III-1972, E. Matthews leg. 1♂; South Australia, Stzelecki Desert, 5-11-IV-1997, 2♂♂ 3♀♀ (SAMC).

Included species: *Hillieria acuminata* Distant, 1910.

Distribution: Australia: Northern Territories, South Australia.

Comments: This genus is closely related to *Menestheus*, *Aeliosoma*, and New Genus 1, however it can be easily distinguished by its unique head shape and by the relatively long, apically acute anterior spines on the pronotum.

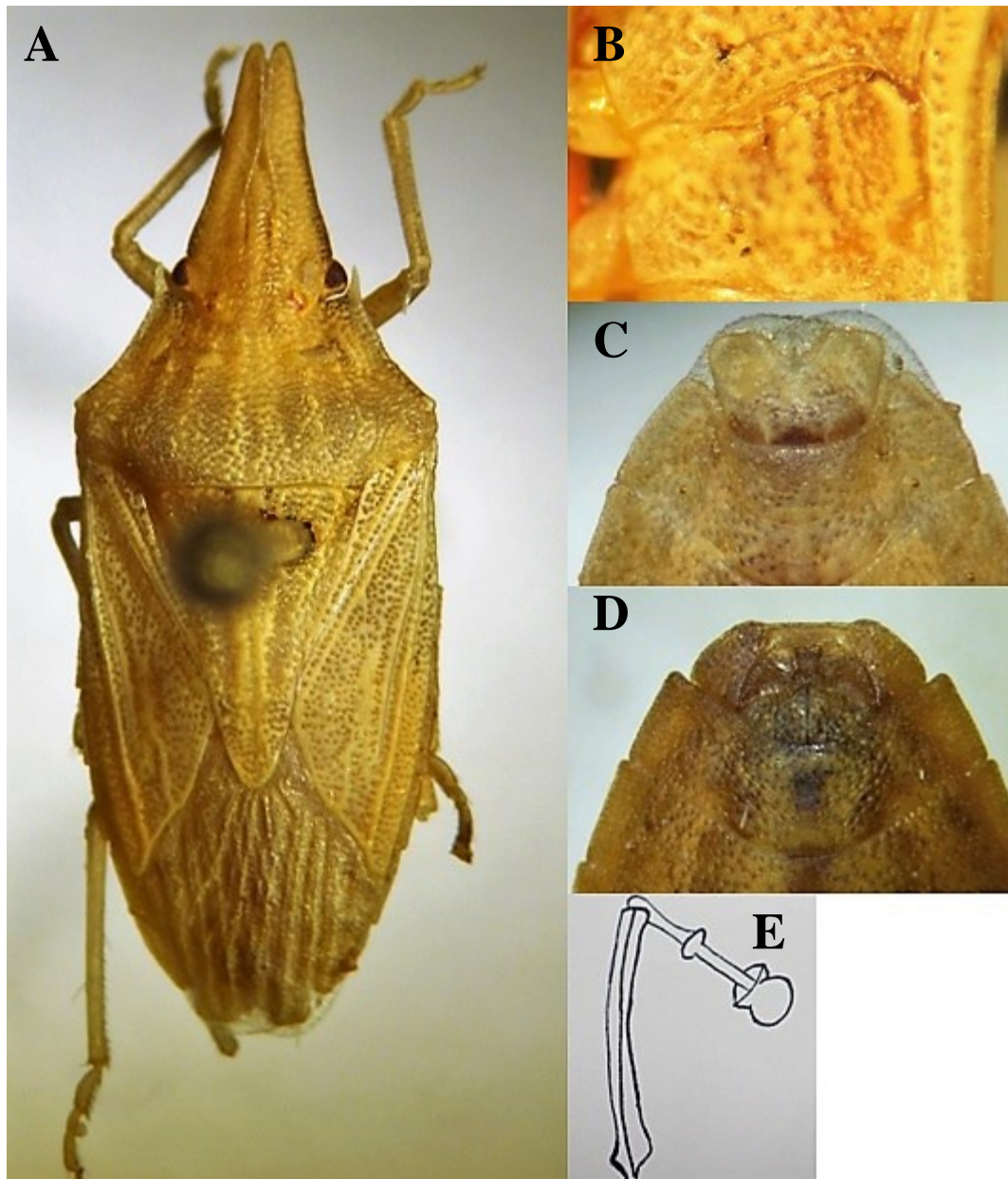


Fig. 4. *Hillieria acuminata*. A, habitus; B, metapleuron, C, male pygophore, ventral view; D, female genitalia, ventral view; E, spermatheca.

Menestheus Stål, 1868

(Figs. 5, 6, 7)

Type species: *Menestheus cuneatus* Distant, 1899, by present designation (see note below).

1868 *Menestheus* Stål, Öfv. Vet. Akad. Förh. 24(7)[1867]:504.

1876 *Menestheus*: Stål, Sv. Vet. Akad. Handl. 14(4):51. (key)

1893 *Menestheus*: Lethierry & Severin, Cat. Gén. Hém. 1:109. (catalog)

1909 *Menestheus*: Kirkaldy, Cat. Hem. 1:181. (catalog)

1910 *Menestheus*: Distant, Ann. Mag. Nat. Hist. (8)6:469. (description)

1975 *Menestheus*: Gross, S. Austral. Het. 1:177, 178. (description)

2002 *Menestheus*: Cassis & Gross, Zool. Cat. Australia: 27 (catalog)

Description: General body features: Elongate body (2.50 to 3.10 times longer than wide), dorsal coloration yellowish-cream, dorsal and ventral surface finely, densely punctate.

Head: Elongate, acute (1.33 to 1.44 times longer than wide), longer than pronotum, paraclypei considerably longer than clypeus, contiguous anteriorly; eyes prominent. Antenniferal tubercles short, each with a small, acute tooth; antennae 5-segmented. Bucculae straight ventrally, rounded posteriorly; rostrum 4-segmented, first segment extending beyond posterior margins of bucculae, reaching prosternum, apex of the rostrum reaching base of abdomen.

Thorax: Pronotum trapezoid, humeral angles rounded, anterior angles with a small rounded projection. Scutellum isosceles triangular shaped, with 4 foveae along basal margin, apical portion narrow, apex rounded. Hemelytra elongate, membranes with several longitudinal veins. Thoracic sterna distinctly sulcate without median keel; prosternal sulcus bordered on each side by a strongly elevated ridge which forms an obtuse flap anteriorly near base of head. Ostiolar peritreme short, auriculate; evaporatoria rugose, reaching two thirds of distance to lateral margin of metapleuron, continuing onto apical portion of adjacent mesopleuron; ostiolar plates strongly punctate. Legs without spines, superior surface of each tibiae sulcate; tarsi 3-segmented.

Abdomen: Lateral connexival margins straight, each segment unicolored. Base of abdomen lacking tubercle or spine; segments 4, 5, and 6 with a pair of black or brown dots. Genitalia: First gonocoxae truncate, second gonocoxae trapezoid, paratergites fused, paratergites 9 subtriangular; female spermatheca with sclerotized rod elongate, apex bent distally; dilation of spermathecal duct ovate, thin, restricted to a small membranous area around the sclerotized rod; spermathecal bulb with two digitiform processes one on each side, proximal flange of pump rounded with a conic dilation below flange, distal flange of the pump circular and subconic posteriorly. Male pygophore ventrally with a truncate excavation, dorsally with two triangular processes on each side. Parameres each with a basal and proximal lobe, basal lobe with small teeth on the upper surface.

Comments: *Menestheus* was originally described based on a misidentified species (Bergroth, 1912). That species is currently in a different genus - *Paramenestheus nervicus* (Dallas, 1851). Bergroth (1912) wrote that Stål probably examined a specimen of *M. cuneatus* or another closely related species, and the current identity of the genus is associated with the concept of *M. cuneatus*. According to the ICZN (1999, art. 70.3), *M. cuneatus* should be fixed as the type species of *Menestheus*, thus avoiding any confusion.

Menestheus mcphersoni n. sp. (manuscript name)

(Fig. 5)

Description: Head: elongate (1.44 times longer than wide), dull cream colored with dense concolorous punctation. Eyes small, prominent. Ocelli small, rounded, located at base of head, behind compound eyes, but not contiguous with pronotum. Paraclypei strongly sharpened, elongate, lateral margins straight. Antennae yellowish, first antennal segment shorter than head.

Rostrum elongate, yellowish, apex broad, truncate, black, reaching but not surpassing first abdominal segment.

Thorax: Pronotum trapezoid, dull cream colored with dense concolorous punctation; cicatrices with several brown dots on each mesial angle; anterior margin strongly concave. Scutellum isosceles triangular shaped, scutellar disc elevated, with a weak, median unimpunctate line (nearly imperceptible in some specimens), basal margin with 4 small brown foveae. Hemelytra long, usually surpassing apex of abdomen, coria and clavi dull cream colored, covered with dense concolorous punctation, membranes hyaline with numerous longitudinal veins. Thoracic sterna yellowish with a band of distinct light brown punctures along lateral margins. Metapleuron and legs, as in generic description.

Abdomen: Elongate, dull cream colored dorsally and ventrally; spiracular peritremes light brown. Male genitalia: pygophore as in generic description, ventral excavation nearly rectangular, dorsal rim well developed as a bilobed structure, also visible from ventral view. Parameres rod shaped, each with basal lobe longer than distal lobe, with two well defined teeth on dorsal surface, distal lobe acute apically with apex narrowly rounded. Female genitalia: First gonocoxae subtrapezoid, posterior margins slightly concave, second gonocoxae longer than wider, Paratergites 8 fused into a single structure, posterolateral margins slightly convex, posterior margin straight, paratergite 9 drop shaped, wider than long.

Measurements (Female in parentheses): Total length: 14.01 (14.93); pronotum width: 4.58 (4.86); head length: 4.04 (4.17); head width: 2.84 (2.91); scutellum length: 2.86 (2.95); scutellum width: 1.27 (1.61).

Type material: Holotype: Australia, NT, Leila Lagoon, McArthur R. 4km N., 25-IX-1977, leg. G. F. Gross, 1♂ (SAMC). **Paratypes:** Same data as holotype 1♂, 1♀ (SAMC);

Australia, NT, Daly River, leg. H. Wesselman, 2♀♀, 1♂ [SAMC]; Australia, Stewart R. Q., leg. W. D. Dood, 1♀ (SAMC); Australia, Qld, Normanton, 4-V-1963, at light, leg. N. B. Tindale, 1♀(SAMC); Australia, NT, Cape Crawford, 17 to 19-IV-2004, at MV light, woodid, grass, legs. G. Montheith & D. Cook, 1♀(QUMC); Australia, Cloncurry (3km East), 3-II-1999, leg. A. Ewart, 1♀ (QUMC); Australia, Mornington, 12-V-1963, at light, legs. P. Aitken & N. Tindale, 1♂ (SAMC).

Etymology: We dedicate this species to J. E. McPherson (Southern Illinois University), in recognition to his contribution to the knowledge of Pentatomidae, and to acknowledge his comments and suggestions on a previous version of this work.

Menestheus cuneatus Distant, 1899

(Fig. 5)

Material examined: Australia, QLD, Millestone, 24-XII-1964, leg. G. Monteith, 2♀♀, 2♂♂ (QUMC); Australia, N. QLD. Kowanyama, 7-I-1977, leg. D. L. Hancock, 1♀ (QUMC) Australia, Bogom, 1♀ (QUMC); Australia, QLD, Bowen, leg. A. Simson, 1♂ (SAMC); Australia, rest illegible, 1♂ (SAMC).

Comments: Records given by Cassis & Gross (2002) for *M. cuneatus* from Daly and McArthur rivers and from Mornington Island probably belong to *M. mcphersoni*.

Menestheus mcphersoni n.sp. differs from *M. cuneatus* by the following characters: in *M. mcphersoni*, the body is more elongate, 3.07 times longer than wide; whereas in *M. cuneatus*, the body is somewhat shorter, 2.53 times longer than wide. The punctation on the dorsal surface and the foveae on the scutellum are reduced and are nearly concolorous in *M. mcphersoni*; whereas these are conspicuously dark brown in *M. cuneatus*. The spiracles are brown in *M. mcphersoni*; whereas they are black in *M. cuneatus*. The shape of the head is more acute and elongate (1.44

times longer than wide), with the eyes reduced in *M. mcphersoni*; whereas the head is more rounded and less elongate (1.33 times longer than wide) in *M. cuneatus*. In the female genitalia, the paratergites 8 are less convex in *M. mcphersoni* than in *M. cuneatus*; paratergites 9 are wider in *M. mcphersoni* than in *M. cuneatus*; the first gonocoxae are wider in *M. mcphersoni* than in *M. cuneatus*. In the male genitalia, the concave section of the posterior margin of the pygophore is wider in *M. mcphersoni* than in *M. cuneatus*; the posterolateral processes and the dorsal rim are more developed in *M. mcphersoni* than in *M. cuneatus*; the parameres in *M. mcphersoni* are broader in lateral view, with the dorsal teeth more developed; whereas the parameres in *M. cuneatus* are more slender in lateral view, with the teeth less developed. Additionally, *M. mcphersoni* is distributed in the north western portions of Australia; whereas *M. cuneatus* is restricted to the eastern part of that country.

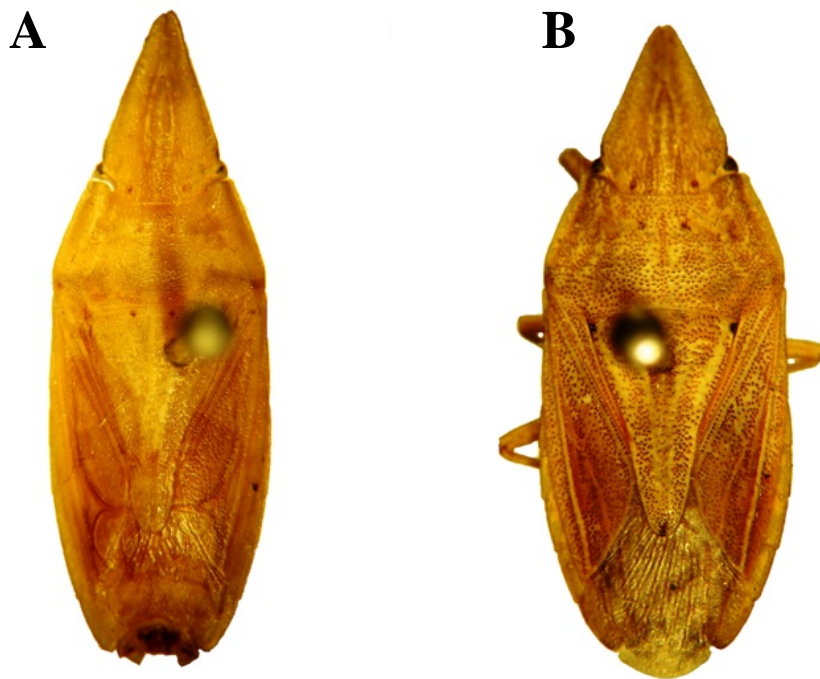


Fig 5. *Menestheus* spp. A, *Menestheus mcphersoni* n. sp., male holotype, habitus; B. *Menestheus cuneatus* Distant, 1899, male, habitus.

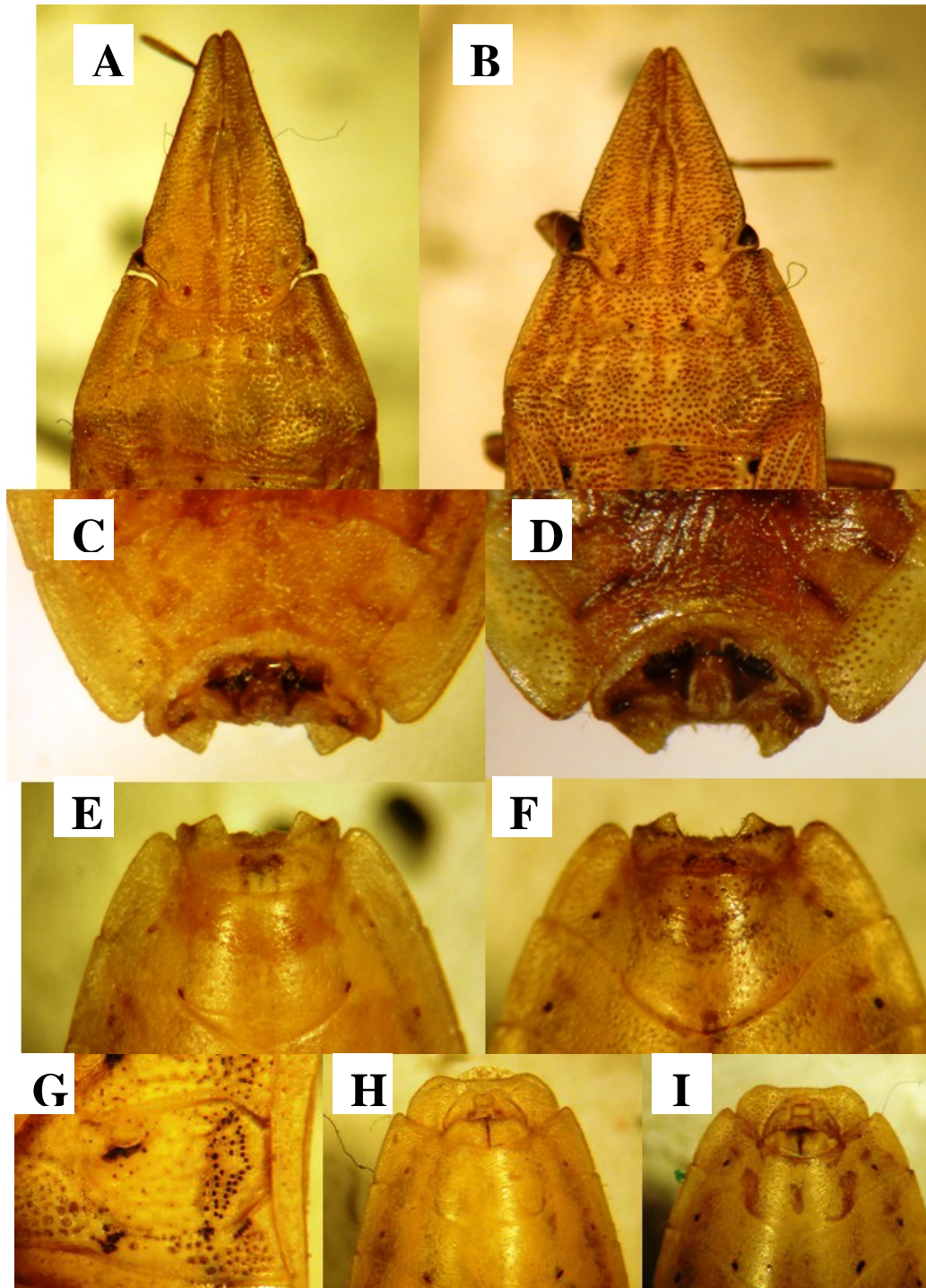


Fig. 6. *Menestheus* spp.2. A, *Menestheus mcphersoni*, n. sp. head and pronotum, dorsal view; B. *Menestheus cuneatus* Distant, 1899, head and pronotum, dorsal view; C. *M. mcphersoni*, pygophore, dorsal view; D. *M. cuneatus*, pygophore, dorsal view; E. *M. mcphersoni*, pygophore, ventral view; F. *M. cuneatus*, pygophore, ventral view; G. *Menestheus mcphersoni* n. sp. metapleuron; H. *M. mcphersoni*, female genitalia, ventral view; I. *Menestheus cuneatus* Distant, 1899, female genitalia, ventral view.

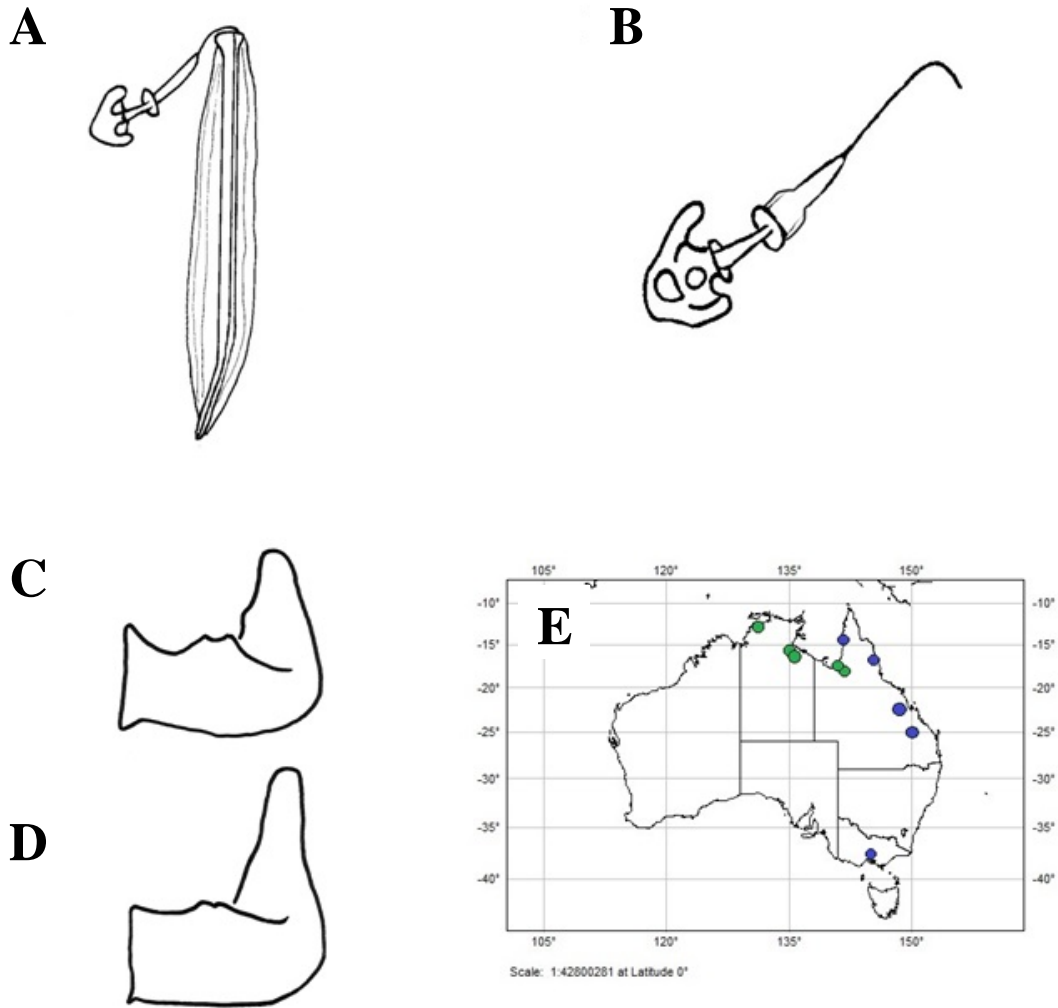


Fig. 7. *Menesthus* spp. 3. Fig. A. *Menesthus mcphersoni* n. sp., spermatheca; B. *M. mcphersoni*, spermatheca, pump enlarged; C. *M. mcphersoni*, left paramere; D. *Menesthus cuneatus* Distant, 1899, left paramere; E. Distribution of the species of *Menesthus* (*M. elongatus* in green, *M. cuneatus* in blue).

Paramenestheus Breddin, 1900

Type species: *Paramenestheus terricolor* Breddin, 1900, by monotypy.

1900 *Paramenestheus* Breddin, Ent. Nachr. Berlin 26(2-3):20-21.

1908 *Paramenestheus*: Bergroth, Mém. Soc. Ent. Belg. 15:157. (catalog)

1909 *Paramenestheus*: Kirkaldy, Cat. Hem. 1:181. (catalog)

1975 *Paramenestheus*: Gross, S. Austral. Het. 1:178, 186-187. (description, key)

2002 *Paramenestheus*: Cassis & Gross, Zool. Cat. Australia 27(3B):451. (catalog)

Description: General body features: Ovate, compact to slightly slender (Figs. 8-14), dorsal coloration yellowish-cream to ochraceous, with some reddish patches on coria, sometimes with blackish irregular bands or patches. Dorsal surface strongly and densely punctate, with black, dark brown, or concolorous punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface, some distinctly darkened, forming a dark longitudinal band on each side.

Head: Relatively broad, paraclypei much longer than clypeus, contiguous or nearly contiguous anteriorly, with sides forming a small sulcus apically; eyes prominent. Antenniferal tubercles compact, each with two acute teeth; antennae 5-segmented, often lying in in sternal sulcus at rest, antennomeres usually progressively increasing in size, with constant thickness. Bucculae straight or slightly concave ventrally, subtruncate posteriorly; rostrum 4-segmented.

Thorax: Pronotum trapezoid to deltoid with humeral angles obtuse or sometimes spinose (Figs. 8-14). Thoracic sterna longitudinally sulcate medially, with lateral carinae; prosternum usually with a tooth oriented anteriorly. Scutellum isosceles triangle shaped, apex rounded, scutellar disk not elevated, with 2-4 basal foveae. Hemelytra convex laterally, sometimes with a distinct carinae along radial vein. Ostiolar peritremes short (each reaching one third of distance to lateral margin of metapleuron), straight, auriculate; evaporatoria rugose, each reaching two thirds of distance to lateral margin of metapleuron, continuing onto adjacent mesopleuron; ostiolar plates narrow, convex, slightly darker than evaporatoria. Legs with strong spine like setae; superior surface of each tibia sulcate; tarsi 3-segmented.

Abdomen: Connexiva slightly rounded; base of abdomen lacking tubercle or spine; spiracle peritremes distinctly dark. Genitalia: Female paratergites apically rounded, compact, first and second gonocoxae subtruncate, convex posteriorly, mesial margins straight (Figs. 8-14). Spermathecal bulb bilobate, distal flange of pump elongate; sclerotized rod straight with apex pointed. Posterior margin of male pygophore subrectangular in ventral view, with small big subrectangular to v-shaped medial emargination, posterolateral angles truncate, produced, prominent, a faint, arcuate carina between the two posterolateral angles, posterior rim nearly bilobulate, broad in dorsal view. Parameres each with two lobes, wide, apical lobe with at least one lateral tooth (Fig. 15).

Comments: The taxonomic history of this genus has been very complex with various species placed as synonyms of each other and then later removed from synonymy. Currently all described species except for *P. nercivus* are synonymized under *P. terricolor*. The examination of new material indicates that all of these described species are valid species, and that there are two more species that remain undescribed.

Key to the species of *Paramenestheus*

- 1 Humeral angles with small spine or cleft; anterolateral pronotal margins concave..... *nercivus* (Dallas)
- Humeral angles obtuse or rounded 2
- 2(1) Head relatively broad anterior to compound eyes, nearly semicircular, lateral margins of paraclypei strongly convexly rounded *terricolor* Breddin
- Head not strongly broadened or semicircular beyond compound eyes, lateral margins of paraclypei not or only slightly rounded 3
- 3(2) Connexiva unicolorous 4
- Connexiva with patches of distinct dark punctures 5

- 4(3) Head somewhat pointed apically, dorsal punctation strong, sparse; male paramere with large rectangular process on apical lobeNew Species 1
- Head more rounded apically, dorsal punctation dense, fine; male paramere without large rectangular process on apical lobe*brevis* Van Duzee
- 5(3) Head pointed apicallyNew Species 2
- Head rounded apically 6
- 6(5) Abdomen ventrally uniformly colored; pronotum trapezoid, body compact
..... *abditus* Bergroth
- Abdomen ventrally with distinct black patches or stripes; pronotum deltoid, body broadened.....*semoni* (Horváth)

Paramenestheus abditus Bergroth, 1916, stat. rest.

(Figs. 8, 15A)

1916 *Paramenestheus abditus* Bergroth, Proc. R. Soc. Victoria (ns) 29(1):7-8.

Description: General body features: Body compact (Fig. 8A), finely, densely punctate, ochraceous to reddish colored.

Head: Rounded apically, paraclypei convex; rostrum reaching metacoxae.

Thorax: Pronotum trapezoid with flattened sides (Fig. 8D), each anterior angle with a rudimentary tooth; humeral angles obtuse; cicatrices surrounded by very dark punctures.

Scutellum with a well-developed fovea in each basal angle, more medial pair of basal spots nearly obscure. Tooth associated with prosternal sulcus obsolete.

Abdomen: Connexiva with sparse, dark punctures. Spiracular peritremes very dark. Ventral surface unicolorous. Female genitalia (Fig 8E): Paratergites 8 fused, rounded apically; paratergites 9 short, rounded apically; first gonocoxae subtriangular with rounded margins,

second gonocoxae small, very convex, rounded apically. Male genitalia: Pygophore subrectangular with median posterior invagination somewhat wide with sides inclined (Fig. 8B-C), apical lobes subtruncate, produced slightly laterad. Parameres very compact in lateral view, each with apical lobe very short, wide (Fig. 15A).

Type material: ST(S) (♂), Queensland [Australia] (MVMA) (Examined by photo)

Material examined: Australia, Queensland, Valley of Lagoons, 8-IX-2008 M & T leg. 3♂♂4♀♀ (AUMC); Northern Territories, Horn Island, 15-21-II-1968, B. Cantrell leg. 1♂. (QMSA); Queensland, Chalaville, 31-X-1998, Schuh, Cassis & Silveria leg. 2♂♂1♀ (AUMC).

Distribution: Australia, Queensland, Northern Territories.

Comments: This species was synonymized with *P. terricolor*; however, by the examination of new material and both general morphology and genitalia, especially by the shape of pygophore and paramere of the male, here it is revalidated.

Paramenestheus brevis (Van Duzee, 1905), stat. rest.

(Figs. 9, 15B)

1905 *Menestheus brevis* Van Duzee, Bull. Am. Mus. Nat. Hist. 21(11):200-201.

1908 *Paramenestheus brevis*: Bergroth, Mém. Soc. Ent. Belg. 15:157. (catalog)

1909 *Menestheus brevis*: Kirkaldy, Cat. Hem. 1:181. (catalog)

Description: General body features: Body compact (Fig. 9A), finely dense punctate with nearly concolorous punctation, ochraceous.

Head: Rounded apically, paraclypei convex; rostrum reaching metacoxae.

Thorax: Pronotum subtrapezoid with slightly flattened sides (Fig. 9D), anterior angles each with a rudimentary rounded tooth, humeral angles obtuse, cicatrices immaculate. Scutellum

with each lateral basal fovea well developed, two mesad foveae absent. Tooth associated with prosternal sulcus obsolete.

Abdomen: Connexiva unicolorous; spiracular peritremes slightly darkened; ventral surface nearly unicolorous. Female genitalia: Paratergites 8 fused, rounded apically, paratergites 9 short, rounded apically, first gonocoxae subtriangular with rounded margins, second gonocoxae small, very convex, rounded apically. Male genitalia: Pygophore subrectangular with median posterior invagination broad, rounded (Figs. 9B-C), apical lobes subtruncate, oriented inwardly. Parameres large in lateral view, basal lobe of each robust, wide, apical lobe elongate with rounded apex, lateral tooth strong (Fig. 15B).

Type material: STS (1♂, 1♀), New South Wales (AMNH) (examined by photo).

Material examined: Australia, Northern Territories, Cape Crawford, 16-19-IV-2004, at light, in grass, Monteith & Cook leg. 3♂♂2♀♀ (QMCA); Queensland, Iron Ranch, 3-9-VI-1971, Monteith leg. 1♂♂2♀♀ (QMCA).

Distribution: Australia, New South Whales, Northern Territories, Queensland.

Comments: This species was was synonymized with *P. terricolor*; however, it is revalidated here based on external morphology and male genitalia.

Paramenestheus nercivus (Dallas, 1851)

(Figs. 10, 15C)

1851 *Sciocoris Nercivus* Dallas, List Hem. 1:133.

1859 *Sciocoris nercivus* [sic]: Dohrn, Cat. Hem.: 10. (list)

1867 *Sciocoris Nercivus*: Walker, Cat. Hem. Het. Brit. Mus. 1:178. (catalog)

- 1868 *Menestheus Nercivus*: Stål, Öfv. Vet. Akad. Förh. 24(7)[1867]:504. (misdetermination, see note under *Menestheus*)
- 1876 *Menestheus Nercivus*: Stål, Sv. Vet. Akad. Handl. 14(4):51. (list)
- 1893 *Menestheus Nercivus*: Lethierry & Severin, Cat. Gén. Hém. 1:109. (catalog)
- 1900 *Menestheus Nercivus*: Horváth, in: Semon, Zool. Austral. Malay. Archipel: 631. (also Jena. Denkschr. 8:115; description)
- 1905 *Menestheus nercivus*?: Van Duzee, Bull. Am. Mus. Nat. Hist. 21(11):200. (description)
- 1909 *Menestheus nercivus*: Kirkaldy, Cat. Hem. 1:181. (catalog)
- 1912 *Paramenestheus nercivus*: Bergroth, Ent. News 23:25. (questions determination by Stål, 1867)
- 1975 *Paramenestheus nercivus*: Gross, S. Austral. Het. 1:187-189, figs. 69A-D, 70. (description; taxonomic discussion)
- 2002 *Paramenestheus nercivus*: Cassis & Gross, Zool. Cat. Australia 27(3B):451.

Description: General body features: Body elongate, densely punctate with slightly darkened punctation, ochraceous (Fig. 10A).

Head: Triangularly rounded, paraclypei slightly convex; rostrum reaching base of abdomen.

Thorax: Pronotum subtrapezoid, anterior angles each with a rudimentary tooth; humeral angles each produced into a small spine (Fig. 10D); anterolateral pronotal margins concave; cicatrices surrounded by dark punctation. Scutellum with each lateral basal fovea well developed, more mesial foveae obsolete. Tooth associated with prosternal sulcus nearly obsolete.

Abdomen: Connexiva unicolorous; spiracular peritremes strongly darkened; ventral abdominal surface nearly unicolorous. Female genitalia (Fig. 10E): Paratergites 8 fused, nearly

straight apically, paratergites 9 broad, long, slightly pointed apically, first gonocoxae subtriangular with rounded edges, second gonocoxae small, very convex, subtruncate apically. Male genitalia: Pygophore subrectangular with median posterior invagination broadly v-shaped, apical lobes subtruncate, oriented inwardly (Fig. 10A-B). Parameres large in lateral view, each with basal lobe elongate, apical lobe widened with rounded apex, lateral tooth strong (Fig. 15C).

Distribution: Australian: Australia (New South Wales, Northern Territory, Queensland, South Australia, Victoria, Western Australia).

Type material: ST(S) (♀), unknown locality, probably BMNH.

Material examined: Australia, North Australia, Burnside, 23-III-1929, T. Campbell leg. 1♂2♀ (AUMC); Australia, North Australia, Brook Creek, 29-III-1929, T. Campbell leg. 2♂♂1♀ (AUMC).

Distribution: Australia, Northern Territories, Queensland, New South Whales.

Comments: This is the most distinctive species of the genus, particularly due to the shape of pronotum, having produced and sharp humeral angles. This species may deserve to be placed in a new genus; future molecular studies will probably help determine whether it should be retained within *Paramenestheus* or whether it should be moved to a new genus. For now, I prefer to take the conservative approach and still include it within this genus, slightly expanding the concept of *Paramenestheus*.

Paramenestheus semoni (Horváth, 1900), stat. rest.

(Figs. 11, 15D)

1900 *Menestheus Semoni* Horváth, in: Semon, Zool. Austral. Malay. Archipel: 631. (also Jena. Denkschr. 8:115)

1906 *Paramenestheus Semoni*: Bergroth, Wein. Ent. Ztg. 25:2. (type)

1908 *Paramenestheus Semoni*: Bergroth, Mém. Soc. Ent. Belg. 15:157. (catalog)

1909 *Paramenestheus semoni*: Kirkaldy, Cat. Hem. 1:181. (catalog)

1912 *Menestheus brevis*: Grossbeck, Bull. Am. Mus. Nat. Hist. 31:360. (type)

2000 *Menestheus brevis*: Loch, Biol. Control 18:121. (parasitoid)

Description: General body features: Body wide, strongly, densely punctate, punctures distinctly darkened, ochraceous (Fig. 11A).

Head: Rounded apically, paraclypei convex; rostrum reaching metacoxae.

Thorax: Pronotum deltoid with anterolateral margins nearly straight (Fig. 11D); anterior angles each with a rudimentary rounded tooth; humeral angles obtuse; cicatrices surrounded by dark punctures. Scutellum with each lateral basal fovea well developed, mesial foveae absent. Tooth associated with prosternal sulcus obsolete.

Abdomen: Connexiva with dark patches along anterior margin of each segment; spiracular peritremes darkened; ventral abdominal surface with dark patches or bands. Female genitalia (Fig. 11E): Paratergites 8 fused, rounded apically, paratergites 9 short, broad, rounded apically, first gonocoxae subtriangular with rounded edges, second gonocoxae small, nearly straight apically. Male genitalia: Pygophore subrectangular with median posterior invagination small, nearly square shaped, apical lobes subtruncate, straight (Fig. 11A-B). Parameres short, compact in lateral view, each with basal lobe strong, wide, apical lobe short, pointed, lateral tooth small (Fig. 15D).

Type material: HT ♀, Burnet River District [Australia, Queensland] (HNHM); no PTS (Not examined).

Material examined: Australia, Queensland, Valley of Lagoons, 8-IX-2008 M & T leg. 3♂♂1♀♀ (AUMC); Queensland, Marzeppa, 18-XII-2000, Cook & Monteith leg. 4♂♂2♀♀ (QMCA); Brisbane, rest illegible 1♂; Brisbane, Sekon leg. Rest illegible 3♂♂2♀♀(UQCI and SAMC).

Distribution: Australia, Northern Territories, Queensland.

Comments: This species was synonymized with *P. terricolor*; however, it is revalidated here by the external morphology and the male genitalia.

Paramenestheus terricolor Breddin, 1900

(Figs. 12, 15E)

1900 *Paramenestheus terricolor* Breddin, Ent. Nachr. Berlin 26(2-3):21-22.

1908 *Paramenestheus terricolor*: Bergroth, Mém. Soc. Ent. Belg. 15:157. (catalog)

1909 *Paramenestheus terricolor*: Kirkaldy, Cat. Hem. 1:181. (catalog)

1971 *Paramenestheus terricolor*: Gaedike, Beitr. Ent. 21(1-2):101. (lectotype designation)

1975 *Paramenestheus terricolor*: Gross, S. Austral. Het. 1:187. (description)

2002 *Paramenestheus terricolor*: Cassis & Gross, Zool. Cat. Australia 27(3B):451-452. (catalog)

Description: General body features: Body relatively broad, densely punctate with nearly concolorous punctures, ochraceous colored (Fig. 12A).

Head: Rounded apically, paraclypei convex, relatively broad anterior to compound eyes, giving head a semi-circular appearance; rostrum reaching metacoxae.

Thorax: Pronotum trapezoid with anterolateral margins slightly convex (Fig. 12D), anterior angles with a rudimentary rounded tooth; humeral angles obtuse; cicatrices with dark

punctures on lateral margins. Scutellum with all four basal foveae well developed. Tooth associated with prosternal sulcus slightly developed.

Abdomen: Connexiva unicolorous. Spiracular peritremes slightly darkened. Ventral abdominal surface with two rows of dark patches. Female genitalia (Fig. 15E): Paratergites 8 fused, nearly straight, paratergites 9 short, rounded apically, first gonocoxae subtriangular with rounded margins, second gonocoxae large, very convex, rounded apically. Male genitalia: Pygophore subrectangular with median posterior emargination shallow, truncate (Fig. 12B-C), apical lobes subtruncate oriented outwardly. Parameres large in lateral view, each with basal lobe strong, short, apical lobe broad basally, pointed apically, lateral tooth strong (Fig. 15E).

Material examined: Australia, New South Wales Bundjulong, Black Rocks, 15-XI-1993, 3♂♂2♀♀ G. Cassis leg. (AUMC); Australia, Queensland, 14-IV-1980, 3♂♂2♀♀ Fortin leg. (AUMC).

Distribution: Australia, New South Wales, Northern Territory, Queensland, Tasmania.

Type material: LT (Gaedike, 1971), Australia, New South Wales, Richmond (DEIC); at least one PLT, deposition unknown (not examined).

***Paramenestheus* sp. nov. 1**

(Figs. 13, 15F)

Description: General body features: Body elongate, strongly, densely punctate with distinctly strong, dark punctures, ochraceous (Fig. 13A).

Head: Elongate, slightly pointed apically, paraclypei convex laterally, ocelli large, ovate. Bucculae slightly concave mesially; rostrum reaching mesocoxae.

Thorax: Pronotum trapezoid with anterolateral margins straight, slightly flattened; anterior angles each with a rudimentary, rounded tooth (Fig. 13D); humeral angles obtuse. Cicatrices surrounded by dark punctures. Scutellum with each lateral basal fovea well developed, two more mesial foveae poorly developed. Hemelytra convex laterally, with few impunctate lines. Tooth associated with prosternal sulcus short; ventral thoracic coloration with two stripes of dark punctures, one on each side, a unicolorous line in middle.

Abdomen: Connexiva unicolorous. Spiracular peritremes caramel colored. Ventral abdominal surface with slightly darkened patches mesially. Female genitalia (Fig. 13D): Paratergites 8 fused, straight apically; paratergites 9 subtriangular, wide, rounded apically, first gonocoxae subtriangular with rounded margins, second gonocoxae large, subtriangular, very convex apically. Male genitalia: Pygophore subrectangular with median posterior emargination small with inclined sides, apical lobes subtruncate, oriented laterally, apices concave (Fig. 13A-B). Parameres short, compact in lateral view, each with basal lobe strong, broad, apical lobe pointed, with very distinct rectangular process, lateral tooth small (Fig. 15F).

Measurements: (Females in parentheses): Total length: 9.31 (9.45); pronotum width: 4.38 (4.76); head length: 2.11 (2.19); head width: 2.60 (2.79); scutellum length: 2.50 (2.75); scutellum width: 1.17 (1.55). Antennae: I=0.44, II=0.62, III=0.43, IV=1.03, V=1.18. Rostrum: I=1.42, II=1.66, III=0.57, IV=0.54.

Type material: Holotype: Northern Territories, Cape Crawford, 16-19-IV-2004, at light, in grass, Monteith & Cook leg. 1♂ (QMSA). Paratypes: Same as holotype 2♂♂2♀♀; Northern Territories, Leila Lagoon, 25-IX-1977, Forrest leg. 1♂ (SAMC).

Distribution: North and northwestern Australia.

Comments: This is the only species in this genus that has a distinct rectangular process on each male paramere. It is related to *P. brevis* from which it can be distinguished by the characters of the male genitalia, and by the more pointed head.

***Paramenestheus* sp. nov. 2**

(Figs. 14, 15G)

Description: General body features: Body small, slender; strongly, densely punctate with distinctly, strong dark punctures, ochraceous-brown (Fig. 14A).

Head: Triangular, elongate, pointed apically, paraclypei convex, slightly curled towards apex; ocelli small, rounded. Bucculae nearly straight ventrally; rostrum reaching base of abdomen.

Thorax: Pronotum trapezoid with anterolateral margins straight, flattened; anterior angles each with a rudimentary, nearly obsolete tooth; humeral angles obtuse each with a small cleft (Fig. 14D); cicatrices with black dots on lateral and mesial limits. Scutellum with each lateral basal fovea well developed, two more mesial foveae poorly developed. Hemelytra convex laterally, with a few impunctate patches. Tooth associated with prosternal sulcus nearly obsolete; ventral thoracic coloration with two stripes of dark punctures on the sides and a unicolorous punctured line mesially.

Abdomen: Connexiva bicolored, reddish mesially, ochraceous laterally. Spiracular peritremes strongly, dark colored. Ventral abdominal surface with two bands of darkened punctures on each side and on base of first abdominal segment. Female genitalia (Fig. 14E): Paratergites 8 fused, straight apically with two small convexities; paratergites 9 subtriangular, slender, rounded apically, first gonocoxae trapezoid with straight margins, second gonocoxae

compact, subtriangular, slightly convex, rounded apically. Male genitalia: Pygophore subrectangular with median posterior emargination deep, broadly U-shaped, apical lobes subtruncate, straight, apices straight (Fig. 14B-C). Paramere long, slender in lateral view, each with basal lobe strong, wide, apically elongate, rounded, lateral tooth well developed (Fig. 15G).

Measurements (Female in parentheses): Total length: 6.55 (7.28); pronotum width: 4.48 (4.76); head length: 2.04 (2.25); head width: 2.24 (2.47); scutellum length: 2.11 (2.55); scutellum width: 1.07 (1.34). Antennae: I=0.45, II=0.83, III=0.50, IV=0.97, V=1.07. Rostrum: I=1.78, II=1.90, III=0.34, IV=0.45.

Type material: Holotype: Papua New Guinea, Port Moresby X-1985, Gordon leg. 1♂ (USNM). Paratypes: Same as holotype 2♂♂1♀; Papua New Guinea, Central Province, Port Moresby, 26-II-1989, Penny leg. 1♂1♀ (CASC).

Distribution: Papua New Guinea.

Comments: This is the only species of this genus recorded from outside of Australia. It can be easily differentiated from all the other species by the male genitalia, by its smaller size, and by its relatively slender body.

Conclusion

The genus *Paramenestheus* is currently comprised of seven species. In this study, four species are removed from the synonymy of other species and are now considered to be valid species; also two new species are herein described. The dorsal fascies allow differentiating many of the species, but in some cases, it is necessary to examine the male genitalia to accurately identify the species. This genus is rather diverse and its members are distributed in all the regions of Australia. There may be additional undescribed species to be found; therefore, additional collecting is needed. New Species 2 is the first species of this genus (and the tribe Aeptini) to be

recorded from Papua New Guinea. Additional genera and species may be discovered from this under-collected area.

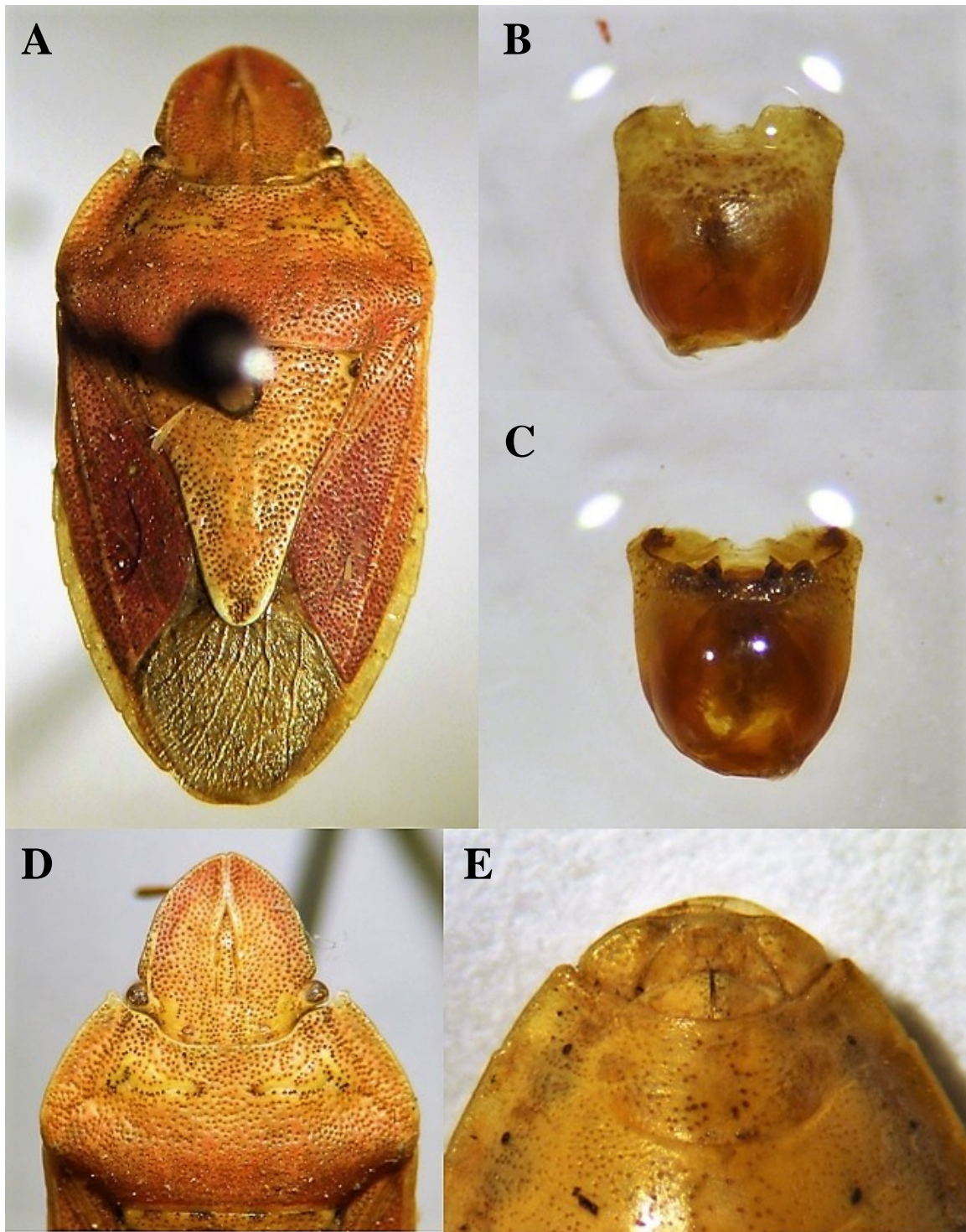


Fig. 8. *Paramenestheus abditus*. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail, E. Female terminalia, ventral view.

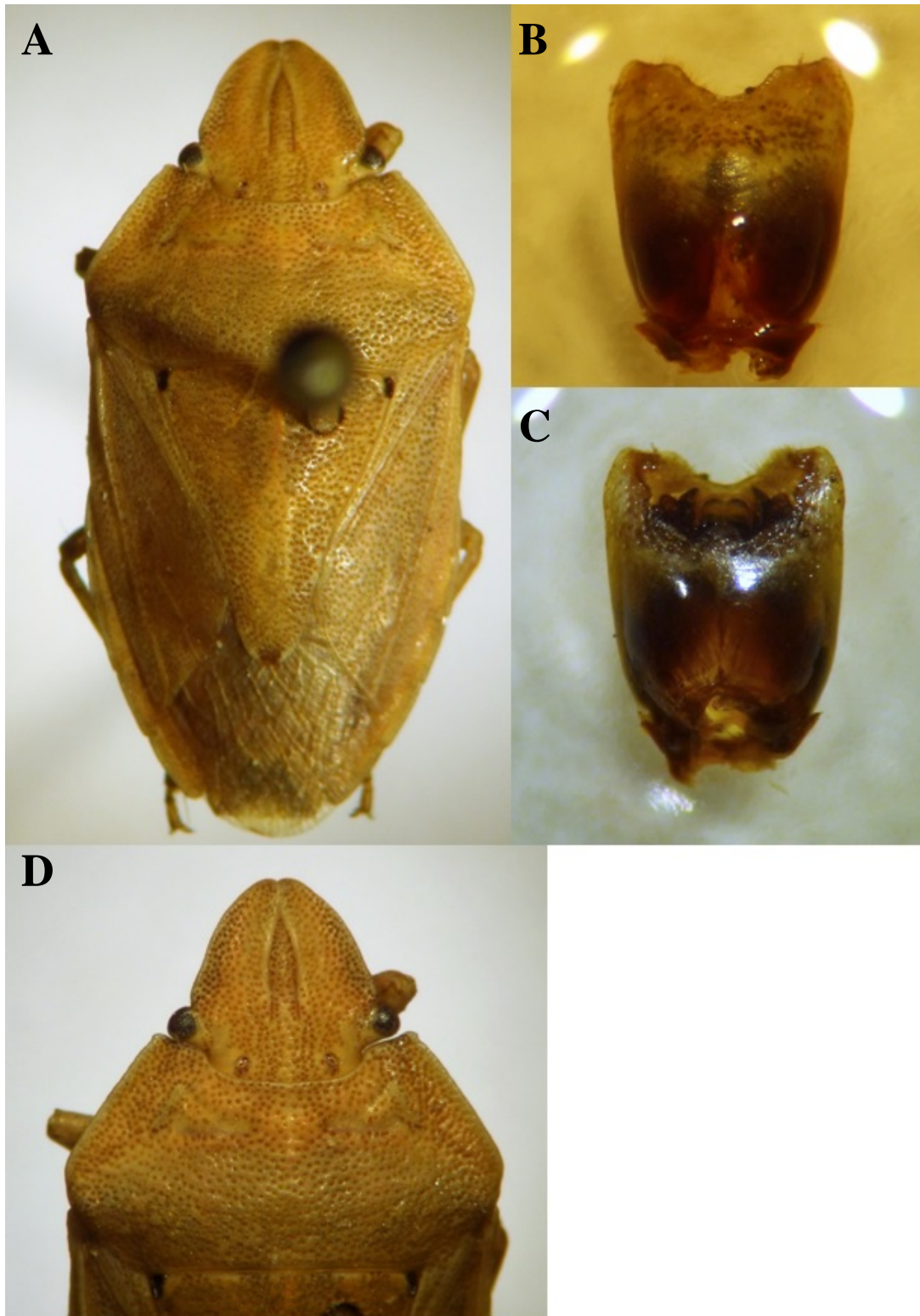


Fig. 9. *Paramenestheus brevis*. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail.

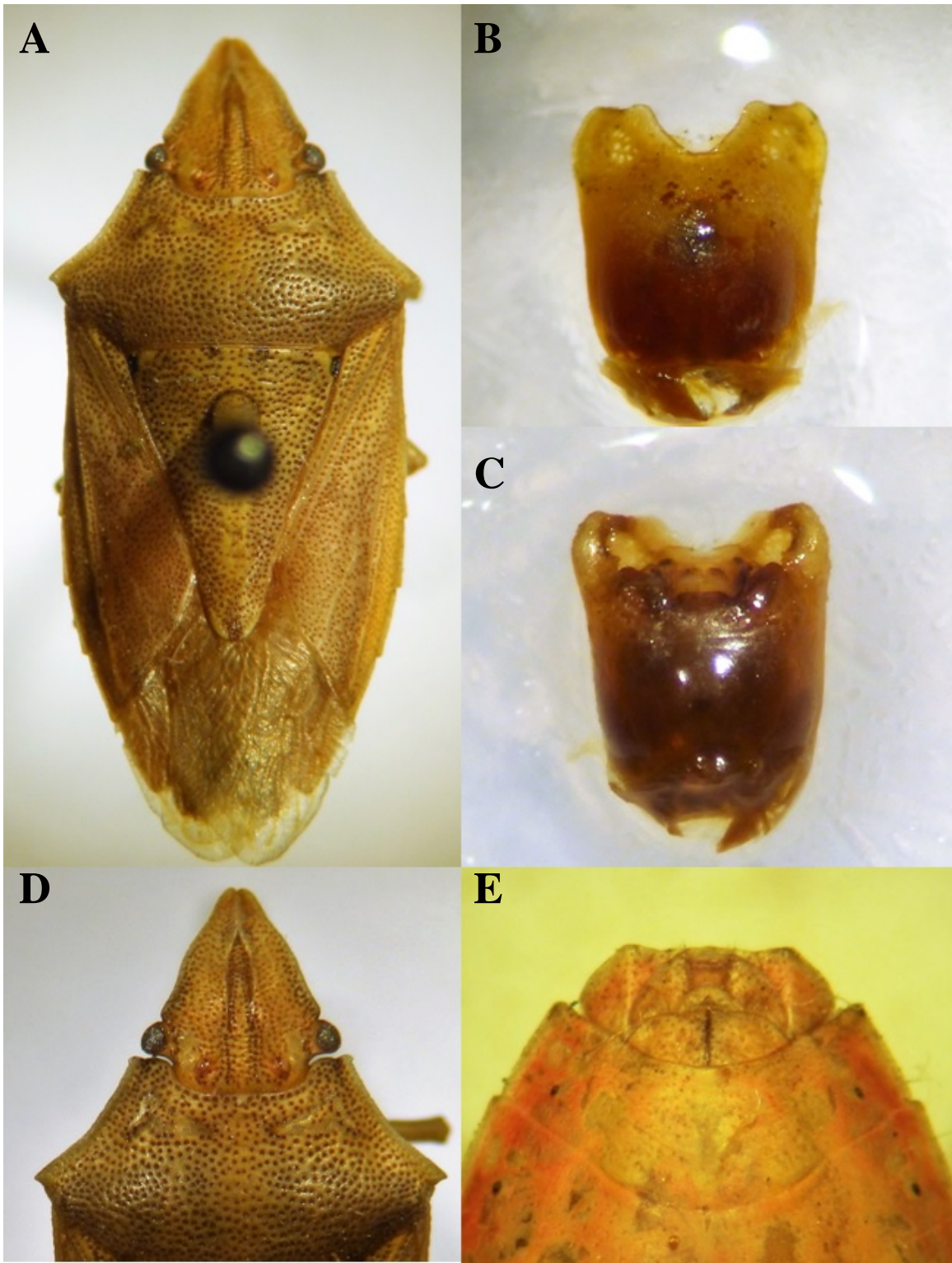


Fig. 10. *Paramenestheus nercivus*. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail, E. Female terminalia, ventral view.

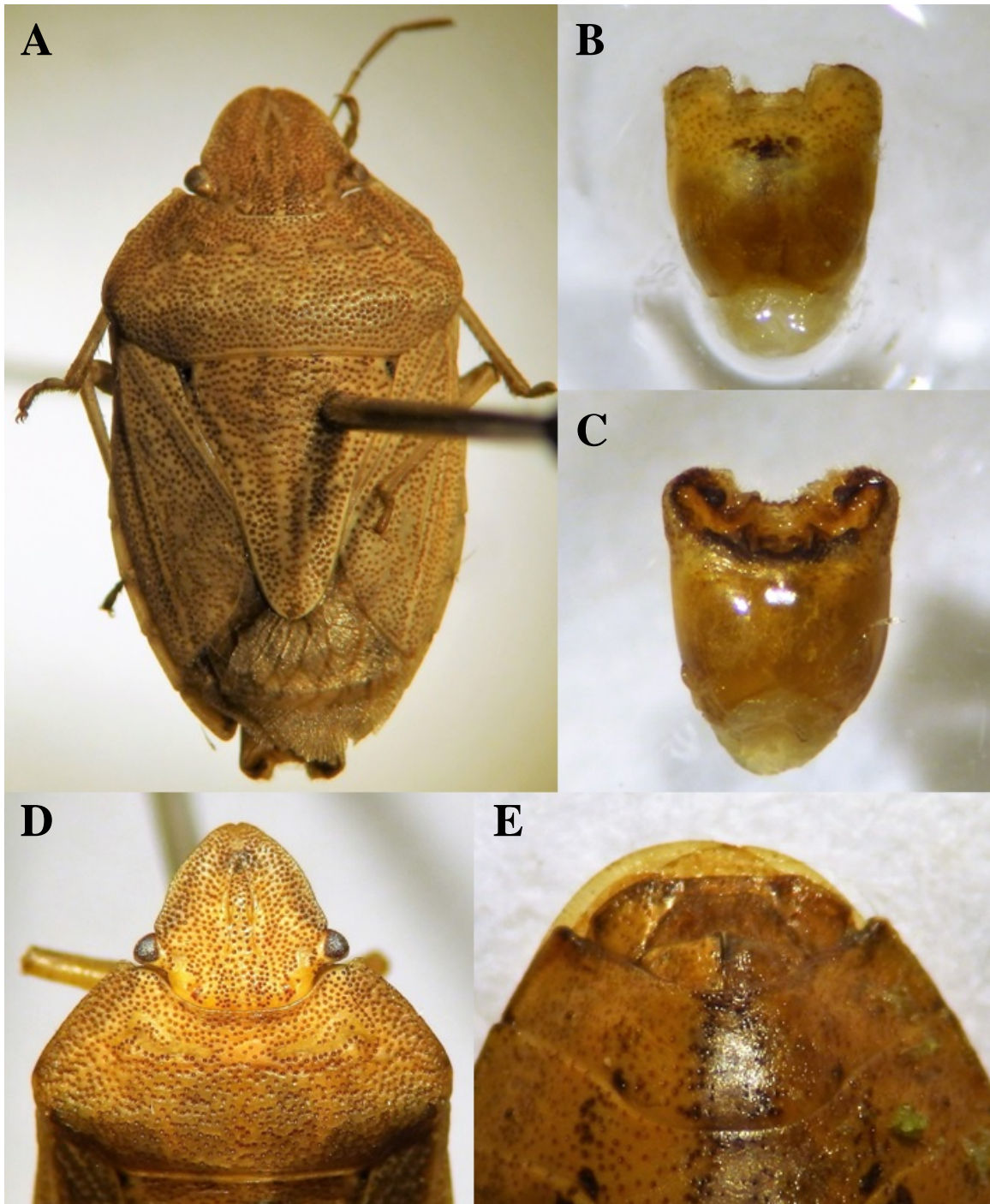


Fig. 11. *Paramenestheus semoni*. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail, E. Female terminalia, ventral view.

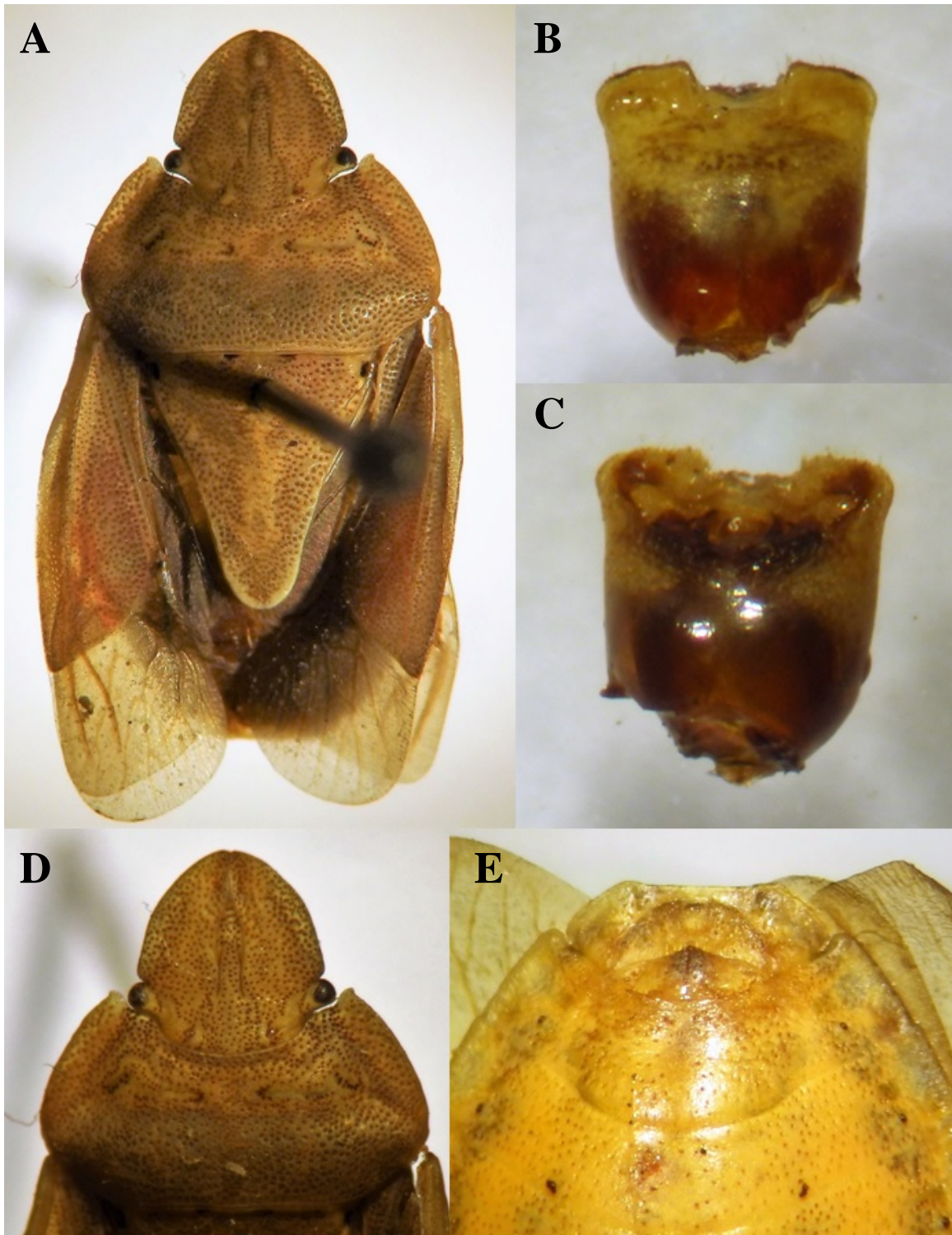


Fig. 12. *Paramenestheus terricolor*. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail, E. Female terminalia, ventral view.

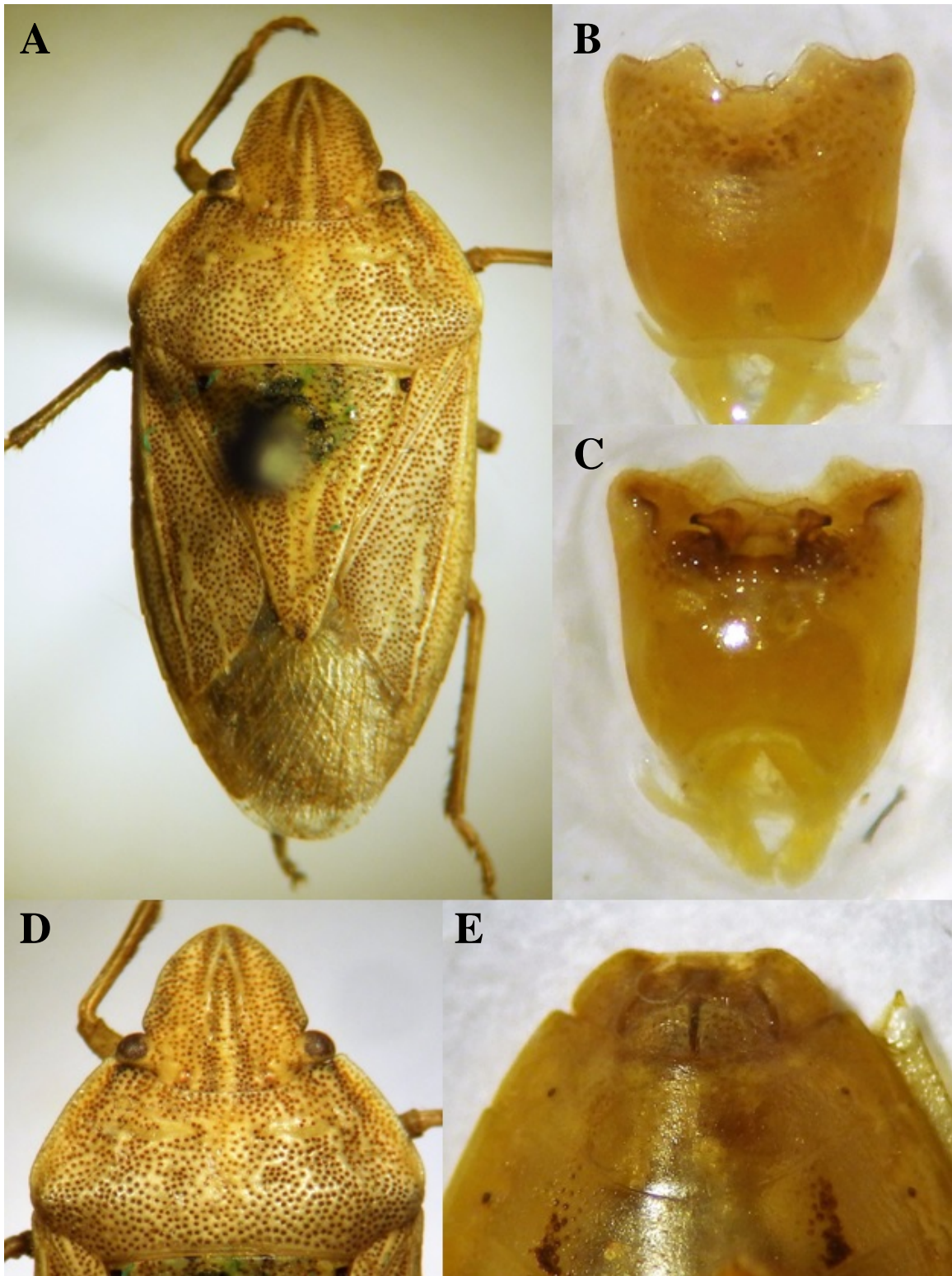


Fig. 13. *Paramenestheus* sp. nov.1. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail, E. Female terminalia, ventral view.

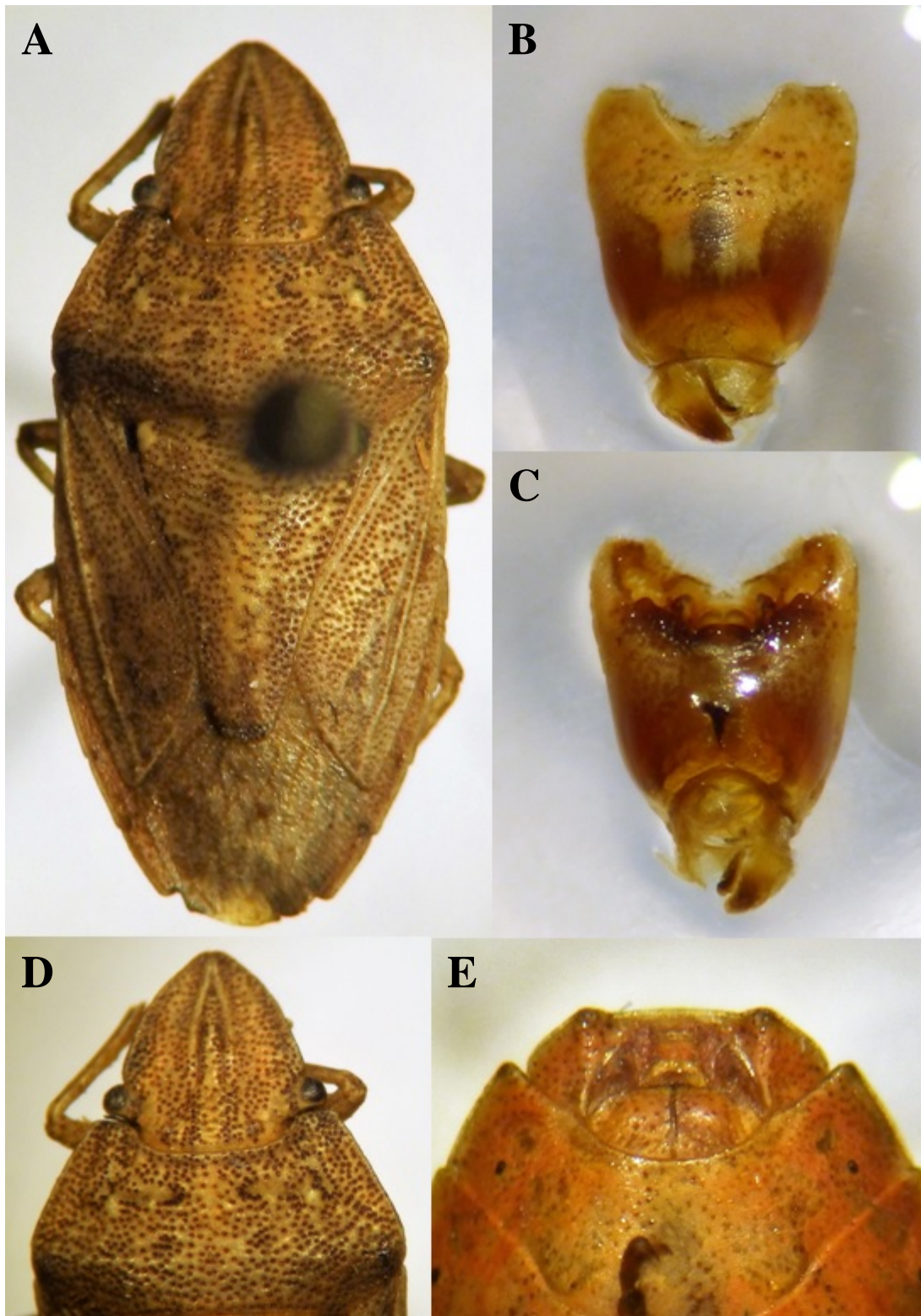


Fig. 14. *Paramenestheus* sp. nov.2. A. Habitus, B. Male pygophore, ventral view. C. Male pygophore, dorsal view, D. Head and pronotum detail, E. Female terminalia, ventral view.

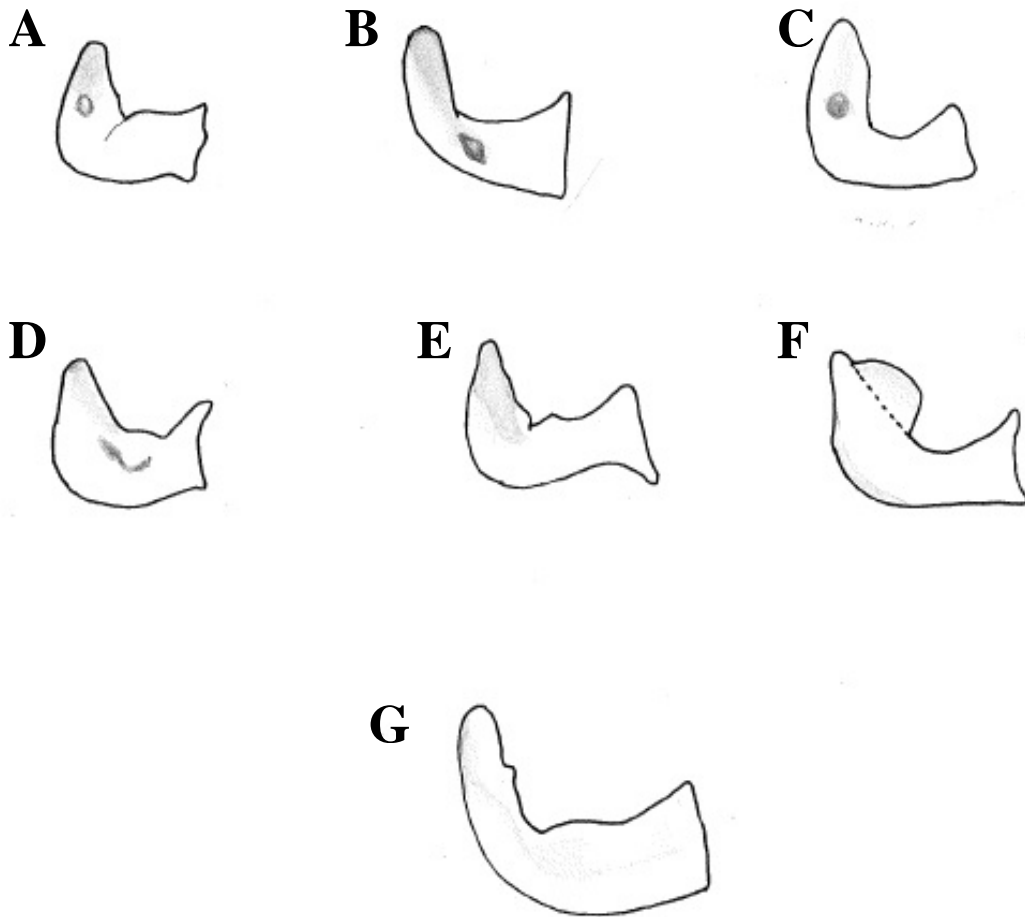


Fig. 15. *Paramenestheus* spp. Parameres, lateral view. A, *P. abditus*, B, *P. brevis*, C, *P. nercivus*, D, *P. semoni*, E, *P. terricolor*, F, *P. sp. nov1*, G, *P. sp. nov2*.

Pseudaelia Distant, 1910

(Fig. 16)

Type **species:** *Pseudaelia clementi* Distant, 1910, by monotypy.

1910 *Pseudaelia* Distant, Ann. Mag. Nat. Hist. (8)6:478-479.

1975 *Pseudaelia*: Gross, S. Austral. Het. 1:178-179. (description, key)

2002 *Pseudaelia*: Cassis & Gross, Zool. Cat. Australia 27(3B):452. (catalog)

Description: General body features: Elongate body (about 2 times longer than wide) (Figs.16 A-B), dorsal coloration yellowish-cream to ochraceous, with distinct medial, longitudinal pale line extending from apex of clypeus to apex of scutellum, in some species multiple longitudinal lines. Dorsal surface finely, densely punctate, with black or dark brown punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface; some species with dark longitudinal stripes.

Head: Elongate apically, slightly longer than wide, paraclypei much longer than clypeus, but not contiguous anteriorly; eyes prominent; antenniferal tubercles elongate, each with a large, acute lateral tooth. Antennae 5-segmented (antennomeres 2 and 3 partially fused). Bucculae concave ventrally, truncate posteriorly; rostrum 4-segmented.

Thorax: Pronotum trapezoid with a small cleft or spine on each humeral angle, usually with transverse ivory carinae variable in length on each species. Thoracic sterna longitudinally sulcate, with lateral carinae, prosternum with a tooth extending posteriorly. Scutellum isosceles triangular shaped, with broad, ivory, medial carina. Hemelytral membranes smoky or bicolored, veins contrastingly darker. Ostiolar peritremes short, auriculate; evaporatoria small, obscure, each not reaching halfway to lateral margin of metapleuron; ostiolar plates narrow, convex, slightly darker than evaporatoria. Legs with strong setae; superior surface of each tibia sulcate; tarsi 3-segmented.

Abdomen: Connexiva slightly serrate, each segment unicolorous. Base of abdomen lacking tubercle or spine. Genitalia: Female paratergites apically rounded, first and second gonocoxae rounded, convex posteriorly, mesial margins straight. Spermathecal bulb rounded, distal flange of pump discoidal; sclerotized rod straight with expanded, pointed apex (Fig. 16F). Posterior margin of male pygophore subrectangular in ventral view (Fig. 16C), with strong,

subrectangular, medial emargination, a subtriangular posterior projection on each side of medial emargination. Parameres broad, each tapering to a narrowly acute apex, more robust basally, with a truncate process.

Material examined: *P. clementi*: Australia, Northern Territories, Alleron, XI-1974, Bailey & Storey leg. 1♂1♀ (QMCA); Northern Territories, Alice Springs, 17-II-1972 Forbes leg. 1♂ (SAMC); Queensland, Selwyn Mine, 25-IV-1991, Woodger leg. 1♂ (DARC); South Australia, Mt. Lindsay, 15-X-1976, 1♂1♀ (SAMC); South Australia, Moomba, V-1979, Riolo leg. 1♂ (SAMC). Type material of *P. gnielae*, *P. rectimargo* and *P. sp. nov.*

Included species: *Pseudaelia clementi* Distant, 1910; *Pseudaelia gnielae* Gross, 1975; *Pseudaelia rectimargo* Gross, 1975.

Distribution: Australia: Northern Territories, South Australia, Western Australia.

Comments: This genus is comprised of two species groups, one including only *P. clementi* and the other including the rest of the species. The singular morphology of *P. clementi* including its developed striped design may be a more derivate state, which may function as a way to be better camouflaged in grasses; whereas the other species may be in a more primitive stage of coloration. This genus is close to New Genus 2, from which can be easily differentiated by the shorter length of paraclypei, and the absence of basal abdominal sulcus. In addition to the above listed species, within the examined material, a new undescribed species was discovered, which is described below.

***Pseudaelia* sp. nov.**

(Fig. 16B-F)

Description: General body features: body elongate, coloration dark brownish and ochraceous.

Head: Elongate, longer than wide, dull cream colored with blackish stripes; punctation dense, dark. Eyes prominent, reddish; ocelli large, oval, translucent, located at base of head, behind an imaginary line drawn through the posterior margins of compound eyes, but not contiguous with pronotum (Fig. 16B). Clypeus with a longitudinal, pale, ivory line, which extends posteriorly to distal end of scutellum (Fig. 16B). Paraclypei enlarged, punctate, apices narrowly rounded but not acute. Lateral margins of head nearly straight for basal two-thirds, then bending mesad for last third. Antennae, dull cream colored at base, becoming orange to dark reddish apically, first antennomere not extending beyond apex of head, second antennomere very short, antennomeres 3 to 5 elongate, subequal, diameter greater than the diameter first two antennomeres. Rostrum reaching base of the abdomen.

Thorax: Pronotum trapezoid, dull cream colored with dense punctation, with two weak ivory stripes on each side of the disc, posterolateral margins strongly concave, with a rudimentary rounded projection at each anterior angle, a longitudinal, ivory stripe present medially, cicatrices immaculate, humeral angles with an acute cleft projected laterally. Scutellum triangular, dull cream colored with blackish, dense punctures, longitudinal, calloused pale line present medially, lateral foveae very dark, conspicuously surrounded by a callous, apex rounded. Coria dull cream colored with dense dark punctures; hemelytral membranes smoky with conspicuous contrastingly brown longitudinal veins. Thoracic sterna yellowish with light brown dense punctures, a weak brownish stripe on each marginal side. Prosternal tooth of the sulcus poorly developed and rounded. Metapleura dull cream colored with dark dense punctation; ostiolar peritremes short, each not reaching halfway to lateral margin of metapleuron; evaporatoria relatively small, restricted to very small rugose area around each ostiolar peritreme;

ostiolar plates impunctate. Legs yellow, with strong dark setae, tibiae and femora subequal in length; sulcus on superior surface of each tibia with distinct dark setae.

Abdomen: Yellowish dorsally, connexiva dull, cream colored, slightly serrate, with dark punctures on the lateral half of each segment; abdominal venter dull, cream colored, with dense, concolorous punctures, with some dark punctures laterally and medially; spiracles dark brown, not placed on a distinct callus. Female unknown. Male genitalia: posterior margin of pygophore subrectangular in ventral view (Fig. 16 B-C), with two truncate projections on lateral apices, ventral border of pygophore wide with a broad subrectangular shaped emargination medially. Parameres cane shaped, dark, wide, each tapering to an acute apex, basal lobe with a strong truncate process (Fig. 16D).

Measurements: Total length: 10.98; pronotum width: 5.15; head length: 2.78; head width: 2.68; scutellum length: 2.57; scutellum width: 1.39. Antennae: I=0.43, II=0.26, III=1.60, IV=1.73, V=1.43. Rostrum: I=2.30, II=2.24, III=0.53, IV=0.71.

Comments: This species is very close to *Pseudaelia gnielae*, but differs by having the broader medial emargination in the ventral margin of the pygophore, by the strongly concave anterolateral pronotal margins, by the less developed pronotal carinae, and by the tooth on each humeral angle more acutely defined. From *P. rectimargo* it can be easily told apart by the anterolateral margins of the pronotum, which are straight in *P. rectimargo*, and by the development of pronotal carinae. It also differs from *P. clementi* by the absence of stripes on both the dorsal and ventral surfaces.

Type material: Holotype: Western Australia, Gill Pinnacle Mural Crescent, at light 5-XI-1966, Altken & Tindale leg. 1♂ (SAMC). Paratypes: Same data as holotype, 1♂; same data as holotype but 5-XI-1966, 1♂ (SAMC).

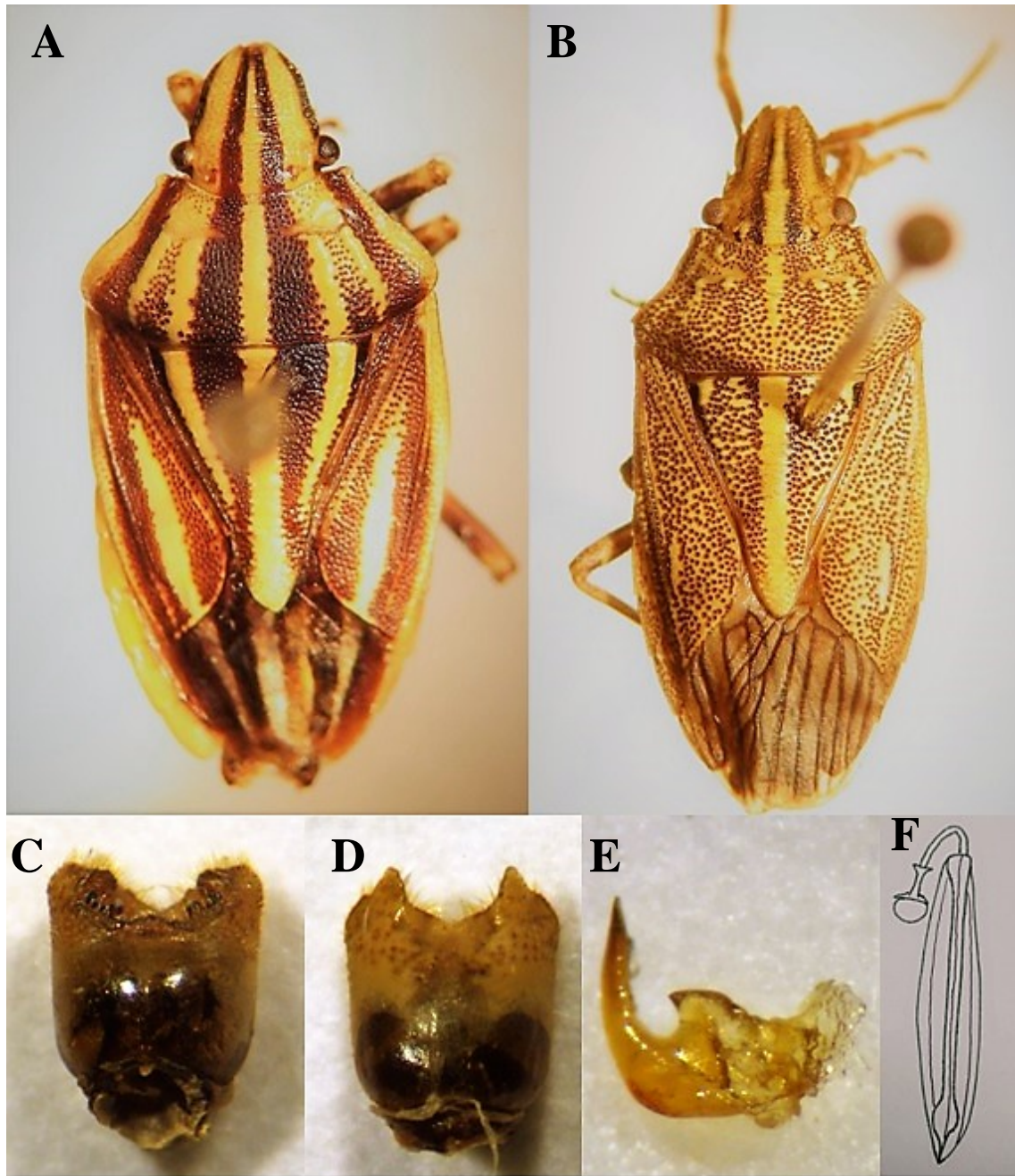


Fig. 16. *Pseudaelia* spp. A. *Pseudaelia clementi*, habitus; B-F. *Pseudaelia* sp. nov. B, habitus; C, pygophore, dorsal view; D, pygophore, ventral view; E, paramere lateral view; F, spermatheca.

New genus 1

(Fig. 17)

Type species: New Genus 1, sp. nov. 1, by present designation.

Description: General body features: Body elongate (about 2 times longer than wide) (Fig. 17), dorsal coloration yellowish-cream to ochraceous, with a distinct medial, longitudinal pale line extending from apex of clypeus to apex of scutellum (Figs. 17A). Dorsal surface finely, densely punctate, punctures mostly concolorous with surface. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface, dark longitudinal stripes on thoracic sterna.

Head: Elongate, longer than wide, paraclypei much longer than clypeus, but not contiguous anteriorly; eyes prominent. Antenniferal tubercles short, each with a rudimentary lateral tooth; antennae 5-segmented (antennomeres 2 and 3 partially fused). Bucculae straight ventrally, evanescent posteriorly; rostrum 4-segmented.

Thorax: Pronotum trapezoid with humeral angles rounded, anterior angles each with a spine like tooth oriented anteriorly. Thoracic sterna longitudinally sulcate, with lateral carinae, prosternal carina with a rudimentary tooth, extending backwards. Scutellum isosceles triangular, with two basal foveae. Hemelytral membranes smoky. Ostiolar peritremes short, auriculate (Fig. 17F); evaporatoria rudimentary (Fig. 17F); ostiolar plates narrow, convex, slightly darker than evaporatoria. Legs with strong setae; superior surface of each tibia not sulcate; tarsi 3-segmented.

Abdomen: Connexiva rounded, each segment unicolorous; base of abdomen lacking tubercle or spine. Female genitalia: Female paratergites apically rounded, first and second gonocoxae rounded, convex posteriorly, mesial margins straight (Fig. 17B). Male genitalia: Posterior margin of male pygophore subrectangular in ventral view, with strong subrectangular medial emargination, a subtriangular posterior projection on each side of medial emargination, parameres wide, each tapering to a narrowly acute apex, more robust basally.

Distribution: Australia, Western Australia.

Comments: The new genus is closely related to *Hillieria* and *Pseudaelia*. The shape of the head, with the open, wide and rounded paraclypei, the shape of the anterolateral angles of the pronotum oriented anteriorly and the not sulcate tubular tibiae set this genus apart from both *Hillieria* and *Pseudaelia*.

New Genus 1. sp. nov 1.

Description: General body features: body elongate, acute, ochraceous colored.

Head: Elongate, longer than wide, dull cream colored, with dense, dark concolorous punctation. Eyes prominent, reddish. Ocelli small, circular, located at base of head, behind imaginary line drawn through the posterior margins of compound eyes, but not contiguous with pronotum. Paraclypei enlarged, punctate, apices of paraclypei rounded. Lateral margins of head nearly straight for basal two-thirds, then bending mesad for apical third. Antennae dull cream colored at base, becoming orange to dark reddish apically, first antennomeres not extending beyond apex of head, third antennomere very short, antennomeres 4 and 5 elongate, subequal. Rostrum reaching metacoxae.

Thorax: Pronotum trapezoid, dull cream colored with dense punctation, anterior disk slightly darkened, with a longitudinal, weak stripe medially; cicatrices with black patches on lateral margins. Anterolateral pronotal margins straight, with a spine like projection at each anterior angle; humeral angles rounded. Scutellum triangular, dull cream colored with concolorous, dense punctures, basal lateral foveae very dark and conspicuous, scutellar apex rounded. Coria dull cream colored with dense, dark punctation; hemelytral membranes smoky with longitudinal veins conspicuous. Thoracic sterna yellowish with light brown dense punctures, a brownish stripe on each marginal side. Tooth associated with prosternal sulcus

poorly developed, rounded, Metapleura dull cream colored with dark, dense punctation. Ostiolar peritremes short, each not reaching halfway to lateral margin of metapleuron; evaporatoria relatively small, restricted to a very small rugose area around each ostiolar peritreme; ostiolar plates densely punctured. Legs yellow, with strong, dark setae, tibiae cylindrical, superior surfaces not sulcate.

Abdomen: yellowish dorsally; connexiva dull, cream colored, rounded, venter dull, cream colored, with dense, concolorous punctures, with dark stripes on the sides along the spiracles. Spiracles dark brown, not placed on distinct callus. Male genitalia: Pygophore with a truncate excavation ventrally, dorsally with two triangular processes on each side (Fig. 17C). Parameres each with a basal and proximal lobe, basal lobe with strong teeth on the upper surface and two smaller teeth on inner margin (Fig. 17C).

Measurements: Total length: 7.90 (7.50), pronotal width: 4.08–4.14 (3.90), head length: 1.73 (1.76), head width: 1.77 (1.69), scutellum length: 2.96 (2.96), scutellum width: 2.48 (2.50), rostral segments: I: 1.22 II: 0.92 III: 0.44 IV: 0.49, antennal segments: I: 0.59 II: 1.29 III: 0.78, IV: 0.44.

Type material: Holotype: Australia, Western Australia, Drummond, 16-XI-1973, N. McFarland leg. 1♂. Paratypes: Same as holotype 4♂♂ 1♀.

Distribution: Australia: Western Australia.

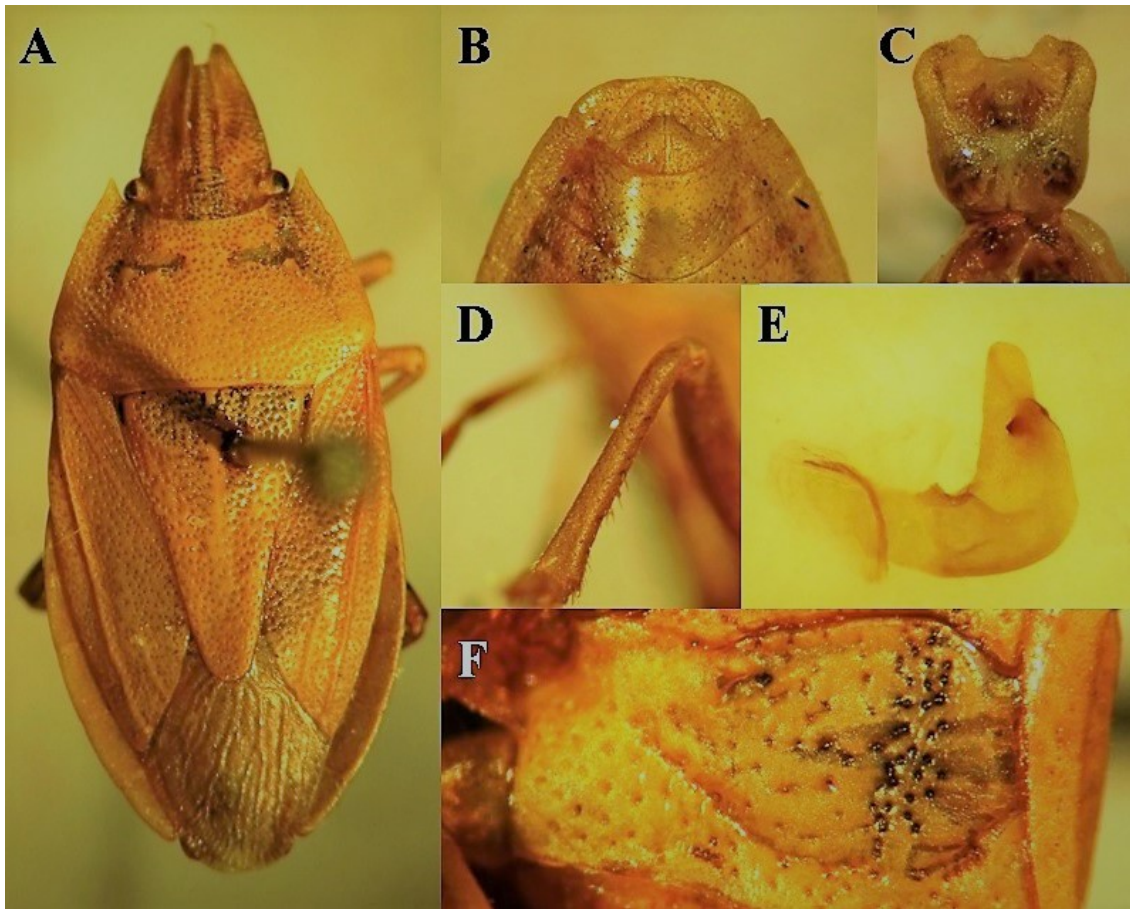


Fig. 17. New genus 1 new species 1. A. Habitus, B. External female genitalia, ventral view. C. Male pygphore, dorsal view. D. Tibia. E. Male paramere lateral view. F. Metapleuron.

New Genus 2

(Figs. 18-21)

Type species: New Genus 2, new species 1, by present designation.

Description: General body features: Body elongate (about 2 times longer than wide) (Figs. 18-21), dorsal coloration yellowish-cream to ochraceous, in some species multiple longitudinal lines present. Dorsal surface finely, densely punctate, with concolorous black or dark brown punctures. Ventral surface yellowish, with punctures fine, dense, nearly concolorous with body surface; some species with dark patches.

Head: Elongate apically, slightly longer than wide, paraclypei much longer than clypeus, contiguous or nearly contiguous anteriorly (Figs. 31A-C); eyes prominent. Antenniferal tubercles short, conical; antennae 5-segmented (antennomeres 2 and 3 partially fused). Bucculae straight ventrally, widened and extensively rounded anteriorly, evanescent posteriorly; rostrum 4-segmented.

Thorax: Pronotum trapezoid with rounded humeral angles, darkened laterally. Thoracic sterna longitudinally sulcate, with lateral carinae, prosternum with a rudimentary tooth oriented backwards. Scutellum isosceles triangular, with two to four foveae along basal margin, scutellar apex rounded. Hemelytral membranes smoky or translucent, veins contrastingly darker. Ostiolar peritremes short, very reduced; evaporatoria small, each restricted to a small area around peritreme; ostiolar plates narrow, convex, slightly darker than evaporatoria. Legs with strong setae; superior surface of each tibia sulcate; tarsi 3-segmented.

Abdomen: Connexiva slightly serrate; base of abdomen with a median sulcus. Female genitalia: Paratergites 9 fused, apically pointed; first and second gonocoxae rounded, convex posteriorly, mesial margins straight. Spermathecal bulb rounded, distal flange of pump discoidal; sclerotized rod short, funnel shaped (Fig. 21D). Male genitalia: Posterior margin of male pygophore subrectangular in ventral view, with distinct subrectangular medial emargination, a subtriangular posterior projection on each side of medial emargination. Parameres wide, each tapering to a narrowly acute apex, more robust basally, with a truncate process.

Comments: This new genus is close to *Pseudaelia* from which can be easily differentiated by the characters discussed in *Pseudaelia*, especially body shape, and paraclypei.

Distribution: Australia: Northern Territories, Western Australia.

New Genus 2. sp. nov. 1

(Fig. 18, 21A, 21D, 21E)

Description: General body features: Body elongate and sharp, ochraceous colored. Head: Elongate, longer than wide, dull cream colored, with fine, dense, concolorous punctures. Eyes prominent, reddish. Ocelli large, ovate, located near base of head, behind an imaginary line drawn through posterior margins of compound eyes, but not contiguous with pronotum (Fig. 19). Paraclypei enlarged, punctate, apices of paraclypei rounded. Lateral margins of head nearly straight for basal two-thirds, then bending mesad for apical third. Antennae dull cream colored at base, becoming orange to dark reddish apically, first antennomere not extending beyond apex of head, third antennomere very short, antennomeres 4 to 5 elongate, subequal. Rostrum reaching base of the abdomen.

Thorax: Pronotum trapezoid, dull cream colored with dense punctation, anterior disk slightly darkened; anterolateral margins slightly concave, crenulated along anterior half, with a rudimentary projection at each anterior angle; with 4 to 5 longitudinal ivory carinae; cicatrices with black patches on lateral margins; humeral angles rounded. Scutellum triangular, dull cream colored with concolorous, dense punctation, lateral basal foveae very dark, conspicuous, mesial basal foveae weak; scutellar disk elevated; apex rounded. Coria dull cream colored with dense dark punctation; hemelytral membranes smoky with conspicuous longitudinal veins. Thoracic sterna yellowish with light brown, dense punctures, with a brownish stripe on each side laterally. Prosternal tooth associated with sulcus poorly developed, rounded, Metapleura dull cream colored, with concolorous, dense punctation; ostiolar peritremes short, each not reaching halfway to lateral margin of metapleuron; evaporatoria relatively small, each restricted to very small

rugose area around ostiolar peritreme; ostiolar plates densely punctured. Legs yellow, with strong dark setae, tibiae conical, superior surface of each sulcate.

Abdomen: Yellowish dorsally, connexiva dull, cream colored, rounded; abdominal venter dull, cream colored, with dense, concolorous punctation, with a darkened patch in middle area; spiracles caramel colored, each not placed on distinct callus. Female genitalia: Paratergites 8 fused, M-shaped, with apex acute; paratergites 9 short, ovate; first gonocoxae rounded, second gonocoxae subtriangular, convex apically.

Male genitalia: Pygophore with a truncate emargination, base of emargination rounded, convex, sides with two subtruncate processes, pointed on mesial limits. Parameres each with a basal and proximal lobe, basal lobe wide, strong; apical lobe short, compact with apex straight.

Measurements (Female in parentheses): Total length: 8.41 (8.73); pronotum width: 3.31 (3.55); head length: 2.04 (2.29); head width: 1.87 (2.01); scutellum length: 2.07 (2.44); scutellum width: 1.07 (1.30). Antennae: I=0.23, II=0.32, III=0.25, IV=1.12, V=1.20. Rostrum: I=1.55, II=1.48, III=0.31, IV=0.35.

Type material: Holotype: Australia, Northern Territories, Dunmara, 26-X-1952, 1♂ (CASC). Paratypes: Same as holotype, 1♂♂2♀♀ (CASC).

Distribution: Australia, Northern Territories.

Comments: This species is the smallest in the genus and can be easily differentiated by its lighter color, by the short paraclypei as compared to other species in the genus, by the shape of the base of the emargination of the male pygophore, by the shape of the parameres, and by the well-developed paratergites 9.

New Genus 2. sp. nov. 2

(Figs. 19, 21B, 21F)

Description: General body features: body elongated, ochraceous colored.

Head: Elongate, longer than wide, dull cream colored with black stripes on the sides, with fine, dense, concolorous punctation. Eyes prominent, reddish. Ocelli large, ovate, located near base of head, behind an imaginary line drawn through the posterior margins of compound eyes, nearly contiguous with pronotum. Paraclypei enlarged, punctate, apices rounded. Lateral margins of head nearly straight for basal two-thirds, then bending mesad for apical third. Antennae dull cream colored at base, becoming orange to dark reddish apically, first antennomere not extending beyond apex of head, third antennomere very short, antennomeres 4 to 5 elongate, subequal. Rostrum reaching base of abdomen.

Thorax: Pronotum trapezoid, compact, dull cream colored with dense punctation; anterior disk and sides slightly darkened, anterolateral margins straight, with a rudimentary projection on each anterior angle; cicatrices with black patches on lateral margins; humeral angles rounded. Scutellum triangular, dull cream colored with concolorous, dense punctation, basal lateral foveae very dark, conspicuous, basal mesial foveae weak; scutellar disk elevated, apex rounded. Coria dull cream colored, each with a dark mesial longitudinal band; hemelytral membranes smoky with conspicuous reticulate veins. Thoracic sterna yellowish with light, brown, dense punctures forming a brownish stripe on each side laterally. Prosternal tooth of sulcus poorly developed, rounded; metapleura dull cream colored with concolorous, dense punctation; ostiolar peritremes short, each not reaching halfway to lateral margin of metapleuron; evaporatoria relatively small, restricted to very small rugose area around each ostiolar peritreme; ostiolar plates densely punctured. Legs yellow with dark round spots, with strong, dark setae; tibiae conical, superior surface of each sulcate.

Abdomen: Yellowish dorsally, connexiva dull, cream colored, rounded; abdominal venter dull, cream colored, with dense, concolorous punctation forming a darkened patch in middle area, and a dark stripe along spiracles; spiracles brown, each not placed on distinct callus.

Female genitalia: Paratergites 8 fused, apex undulate, straight medially; paratergites 9 elongate, ovate; first gonocoxae elongate, second gonocoxae compact, subtriangular, convex apically.

Male genitalia: Pygophore with a truncate emargination, base of emargination convex, bilobed, side with two subtruncate processes, projected inwardly. Parameres each with basal and proximal lobes, basal lobe wide, strong with a rectangular process; apical lobe fine, elongate, with very pointed apex.

Measurements (Female in parentheses): Total length: 9.35 (9.65); pronotum width: 3.71 (3.98); head length: 2.19 (2.44); head width: 2.38 (2.42); scutellum length: 2.17 (2.54); scutellum width: 1.25 (1.41). Antennae: I=0.25, II=0.31, III=0.33, IV=1.10, V=1.20. Rostrum: I=1.29, II=1.37, III=0.31, IV=0.33.

Type material: Holotype: Australia, Northern Territories, Cape Crawford, 16-19-IV-2004, at light, in grass, Monteith & Cook leg. 1♂. (QMCA). Paratypes: Same as holotype, 1♀; Northern Territories, Horn Island, 15-21-II-1968, B. Cantrell leg. 1♂. (QMCA).

Distribution: Australia, Northern Territories.

Comments: This species is the largest of the genus and can be easily differentiated by its lighter color, by the brown circular marks on the legs, by the base of the emargination of the male pygophore bilobed, by the shape of the parameres, and by the shape of the female terminalia.

New Genus 2. sp. nov. 3

(Fig. 20, 21C, 21G)

Description: General body features: Body elongate, yellowish cream colored with a red longitudinal band. Head: Elongate, longer than wide, dull cream colored, with fine, dense, concolorous punctation. Eyes prominent, dark. Ocelli large, ovate, located near base of head, behind an imaginary line drawn through posterior margins of compound eyes, but not contiguous with pronotum. Paraclypei enlarged, punctate, apices rounded. Lateral margins of head nearly straight for basal two-thirds, then bending mesad for apical third. Antennae dull cream colored at base, becoming orange to dark reddish apically, first antennomere not extending beyond apex of head, third antennomere very short, antennomeres 4 to 5 elongate, subequal. Rostrum reaching base of abdomen.

Thorax: Pronotum trapezoid, dull cream colored, with dense punctation, lateral margins of disk darkened, anterolateral margins straight, with a rudimentary projection on each anterior angle; cicatrices with black patches on lateral angles; humeral angles rounded; pronotal disk with a reddish midline. Scutellum triangular, dull cream colored, with concolorous, dense punctation; basal lateral foveae very dark, conspicuous, basal mesial foveae absent; scutellar disk elevated with a reddish middle line; scutellar apex rounded. Coria dull cream colored, each with a weak, dark, mesial, longitudinal band; hemelytral membranes smoky with conspicuous longitudinal veins. Thoracic sterna yellowish, with a brownish stripe on each lateral margin. Prosternal tooth of sulcus poorly developed, rounded, Metapleura dull cream colored with concolorous dense punctation; ostiolar peritremes short, each not reaching halfway to lateral margin of metapleuron; evaporatoria relatively small, restricted to very small rugose area around each ostiolar peritreme; ostiolar plates densely punctured. Legs yellow, immaculate, with strong, dark setae; tibiae conical, superior surface of each sulcate.

Abdomen: Yellowish dorsally, connexiva dull cream colored, rounded, abdomen venter dull cream colored, with dense, concolorous punctation, and a dark stripe along spiracles. Spiracles brown, each not placed on distinct callus. Female unknown. Male genitalia: Pygophore with a rounded emargination, base of emargination without any projections, side with two subtruncate processes. Parameres each with a basal and proximal lobe, basal lobe wide, strong, convex on the superior surface; apical lobe fine, elongate, with truncate apex.

Measurements: Total length: 9.65, pronotal width: 3.98, head length: 2.44, head width: 1.77–1.78 (1.69), scutellum length: 2.96, scutellum width: 2.00, Antennae: I=0.22, II=0.30, III=0.37, IV=1.01, V=1.11. Rostrum: I: 1.23 II: 1.00 III: 0.47 IV: 0.49,

Type material: Holotype: Australia, Northern Territories, Cape Crawford, 16-19-IV-2004, at light, in grass, Monteith & Cook leg. 1♂. (QMCA). Paratype: Australia, Western Australia, Derby, 13-I-1979, W. Sumling leg. 1♂ (SAMC).

Distribution: Australia, Northern Territories, Western Australia.

Comments: This species can be easily recognized by its lighter coloration, by the reddish stripe on the pronotum and scutellum, and by the rounded emargination of the male pygophore.

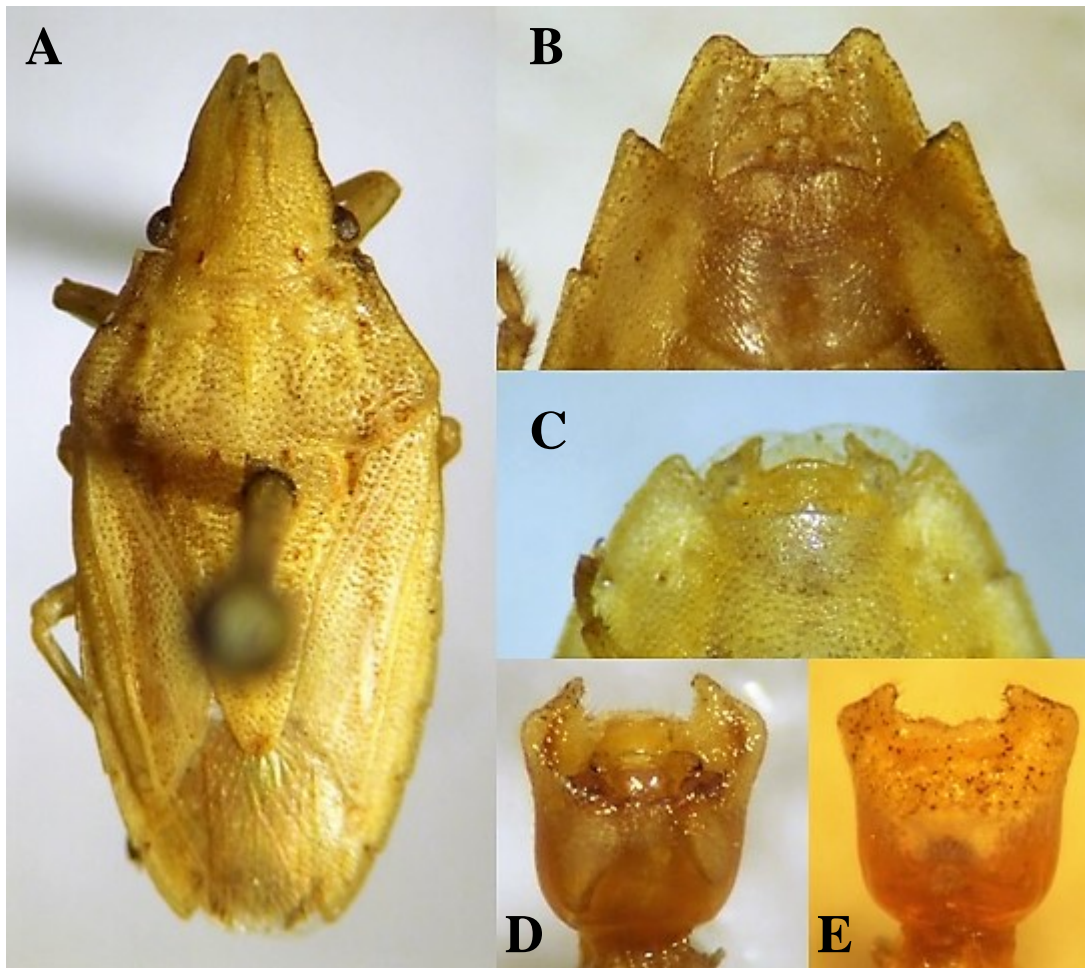


Fig. 18. New genus 2 new species 1. A, habitus; B, Female terminalia, ventral view; C, male pygophore, ventral view; D, male pygophore, dorsal view; E, male pygophore, ventral view.

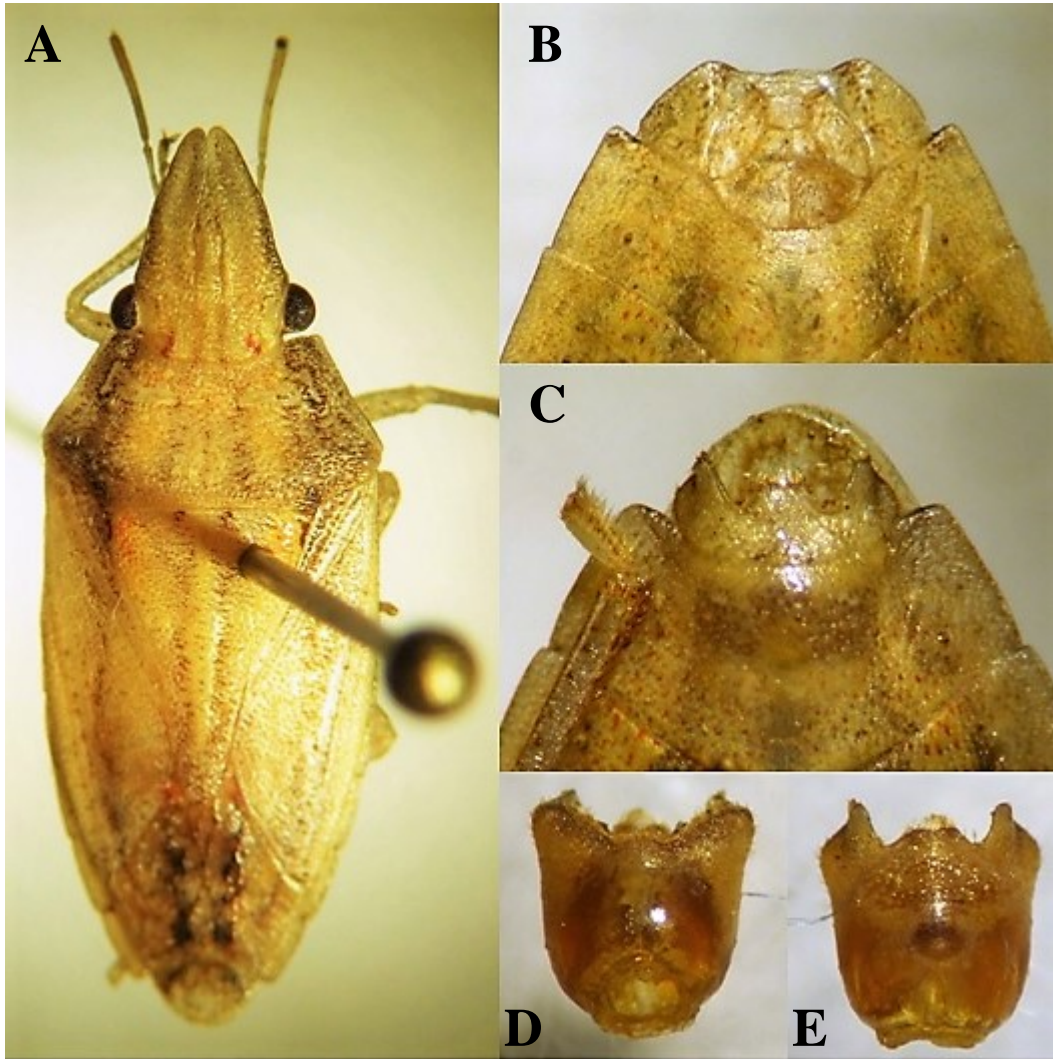


Fig. 19. New genus 2 new species 2. A, habitus; B, Female terminalia, ventral view ; C, male pygophore, ventral view; D, male pygophore, dorsal view; E, male pygophore, ventral view.

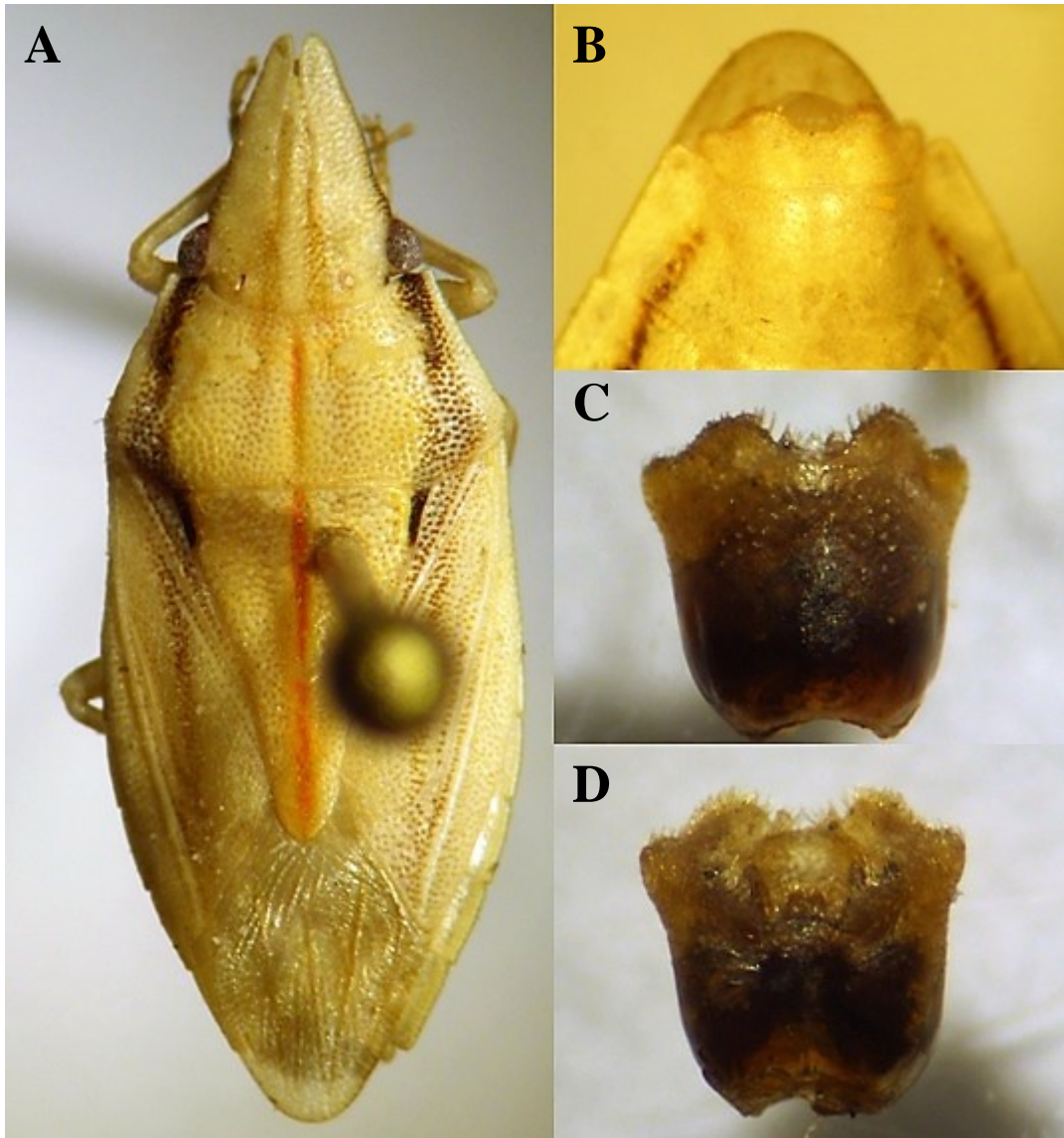


Fig. 20. New genus 2 new species 3. A, habitus; B, male pygophore, ventral view; C, male pygophore, dorsal view; D, male pygophore, ventral view.

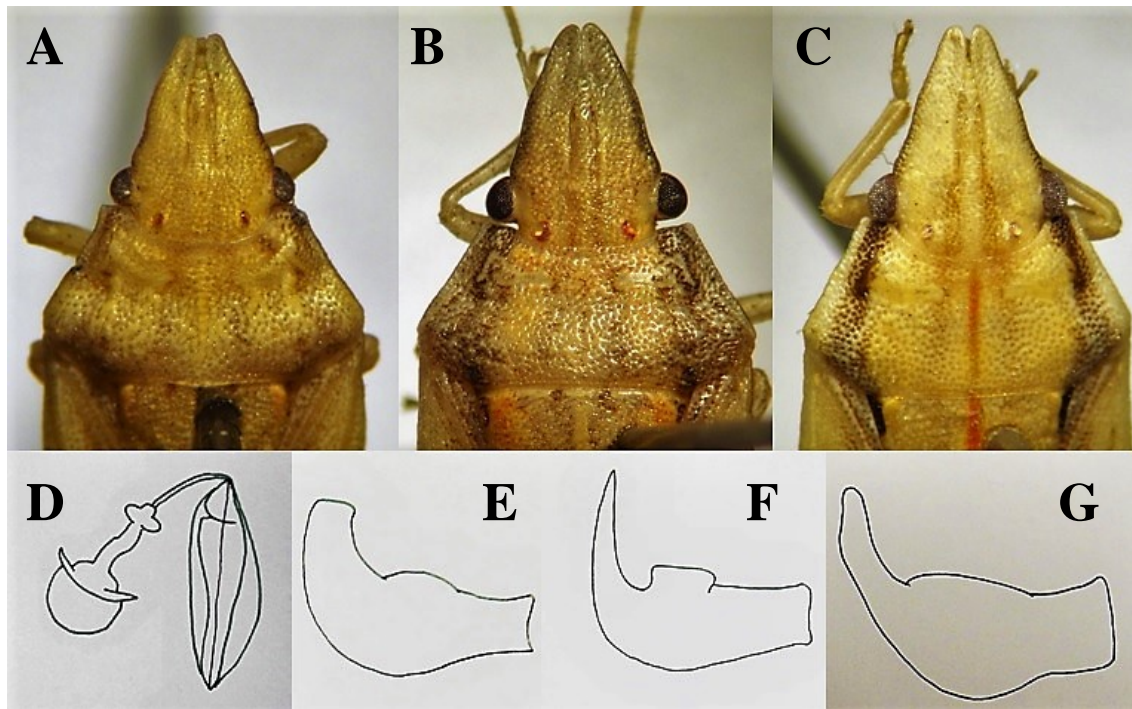


Fig. 21. New genus 2 spp. A, species 1, head and pronotum; B, species 2, head and pronotum; C, species 3, head and pronotum; D, species 1, spermatheca; E, species 1, paramere, lateral view; F, species 2, paramere, lateral view?; G, species 3, paramere, lateral view.

Insertae sedis

Caridillus Bergroth, 1909

Type species: *Caridillus curtus* Bergroth, 1909, by monotypy.

1909 *Caridillus* Bergroth, Deut. Ent. Zeitschr. 1909:330-331.

2002 *Caridillus*: Cassis & Gross, Zool. Cat. Australia 27(3B):448. (catalog)

Comments. This monotypic genus was described from a single specimen, which is apparently lost. From the original description, this species could belong in the Aeptini or the Sciocorini. It is possible that this genus is near or even congeneric with the aeptine genus *Eribotes*, but it is not possible to tell for sure unless authentic type material is located. Therefore, I place it as *insertae sedis* until additional evidence can be studied.

Conclusions

After this revision, the Aeptini is now comprised of nine genera and 30 species. These numbers, however, may still increase as several of the other included genera are studied more thoroughly. Also, very few specimens were available from Western Australia for this study. Several species are presently only known from a few specimens from that region; when more specimens become available, it may be discovered that additional species will need to be described. Additionally, the discovery of an undescribed species of *Paramenestheus* in Papua New Guinea may indicate that other undescribed taxa may occur in that country.

In the next chapter, the relationships among the aeptine taxa here treated and their relationships with other pentatomine groups will be analyzed using cladistics methodologies. Also, the biogeographical inferences will be discussed.

CHAPTER II. PHYLOGENETIC AND BIOGEOGRAPHICAL ANALYSIS

Introduction

For this analysis, all known Aeptini genera have been included and codified. I also selected taxa for use as outgroups, based on biogeographical information. First, I selected *Archaeoditomotarus* Faúndez, Carvajal & Rider, 2014, a Gondwanian relict member of the family Acanthosomatidae (with its only species *A. crassitylus*), which other studies have determined is more primitive than pentatomids (Grazia *et al.*, 2008). I also chose a representative each of *Thestral* Faúndez & Rider, 2014 (monoespecific) and *Poecilotoma* Dallas, 1851 (*P. grandicornis*), as both are considered to be possible gondwanian relict taxa related to both Australian and South American pentatomine genera; *Oenopiella* Bergroth, 1891 (including *O. unidentata* and *O. punctaria*). Representatitves of both *Graphorn* Faúndez, Rider & Carvajal, 2017 (monoespecific), and *Chinavia* Orian, 1965 (species of the *C. apicicornis* group) were also seleted to provide a broad view of different morphologies from related pentatomines.

The characters selected for analysi are those considered to be of generic level importance (Rolston & McDonald, 1981), and have been used in other recent phylogenetic analyses (Grazia *et al.*, 2008). In addition, a few family characters (i.e. number of tarsi, the state of spermathecal sclerotized rod, Pendergrast's organs) have been added to help polarize the characters and to set apart the main acanthosomatid outgroup. In addition, regional level biogeography has been added as a character to help in the biogeographical inferences.

Characters and states

Head:

1. Shape of the head (CI=1; RI=1)

0 – Elongate.

1 – Broad.

The shape of the head may be slender and elongate as in species of *Hillieria*, or it may be more short and compact as in species of *Eribotes*.

2. Paraclypei (CI=0.33; RI=0.33)

0 – At level or nearly at level with anteclypeus.

1 – Clearly surpassing anteclypeus but not contiguous.

2 – Surpassing anteclypeus and contiguous anteriorly.

The paraclypei may be short, more or less subequal in length with the anteclypeus, as in species of *Oenopiella*, they may clearly surpass the anteclypeus but remain separate anteriorly, such as in species of the New Genus 1, or they may surpass the anteclypeus, and meet anteriorly, such as in species of *Aeptus*.

3. Antennae segmentation (CI=0.5; RI=0.5)

0 – 4-segmented.

1 – 5-segmented.

4. Antennifer (CI=0.33; RI=0.33)

0 – Unarmed.

1 – With lateral spine(s).

5. Bucculae, anterior margins (CI=0.5; RI=0.6)

0 – Rounded.

1 – With a tooth.

The anterior bucculae margins may be rounded such as in species of New Genus 2, or they may be armed with a small tooth such as in species of *Thestral*.

6. Bucculae, posterior margins (CI=0.33; RI=0.6)

0 – Evanescent.

1 – Truncate or rounded.

The posterior margins of the bucculae may end evanescently or they may be more rounded or truncate.

7. First rostral segment length (CI=1; RI=1)

0 – First rostral segment not surpassing posterior margin of bucculae.

1 – First rostral segment surpassing posterior margin of bucculae.

8. Ocelli, shape (CI=0.5; RI=0.5)

0 – Rounded.

1 – Ovate.

Thorax:

9. Pronotal shape (CI=0.33; RI=0)

0 – Pronotal shape trapezoid.

1 – Pronotal shape hexagonal.

The shape of the pronotum may be trapezoid such as in species of *Menestheus*, or it may be more hexagonal such as in species of *Chinavia*.

10. Pronotal humeral angles, shape (CI=0.5; RI=0.5)

0 – Humeral angles rounded.

1 – Humeral angles with a small indentation or cleft.

2 – Humeral angles produced into a small spine.

The humeral angles can be rounded or obtuse such as in species of *Aeptus*; they may have a small indentation or cleft such as in species of *Oenopiella*, or they may be produced into a small spine such as in species of *Graphorn*.

11. Anterolateral margins of pronotum (CI=0.5; RI=0)

0 – Straight with no teeth or crenulations.

1 – Anterolateral pronotal margins crenulate or provided with small teeth.

The anterolateral pronotal margins may be straight, without crenulations or teeth such as in species of *Paramenestheus*, or they may have crenulations or small teeth such as in species of *Graphorn*.

12. Anterior angles of pronotum (CI=0.5; RI=0.5)

0 – Each anterior pronotal angle provided with a small or rudimentary tooth oriented laterally.

1 – Each anterior pronotal angle provided with a tooth oriented anteriorly.

Each anterior pronotal angle may be rounded or armed with a small tooth oriented laterally such as in species of *Menestheus*, or they may have a more distinct tooth oriented anteriorly such as in species of *Hillieria*.

13. Cicatrices (CI=0.25; RI=0.40)

0 – Immaculate.

1 – With black or ivory spots in mesial or lateral limits.

The cicatrices can be immaculate such as in species of *Thestral*, or they may have black or ivory maculae in the mesial and/or lateral angles such as in species of *Paramenestheus*.

14. Scutellum shape (CI=1; RI=1)

0 – Scutellum U-shaped, spatulate.

1 – Scutellum triangular in shape.

The scutellum may be somewhat enlarged, U-shaped or spatulate as seen in species of *Eribotes*, or the scutellum may be smaller and triangular-shaped such as in species of *Hillieria*.

15. Scutellum apex (CI=1; RI=0)

0 – Pointed.

1 – Rounded.

The scutellum apex may be pointed such as in species of *Thestral*, or it may be rounded such as in species of New Genus 2.

16. Hemelytra (CI=1; RI=1)

0 – With brachypterous or micropterous forms.

1 – With only macropterous forms.

The hemelytra may be reduced; that is, specimens can be micropterous or brachypterous such as in species of *Aeptus*, or all known specimens may have only fully developed hemelytra (macropterous forms) such as in species of *Menestheus*.

17. Prosternum (CI=0.66; RI=0.75)

0 – Not sulcate.

1 – Sulcate.

2 – Sulcate and carinate.

The prosternum may be asulcate (flattened or convex, and may have a medial carina) such as in species of *Chinavia*: it may have a medial, longitudinal sulcus such as in species of *Thestral*; or it may have medial, longitudinal sulcus with a carina such as in species of *Hillieria*.

18. Mesosternum (CI=0.5; RI=0.66)

0 – Not sulcate.

1 – Sulcate.

The mesosternum may be asulcate such as in species of *Oenopiella*, or it may have a medial, longitudinal sulcus such as in species of *Aeptus*.

19. Ostiolar peritreme (CI=0.5; RI=0)

0 – Vestigial.

1 – Short.

2 – Elongate.

The ostiolar peritreme may be very small, nearly vestigial such as in species of *Aeptus*; it may be distinct, but relatively short (reaching no more than one-third of the distance to the lateral margin of the metapleuron) such as in species of *Thestral*, or it may be relatively long (reaching more than halfway of the distance to the lateral margin of the metapleuron) such as in species of *Chinavia*.

20. Evaporatoria (CI=0.25; RI=0.40)

0 – Small.

1 – Extensive.

The evaporatoria can be relatively small, restricted to a small area around each ostiolar peritreme, such as in species of New Genus 2; or it may be much more extensive, occupying at least half of the metapleural surface, and may continue onto adjacent areas of the mesopleuron such as in species of *Chinavia*.

21. Sternal sutures (CI=1; RI=1)

0 – Immaculate.

1 – With black or ivory patches

The sternal sutures may be immaculate laterally such as in species of *Archaeoditomotarsus*, or they may be adorned with ivory or black patches such as in species of *Eribotes*.

22. Tibiae, superior surfaces (CI=0.25; RI=0)

0 – Conical, asulcate.

1 – Sulcate.

The superior surface of each tibia may can be flattened or convex, but not having a longitudinal sulcus such as in species of New Genus 1, or they may have a distinct, longitudinal sulcus such as in species of *Hillieria*.

23. Tarsi (CI=1; RI=0)

0 – 2-segmented.

1 – 3-segmented.

The tarsi can be 2-segmented such as in species of *Archaeitomotarsus*, or they may be 3-segmented such as in species of *Aeptus*.

Abdomen:

24. Connexiva (CI=0.33; RI=0.33)

0 – Serrate.

1 – Smooth, non-serrate.

25. Base of the abdomen (CI=0.66; RI=0.5)

0 – Smoothly rounded.

1 – Armed with a small spine or tubercle.

2 – With a medial sulcus.

The base of the abdomen may be smoothly rounded such as in species of *Thestral*, it may be armed with a small, forwardly projecting spine or tubercle such as in species of *Chinavia*, or it may be unarmed, but it may have a medial sulcus such as in species of New Genus 2.

26. Pendergrast's organ (CI=1; RI=0)

0 – Absent.

1 – Present.

The Pendergrast's organ may be present such as in species of *Archaeoditomotarsus* or it may be absent such as in *Aeptus*.

Genitalia:

27. Male parameres (CI=0.5; RI=0)

0 – Bilobate simple.

1 – Bilobate complex.

The form of the parameres may be bilobate simple (without further ramifications) such as in species of *Paramenestheus*, or they may be bilobate complex such as in species of *Chinavia* (further ramificated).

28. Male pygophore, ventral margin (CI=0.5; RI=0.66)

0 – Straight or convex.

1 – Deeply invaginated.

The ventral margin of the pygophore may be straight or convex such as in species of *Archaeoditomotarsus*, or it may be distinctly emarginated such as in species of *Menestheus*.

29. Male aedeagus (CI=1; RI=1)

0 – With phallic processes absent.

1 – With phallic processes present.

30. Female paratergites 8 (CI=1; RI=1)

0 – Not fused.

1 – Fused.

In the female genital plates, paratergites 8 may be separate (not fused) such as in species of *Archaeoditomotarsus*, or they may be fused such as in species of New Genus 2.

31. Female paratergites 9 (CI=0.25; RI=0.5)

0 – Relatively broad.

1 – More elongate, not so broad.

In the female genital plates, paratergites 9 may be relatively broad such as in species of *Oenopiella*, or they may be more elongate such as in species of *Hillieria*.

32. Sclerotized rod of the spermatheca (CI=0.66; RI=0)

0 – Absent.

1 – Present, long and narrow.

2 – Present, short and conical.

The sclerotized rod in the female spermathecal may be absent such as in species of *Archaeoditomotarsus*, it may be more elongate and narrow such as in species of *Paramenestheus*, or it may be short and conical such as in species of New Genus 2.

33. Spermathecal pump (CI=0.33; RI=0)

0 – Without digitiform processes.

1 – With digitiform processes.

The spermathecal bulb of the pump region can be rounded or ovate without any digitiform processes such as in species of *Thestral*, or it can be rounded or ovate, and have one to several digitiform processes such as in species of *Paramenestheus*.

General body features:

34. Body shape (CI=0.4; RI=0.63)

0 – Short and compact.

1 – Elongate.

2 – Narrow and elongate.

The general body shape can be relatively short and compact such as in species of *Eribotes*, it can be more elongate such as in species of *Thestral*, or it can be much more narrow and elongate such as in species of *Aeliosoma*.

35. Longitudinal ivory ridges (CI=0.5; RI=0.5)

0 – Absent.

1 – Present.

The dorsal surface may have one to several longitudinal, ivory ridges present such as in species of *Thestral*, or these longitudinal, ivory ridges may be absent such as in species of *Archaeoditomotarsus*.

Biogeography:

36. Regional biogeography (CI=0.66; RI=0.75)

0 – Andean/Neotropical.

1 – Australasian.

2 – Afrotropical.

Regional biogeographic origin can be Andean/Neotropical such as several species of *Chinavia*, Australasian such as species of *Menestheus*, or Afrotropical such as *Aeptus*.

Results

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
Archaeoditomotarsus	1	0	1	0	0	0	0	0	0	1	0	0	0	1	1	1	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Graphorn	0	0	1	1	1	1	0	0	1	2	1	0	1	1	1	1	0	0	1	0	1	0	1	0	0	0	1	?	?	?	0	1	1	0	0	0	0		
Oenopiella	1	0	1	0	0	1	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0		
Chinavia	1	0	1	1	1	0	0	0	1	0	0	0	1	1	1	1	0	0	2	1	0	0	1	1	1	1	0	0	0	1	1	1	1	0	0	1	1	0	0
Thestral	0	1	0	1	1	1	0	0	0	1	1	0	0	1	0	1	1	1	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	1	0	1	1	0	
Poecilotoma	0	1	0	1	1	1	0	0	0	1	1	0	0	1	1	1	1	1	1	0	1	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1	1	1	
Aellosoma	0	0	0	1	0	0	1	0	0	1	0	0	0	1	1	1	2	1	1	1	1	1	1	0	0	1	0	1	1	?	?	?	?	?	2	0	1		
Aeptus	0	2	1	0	0	1	1	0	0	0	0	0	0	1	0	1	0	2	1	0	0	1	0	1	0	2	1	0	1	1	1	0	1	0	0	0	2		
Eribotes	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	1	0	2	1	1	0	1	0	1	0	0	1	0	1	1	1	0	2	0	0	0	1		
Hillieria	0	2	1	1	0	0	1	1	0	1	0	1	0	1	1	1	2	1	1	1	1	0	1	0	0	1	0	1	1	1	1	0	1	0	2	0	1		
Menestheus	0	2	1	1	0	0	1	0	0	0	0	0	1	1	1	1	2	1	1	1	1	0	1	0	0	1	0	1	1	1	1	1	1	1	2	0	1		
Paramenestheus	0	2	1	0	0	1	1	0	0	1	0	0	1	1	1	1	2	1	1	0	1	0	1	0	0	1	0	1	0	1	1	1	0	1	1	1	0	1	
Pseudaelia	0	0	1	1	0	1	1	1	0	1	0	0	1	1	1	1	2	1	1	1	1	0	1	0	2	1	0	1	1	1	0	1	0	1	1	1	1		
New genus 1	0	1	1	1	0	0	1	0	0	0	0	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	1	1	1	1	1	1	?	2	0	1			
New genus 2	0	2	1	1	0	1	1	1	0	1	1	0	1	1	1	1	2	1	0	0	1	0	1	1	2	1	0	1	1	1	1	2	0	2	0	1			

Figure 22. Matrix from Nexus Data Editor® of the codified characters for the cladistic analysis.

After codification of the characters, two different analyses were run including a parsimony (P) analysis through Mesquite® (Fig. 23), and a maximum likelihood (ML) analysis on IQ-TREE (Trifinopoulos *et al.* 2016) (Fig. 24).

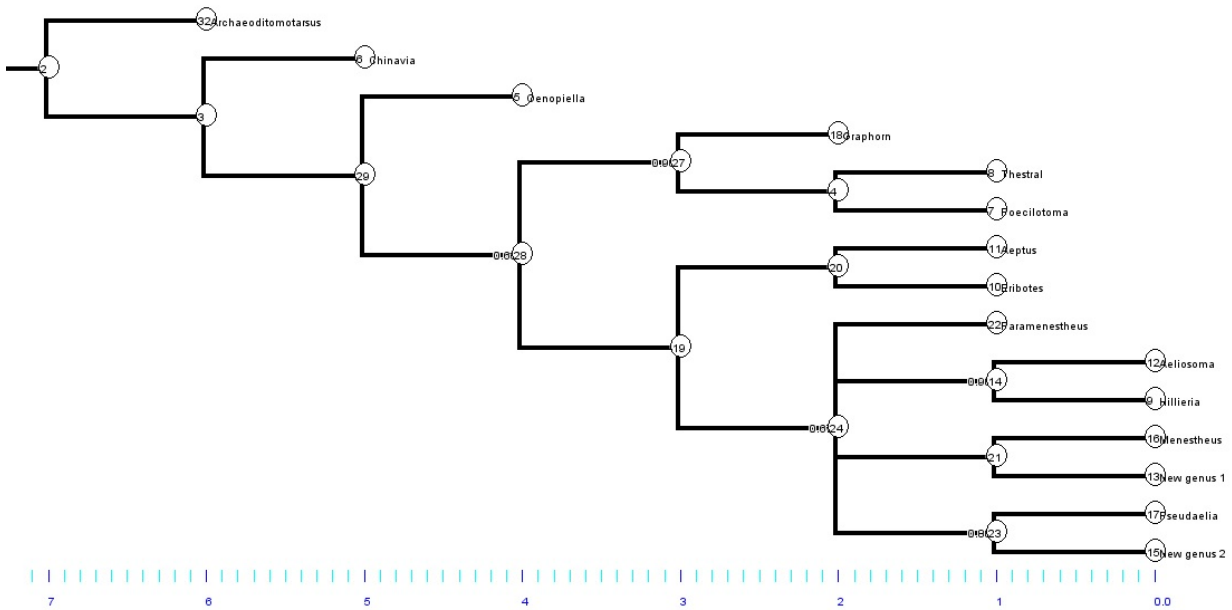


Fig. 23. Tree generated by Mesquite Heuristic's search. The tree was generated by a majority rule consensus on 1000 maxtrees. Numbers indicate frequency of consensus. The tree was made on treelength basis. The tree was rerooted based on the Acanthosomatid outgroup.

This tree indicates the monophyly of the Aeptini. There are two clear groups within it one including *Aeptus*+*Eribotes*, and the other the rest of the Aeptini.

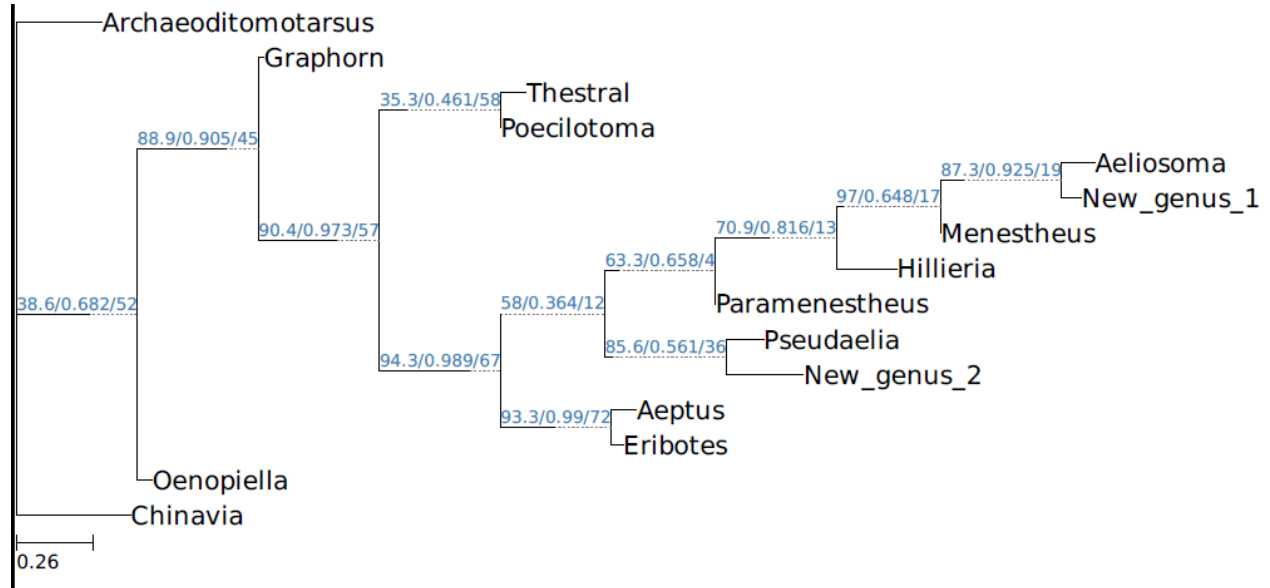


Fig. 24. Tree generated by IQ-TREE maximum likelihood analysis. Tree with 1000 max iterations. Numbers indicate SH-aLRT support/ eBayes Support/ Standard Bootstrap support.

Similarly to the previous tree, the ML supports the monophyly of Aeptini with its two subtribal units. It also places *Thestral*+*Poecilotoma* genus group together, however with lower values, that need to be further studied heading on the true phylogenetic position of the group.

Discussion and conclusions

Both analyses produced very similar results and indicated that 1) the Aeptini is a monophyletic group, 2) the *Thestral* + *Poecilotoma* genus group is the sister group of the Aeptini and the South American Carpocorini, and 3) the Aeptini can be separated into two clades, one including *Aeptus* + *Eribotes*, and the other including all other aeptine genera.

Although both analyses produced similar results, the ML analysis is slightly more robust in that it does not have unresolved areas in the tree. In this case, the position of *Paramenestheus* and the clade containing *Pseudaelia* + New Genus 2 is more resolved than in the parsimony

analysis. In both cases, the position of *Aeliosoma* must be treated with some reservations, as the female is still unknown. This genus is remarkable by having 4-segmented antennae, a character it shares with *Thestral* + *Poecilotoma*; this might be interpreted as a more primitive condition, but it has also appeared several times within the Pentatomidae as a secondary loss (Gross, 1975; Rider *et al.* 2016). Therefore, if the position of *Aeliosoma* is confirmed with the female data, it may be considered a more derived group with the secondary loss (or fusion of two segments) of one antennal segment.

Finally, in the future, it would be good to incorporate molecular data, but to do this, new fresh specimens need to be collected. This would certainly enhance the analyses and would probably produce more robust results in both P and ML.

Biogeographically, this group shows a classical Gondwanian pattern. Although it is absent in South America, this situation has occurred within several other animal and vegetal groups (Lomolino *et al.* 2006). This may occur either by the South American representatives evolving differently, or perhaps they were replaced by other taxa. Faúndez & Carvajal (2016) indicated that several pentatomine groups have evolved differently in South America by migrating from the Andean Region to the Neotropical Region. The Andean fauna has remained dominated by mostly gondwanian relict acanthosomatids. Therefore, few species remain of more restricted taxa (eg. *Thestral*) representing this ancestral condition in heteropterans. Most of the diversity in pentatomid species is found in the tropics (Neotropical and Transition zone with the Andean Region). In these regions, the pentatomid groups have evolved and now dominate over the acanthosomatids (Faúndez & Rider, 2014, 2015; Faúndez & Ashworth, 2015; Faúndez & Carvajal, 2016).

The origin of the Aeptini is probably sometime during the Mesozoic, in the territories that currently comprise the Antarctic, before the breaking up of Gondwanaland. *Aeptus* probably was isolated sometime during in the Cretaceous by the separation of Africa (nearly 100 Mya). That may explain its peculiar morphology and the presence of brachypterous forms, differing from other members of the Aeptini; it still appears to be, however, closely related to the Australian genus *Eribotes*. *Eribotes* may be considered a more primitive genus within the Australian Aeptini. On the other hand, the Australian Aeptini may have evolved differently later, as Australia totally separated from Antactica about 45Mya. Therefore, primitive relatives, such as *Poecilotoma*, remained with the ancestral proto Aeptini (somewhat similar to *Eribotes*), then with climate change, these evolved to the more elongate forms we see in many of the other present-day aeptine genera (i.e. *Paramenestheus*, *Menestheus*, etc.). This may have evolved as a way for these groups to adapt to drier climates and they probably developed a grass-type crypsis (e.g. elongated bodies, sharp endings, striped patterns). This may have allowed these genera to spread throughout most of Australia, whereas species of *Eribotes* may still occupy some of the old niches.

In addition, this analysis seems to initially confirm the hypothesis proposed by Faúndez & Rider (2014), that *Thestral* + *Poecilotoma* forms a different clade, which may be a primitive gondwanian relict.

The absence of the Aeptini in New Zealand, New Caledonia and South America may have an ecological component as we mentioned previously by competing with other heteropterans. However, there is also some geological events that may have helped to the disappearance of Aeptini from certain areas, such as flooding on places like New Zealand and New Caledonia, extinction events, glaciation events with floristic and faunistic migrations and

climate change (Lomolino *et al.* 2006; Morrone, 2001; Faúndez & Rider, 2016). In addition, the study of the relationships among sulcate sternum groups within the pentatominae may help to elucidate the possible dispersion and a possible common origin among these taxa, where probably the Aeptini is in a basal position. Therefore it may be related to groups like Aeliini, Diploxyini, Myrocheini, Sciocorini. This kind of evolutionary+biogeographical patter has been observed in several other heteropteran groups such as Acanthosomatidae, Aradidae, Gelastocoridae, Nabidae, Tingidae (Faúndez & Ashworth, 2015; Faúndez & Rider, 2015), giving also strength to this hypothesis.

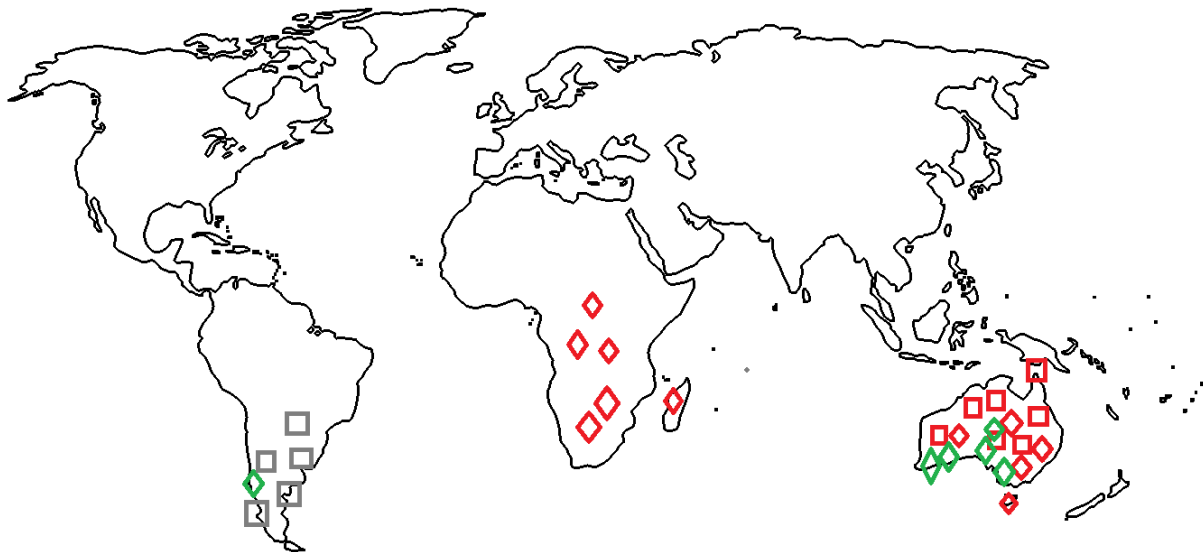


Fig. 25. Distribution of the taxa treated in the phylogenetic analysis. Red= Aeptini; diamonds Aeptina; Squares Menesthina; Green= *Thestral*+*Poecilotoma* genus group; Grey= Outgroups (*Archaeoditomotarsus*, *Oenopiella*, *Chinavia apicicornis* group, *Graphorn*).

Description of the tribe Aeptini and its subtribes

According to the results of this study, the genera of the Aeptini form a monophyletic group, which can be characterized as follows:

Aeptini Stål, 1871

Type genus: *Aeptus* by original designation.

Head elongate head (at least 1.5 times longer than wide), anterior margins of bucculae obtuse, lacking teeth. Prosternum and mesosternum each with a medial, longitudinal sulcus, with the prosternal sulcus carinate. Femora unarmed. Ostiolar peritremes short to vestigial. Base of abdomen rounded, unarmed. Male parameres bilobate, simple. Female paratergites 8 fused.

Also, according to the results of this study, the tribe Aeptini can be divided into two subtribes, one including *Aeptus* and *Eribotes*, and the other including the rest of Aeptini genera; they are described below:

Aeptina s. str.

Type genus: *Aeptus*, here designated.

General body shape short, compact (no more than 2.5 times longer than wide). Scutellum distinctly spatulate, U-Shaped. Brachyptery and microptery common. Spermathecal bulb without digitiform processes.

Included genera: *Aeptus*, *Eribotes*.

Menesthina new subtribe

Type genus: *Menestheus*, here designated.

General body form more elongate (more than 2.5 times longer than wide). Scutellum triangular in shape. Wings always macropterous. Spermathecal bulb may or may not have digitiform processes.

Included genera: *Aeliosoma*, *Hillieria*, *Menestheus*, *Paramenestheus*, *Pseudaelia*, New Genus 1, New Genus 2.

Future research and significance of the present study

Future research plans aims to work further phylogenetic studies including molecular data. Additionally, I would like to broaden the study of the evolution of the sulcate condition of the mesosternum. There are several other tribes of Pentatominae in which the included genera have sulcate thoracic sterna. It would be interesting to investigate the relationships among all of these genera. It is possible that all of these groups may form a clade deserving subfamily rank (Rider *et al.* 2016; 2017). There are also several pentatomine genera from Australia, Africa, and India that are presently unplaced in any tribes; further study of these genera may indicate that they belong in the Aeptini or one of the related asulcate groups. The results of this dissertation have a big importance in understanding the whole relationships among Pentatominae. This study seems to confirm that the mesosternal sulcus is a very important character in this group. This structure has an apparent function protecting other appendices like antennae and rostrum. It is supported by the scarce amount of antennal teratological cases found on sulcate species compared with asulcate ones (Faúndez & Rider, 2017). Furthermore, sulcate species have rather other cephalic malformations which are less detrimental in the ontogenic development of these individuals (Faúndez & Rider, 2017). Thus the sulcus has an evolutive significance and probably all the sulcate groups of the pentatominae may be rearranged in a different subfamily, having the Aeptini as one of the basal groups in this taxonomic scenario.

REFERENCES

- Baehr, M. 1985. On a collection of shield bugs from arid areas of central and southern Australia (Insecta, Heteroptera, Pentatomoidea). *Spixiana*, 8(2):135-143.
- Barão, K. R., A. Ferrari, & J. Grazia. 2012. Phylogeny of the South Asian Halyini? Comments on Memon et al. (2011): Towards a better practice in Pentatomidae phylogenetic analysis. *Annals of the Entomological Society of America*, 105(6): 751-752.
- Bergroth, E. 1908. Enumeratio Pentatomidarum post Catalogum bruxellensem descriptorum. *Mémoires de la Société Entomologique de Belgique*, 15(10):131-200.
- Bergroth, E. 1909. Vier neue australische Hemipteren-Gattungen. *Deutsche Entomologische Zeitschrift*, 1909:328-335.
- Bergroth, E. 1912. Notes on Australian Pentatomidae (Rhynch.). *Entomological News*, 23:21-29.
- Bergroth, E. 1920. New species of the genus *Eribotes* Stål (Hemiptera, Pentatomidae). *Arkiv för Zoologi*, 12(18):1-5.
- Bredden, G. 1900. Hemiptera nonnulla regionis australicae. *Entomologische Nachrichten*, 26 (2-3): 17-46.
- Cassis, G. & G. F. Gross. 2002. Hemiptera: Heteroptera (Pentatomomorpha). In: Houston, W. W. K. and A. Wells (eds.), *Zoological Catalogue of Australia*. Vol. 27.3B. CSIRO Publishing, Melbourne, Australia. xiv + 737 pp.
- Dallas, W. S. 1851. *List of the Specimens of Hemipterous Insects in the Collection of the British Museum Part I*. Printed by order of the Trustees, London, 368pp.
- Distant, W. L. 1910. Rhynchotal notes. - LI. African Pentatomidae. *Annals and Magazine of Natural History*, (8)6:77-99.
- Dohrn, A. 1859. *Catalogus hemipterorum*. Buchdruckerei von Herrcke & Lebeling. 112pp.

- Faúndez, E. I. 2014. A new genus for a Chilean species of Acanthosomatidae (Hemiptera: Heteroptera). *Zootaxa*, 3768(5): 596-600.
- Faúndez, E. I. & Ashworth, A. C. 2015. Notas sobre la familia Gelastocoridae (Hemiptera: Heteroptera) en el extremo sur de Chile, con descripción de un subgénero y especie nuevos. *Anales del Instituto de la Patagonia*, 43(2): 69-74.
- Faúndez, E. I. & Carvajal, M. A. 2016. Description of the 5th instar nymph of *Oenopiella punctaria* (Stål, 1859) (Hemiptera: Heteroptera: Pentatomidae), with new distributional records from Southern Patagonia. *Zootaxa*, 4067(2): 246-250.
- Faúndez, E. I. & D. A. Rider. 2014. *Thestral incognitus*, a new genus and new species of Pentatomidae from Chile (Heteroptera: Pentatomidae: Pentatominae: Carpocorini). *Zootaxa*, 3884(4): 394-400.
- Faúndez, E. I. & D. A. Rider. 2015. Preliminary studies on the Gondwandian relationships among heteropteran, 63rd Annual Meeting of the Entomological Society of America, Minneapolis, Minnesota.
- Faúndez, E. I. & D. A. Rider. 2017. Two teratological cases in *Hillieria acuminata* Distant, 1910 (Heteroptera: Pentatomidae: Pentatominae: Aeptini). *Boletín de la Sociedad Entomológica Aragonesa*, 60: 353-354.
- Gaedike, H. 1971. Katalog der in den Sammlungen des ehemaligen Deutschen Entomologischen Institutes aufbewahrten Typen.-V. *Beiträge zur Entomologie*, 21(1-2):79-159.
- Grazia, J., R. T. Schuh, & W. C. Wheeler. 2008. Phylogenetic relationships of family groups in Pentatomoidea based on morphology and DNA sequences (Insecta: Heteroptera). *Cladistics*, 24: 1-45.

- Grossbeck, J. A. 1912. List of insects collected by the " Albatross" expedition in Lower California in 1911: with description of a new species of wasp. *Bulletin of the American Museum of Natural History*, 31:323-326.
- Gross, G. F. 1975. *Handbook of the flora and fauna of South Australia. Plant-feeding and other bugs (Hemiptera) of South Australia. Heteroptera - Part I*. Handbooks Committee, South Australian Government, Adelaide, pp 1-250, 4 col. pls.
- Gross, G. F. 1976. *Plant-feeding and other bugs (Hemiptera) of South Australia, Heteroptera- Part II*. Handbooks Committee, South Australian Government, Adelaide, pp 251-501.
- Henry, T. J. 1997. Phylogenetic analysis of family groups within the infraorder Pentatomomorpha (Hemiptera: Heteroptera), with emphasis on the Lygaeoidea. *Annals of the Entomological Society of America*, 90(3):275-301.
- Horváth, G. 1900. Hemiptera. In: Semon R., *Zoologische Forschungsreisen in Australien und dem Malayischen Archipel: Verlag von Gustav Fischer in Jena*, 1900. 5:615-642.
- Kirkaldy, G. W. 1909. *Catalogue of the Hemiptera (Heteroptera) with biological and anatomical references, lists of foodplants and parasites, etc.* Vol. I. Cimicidae. Berlin, xl + 392 pp.
- Lethierry, L. & G. Severin. 1893. *Catalogue général des Hémiptères*. Bruxelles, Pentatomidae, 1: x + 286 pp.
- Linnavuori, R. E. 1982. Pentatomidae and Acanthosomatidae (Heteroptera) of Nigeria and the Ivory Coast, with remarks on species of the adjacent countries in West and Central Africa. *Acta Zoologica Fennica*, 163: 176 pp.
- Loch, A. D. 2000. Abundance, distribution, and availability of *Trissolcus basalus* (Wollaston) (Hymenoptera: Scelionidae) hosts in a soybean agricultural system in southeastern Queensland. *Biological Control*, 18(2): 120-135.

- Lomolino, M., B. Riddle, & J. Brown. 2006. *Biogeography*, 3rd ed. Sinauer Assoc., Sunderland, Massachusetts.
- McDonald, F. J. D. 1966. The genitalia of North American Pentatomoidea (Hemiptera: Heteroptera). *Quaestiones Entomologicae*, 2:7-150.
- Memon, N., F. Gilbert, & I. Ahmad. 2011. Phylogeny of the south Asian halyine stink bugs (Hemiptera: Pentatomidae: Halyini) based on morphological characters. *Annals of the Entomological Society of America*, 104: 1149-1169.
- Morrone, J. J. 2001. *Biogeografía de América Latina y el Caribe*. M&T–Manuales & Tesis. SEA, vol. 3. Zaragoza, 148 pp.
- Pendergrast, J. G. 1957. Studies on the reproductive organs of the Heteroptera with a consideration of their bearing on classification. *The Transactions of the Royal Entomological Society of London*, 109(1):1-63.
- Rider, D. A. 2000. Stirotarsinae, new subfamily for *Stirotarsus abnormis* Bergroth (Heteroptera: Pentatomidae). *Annals of the Entomological Society of America*, 93(4):802-806.
- Rider, D. A., Schwertner, C. F. & Faúndez, E. I. 2016. The classification of the Pentatomidae (Hemiptera: Heteroptera): Past, present, and future.. International Congress of Entomology, ICE., Orlando, FL, USA.
- Rider, D. A. 2017. Pentatomoidea Home page. Available from:
<http://www.ndsu.edu/ndsu/rider/Pentatomoidea/>
- Rolston, L. H. & F. J. D. McDonald. 1979. Keys and diagnoses for the families of Western Hemisphere Pentatomoidea, subfamilies of Pentatomidae and tribes of Pentatominae (Hemiptera). *Journal of the New York Entomological Society*, 87(3):189-207.

- Rolston, L. H. & F. J. D. McDonald. 1984. A conspectus of Pentatomini of the Western Hemisphere. Part 3 (Hemiptera: Pentatomidae). *Journal of the New York Entomological Society*, 92(1):69-86.
- Schaefer, C. W. 1968. The homologies of the female genitalia in the Pentatomoidea (Hemiptera-Heteroptera). *Journal of the New York Entomological Society*, 76(2):87-91.
- Schaefer, C. W. 1975. Heteropteran trichobothria (Hemiptera: Heteroptera). *International Journal of Insect Morphology & Embryology*, 4(3):193-264.
- Schaefer, C. W. 1993. The Pentatomomorpha (Hemiptera: Heteroptera): An annotated outline of its systematic history. *European Journal of Entomology*, 90:105-122.
- Schaefer, C.W. & Panizzi, A.R. 2000. *Heteroptera of Economic Importance*. CRC press, Boca Raton, 856 pp.
- Schouteden, H. 1912. Notes sur quelques Cimicides de Queensland et de Madagascar. *Annales de la Societe Entomologique de Belgique*, 56: 353-356.
- Schuh, R. T. & J. A. Slater. 1995. *True Bugs of the World (Hemiptera: Heteroptera): Classification and Natural History*. Cornell University Press, Ithaca, New York, 336 pp.
- Schwertner, C. F. & J. Grazia. 2006. Descrição de seis novas espécies de Chinavia (Hemiptera, Pentatomidae, Pentatominae) da América do Sul. *Iheringia, Série Zoologia*, 97(2): 237-348.
- Stål, C. 1868. Bidrag till Hemipterernas systematik. Conspectus generum Pentatomidum Asiae et Australiae. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, 24(7)[1867]:501-522

- Stål, C. 1871. Hemiptera insularum Philippinarum. Bidrag till Philippinska öarnes Hemipter-fauna. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, 27(7)[1870]:607-776, pls. 7-9.
- Stål, C. 1876. Enumeratio Hemipterorum. Bidrag till en Förteckning öfver alla hittills kända Hemiptera, Jemte Systematiska Meddelanden. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, 14(4):1-162.
- Trifinopoulos, J., Nguyen, L. T., von Haeseler, A., & Minh, B. Q. 2016. W-IQ-TREE: a fast online phylogenetic tool for maximum likelihood analysis. *Nucleic acids research*, 44(W1): W232-W235.
- Van Duzee, E. P. 1905. Notes on Australian Pentatomidae, with descriptions of a few new species. *Bulletin of the American Museum of Natural History*, 21(11):187-214.
- Walker, F. 1867. *Catalogue of the specimens of Hemiptera Heteroptera in the collection of the British Museum*. Part I. E. Newman, London, pp. 1-240.
- Wheeler, W. C., R. T. Schuh, & R. Bang. 1993. Cladistic relationships among higher groups of Heteroptera: congruence between morphological and molecular data sets. *Entomologica Scandinavica*, 24:121-137.