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Male and Female Genitalia Characters in the Establishment of a New Subgenus of Cotton Stainer's Genus *Dysdercus* Guérin-Méneville (Hemiptera: Pyrrhocoridae)*

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Abstract.- Characters of male and female genitalia including those of pygophore, paramere and inflated aedeagus and ovipositor and spermatheca in the female provide beyond all doubt the reasons for the establishment of the new subgenus evolved from Ethiopian fauna but endemic to American subcontinent.

Keyword: *Dysdercus*, genitalia, Hemiptera, Pyrrhocoridae, phylogeny.

INTRODUCTION

Freeman (1947) for the first time used genitalia characters for splitting subgeneric groups of cotton stainers genus *Dysdercus* Guérin-Méneville on the basis of absence or presence of vertical processes of pygophore categorized his subgeneric groups into I and II respectively. His group I included all the species from Ethiopian region except *D. festivus* (Gerstaecker) which possessed vertical processes of pygophore, and therefore was placed in his group II. Freeman (1947) further split his group I into Ia and Ib with the former having round apex of pygophore and spermatheca with no separate accessory gland with proximal portion of spermathecal duct wide and comparatively short probably itself glandular. This Ia subgroup he named after *D. superstiosus* (F.). Freeman's subgroup Ia was given formal subgeneric status by Stehlik (1965a) as subgenus *Dysdercus* sensu stricto with *D. peruvianus* as its type species who extended its geographical range from Ethiopian to Neotropical and Nearctic regions. Stehlik (1965a & b) emphasized upon the importance of parameral characters and those of conjunctival appendages of aedeagus but there were some overlapping and confusions. Van Doesburg (1968) for the first time worked on the phylogenetic relationships of all new world *Dysdercus* species. Van Doesburg agreed

with Freeman (1947) and Stehlik (1965a, b) that new world species belonged to Stehlik's subgenus *Dysdercus* s. str. using and emphasizing upon the importance of parameral characters and those of first and second gonocoxae in the female ovipositor. Van Doesburg (1968) split new world *Dysdercus* species into six species groups but he could not place four species i.e. *D. andreae* (L.), *D. mimuloides* Blöte, *D. lunulatus* Uhler and *D. ruficollis* (L.). None of the above workers studied the characters of inflated aedeagi and spermatheca of all or most of the new and old world species of *Dysdercus*. While trying to resolve the phylogenetic status of four of the above new world *Dysdercus* species which Van Doesburg (1968) could not place in any of his six groups of species we found that in three of these four species available to us spermathecal duct was relatively long, narrow and coiled (not comparatively short and proximally swollen) as described and illustrated by Freeman (1947) for his group Ia. More over in some species examined of this group pygophore apically is ovate or conical (usually rounded in the species of the subgenus *Dysdercus* s. str.), ventral rim always extended in contrast to never extended in the species of *Dysdercus* s. str., infolding of ventral rim round as opposed to sharp in the species of *Dysdercus* s. str., parameral stem or shaft sparsely hirsute and parameral dorsal side always having spur like projections in contrast to parameral stem or shaft largely hirsute and dorsal side not as always having spur like projection. In the female ovipositor first gonocoxae always moderate or large as opposed to moderate or reduced and second gonocoxae usually

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not medially fused as opposed to usually fused or remarkably close to each other in the species of the subgenus *Dysdercus* s. str.

Presently we are highlighting here the male and female genital traits of three of four species that Van Doesburg (1968) could not place in any of his six sub groups *i.e.* *D. andreae* (L.), *D. lunulatus* Uhler and *D. ruficollis* (L.). In addition to above *D. mimulus* Hussey is also described and illustrated with reference to their genital traits and in this light these are separated from those of *Dysdercus* s. str. and a new subgeneric status is proposed here for them.

MATERIALS AND METHODS

For the study of male genitalia particularly for the inflation of the aedeagus the techniques of Ahmad (1986) and Ahmad and McPherson (1990, 1998) were generally followed. For the inflation of aedeagus the pinned dry specimen after removing the label, was plunged into boiling water in a beaker, for 4-5 minutes. The specimen was then slipped off the pin. The genital capsule (Pygophore) was removed from the relaxed specimen under a binocular stereoscope microscope, using very fine watch maker forceps (5 or finer). The genital capsule was placed in 10% KOH and was warmed at 40°C for 5-10 minutes in a cavity block. The capsule was removed in tap water (room temperature) in a depression dish and was washed thoroughly. The fine forceps were used to hold the basal plate (attaching aedeagus to capsule) and then with the help of forceps the opening of phallosome was widened very carefully and the vesica was pulled out gently. This was done very carefully because the distal tip of vesica is very delicate and breaks off quickly.

For the dissection of the female spermatheca, the entire abdomen was removed from the specimen and warmed on a bench lamp (after completing the external view diagram of the ovipositor) for 15 minutes. The spermatheca was dissected under water after washing the specimen thoroughly. The components of male and female genitalia were preserved in glycerine in micro vials pinned with the specimens. All illustrations are to the given scales.

RESULTS

Dysdercus andreae (L.)

(Fig. 1)

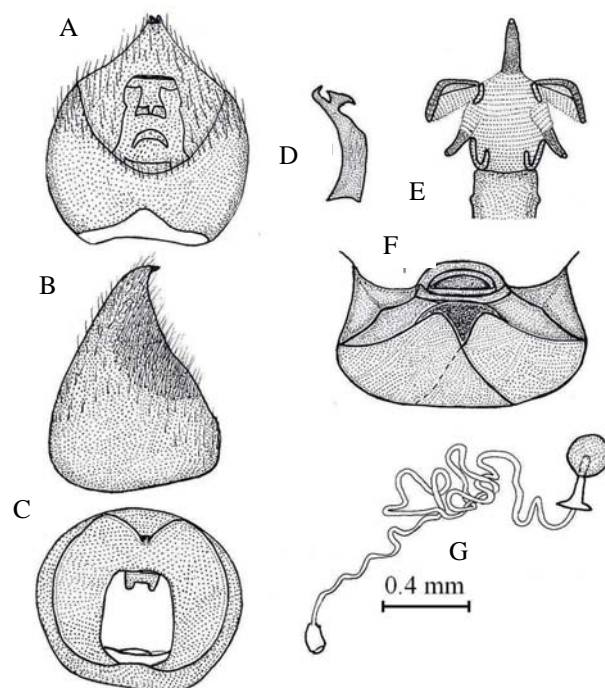


Fig. 1 *Dysdercus andreae* (L.); A, pygophore dorsal view; B, pygophore lateral view; C, pygophore, apical view; D, paramere lateral view; E, inflated aedeagus, ventral view; F, female terminalia, ventral view; G, spermatheca lateral view.

Male genitalia

Pygophore (Fig. 1A,B,C) somewhat ovate, ventrally apical portion conically produced, curved upward, apically bifid, with two teeth like tubercles on either side of middle minute depression; short triangular capsular lamella narrow, tridentate, erect; paramere (Fig. 1D) with parameral stem short, neck small, thin, head with two spurs, proximal spur large, strongly recurved and dorsally also elevated into a sharp tooth, apical spur small and distally truncate; inflated aedeagus (Fig. 1E) with pair of slender, obtuse, angulate third dorsal conjunctival appendages with apex broad, pair of second conjunctival appendages conical, semi membranous, sclerotized at apex, pair of first conjunctival appendages curved, slender.

Female genitalia

First gonocoxae (Fig. 1f) moderately large, broad, angularly produced covering second gonocoxae, distal and lateral margins concave, at base overlapping each other; second gonocoxae somewhat fused, forming sclerotized plate, distal margin sharply produced medially, deeply concave laterally; ninth paratergites somewhat quadrate much longer than eighth paratergites; spermatheca (Fig. 1g) with proximal flange prominent, bulb somewhat ovate, pump region slender, spermathecal duct long, coiled with uniform width.

Dysdercus lunulatus Uhler
(Fig. 2)

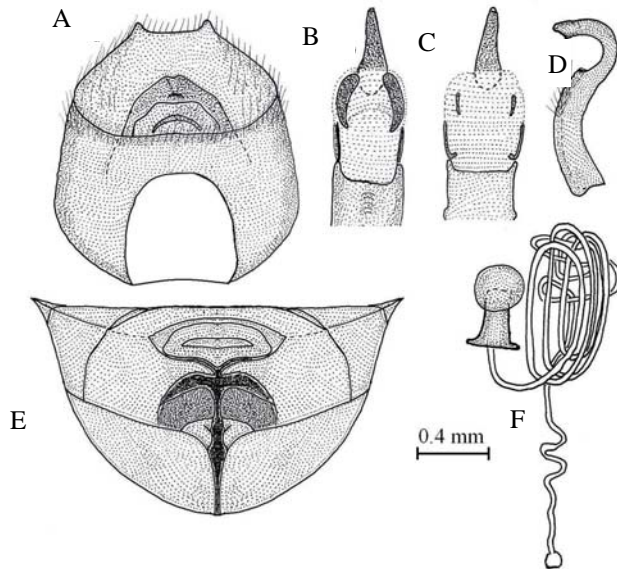


Fig. 2. *Dysdercus lunulatus* Uhler; A, pygophore dorsal view; B, inflated aedeagus, dorsal view; C, inflated aedeagus, ventral view; D, paramere lateral view; E, female terminalia, ventral view; F, spermatheca, lateral, view.

Male genitalia

Pygophore (Fig. 2A) somewhat ovate; ventral apical margin slightly produced, curved upward, apically dorsally directed, lobes on each side in middle, with short, triangular capsular lamella; paramere (Fig. 2D) with parameral stem slender, slightly curved, middle shoulder slightly produced, neck short, head with one large strongly recurved spur, apex of spur flat, truncated; inflated aedeagus

(Fig. 2B,C) with pair of large spindle shaped third dorsal conjunctival appendages with apex broad, pair of short slendrical second conjunctival appendages, pair of curved, slendrical first conjunctival appendages.

Female genitalia

First gonocoxae (Fig. 2E) large, broad, slightly angularly produced, lateral margin concave, at base, overlapping each other; second gonocoxae large contiguous in midline, deeply concave distally; ninth paratergites somewhat quadrate, much larger than eighth paratergites; spermatheca (Fig. 2F) with prominent proximal flange, bulb somewhat ovate, pump region semi slendrical, spermathecal duct long and convoluted, of uniform width.

Dysdercus mimulus Hussey
(Fig. 3)

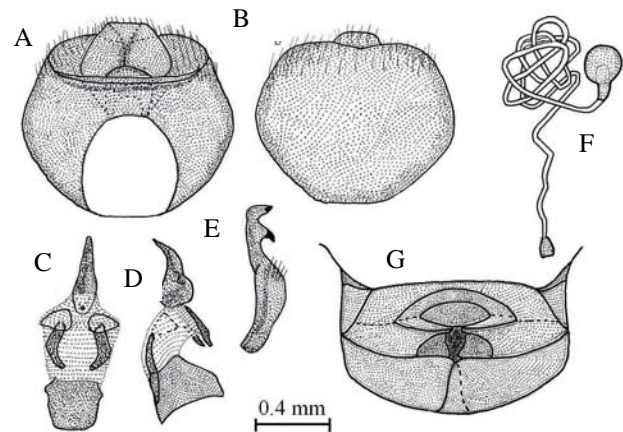


Fig. 3. *Dysdercus mimulus* Hussey; A, pygophore dorsal view; B, pygophore, ventral view; C, inflated aedeagus, dorsal view; D, inflated aedeagus, lateral view; E, paramere, lateral view; F, spermatheca lateral view; G, female terminalia, ventral view.

Male genitalia

Pygophore (Fig. 3A,B) somewhat roundly ovate, ventral apical margin at side convex, medially concave; small erect capsular lamella raised upward; paramere (Fig. 3E) with parameral stem large, slender, neck short curved, head angular, proximal spur straight, obliquely truncate at apex,

distal spur large, recurved; inflated aedeagus (Fig. 3C,D) with pair of large broad distally narrow curved third dorsal conjunctival appendages, pair of short conical second conjunctival appendages, pair of slender first conjunctival appendages.

Female genitalia

First gonocoxae (Fig. 3G) of moderate size, somewhat reduced, distal margin concave, apical margin inwardly rounded, apically produced, inner margin concave; second gonocoxae convex above, apical margin round, inner angle close together, separate; ninth paratergites somewhat quadrate, much larger than eighth paratergites; spermatheca (Fig. 3F) with not prominent proximal flange, bulb somewhat oval, pump region small, conical spermathecal duct long and coiled, of uniform width.

Dysdercus ruficollis (L.) (Fig. 4)

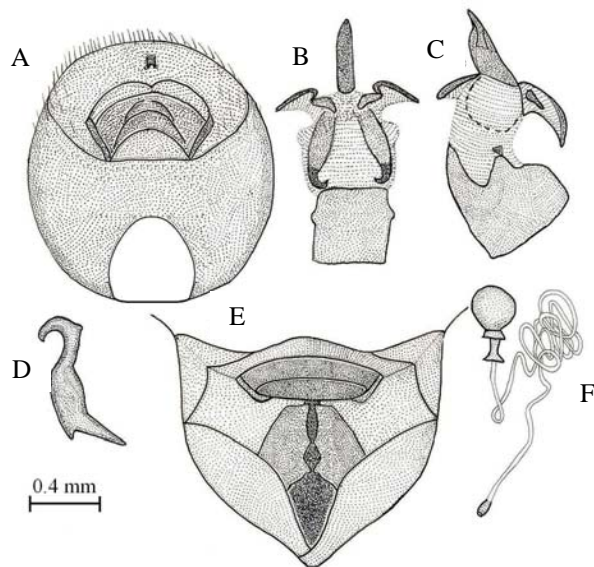


Fig. 4. *Dysdercus ruficollis* (L.); A, pygophore, dorsal view; B, inflated aedeagus, dorsal view; C, inflated aedeagus, lateral view; D, paramere, lateral view; E, female terminalia, ventral view; F, spermatheca, lateral view.

Male genitalia

Pygophore (Fig. 4A) somewhat oval, ventral apical margin convex, inner side with apical process bifid, lateral margin sinuate, narrow, capsular

lamella narrow, medially concave, paramere (Fig. 4D) with parameral stem long, broad, neck narrow, short, head rounded, with one hook like, recurved spur, sub apically with small lobe on opposite side; inflated aedeagus (Fig. 4B,C) with pair of large broad distally narrow curved third dorsal conjunctival appendages, with apex broad, pair of spindle shaped second conjunctival appendages, pair of small triangular first conjunctival appendages.

Female genitalia

First gonocoxae (Fig. 4E) of moderate size, somewhat rounded laterally, inner margin concave; second gonocoxae broad, convex, medio-ventrally deeply indented, touching each other; ninth paratergites somewhat quadrate, much larger than eighth paratergites; spermatheca (Fig. 4F) with prominent proximal and distal flanges, bulb somewhat roundly oval, pump region short but marked, spermathecal duct long and convoluted, of uniform width.

DISCUSSION

The present species appear to be endemic to the American subcontinent. These species share the apomorphies of very long and markedly coiled spermathecal duct, narrow throughout with uniform width which does not appear to have secretory cells fused. They also appear to have the apex of pygophore ovate or conical having paramere if at all with very slightly hirsute stem. It appears that these species form an independent subgenus evolved from Ethiopian species without a vertical process of the pygophore, later mostly round, paramere stout, parameral blade with the dorsal side having a spur like projection, spermathecal duct short, largely swollen, probably incorporating secretory cells. Our cladogram (Fig. 5) therefore shows that our endemic species appear restricted to the American subcontinent. These appear to play a sister group relationship with those of Ethiopian, Neotropical and Nearctic species placed by Stehlik (1965a,b) and Van Doseburg (1968) in the subgenus *Dysdercus* s. str.

The presently included species of the presently newly proposed subgenus appear to form an independent clade with clear cut apomorphies as

stated above *i.e.* pygophore ovate, conical or roundly ovate with ventral apical margin usually convex, with parameral stem if at all very slightly hirsute and first gonocoxae usually large or of moderate size and spermathecal duct very long, coiled and of uniform width. *D. andreae* is hereby designated as its type species.

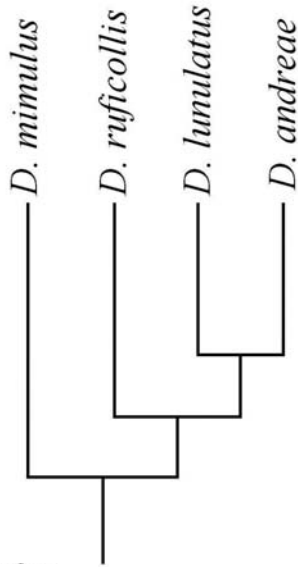


Fig. 5. Cladogram showing phylogenetic relationship of *Dysdercus* species.

D. mimulus appears to form an out group relationship with the rest of the clade (Fig. 5) *i.e.* *D. ruficollis*, *D. lunulatus* and *D. andreae* with apomorphies *i.e.* pygophore some what roundly ovate with ventral apical margin on sides convex but medially distinctly concave, capsular lamellae small but erect, raised upward, parameral stem large, slender, neck short, curved, head angular, proximal spur straight, obliquely truncated at apex, distal spur large, curved and in the inflated aedeagus first pair of conjunctival appendages slender, female with first gonocoxae of moderate size but somewhat reduced, distal margin more or less straight, sides concave, second gonocoxae close together but separate and spermatheca with proximal flange only a little marked. *D. ruficollis* clearly plays outgroup relationship with *D. lunulatus* and *D. andreae* which play sister group relationship with each other.

The three species share the apomorphies of

pygophore with ventral apical margin having medial depression, capsular lamellae short or narrow, erect, tridentate but never raised upward, in the inflated aedeagus thecal lobes significantly behind distal margin and third conjunctival appendages curved and in the female with first gonocoxae large or of moderate size, some times round but never reduced and spermatheca with well developed and marked proximal flange. In *D. ruficollis* the ventral margin of pygophore is apically convex throughout, capsular lamella medially concave or bifid with two teeth like structures or tubercles on either side of medial depression, paramere with proximal spur or lobe on the opposite side of the distal spur and in the inflated aedeagus the first pair of conjunctival appendages small, conical, in female first gonocoxae some what round, second gonocoxae broad, convex, medio-ventrally deeply indented, in the spermatheca the distal flange is also well marked. *D. andreae* and *D. lunulatus* appear to have slightly produced, curved, with short triangular capsular lamella, inflated aedeagus with pair of curved slender first conjunctival appendages, females having first pair of gonocoxae moderately large, broad, angularly produced, lateral margin concave, at above, over lapping each other, pump region of spermatheca semispherical or slender. *D. andreae* appears to possess apomorphies of pygophore with ventral apical portion conically produced, curved upward, apically bifid with two teeth like tubercles, one on each side of middle depression, capsular lamella tridentate, erect; paramere with short stem, thin head with two spurs, proximal one large, strongly recurved, and dorsally also elevated into a sharp tooth, distal spur small and distally truncate, inflated aedeagus with pair of slender obtuse angulate, third pair of dorsal conjunctival appendages with apex broad, second pair of conjunctival appendages conical, semi membranous, sclerotized at apex, females with second gonocoxae medially fused, forming sclerotized plate, with the distal margin sharply produced medially. *D. lunulatus* has apomorphies of the pygophore with the ventral apical margin slightly produced, curved upward, apically bifid and with two tubercles like teeth, one on each side of cup like median depression, paramere with middle shoulder slightly produced, head with one large

strongly recurved spur, apex of which flat, female second gonocoxae large contiguous in the middle, deeply concave distally.

CONCLUSIONS

Characters of male and female genitalia including those of pygophore, paramere and inflated aedeagus and ovipositor with first and second gonocoxae and spermatheca in the female provide, beyond all doubt, the reasons for the establishment of the new subgenus evolved from Ethiopian fauna but endemic to American subcontinent.

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