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## The planthopper genus *Remanodelphax* DROSOPoulos and related taxa (Hemiptera: Fulgoromorpha: Delphacidae)

With 29 Figures

MANFRED ASCHE

**Abstract.** The hitherto monotypic delphacid genus *Remanodelphax* DROSOPoulos is redefined to accommodate three species: the type species *R. cedroni* DROSOPoulos from Greece and Lebanon, *R. pullata* (MUIR) comb. n. and *R. glycophilos* sp. n., both from South Africa. Thus, *Remanodelphax* appears to be an Afrotropical group with its northernmost occurrence in the Eastern Mediterranean Region. A brief overview refers to those Afrotropical species originally placed in *Eurysa* FIEBER. *Eurysa atrata* MUIR and *E. ornata* VAN STALLE are transferred to *lubsoda* NAST: *lubsoda atrata* (MUIR) comb. n. and *lubsoda ornata* (VAN STALLE) comb. n..

### Introduction

One of the apparently most cryptic and therefore rarely documented groups within the planthopper family Delphacidae concerns the genus *Remanodelphax* DROSOPoulos. This genus was erected monotypically with the type species *Remanodelphax cedroni* DROSOPoulos originally collected in Greece near Thessaloniki, Cedron-hill (type locality), and on the island of Euboea (DROSOPoulos 1982), and later also found in some other localities of the Eastern Mediterranean region (see below). Based on external features, e.g. head with smooth and rounded transition from vertex to frons, post tibial spur devoid of marginal teeth, *Remanodelphax* was placed in the subfamily Stenominae WAGNER (WAGNER 1963) which later was integrated in the large group of Delphacinae: Delphacini *sensu* ASCHE (1985). *Remanodelphax* was distinguished from other "stiomine" taxa with similar external appearance by unique structures of the male genitalia, especially of the aedeagus (DROSOPoulos 1982).

Studies on South African Delphacidae have now revealed that one species originally placed in *Eurysa* FIEBER and a new species described below must be regarded as congeners of *Remanodelphax*. The extension of this genus to the Afrotropical fauna may indicate a further distribution throughout Africa with its northernmost limits in the East Mediterranean as is known for several other Afrotropical genera, e.g. *Delphacodoides* MUIR (see ASCHE 1983).

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#### Address of the author:

Dr. Manfred Asche, FLS, Research Associate, Department of Natural Sciences, Entomology, Bishop Museum, P.O. Box 19000-A, Honolulu, Hawaii 96817 (U.S.A.)

Current address: Museum für Naturkunde der Humboldt Universität zu Berlin, Institut für Systematische Zoologie, Invalidenstrasse 43, D-10115 Berlin (Germany)

## Taxonomy

*Remanodelphax* DROSOPoulos

*Remanodelphax* DROSOPoulos, 1982: 2. Type species: *Remanodelphax cedroni* DROSOPoulos, 1982, by original designation.

Diagnosis: Small-sized, stramineous-orange, pale or dark brown delphacids; head at apex relatively broad and rounded, carinae of vertex and frons vanishing; interior margin of post tibial spur devoid of teeth. Male genitalia with gonostyles distally deeply furcate; anal segment ventrocaudally with 2 short and flattened diverging processes with slightly undulate margin; aedeagus subtubular, straight to slightly bent ventrad, with 2–3 longitudinal rows of short teeth, one row dorsally (if present), one row each flanking the lateral or lateroventral margin; ventral side of aedeagus largely membranous with slit-like phallosome subapically on ventral side or apically exposed to ventral side.

Geographical distribution: Greece, Lebanon, South Africa.

Remarks: None of the "stromine" taxa from the Palaearctic and Nearctic Regions (e.g., NAST 1972; BEAMER 1952) appears to be closely related to *Remanodelphax*. However, the genus shows morphological similarities in male genital characters to some of the Afrotropical species originally referred to as *Euryso* FIEBER. Whether or not these similarities also reflect phylogenetic relationships remains to be analyzed.

Key to the species of *Remanodelphax*

- |  |                                   |
|--|-----------------------------------|
| 1. Vertex, pro- and mesonotum without conspicuous markings.            | 2                                 |
| – Vertex and pronotum each with one, mesonotum with two dark markings. |                                   |
|  | <i>R. glycephilos</i> sp. n.      |
| 2. Coloration of head and thorax uniformly stramineous to pale brown.  |                                   |
|  | <i>R. cedroni</i> DROSOPoulos     |
| – Coloration of head and thorax shiny dark brown.                      | <i>R. pullata</i> (Muir) comb. n. |

*Remanodelphax cedroni* DROSOPoulos, 1982 (Figs 11, 13, 15, 17, 19)

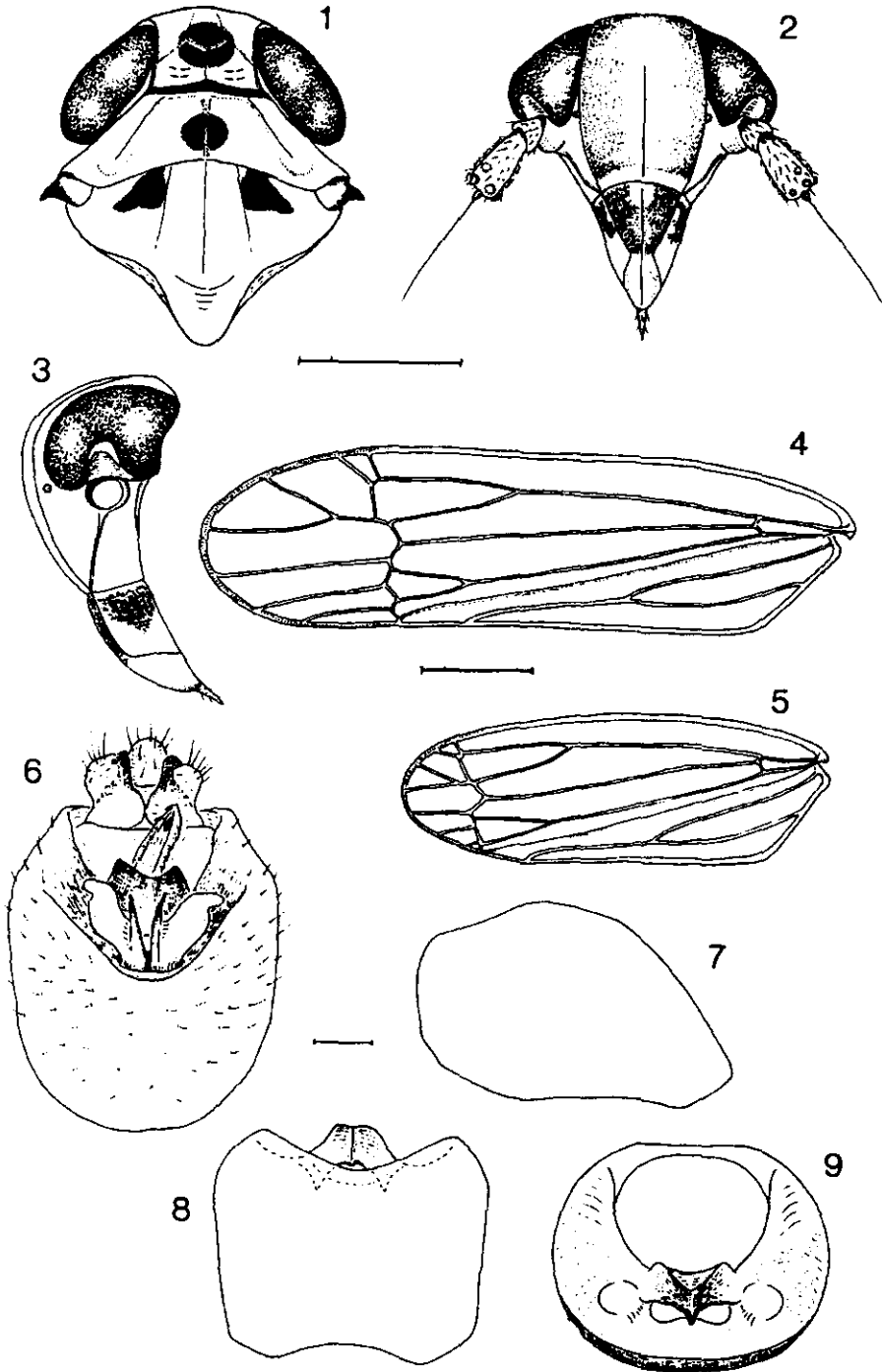
*Remanodelphax cedroni* DROSOPoulos, 1982: 3.

Diagnosis: *Remanodelphax cedroni* can be distinguished from *R. glycephilos* sp. n. by its uniformly ochraceous to pale brown colouration devoid of any spot-like colour patterns on head, pro- and mesonotum, and from *R. pullata* by its much lighter colouration (*R. pullata* is shiny dark brown). In the male genitalia, *R. cedroni* is generally similar to *R. glycephilos* especially in the shape of the gonostyles but differs from this species by having the margin of tip of the processes of the anal segment sinuate and not truncate (Figs 12–13), by an aedeagus with 8 (instead of 7) teeth on the left ventral side, with 12 (instead of 7) teeth on the right ventral side, and with 6 (instead of 2) teeth on the dorsal side (Figs 14–19). The phallosome is much more elongate and extends almost over the entire ventral

Figs 1–9: *Remanodelphax glycephilos* sp. n.

Figs 1–4: paratype female macropterous; Fig. 5: paratype female brachypterous; Figs 6–9: holotype male. Scale bar for Figs 1–5: 0.5 mm, for Figs 6–9: 0.1 mm.

1: head and thorax dorsal aspect; 2: head frontal aspect; 3: head left lateral aspect; 4: left tegmen, macropterous female; 5: left tegmen, brachypterous female; 6: male genitalia ventrocaudal aspect; 7: pygofer left lateral aspect; 8: pygofer ventral aspect; 9: pygofer caudal aspect.



membraneous side (instead of being located subapically as in *R. glycephilos*) (Figs 16-17). From *R. pullata* it differs by the shape of the gonostyles (Figs 11, 25, inner process spine-shaped instead of triangular) and by a straight aedeagus bearing dorsal teeth instead of a curved aedeagus devoid of dorsal teeth (Figs 15, 27).

Material examined: Greece: 2♂♂, 2♀♀, Thessaloniki, Cedron Hill (type locality), 21. XII. 1981, S. DROSOPoulos (part of the series referred to in DROSOPoulos, ASCHE & HOCH 1983). Lebanon: 2♂♂, Meeyane, 8. VI. 1984; 1♂, Lakkouk, Houet el Queddéha, on low plants, 6. VII. 1986; all H. ABDUL-NOUR.

The type material (holotype ♂, 1 paratype ♂, 3 paratypes ♀♀) are preserved in coll. DROSOPoulos at the Agricultural University Athens, Greece.

Host plant: *Dichanthium ischaemum* (Gramineae) (DROSOPoulos 1982 <referred to as *Andropogon ischaemum*>, DROSOPoulos, ASCHE & HOCH 1983).

Geographical distribution: Greece including Crete and Euboea (DROSOPoulos 1982, DROSOPoulos, ASCHE & HOCH 1983). Lebanon (ABDUL-NOUR 1983, ASCHE & HOCH 1986).

*Remanodelphax glycephilos* sp. n. (Figs 1-10, 12, 14, 16, 18)

Description:

**Total length:** Male: 3.4 mm (macropterous, n = 1). Female: 3.7 mm (macropterous, n = 1); respectively 2.75 mm (brachypterous, n = 1).

**Habitus:** Small, slender, delphacid species with distinct colour patterns on head and thorax, in appearance slightly resembling the European species of *Stironia* FIEBER.

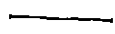
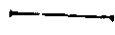
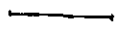
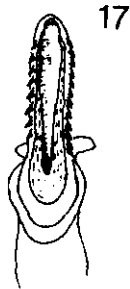
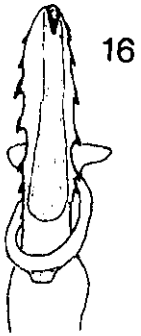
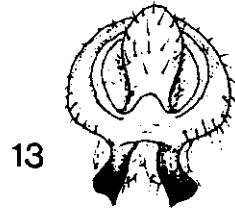
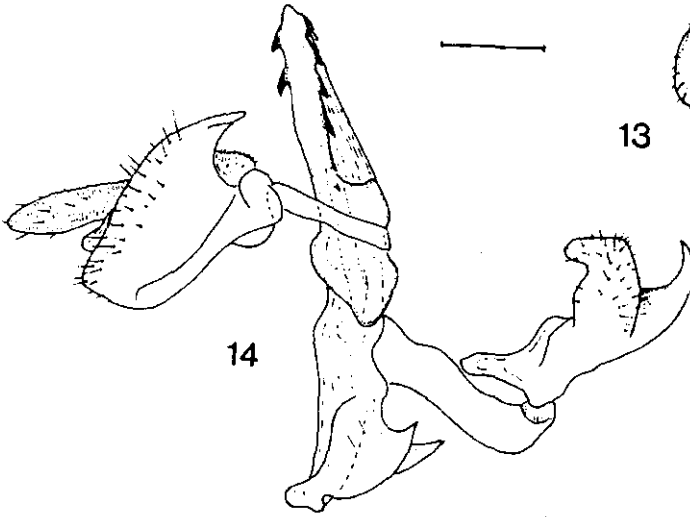
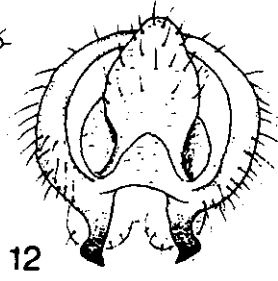
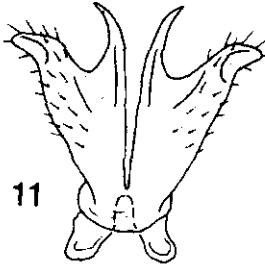
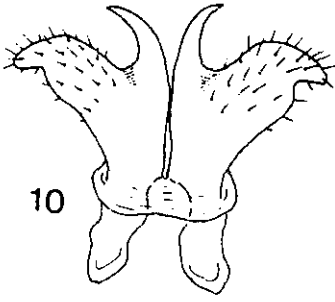
**Colouration:** Body, legs, and antennae ochraceous to orange. Center of vertex and pronotum each with a conspicuous dark brown spot, mesonotum anteriorly on each side with an extended dark brown marking. Frons ochraceous to pale brown, above postclypeal suture pale yellow; postclypeus diffusely dark brown, anteclypeus ochraceous, lorae in upper part dark brown. Meso- and postpleurae each with a large dark brown marking. Tegulae with brown margin, especially expressed in macropterous specimens. Tegminae translucent with pale yellow veins, outer distal margin darkened; wings translucent, veins brownish. Abdominal tergites laterally brown forming a broad brown stripe on each side; sternites stramineous to pale brown. Anal style dark brown. Male genital segment with laterocaudal brown marking extending onto diaphragm, otherwise stramineous. Ovipositor yellowish-brown.

**Head** (Figs 1-3): Short and wide, in lateral aspect strongly rounded, area between anterior margins of compound eyes and lateral frontal carinae very narrow; head including compound eyes ca. 2.5 times wider than vertex at base. Vertex 1.6 times wider at base than medially long, lateral carinae slightly diverging to frons; carinae of vertex faint and vanishing anteriorly; vertex broadly rounding onto frons, transition smooth without carinae. Frons ca. 1.45 times higher than its maximum width, widest at level of antennal bases, lateral frontal margins slightly convex, median carina weakly developed and only more conspicuous at base. Postclypeus less than half the height of frons (0.42 : 1) and ca. 1.5 times higher than anteclypeus; median carina on post- and anteclypeus well defined. Rostrum short, attaining the anterior margin of middle coxae. Antennal segments subcylindrical, second segment ca. 2.5 times longer than first; number and arrangement of antennal sensory fields (plaques): 16 in 7 rows

Figs 10-19: male genitalia.

Figs 10, 12, 14, 16, 18: *Remanodelphax glycephilos* sp. n., holotype male; Figs 11, 13, 15, 17, 19: *Remanodelphax cedroni* DROSOPoulos, paratype male. Scale bar: 0.1 mm.

10: gonostyles ventral aspect; 11: gonostyles ventral aspect (*R. cedroni*); 12: anal segment caudal aspect; 13: anal segment caudal aspect (*R. cedroni*); 14: male genitalia combined without pygofer left lateral aspect; 15: aedeagus left lateral aspect (*R. cedroni*); 16: aedeagus ventral aspect; 17: aedeagus ventral aspect (*R. cedroni*); 18: aedeagus right lateral aspect; 19: aedeagus right lateral aspect (*R. cedroni*).



(see ASCHE 1985). Genae with sharp-edged transverse carina. Compound eyes well developed, ocellae present both in macropterous and brachypterous form.

**Thorax** (Figs 1, 4–5): Pronotum about as wide as head including compound eyes, medially about as long as vertex, tricarinate, carinae sharply ridged, lateral carinae straight, diverging towards but not attaining posterior margin. Mesonotum gently vaulted, medially ca. 1.5 times longer than vertex and pronotum together, tricarinate, carinae obsolete and vanishing towards posterior margin, lateral carinae slightly diverging caudad. Tegulae present in macropterous and brachypterous form. Tegmina in macropterous form surpassing tip of abdomen by one third of their total length, 3.3 times longer than wide at maximum, widest at level of nodal line, outer subapical cell ca. 1.9 times longer than inner, venation complete; wings with complete venation. Cu and M well separated from each other. Tegmina in brachypterous form attaining the end of abdomen, ca. 2.8 times longer than wide, widest well cephalad of nodal line, distally narrowing, distal part caudad of nodal line strongly reduced length, width, and venation; wings vestigial. Post tibia ca. 1.5 times longer than post tarsi together, first post tarsus ca. 1.6 times longer than second and third post tarsus together and 1.6 times longer than post tibial spur; first post tarsal joint distally with 7 rigid spines (grouped 2 at inner side, 5 at outer side, the latter forming an oblique row), second post tarsal joint distally with 4 short rigid spines in a row. Post tibial spur solid, subtriangular in cross-section, anterior upper margin ridged, posterior inner margin devoid of teeth.

**Abdomen** (except genitalia): Laterotergites subrectangular, slightly narrowing caudad, with sharply ridged lateral margin. Sternites 5–8 in males medially sclerotized (not membranous). Drumming organ with apodemes of second sternite elongate and erected dorsad, nearly attaining tergites.

**Male genitalia** (Figs 6–10, 12, 14, 16, 18): Pygofer (6–9) in caudal aspect depressed ovate, ca. 1.4 times wider than high, in lateral aspect trapezoid, ventrally ca. 2 times longer than at level of laterodorsal angles. Diaphragm (Fig. 9) filling almost the entire lower caudal half of the pygofer, slightly sunk cephalad against the lateral margins, the latter rounded with smooth transition to diaphragm; opening for gonostyles depressed ovate with dorsal margin medially acutely projected ventrad; diaphragm above gonostyles-opening medially ridged, dorsal margin projected to a shallowly excavated process. Gonostyles (Figs 10, 14) relatively short and stout, distally deeply incised with an inner spine-like process which is slightly curved laterad and an outer, broader process which narrows subapically and forms a small, finger-shaped tip pointing laterad. Anal segment (Figs 12, 14) short, ring-shaped, ventral side concave, membranous; caudal margin ventrolaterally projected on each side to a short, slightly compressed process which in caudal aspect is obliquely truncate at apex, both processes slightly diverging; beneath each process a short membranous lobe beset with very fine hairs or bristles. Anal style relatively large, compressed. Aedeagus (Figs 14, 16, 18) subtubular, almost straight, narrowing towards apex, ventral side except for basal part largely membranous bearing a longitudinal slit-like phallosome from middle to apex; left and right ventral sclerotized margin each with a longitudinal row of ca. 7 teeth, 3 of them stronger than the others; dorsal side with 2 subapical teeth. Suspensorium (Figs 14, 16, 18) dorsally with short, vaulted plate which then forms a ring embracing the base of aedeagus and connecting at ventral side. Connective (Fig. 14) compressed, dorsally slightly projected at middle.

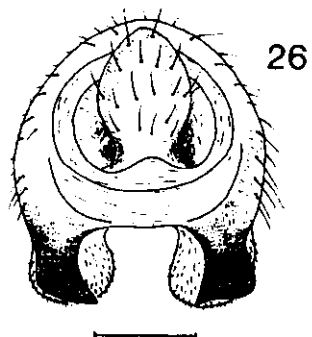
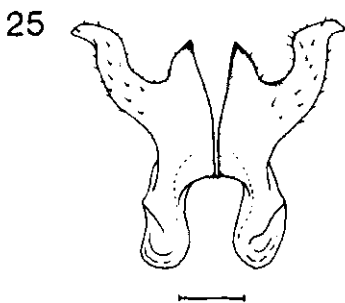
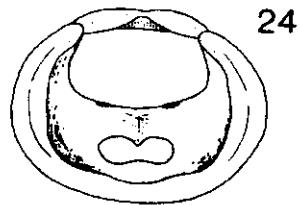
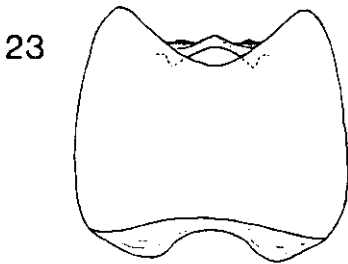
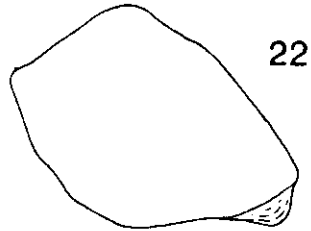
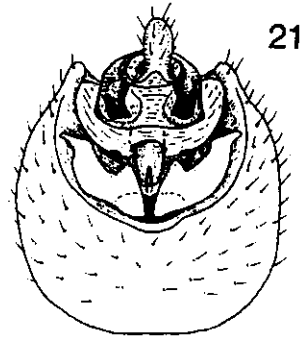
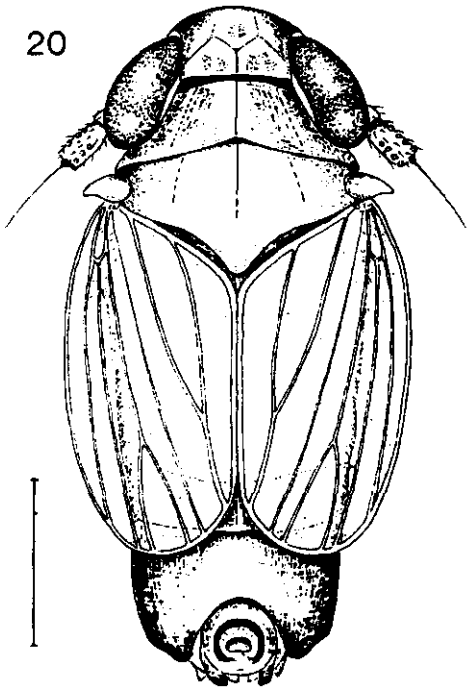
**Female genitalia**: Ovipositor relatively short, just attaining the base of the anal segment; valvifers 8 at inner margin of their anterior base with a distinct edge pointing mediad; no genital scale and atrium plate.

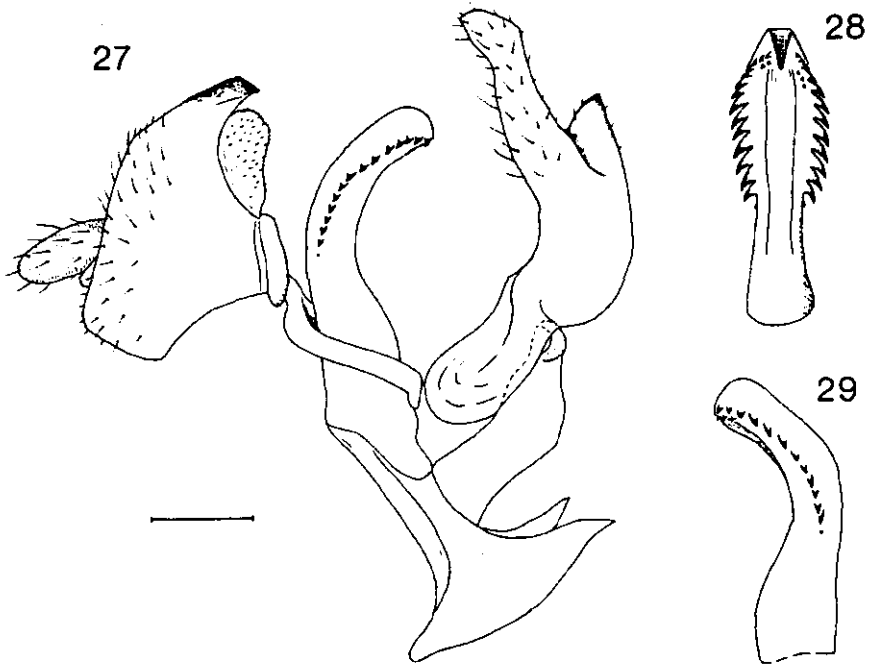
**Diagnosis**: *Remanodelphax glycyphilos* sp. n. can readily be distinguished from the other congeners by characteristic colour patterns of head, pronotum (one dark spot each) and mesonotum (2 dark spots). The male and female genitalia are very similar to those of *R. cedroni* but differ in details as in the truncate tip of the processes of the anal segment (Figs 12–13), in the spine configuration of the aedeagus (left and right 7, dorsally 2 instead of 8/12/6) (Figs 14–19); inner base of valvifer 8 stronger produced

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Figs 20–26: *Remanodelphax pullata* (MUIK), holotype male. Scale bar for Fig. 20: 0.5 mm, otherwise 0.1 mm.

20: habitus: head, thorax and abdomen dorsal aspect; 21: male genitalia ventrocaudal aspect; 22: pygofer left lateral aspect; 23: pygofer ventral aspect; 24: pygofer caudal aspect; 25: gonostyles ventral aspect; 26: anal segment caudal aspect.





Figs 27-29: *Remanodelphax pullata* (Muir), holotype male. Scale bar: 0.1 mm.  
27: male genitalia combined without pygofer left lateral aspect; 28: aedeagus ventral aspect; 29: aedeagus right lateral aspect.

mediad than in *R. cedroni*). From *R. pullata*, *R. glycophilos* differs in larger size and colour patterns (*R. pullata* is very small, 2.3 mm and coloured uniformly dark brown) as well as in structure of the male genitalia: inner process of gonostyles spine-shaped (not a short and broad pointed edge), aedeagus straight with teeth at dorsal apex versus aedeagus curved ventrad devoid of teeth on dorsal side.

Type material: Holotype ♂ brachypterous, South Africa, Cape Province, Stellenbosch, Jonkershoek, by sweeping, 15.V.1968, H. GEERTSMA. Paratypes (2♀♀): 1♀ macropterous, South Africa, Cape Province, Clanwilliam, Cedarberg, 21. XII. 1976, J.G. THERON. 1♀ brachypterous, *ibid.*, Ceres, Slagboom, 13. XII. 1969, J. VAN DYK. Holotype and paratypes in collection of the University of Stellenbosch.

Geographical distribution: South Africa: Cape Province.

Host plant: Unknown.

Etymology: The specific name is a latinized composition of the Greek words *glykos* (sweet) and *philos* (friend) and refers to the well known appreciation for anything sweet in the diet by the person in whose honour the genus was erected.

***Remanodelphax pullata* (Muir) comb. n. (Figs 20-29)**

*Euryssa pullata* Muir, 1926: 20.

Supplementary description:

**Total length:** Male: 2.3 mm (brachypterous, n = 1).

**Habitus** (Fig. 20): Small, somewhat stout species with strongly rounded head and shiny, uniformly dark brown colouration.



**Male genitalia** (Figs 21–29): Pygofer (Figs 21–24) in caudal aspect slightly depressed, ovate, ca. 1.4 times wider than high, relatively long, ventrocaudal margin gently v-shaped, ventral side medially about as long as at level of laterodorsal angles and 2.4 times as long as mediadorsally, dorsal margin deeply excavated to accommodate the anal segment. Diaphragm (Fig. 24) covering lower half of caudal side of pygofer, distinctly sunk cephalad against lateral margins; opening for gonostyles depressed ovate with dorsal margin medially acutely projected ventrad; diaphragm above this opening medially elevated, ridged, dorsal margin shallowly concave with a small lobe-like projection on each side. Gonostyles (Figs 25, 27) deeply furcate, shape in ventrocaudal aspect reminding of a dromedary, inner branch relatively short, stout and distally pointed; outer branch about twice as long than inner, diverging laterodorsad, at apex with finger-shaped tip reflected laterad. Anal segment (Figs 26–27) short, ring-like, ventrally membranous except for two ventrocaudal processes which originate in relatively wide distance from each other and which are distally depressed, outer ventral margin of processes subtruncate with inner edge pointed; below each process a distinct inflated membranous sack-like projection bearing numerous minute hairs or bristles. Aedeagus (Figs 27–29) subulular, broad at base, then narrowing and gently curved ventrad, slightly compressed, ventral side in apical part membranous bearing a longitudinal slit-like phallosome; each side with a regular row of strong teeth, 14 on the left, 12 on the right side; near ventral apex below these teeth on each side 2–3 minute additional teeth. Suspensorium (Fig. 27) with broad, plate-like base connecting to the ventral base of anal segment, ventrally ring-shaped, embracing the base of the aedeagus, connected at ventral side. Connective (Fig. 27) short and sturdy, medially slightly bent cephalad.

**Diagnosis:** *Remanodelphax pullata* (Muir) differs from the other congeners in its uniformly shiny dark brown colouration, its small size (ca. 2.3 mm), and in structures of the male genitalia: gonostyles shaped like a dromedary with short and broad pointed inner process (not spine-like); aedeagus devoid of dorsal teeth (instead of 2 apicodorsal teeth in *R. glycephilos* and 6 apicodorsal teeth in *R. cedroni*).

**Type material:** The holotype ♂ brachypterous and one paratype ♂ brachypterous (here examined) are preserved in the Natural History Museum London, UK. The holotype bears the following labels: (white, printed) "S. Africa, R.E. TURNER, Brit. Mus.-1922-97", (white, printed) "Mossel Bay, Cape Province, Febr. 1922", (white with printed red holotype-label cross-glued at one end, handwritten) "*Euryrsa pullata* MUIR ♂", (circular, white with red margin, printed) "Type". The only paratype found bears the same data as the holotype and lacks the abdomen. Apparently this is the male figured for the original description by MUIR. A slide mount of the genitalia, however, could not be found. The third male mentioned by MUIR (1926) is missing.

**Geographical distribution:** South Africa: Cape Province (MUIR 1926, 1929).

**Host plant:** Unknown.

#### On the taxonomic status of the Afrotropical species originally assigned to *Euryrsa* FIEBER

In the Afrotropical Region, the following 13 species were originally placed in *Euryrsa*: *Euryrsa atrata* MUIR, 1926, *E. furcifera* MUIR, 1926, *E. nigrocacuminis* MUIR, 1926, *E. pullata* MUIR, 1926, *E. semifrons* MUIR, 1929, and *E. perbrincki* FENNAH, 1958, all from South Africa; *Euryrsa atramentaria* LINNAVUORI, 1973, *E. gylippus* FENNAH, 1969, and *E. immatonga* LINNAVUORI, 1973, all from Sudan (Equatoria); *Euryrsa bidentata* LINNAVUORI, 1973 from Yemen; *Euryrsa fastigiarum* VAN STALLE, 1984, and *E. ornata* VAN STALLE, 1984 from Cameroon (Mount Cameroon). One more species from South Africa, *Columbiana turneri* MUIR, 1926, was transferred to *Euryrsa* by MUIR (1929).

More recently, some additions and taxonomic modifications were made. NAST (1975) placed *E. gylippus* FENNAH together with the type species *Liburnia stigmatica* MELICHAR, 1897 (= *Delphax strigosus* MATSUMURA 1910, = *Muirodelphax duffelsi* DLABOLA, 1974) from the Mediterranean Region in his new genus *lubsoda* NAST. FENNAH (1988) established the genus *Leptoeuryrsa* with the type species *Leptoeuryrsa monticola* FENNAH, 1988, from Kenya and Tanzania, and here transferred *Columbiana turneri* MUIR, *Euryrsa perbrincki* FENNAH, *E. immatonga* LINNAVUORI, *E. bidentata* LINNAVUORI, and

*E. fastigiarum* VAN STALLE. Moreover, FENNAH (1988) erected the genus *Scotoeurysa* with the type species *Eurysa nigrocacuminis* MUIR, and included as second species *Eurysa atramentaria* LINNAVUORI in this genus. This situation left 5 African species in *Eurysa*, i.e., *E. atrata* MUIR, *E. furcifera* MUIR, *E. pullata* MUIR, *E. semifrons* MUIR, and *E. ornata* VAN STALLE. *E. pullata* is transferred to *Remanodelphax* DROSOPoulos in this paper.

The examination of type- and various non-type material of the remaining 4 Afrotropical "*Eurysa*" species has revealed that none of them is congeneric with *Eurysa* FIEBER (*sensu stricto*) based on the type species *Delphax lineata* PERRIS, 1857 from France (FIEBER 1866). *Eurysa (sensu lato)* as currently used (e.g. NAST 1972, BEAMER 1952) is supposedly polyphyletic (see ASCHE 1994; REMANE & ASCHE 1983, 1986) and requires a phylogenetically based revision.

The Afrotropical species *Eurysa atrata* MUIR and *E. ornata* VAN STALLE evidently belong to *Iubsoda* NAST which now contains 4 species. The taxonomic consequences are:

***Iubsoda atrata* (MUIR, 1926) comb. n.**

*Eurysa atrata* MUIR, 1926: 22, type locality in South Africa: Cape Province, holotype male in The Natural History Museum London, UK.

***Iubsoda ornata* (VAN STALLE, 1984) comb. n.**

*Eurysa ornata* VAN STALLE, 1984: 4, type locality in Cameroon: Cameroon Mts., holotype male in Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium.

The remaining two species, *Eurysa furcifera* MUIR and *E. semifrons* MUIR appear to be morphologically similar to each other. Their generic placement is subject of an urgently needed phylogenetic analysis and therefore beyond the scope of this paper.

The phylogenetic relationships between *Remanodelphax* and other "*eurysoid*" or "*stirromine*" taxa like *Iubsoda*, *Leptoeurysa*, *Scotoeurysa* and potentially *Makarourysa* REMANE & ASCHE (see REMANE & ASCHE 1986) are yet to be analysed.

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