Genus	Vol. 22(4): 531-543	Wrocław, 27 XII 2011

Paranotus charlotteae n. sp. – a new flatid species from Sierra Leone (Hemiptera: Fulgoromorpha: Flatidae)

Dariusz Świerczewski[1] & Adam Stroiński[2]
[1]Department of Zoology and Animal Ecology, Jan Długosz University, Al. Armii Krajowej 13/15, 42-201 Częstochowa, Poland; e-mail: dswier@ajd.czest.pl
[2]Museum and Institute of Zoology PAS, Wilcza 64, 00-679 Warszawa, Poland; e-mail: adam@miiz.waw.pl

Abstract. *Paranotus charlotteae* n. sp., a new flatid species from Sierra Leone (West Africa), is described and illustrated. The internal female genital structures are presented for this genus for the first time.

Key words: entomology, taxonomy, Hemiptera, Fulgoromorpha, Flatidae, *Paranotus*, new species, West Africa, Sierra Leone.

INTRODUCTION

The African genus *Paranotus* was established by Karsch (1890) for its only species *Paranotus trivirgatus* Karsch, 1890 described on the basis of specimens from Senegal and Zanzibar. Afterwards, Schumacher (1912) described another species from Cameroon under the name *Paranotus kamerunensis* Schumacher, 1912. Moreover, Distant (1910) transferred to this genus *Poeciloptera rufilinea* Walker, 1858 described from Natal resulting in *Paranotus rufilineus* (Walker, 1858). Metcalf (1957) in his catalogue treated *Paranotus trivirgatus* as a junior synonym of *P. rufilineus*, however, Medler (1990, 2001) after examining the male genitalia of both species concluded that *P. trivirgatus* is a valid species. Linnavuori (1973) after studying the flatid material from the area of Upper Nile (Malakal) described additional species named *Paranotus deiopeia* Linnavuori, 1973. Finally, Medler (1988) synonymised *Chopardana lineata* Lallemand, 1942 with the above mentioned *P. trivirgatus*.

Additionally, four species, which were catalogued by METCALF (1957) in the genus, were transferred to other genera: *Paranotus limbatus* DISTANT, 1912 to the genus *Planata* MEDLER, 1999 (MEDLER 1999), *Paranotus maculosus* DISTANT, 1912 was synonymised with *Planata limbata* (DISTANT, 1912) (MEDLER 2000), *Paranotus obsoletus* MELICHAR, 1902 was placed in the genus *Cryptoflata* MELICHAR, 1901 (MEDLER 1990) and *Paranotus praetextus* MELICHAR, 1902 in the genus *Phylliana* METCALF, 1952 (MEDLER 1990).

The authors describe here a new species belonging to the genus *Paranotus* KARSCH, 1890 from Sierra Leone (West Africa).

MATERIAL AND METHODS

Material. The studied material comes from the entomological collection of the Museum of Zoology, Lund University (MZLU), Sweden (Dr R. DANIELSSON, curator).

Preparations and illustration. The abdomens of the specimens examined were cut off and boiled in 10% KOH with a few drops of chlorazol black for dying the ectodermic genital ducts according to the method introduced by CARAYON (1969) and BOURGOIN (1993). Dissections and cleaning of the genital structures were performed in distilled water. Final observations and drawings were done in glycerin using a camera lucida attached to a light microscope. The photos of the habitus were taken using the stereoscopic microscope Leica MZ 16 with the camera IC 3D; final images were produced using the Synoptics Automontage software. The SEM photographs of uncoated specimens were taken in the Laboratory of Scanning Microscopy, MIZ PAS (Warsaw), using the scanning microscope HITACHI S-3400N under Low Vacuum conditions.

Measurements and abbreviations. The following measurements and abbreviations were made and used in this study:

Total length – measured (in dorsal view) from the apex of head to the apex of tegmina;

C/E – width of frons at upper margin/length of frons in mid line;

D/E – maximum width of frons/length of frons in mid line;

G/B – length of mesonotum/ length of pronotum in mid line;

G/H – length of mesonotum in mid line/width of mesonotum between lateral angles;

I/J – length of tegmen measured from the base to the apical margin in median portion/width of tegmen measured from apex of clavus to the anterior margin.

The nomenclature of the male genitalia follows BOURGOIN (1998), BOURGOIN & HUANG (1990) and for the female genitalia BOURGOIN (1993). Vein nomenclature after the interpretation proposed by SZWEDO & ŻYŁA (2009).

TAXONOMY

***Paranotus charlotteae* n. sp.**

(Figs. 1-37)

ETYMOLOGY

The species name refers to the type locality – the village Charlotte located SE of Freetown, the capital of Sierra Leone.

DIAGNOSIS

Panormenis charlotteae SWI. et STR. differs from the other species belonging to the genus by the shape of dorsal and ventral aedeagal appendages.

DESCRIPTION

Total length 7.2-8.2 mm. Body robust (Fig. 2).

Head. Head truncate, with compound eyes (in dorsal view) a little narrower than thorax (Figs. 2, 4).

Vertex transverse (distinctly wider than long in midline), mostly covered by pronotum; anterior margin almost straight, lateral margins weakly arcuate and subparallel, posterior margin straight; disc of vertex without carina.

Frons (Figs. 3, 7-8) a bit shorter than wide, the widest in the line below antennae, proportion C/E = 0.67-0.78, proportion D/E = 1.08-1.22; disc of frons with median carina, short and well visible; upper margin straight, lateral margins of frons carinate.

Antennal segment II (pedicel) a bit wider at the apex, about 1.5 times longer than its width, with long flagellum; sensory organs located at the top of pedicel in the depression (Figs. 18-21).

Compound eye oval with small callus at the lower margin; lateral ocelli present (Fig. 6).

Frontoclypeal suture arcuate (Figs. 3, 7); clypeus without carinae, in median portion weakly convex. Rostrum reaching middle coxae.

Thorax. Pronotum (Figs. 4, 9-11) longer in midline than vertex, partly overlapping the vertex; posterior margin (in lateral view) a bit higher than anterior margin; anterior margin (in dorsal view) almost straight, posterior margin shallowly and widely concave; disc of pronotum flat with weakly visible median carina; postocular carinae absent.

Mesonotum deltoid (Figs. 4, 10-11), proportions: G/B = 2.95–3.50, G/H = 0.89–1.00; anterior and posterior margin in lateral view at the same level as pronotum; lateral angles placed at about 1/3 of the length of mesonotum in midline; disc in median portion flat with three subparallel carinae reaching the posterior margin and separated at the base.

Tegmen (Figs. 1, 12-13) truncate, flat, surface smooth, proportion I/J = 1.76 (2 specimens with undamaged tegmina); costal margin weakly arcuate; apical angle bluntly rounded; apical margin almost straight, sutural angle almost 90° at about the same level in relation to the apical angle; postclaval sutural margin straight, at the same level as claval margin; costal area about the same width of its length with dense and numerous

transverse veinlets, the end of costal area extending a bit the end of clavus; costal cell tapering apicad with transverse veinlets – veinlets of the basal part obsolete, veinlets of the apical part well visible and dense; basal cell elongated.

Vein Sc+RA and RP leaving basal cell separately (Fig. 5), with the first fork at the apical part of tegmen; fork Sc+RA a little before RP; $ScRA_1$ reaching the margin after costal area apex; RA with 2-3 terminals; RP ending with 3-4 terminals, vein M with long stem, diverging distinctly before half of tegmen; location of M_{1+2} fork in respect to M_{3+4} fork variable (Figs. 1, 13), both placed a bit after CuA fork; M_{1+2} ending with 4-5 terminals, M_{3+4} ending with 8 terminals; CuA diverging a little after half of the wing; claval veins PCu and A_1 connected a little before the apex of clavus.

Basal half of tegmen without transverse veinlets, apical half with a net of veinlets forming rectangular cells; posterior part with well developed apical and subapical lines; apical and subapical cells distinctly longer than wide.

Sensory organs placed in the basal part of tegmen in a form of single pores with ring-shaped areas (Figs. 15, 16).

Wing. Vein Sc+R bifurcate with 2 terminals; fork M placed before Sc+R fork with 4 or 5 terminals; CuA and CuP single.

Legs. Fore femur a little longer than fore tibia, middle femur the same length as middle tibia, rectangular in cross section; hind femur much shorter than tibia, partly flattened medially; hind tibia (Fig. 17) with 2 lateral spines placed near the apex and an arcuate row of apical teeth; basitarsomere with V-shaped row of massive setae with socle and two lateral teeth, about as long as a cumulative length of median and apical tarsomeres; median tarsomere with elongated spines covering the ventral side and two lateral teeth.

Male (Figs. 22-28). Anal tube (in lateral view, Fig. 22) elongated and curved, median portion almost straight; apical part distinctly widened with well developed ventral lobe, anus placed before half the length; anal tube (in dorsal view, Fig. 23) bottle-shaped, elongated, anus placed before half the length.

Pygofer (in lateral view, Fig. 22) much higher than wide; dorsal part distinctly narrower than the ventral part; dorsal margin concave, posterior margin arcuate with a shallow incision below half the length.

Genital styles (in lateral view, in direct observation, Fig. 22) triangular, oriented ventrad; sharp and narrow capitulum placed at posterodorsal angle; dorsal margin almost straight, posterior margin shallowly incised below capitulum.

Phallic complex. Periandrium (in lateral view, Fig. 24) distinctly elongated, basal part much wider than the apical one; lateral split reaching half the length of periandrium; dorsal part of periandrium much longer than the ventral part with arcuate posterior margin, apical portion (in ventral view) U-shaped; ventral part of periandrium (Fig. 25) distinctly narrower than the dorsal one with a ventral process oriented ventro-basad; the base of the process widened and membranous, the top of the process sharp and well sclerotized.

Aedeagus (Figs. 26-28): shaft as long as a dorsal part of periandrium, straight, U-shaped, with apically placed big appendage divided into dorsal and ventral processes;

dorsal process longer than the ventral one, oriented basad and tapering apicad, with membranous subapical part and well sclerotized apex; dorsal process with 4 teeth oriented antero-dorsad (1st-3rd shorter, 4th longer); ventral process in a form of a lobe, lower margin with single tooth oriented apicad (visible in ventral view) and 4 teeth oriented ventro-basad, upper margin with 3 teeth oriented dorsad.

Female (Figs. 29-37). Pregenital sternite (Fig. 29) with elongated and well developed lateral lobes. Anterior margin in median portion deeply arcuate, posterior margin in median portion deeply concave.

Anal tube in lateral view (Fig. 30) elongated, basal part wider than the apical one; anus placed a little before half the length; anal tube extending a bit beyond the posterior margin of the gonoplac.

Anal tube in dorsal view (Fig. 31) oval with narrower basal part; anus placed a little before half the length.

Gonoplac (Fig. 32) unilobate, triangular; posterior margin with several rows of elongated teeth – 6 rows in upper part and 3 rows in lower part; small incision at the posteroventral angle forming a sharp, triangular process; membranous lobe absent.

Gonapophysis VIII (in lateral view of the external side, Fig. 33) partly laterally flattened, with sharp apex and 3-4 teeth placed apically; 2 parallel, short, horizontal keels near the lower margin; endogonocoxal process large and rounded with spiniferous microsculpture.

Gonospiculum as in Figs. 36-37.

Bursa copulatrix (Fig. 34) with single and elongated pouch; the wall with well visible cells and sclerotized ornamentation. Spermatheca (Fig. 35) well developed; ductus receptaculi very long, straight and smooth; diverticulum ductus a bit shorter than ductus receptaculi, distal part widened and wrinkled, apical part with bubble-like, membranous bulla.

Coloration. General colour light green with yellowish clypeus, legs and abdomen; postclaval and apical margins of tegmen light brown; two orange and three greenish blue parallel stripes extending from the upper part of frons, through the dorsal part of head and thorax to the end of clavus.

Remarks

Medler (1990) noticed: 'I have seen many specimens in collections with damaged tegmina. Sections of the precostal and apical margins were lost …'. We discovered that it was caused by the characteristic zip-pattern of veinlets of the costal area (Fig. 14).

Type material

Holotype, ♂: [Sierra Leone: Charlotte Village, SE of Freetown 13° 12' W, 8° 25' N 25.XI.1993 loc. 6 swept along roadside], [Lund University Sierra Leone Expedition 1993 leg. L.Cederholm - R. Danielsson - R.Hall] deposited in MZLU

Paratypes: 1♂, 4♀♀ labelled as holotype, deposited: 1♂, 1♀ – MIZ, 3♀♀ – MZLU.

Distribution

So far the species is only known from the type locality in the western part of Sierra Leone.

Acknowledgements

We would like to thank Dr Roy Danielsson for the privilege of studying the flatid material from the entomological collection of the Museum of Zoology, Lund University (Sweden) and Dr Jacek Szwedo (MIZ PAS) for his valuable comments on the manuscript.

REFERENCES

Bourgoin, T., 1988. A new interpretation of the homologies of the Hemiptera male genitalia, illustrated by the Tettigometridae (Hemiptera, Fulgoromorpha). [In:] Vidano, C. & Arzone, A. (eds). 6th Auchenorrhyncha Meeting, Turin, Italy, September 7-11, 1987. CN R-IPRA, Turin, pp. 113-120.

—, 1993. Female genitalia in Hemiptera Fulgoromorpha, morphological and phylogenetic data. Ann. Soc. Entomol. Fr. (N.S.), **26**: 555-564.

Bourgoin, T., Huang, J., 1990. Morphologie compare des genitalia males des Trypetimorphini et remarques phylogénétiques (Hemiptera: Fulgoromorpha: Tropiduchidae). Ann. Soc.Entomol. Fr. (N.S.), **5**: 179-193.

Carayon, J., 1969. Emploi du noir chlorazol en anatomie microscopique des insectes. Ann. Soc.Entomol. Fr. (N.S.), **5**: 179-193.

Distant, W. L., 1910. Insecta Transvaaliensia. A contribution to a knowledge of the entomology of South Africa, **10**: 229-252, pls. 22-23.

Karsch F. 1890. Afrikanische Fulgoriden. Berliner Entomol. Zeitschr., **35**: 57-70.

Linnavuori, R., 1973. Hemiptera of the Sudan, with remarks on some species of the adjacent countries 2. Homoptera Auchenorrhyncha: Cicadidae, Cercopidae, Machaerotidae, Membracidae and Fulgoroidea. (Zoological contribution from the Finnish expeditions to the Sudan no. 33). Notulae Entomol., **53**: 65-137.

Medler, J. T., 1988. Flatidae from the Taï Forest, Côte d'Ivoire, and taxonomic notes on the family in West Africa. Rev. franç. Entomol. (N.S.), **10**: 117-148.

—, 1990. Types of Flatidae XIII, lectotype designations and taxonomic notes on African species in the Zoological Museum of the Humboldt-University Berlin (Homoptera, Fulgoroidea). Deutsche entomol. Zeitschr. N. F., **37**: 105-118.

—, 1999. Flatidae of Indonesia, exclusive of Irian Jaya (Homoptera, Fulgoroidea). Zool. Verhandel., Leiden, **324**: 1-88.

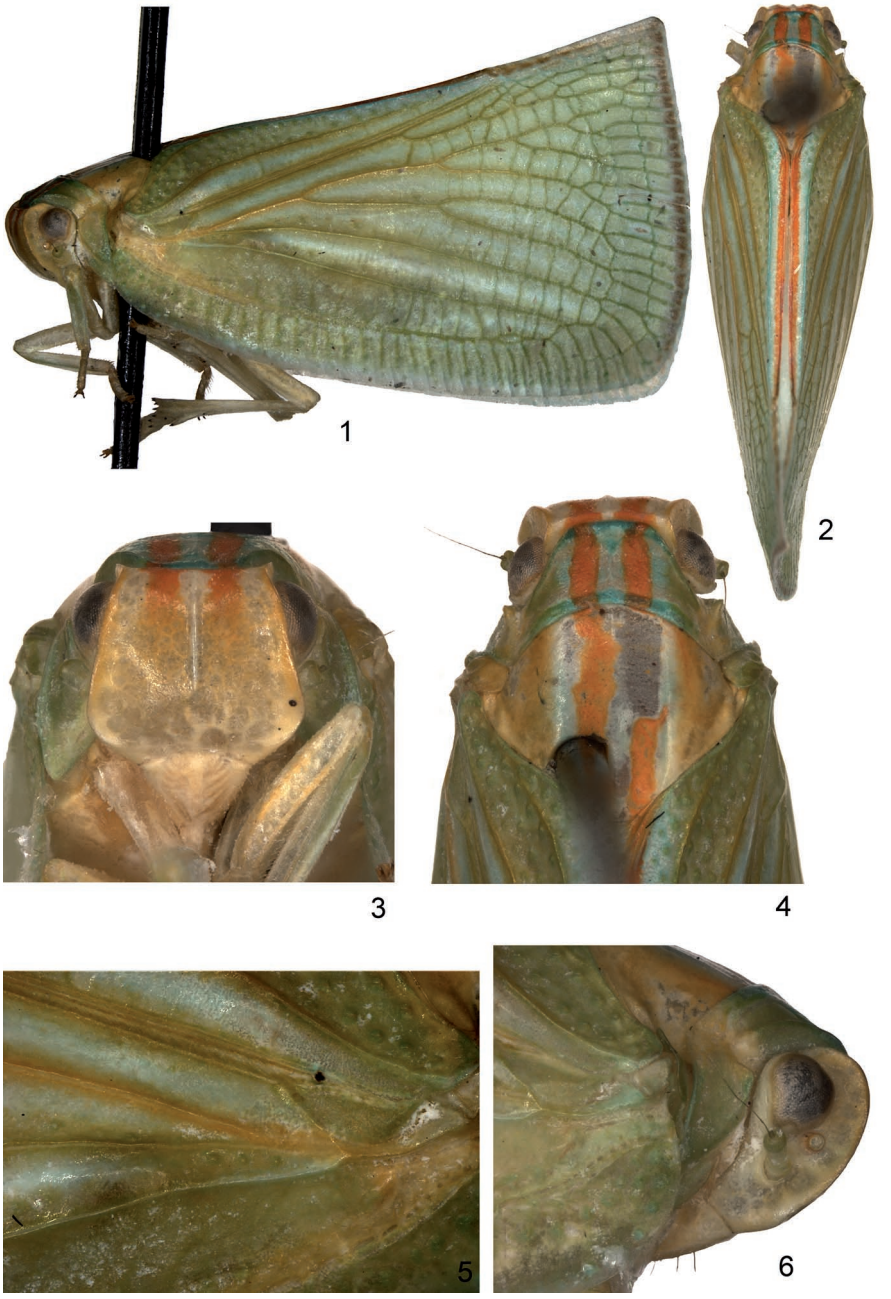
—, 2000. Flatidae of New Guinea and adjacent areas (Homoptera: Fulgoroidea). Bishop Mus. Bull. Entomol., **8**: 1-117.

—, 2001. Review of Flatidae in Southern Africa, with keys and descriptions of new species (Homoptera, Fulgoroidea). Contributions on Entomology, International, **4**: 323-375.

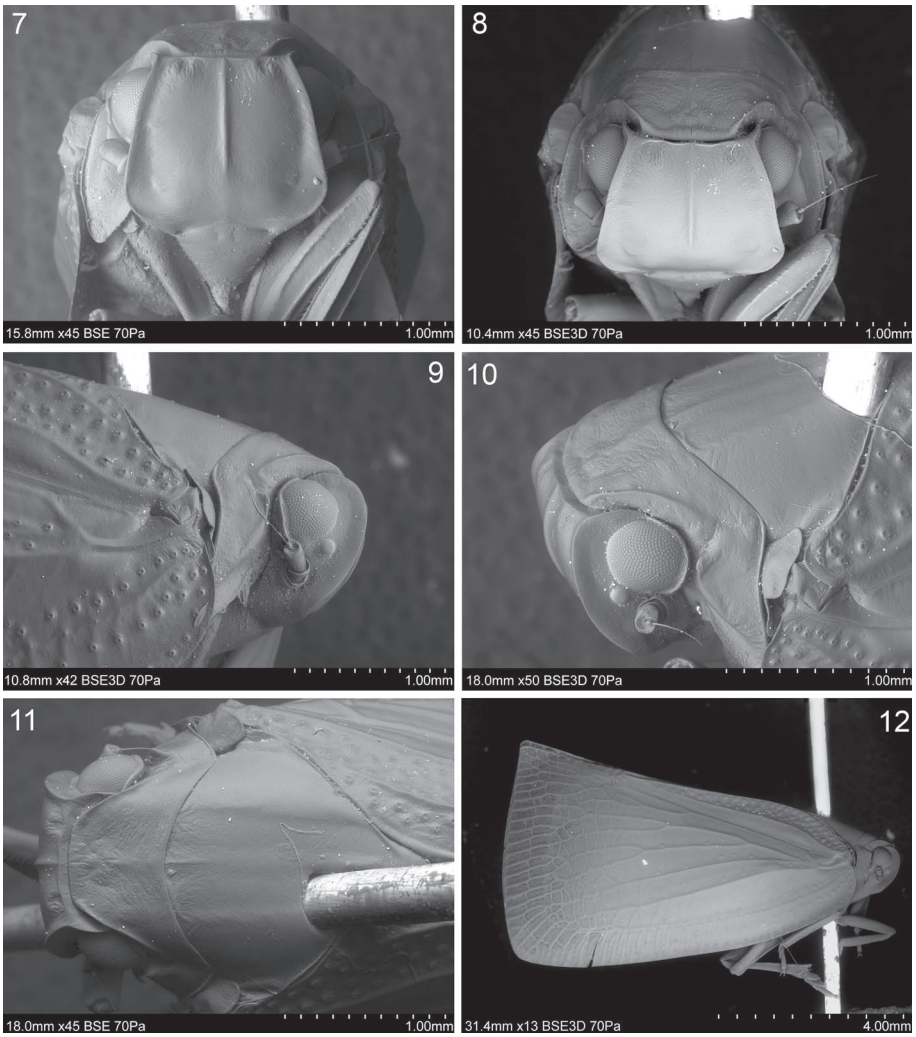
Metcalf, Z.P., 1957. General Catalogue of the Homoptera, Fasc. IV, Part 13, Flatidae. North Carolina State College, Raleigh, N. C. 565 pp.

Schumacher, F., 1912. Über eine Hemipterenausbeute, gesammelt von Herrn E. Hintz im Kamerungebirge. Mitt. Zool. Mus. Berlin, **6**: 313-323.

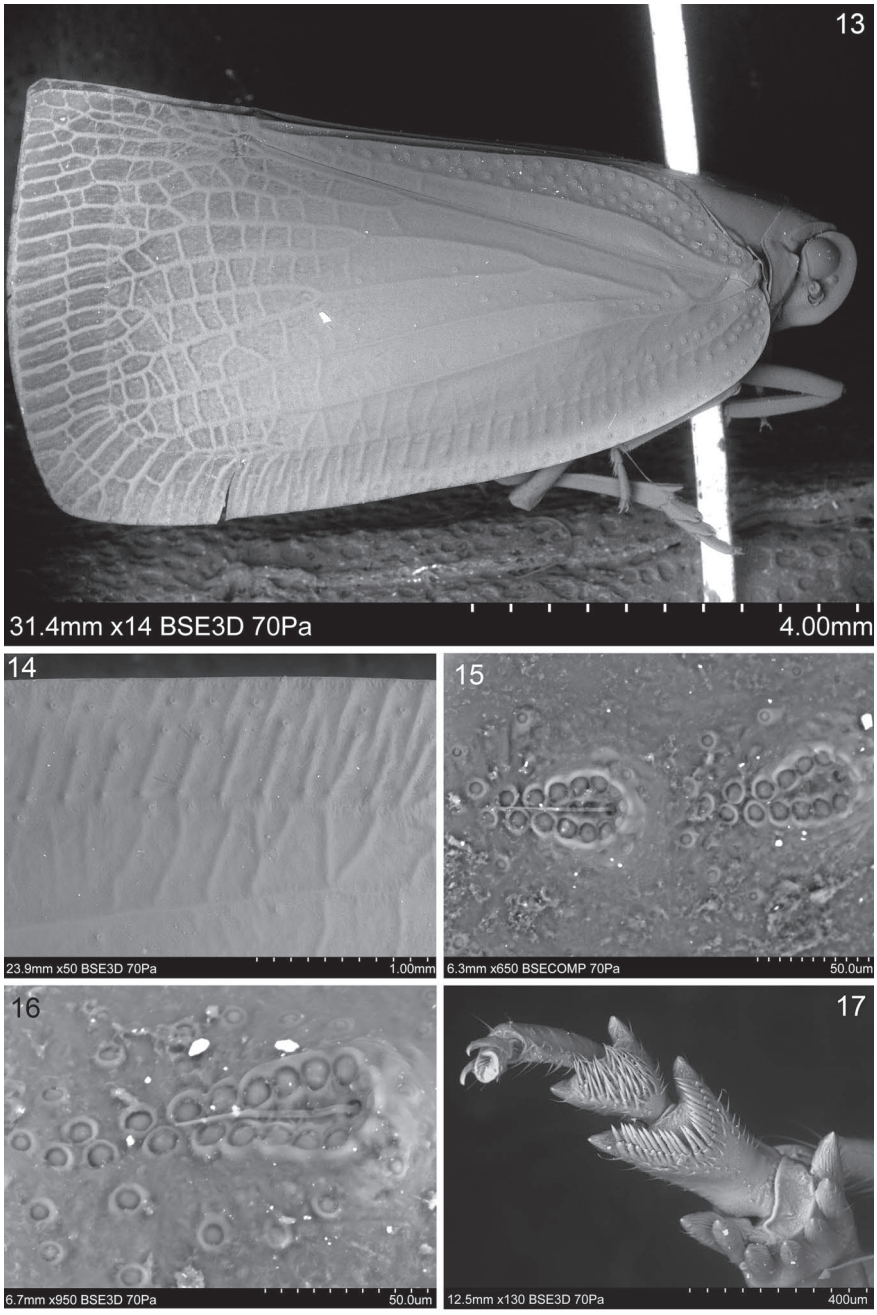
Szwedo, J., Żyła, D., 2009. New Fulgoridiidae genus from the Upper Jurassic Karabastau deposits, Kazakhstan (Hemiptera: Fulgoromorpha: Fulgoroidea). Zootaxa, **2281**: 40-52.



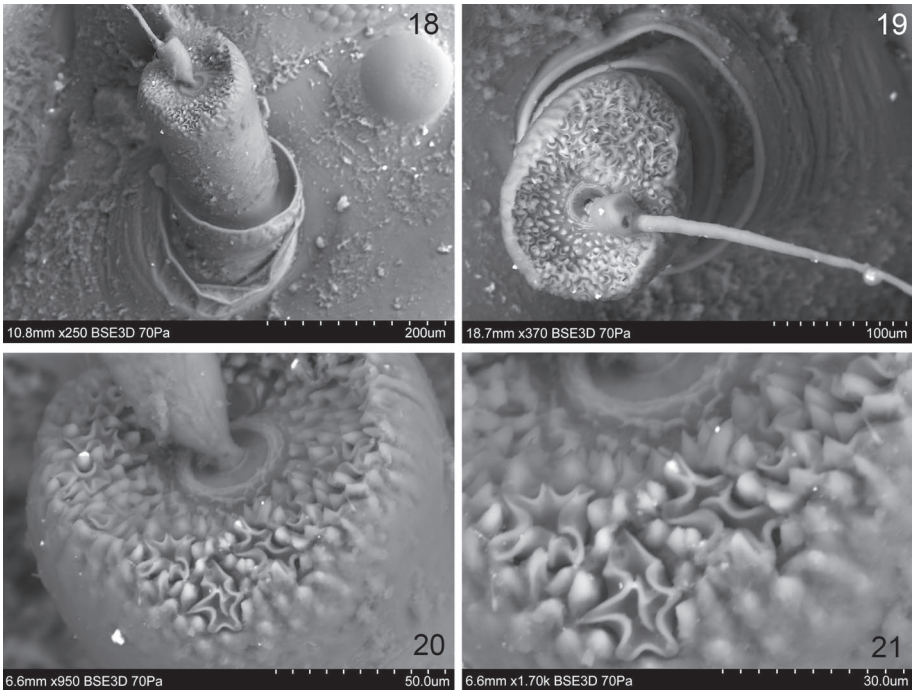
1-6. *Paranotus charlotteae* n. sp., female, paratype: 1 – habitus, lateral view; 2 – same, dorsal view; 3 – anterior part of body, frontal view; 4 – same, dorsal view; 5 – basal part of tegmen; 6 – anterior part of body, lateral view



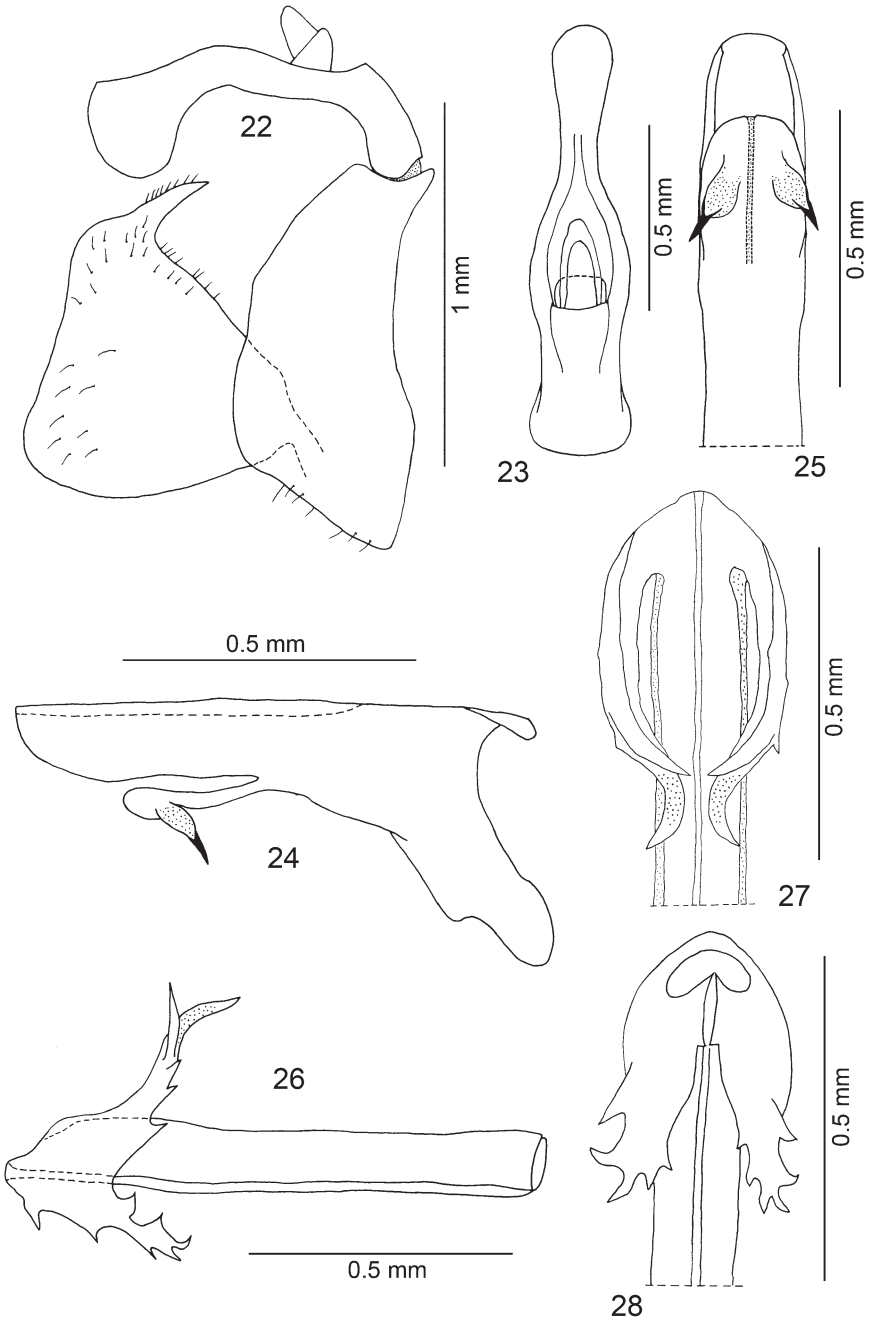
7-12. *Paranotus charlotteae* n. sp., female, paratype: 7–11 – anterior part of body: 7 – frontal view, 8 – antero-dorsal view, 9 – lateral view; 10 – dorso-lateral view, 11 – dorsal view; 12 – habitus, lateral view



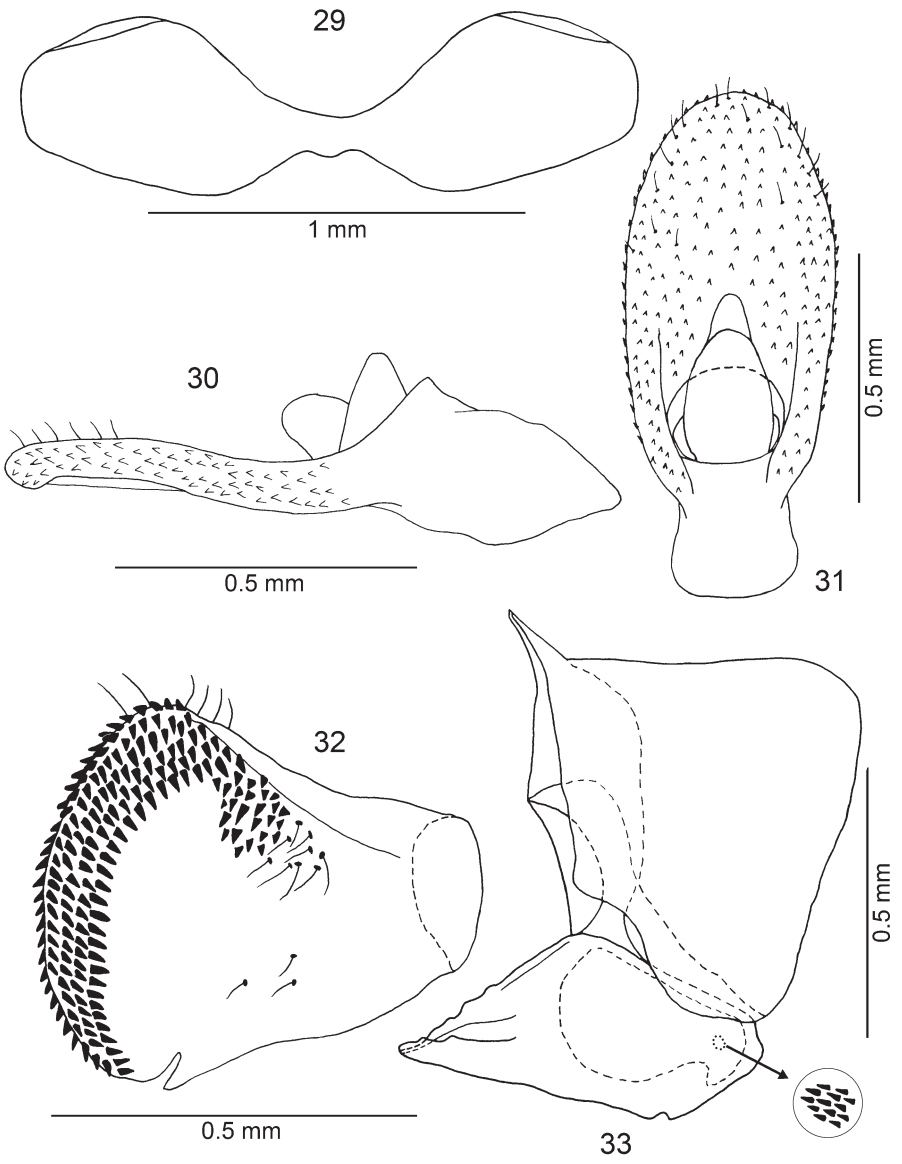
13-17. *Paranotus charlotteae* n. sp., female, paratype: 13 – habitus, lateral view; 14 – anterior part of tegmen with costal area and costal cell; 15–16 – single pore with ring-shaped areas; 17 – apex of hind tibia and tarsomeres, ventral view



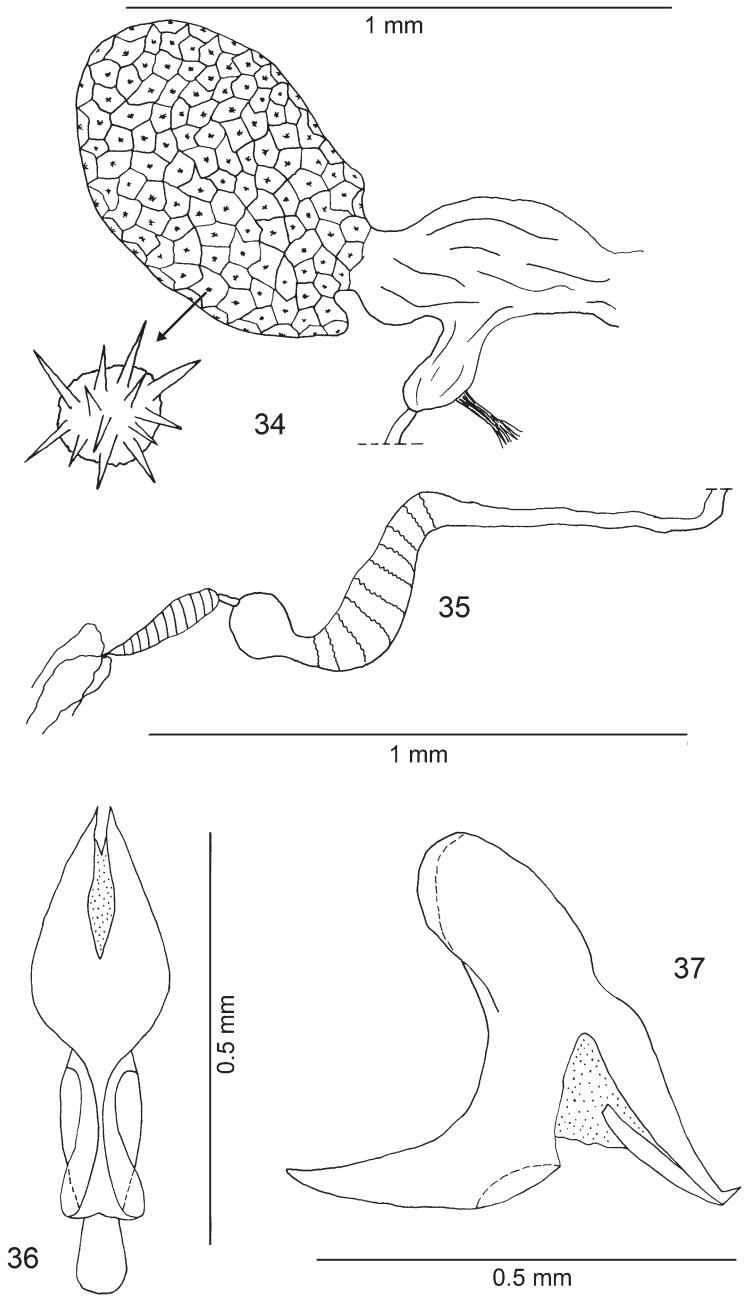
18-21. *Paranotus charlotteae* n. sp., female, paratype: 18–21 – antenna and antennal plate organs



22-28. *Paranotus charlotteae* n. sp., male, holotype: 22 – genital capsule, lateral view; 23 – anal tube, dorsal view; 24 – periandrium, lateral view; 25 – apical part of periandrium, ventral view; 26 – aedeagus, lateral view; 27 – same, dorsal view; 28 – same, ventral view



29-33. *Paranotus charlotteae* n. sp., female, paratype: 29 – pregenital sternite, flattened; 30 – anal tube, lateral view; 31 – same, dorsal view; 32 – gonoplac, internal view; 33 – gonapophysis VIII, lateral view of the external side



34-37. *Paranotus charlotteae* n. sp., female, paratype: 34 – bursa copulatrix, lateral view; 35 – spermatheca, lateral view; 36 – gonapophyses IX and gonospiculum brige, dorsal view; 37 – same, lateral view