FOLIA ENTOMOLOGICA HUNGARICA
ROVARTANI KÖZLEMÉNYEK
Volume 87 2026 pp. 83–93
ISSN 0373-9465 (print) ISSN 2786-2798 (online)
published: 14 May 2026

New species of *Neoproxius* Usinger et Matsuda, 1959 from Bolivia and Cuba (Heteroptera: Aradidae)

Tamás Vásárhelyi

Hungarian National Museum Public Collection Centre – Hungarian Natural History Museum, Department of Zoology, Hemiptera Collection, 1088 Budapest, Baross utca 13, Hungary.
E-mail: vasarhelyi.tamas@nhmus.hu

Abstract – *Neoproxius bolivianus* sp. nov. and *Neoproxius cubanus* sp. nov. (Heteroptera: Aradidae: Carventinae) are described. *Neoproxius gypsatus* (Bergroth, 1898) is recorded for the first time from Paraguay and its ventral side is illustrated.

Key words – flat bugs, Neotropical Region, morphology, species description, incrustation

INTRODUCTION

The genus *Proxius* Stål, 1873 (Heteroptera: Aradidae: Carventinae) was established by Stål (1873) for the single species *Proxius incrustatus* Stål, 1873 from Brazil. The number of described species was subsequently increased to five by Bergroth (1898), Champion (1898), and Heidemann (1904). Usinger & Matsuda (1959), also describing an additional species, divided the genus into three subgenera: *Nesoproxius* Usinger et Matsuda, 1959 (Pacific), *Proxius* sensu stricto, and *Neoproxius* Usinger et Matsuda, 1959 (both Neotropical).

Kormilev (1965, 1966, 1975, 1976, 1982*a*, *b*) described further species and provided a key to the known taxa (Kormilev 1982*a*). Kormilev & Froeschner (1987) raised the rank of all subgenera to generic level. The catalogue of Coscarón & Contreras (2012) lists twelve *Neoproxius* and two *Proxius* species from the Neotropical Region, latter including *Neoproxius schwarzii* (Heidemann, 1904). The generic placement of this species, however, seems doubtful, since the head and pronotum have grooves for reception of the antennae at rest, and spiracle II is not ventral but lateral, conflicting with the definition of *Proxius* sensu stricto (Usinger & Matsuda 1959).

DOI: *https://doi.org/10.17112/FoliaEntHung.2026.87.83*
ZooBank: *https://zoobank.org/urn:lsid:zoobank.org:pub:A89F9577-CE86-41D1-9C03-397DDD96C7E8*

In 1953 N. A. Kormilev examined the Aradidae material of the Hungarian Natural History Museum and identified two specimens as *Proxius gypsatus* Bergroth, 1898 and *Proxius incrustatus* Stål, 1873. The latter identification is now considered incorrect: the specimen has been recognised as an undescribed species, which is described in the present paper.

In a PhD thesis Grillo Ravelo (1988) recorded *Neoproxius schwarzii* from Cuba; his work is unfortunately deficient in diagnostic detail and visual documentation, but the provided photograph clearly shows the characteristic posterior abdominal structure of this species.

Species of the genera *Proxius* and *Neoproxius* were described and figured from dorsal view in the relevant literature: Champion (1898), Heidemann (1904), Heiss & Moragues (2009), Kormilev (1965, 1966, 1982*a*, *b*), Maes & Heiss (without publication date) and photos of the holotype specimen (fixed by monotypy) of *Proxius incrustatus* both in dorsal and ventral views are available online*, allowing comparisons with the specimens at hand.

MATERIAL AND METHODS

Exoskeletal structures were studied and drawings were made using an Opton 47 50 52 – 9901 stereomicroscope supported by a drawing apparatus. Photographs of specimens were made by the author using a NIKON D7200 digital camera mounted with AF-S Micro Nikkor 105 mm 1:2.8 ED objective (operating software: Helicon Remote v. 4.4.4); photos were rendered using Helicon Focus v. 8.2.2 software.

All specimens were mounted on cards using adhesive easily soluble in water. Incrustation was not removed from the specimens; descriptions refer to the incrustated body parts. Due to the good adhesivity to water (wetting) of the porous material of incrustation of *Neoproxius bolivianus* sp. nov., submerging the specimen in water revealed additional morphological characteristics. The incrustation of the other two species treated here showed no such adhesivity. Label data are given verbatim, lines are separated by /, while different labels on the same pin are separated by //.

Abbreviations – Morphological terms: deltg = dorsal external laterotergite (connexivum); PE = posterior-exterior. Depositories: HNHM = Hungarian National Museum Public Collection Centre – Hungarian Natural History Museum, Budapest; SDEI = Senckenberg Deutsches Entomologisches Institut, Müncheberg.

* Swedish Museum of Natural History, http://www2.nrm.se/en/het_nrm/i/proxius_incrustatus.html

TAXONOMY

Neoproxius bolivianus sp. nov.
(Figs 1, 5–9)

Type material – Holotype male: "Bolivia / Mapiri // Proximus / incrustatus Stål / Det. N. Kormilev 53"; deposited in the HNHM.

Diagnosis – The new species can be distinguished from the known species of the genus by the following character states in combination: head, pronotum and scutellum with characteristic whitish incrustation; spiracles II–IV ventral, II far from, III and IV increasingly closer to lateral border of deltgs, V–VII lateral, VIII dorsolateral, preapical.

Description – Macropterous male. Body elongate oval, widening from pronotum to abdominal segment V, with characteristic, elevated incrustation on head, pronotum, scutellum and deltgs II–III.

Colouration: Visible parts of body and antennae brown, legs unicolorous yellowish-brown (honey-brown), incrustation dirty yellow (Fig. 1).

Structure: Head somewhat longer than wide, incrustated except for two parallel grooves for reception of antennae. Genae (incrustated) much surpassing clypeus, almost reaching tip of antennal joint I, chitinous part under incrustation somewhat shorter. Thickness of chitinous part about 1/3 of apparent width of genae including incrustation (Fig. 7). Clypeus in lateral view semicircular, elevated. Antenniferous tubercles curving anteriorly, parallel, almost reaching tip of clypeus, not reaching outer border of eyes. Eyes small, black. Postocular area of head slightly widening posteriorly beyond outer border of eyes, lateral and posterior border straight, tip angular. Median incrustation on vertex widening posteriorly, elevating above highest parts of lateral incrustations, reaching above neck region (Fig. 5). Ventral side entirely covered by incrustation except at neck. Rostral atrium roundly opening from a slit like anterior section, then sides undulated, rostrum short, not reaching posterolateral margin of head (Fig. 8).

Antennae relatively long, joints I, II and IV differently club-shaped, joint III slender, cylindrical, thickening at tip, joints not stylate, with short, dense, curved pubescence, long pilosity at apical part of joint IV only. Relative lengths of antennal joints I to IV as 32:19:60:31.

Pronotum subquadrate, 1.1× as long as head, 1.5× as wide across hind lobe as long. Collar protruding, short. Anterior lobe narrower than posterior lobe, with an S-shaped carina of incrustation (only visible on the right side of the single examined specimen, damaged on the left). Grooves of head for reception of antennae continuing on pronotum, with a sandglass-shaped emerging incrustation between them. Anterior margin (incrustated) lateral to collar surpassing it anteriorly, then concave towards pointed anterolateral edge. Anterior and posterior lobes divided by shallow groove, subequal in length if

collar is omitted. Hind disc bulged, highest at incrustations: one lower protuberance at lateral edge, one higher (narrowing from base, triangular at top) submedially. Prosternum separate, meso- and metasterna and ventrites I–III fused in the middle, intersegmental boundaries marked by weak furrows.

Legs, acetabula and median part of venter mainly bare, without incrustation. Trochanter and femur partially fused, border visible; pulvillus narrow, arcuate, almost as long as claws.

Scutellum triangular, anterior margin concave with high incrustations on anterolateral edges. Posterolateral margins straight, tip rounded, disc with a pair of longitudinal carinae of incrustation, distance between them as wide as a carina, these incrustations bending towards anterolateral ones, nearly connected with them.

Hemelytra with corium short, indistinctly separated from membrane, laterally with an obtuse angled dilatation reaching beyond body margin, in depression of deltg II. Membrane semitransparent, reaching to hind border of tergite VII, broadly rounded apically, with weak venation.

Abdomen widening from base to segment V, then gradually narrowing. PE angles of deltgs protruding, rounded on basal segments, angular on VI and VII. Deltg II and III fused, with elevated incrustation split into two longitudinally, low incrustation appearing on IV–VII, expressed on parandrium. Apodemal impressions surrounded by incrustation. Segment VIII bulbous, dorsolaterally expanded, tip bent upwards (Fig. 7).

Ventral side of body with peculiar pattern of bare (brown) and incrustated surfaces (Fig. 9). Spiracles II–IV ventral, II far from, III and IV increasingly closer to lateral border of deltgs, V–VII lateral, VIII dorsolateral, preapical.

Measurements: Holotype male: length of head (including genae) 0.85 mm, width of head 0.65 mm, lengths of antennal joints I to IV 0.31, 0.19, 0.59, 0.30 mm, length of pronotum 0.85 mm, width of pronotum 2.24 mm, length of scutellum 0.46 mm, width of scutellum 0.78 mm, maximum width of abdomen 1.81 mm (across segment V), width of abdomen across segment VII 1.17 mm, body length 4.37 mm.

Remarks – The new species clearly belongs to *Neoproxius*, and differs from all known species by the characteristics of the incrustation and the position of the abdominal spiracles. The only species in which the position of the spiracles is similar to the new species is *Neoproxius nicaraguensis* Kormilev 1982, but the two species differ in a number of characters: anterolateral border of pronotum concave in *Neoproxius bolivianus* while convex in *Neoproxius nicaraguensis*, anterior disc of pronotum much longer than posterior disc in *Neoproxius bolivianus*, while both discs about equal in length in *Neoproxius nicaraguensis*. The spiracles, especially those on segments II to V, are differently placed in all other congeners. In the key of Kormilev (1982*a*) the new species runs to *Neoproxius peruvianus* Kormilev, 1966 due to the reduced elevation of the anterior lobe of the pronotum, but in the latter species the incrustation is much

different on other parts of the body (e.g., one median emerging incrustation on posterior disc of pronotum, subparallel carinae on scutellum); the shape of the pronotum and the abdomen are also different in the two species, the PE angles of the deltgs are not protruding in *Neoproxius peruvianus*. Pattern of bare (brown) and incrustated surfaces on the ventral side (Fig. 9) is characteristically different from that on *Neoproxius gypsatus* (Fig. 4).

***Neoproxius cubanus* sp. nov.**
(Figs 2–3, 10–17)

Type material – Holotype male: "Coll. Alex. Bierig / Sierra Bonilla / 27. Jan. 1929. / Prov. Hab. CUBA"; paratype female: "Coll. Alex. Bierig / Punta Brava / 1. III. 1931. / Prov. Hab. CUBA"; both deposited in the SDEI.

Diagnosis – The new species can be distinguished from the known species of the genus by the following character states in combination: posterior half of the deltgs II, VI and VII yellow, spiracles II ventral and III–VI not dorsal, anterolateral border of pronotum slightly sinuate, median incrustation on pronotum reaching above head anteriorly, lateral border of deltg VII not reaching PE angle of deltg VI laterally.

Description – Macropterous male and female. Body elongate oval, widest across segment VI, head, pronotum, scutellum, deltgs and ventral side with characteristic incrustation forming elevated carinae on head and pronotum.

Colouration: Body and legs dark brown, femora blackish brown in female, incrustation dirty whitish-yellow, tibiae brown with pale blackish-brown ring basally, tarsi brown, antennae brown, basal two joints darker, basal part of membrane with brownish coloration, deltgs II, VI and VII with clear yellow colouration on posterior part (Figs 2–3).

Structure: Head somewhat shorter than wide across eyes, widest across tip of postocular tubercle (with incrustation). Genae surpassing clypeus, incrustation emerged above clypeus, genae reaching about 3/4 of antennal joint I. Dorsal side incrustated, except two sublongitudinal excavations for the antennae at rest, median longitudinal carina highest, widening posteriorly, with oval area where tip of bristles surrounded by pits are visible. Antenniferous tubercles triangular, slightly diverging. Eyes semiglobose, finely incrustated on male. Postocular portions strongly widening posteriorly, posterolateral angles sharply rounded, posterior margin straight, incrustation narrowing towards neck. Antennae moderately long, joints I, II and IV differently club-shaped, III cylindrical, slightly thickening apically, III and IV stylate. Joint I with incrustation, II–IV bare, IV with long pilosity at apex. Relative length of antennal joints I to IV as 20:13:24:22 (male) / 21:13:26:25 (female). Underside of head incrustated including finely arched lateral carinae of rostral atrium (Fig. 14) and rostrum. Rostrum almost reaching posterior margin of postocular tubercles.

Pronotum irregularly octagonal, bare surfaces greasy. Wide and highly emerging median carinae of incrustation reaching above neck and hind portion of head, bristles in small pits visible on top and at sides. Carinae separated by a median longitudinal groove, terminating posteriorly in a lower, emerging projection. Laterad to carinae and the continued grooves of head for antennae at rest, strong longitudinal carinae reaching forward beyond anterior margin of pronotum. Anterolateral margin slightly sinuate, strongly emerging to blunt anterolateral edges, lateral border of anterior lobe sinuate, ending in small protuberances, shell-like cavity formed by incrustation running parallel with anterolateral margin. Dorsal surface of hind lobe sharply broken along a transversal line, bearing zig-zagged incrustated carinae; pronotum widest at this level. Lateral margins of hind lobe slightly converging posteriorly, posterior margin transversal then deeply cut out to receive incrustation of the scutellum. Incrustated carina emerging along straight posterolateral margin of pronotum laterally. Hemelytra with short corium, widely rounded membrane reaching posterior margin of segment VII.

Prosternum separate, meso- and metasterna and abdominal ventrites I–III fused medially, intersegmental boundary between meso- and metasternum marked by deep and wide depression bent forward at middle.

Scutellum triangular or rather widely V-shaped (anterior margin sinuate), surrounded by moderately emerging incrustation except basal angles and tip. Disc smooth, bare, medially with a reversed Y-shaped, emerging carina.

Abdomen oval, PE angles of deltgs II to V only slightly protruding, VI strongly protruding, VII pointed. Lateral margins straight, that of VII concave, tip posteriorly surpassing any part of segment VIII. Genital segments of female as in Figs 16–17.

Pattern of bare (brown) and incrustated areas on the ventral side of body in male and female basically similar. Eroded incrustation on ventrites I–III revealing depressed areas with rough surface, incrustation emerging from these depressions.

Spiracle II ventral, far from lateral margin, III–VI ventrolateral or lateral, visible (male) / not visible (female) from above, VII slightly dorsolateral, VIII lateral, preapical.

Measurements: Holotype male / paratype female: length of head (including genae) 0.67 mm / 0.73 mm, width of head 0.66 mm / 0.75 mm, length of antennal joints I to IV 0.20 mm, 0.13 mm, 0.24 mm, 0.22 mm (male) / 0.21 mm, 0.13 mm, 0.25 mm, 0.25 mm (female), length of pronotum (from anterior border of median incrustation) 1.00 mm / 1.13 mm, width of pronotum 1.34 mm / 1.49 mm, median length of scutellum 0.48 mm / 0.52 mm, width of scutellum 0.77 mm / 0.83 mm, maximum width of abdomen 1.98 mm / 2.13 mm across segment V, body length 4.42 mm / 5.01 mm.

Remarks – This species cannot be identified using the key of Kormilev (1982*a*). It matches the statement "Spiracles II at least are ventral" (couplet 5), but here *Neoproxius nicaraguensis* has no median ridge on scutellum, while *Neoproxius costariquensis* (Kormilev, 1982) has a different pattern of spiracles (III–VI are all dorsal, but ventrolateral or lateral on *Neoproxius cubanus* sp. nov.) and a number of other morphological differences.

The new species resembles *Neoproxius schwarzii* in general appearance, but differs in the following characters (first the character state of *Neoproxius cubanus* sp. nov. then that of *Neoproxius schwarzii* are mentioned): spiracle II ventral vs. lateral; postocular portion of head about as long as preocular portion vs. postocular portion longer; emerging median incrustation of pronotum reaching forward beyond anteromedian ones and above head vs. median incrustations not reaching beyond anteromedian ones and above head; incrustation on hind disc zig-zagged vs. undulate; deltg VI pentangular vs. quadrangular; lateral border of deltg VII not reaching PE angle of deltg VI laterally vs. reaching it.

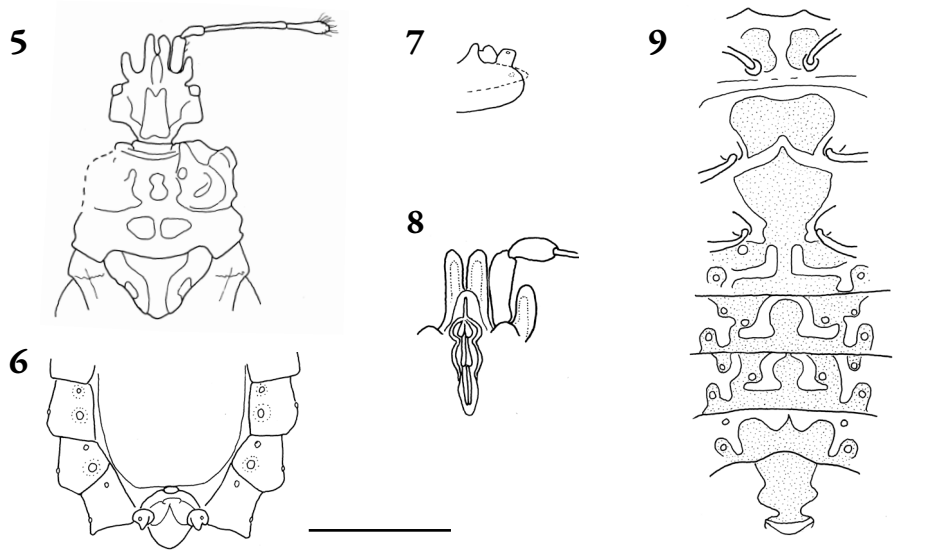
Ventral side of body with similar pattern of bare (brown) and incrustated areas than in *Neoproxius bolivianus* sp. nov., except for the last two abdominal segments.

Neoproxius gypsatus (Bergroth, 1898)
(Fig. 4)

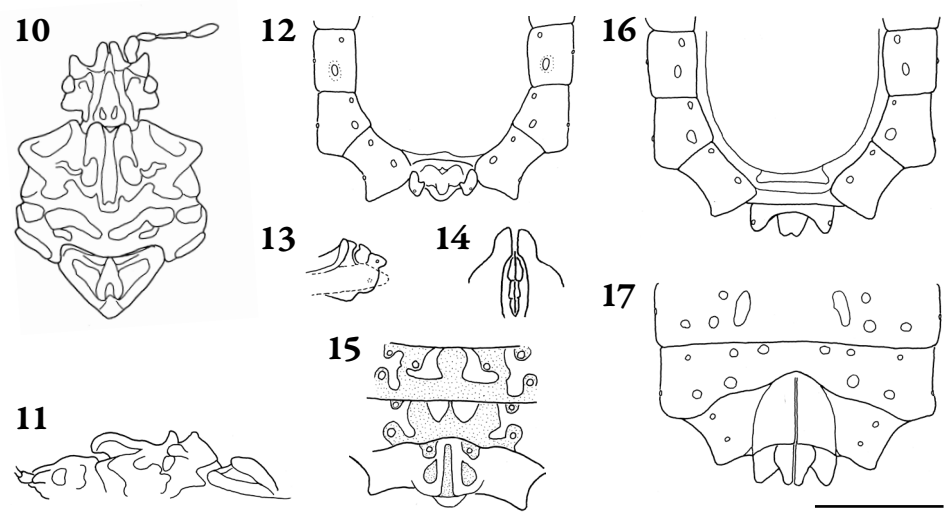
Material examined – One female: "Paraguay / Vezényi // Asuncion / 904. X. 16. // Proxius / gypsatus Bergroth / Det N. Kormilev 53"; deposited in the HNHM.

Remarks – The species was reported from several countries in Central and South America (Heiss 2020), but it has remained unknown from Paraguay. The specimen has an incrustation which shows no adhesivity to water, ventral incrustated (yellow) areas are thus well visible when submerged in water (Fig. 4). The pattern of bare (brown) and incrustated (yellow) areas is distinctly different from those found on the other two species treated here.

Figs 1–4. Habitus photos, 1 = *Neoproxius bolivianus* sp. nov., male holotype, 2 = *Neoproxius cubanus* sp. nov., male holotype (the wing is budged), 3 = *Neoproxius cubanus* sp. nov., female paratype, 4 = *Neoproxius gypsatus* (Bergroth, 1898), female in ventral view (made on in water submerged specimen). Scale bar = 1 mm (photos by Tamás Vásárhelyi)



Figs 5–9. *Neoproxius bolivianus* sp. nov., male holotype, 5 = head, pronotum and scutellum, 6 = tip of abdomen, dorsal view, 7 = same, lateral view, 8 = rostrum in rostral atrium, dotted line shows the size of genae and antenniferous tubercle under the incrustation, 9 = pattern of glabrous (brown, dotted) and incrustated areas on the ventral side. Scale bar = 1 mm, Figs 7–9 are out of scale (drawings by Tamás Vásárhelyi)



Figs 10–17. *Neoproxius cubanus* sp. nov., male holotype (Figs 10–15) and female paratype (Figs 16–17), 10 = head, pronotum and scutellum in dorsal view, 11 = same, lateral view, 12 = tip of abdomen, dorsal view, 13 = same, lateral view, 14 = rostrum in rostral atrium, 15 = pattern of bare (brown, dotted) and incrustated areas on the ventral side of segments V–VII, 16 = tip of abdomen, dorsal view, 17 = same, ventral view. Scale bar = 1 mm, Figs 14–15 are out of scale (drawings by Tamás Vásárhelyi)

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Acknowledgements – The author is indebted to Gábor Bakonyi (former Editor in Chief of *Acta Zoologica Academiae Scientiarum Hungaricae*) for his comments on the manuscript, to Dávid Rédei (National Chung Hsing University, Taichung) for his invaluable help in correcting it, and to Aranka Grabant (HNHM) for her help in the preparation of figures.

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