



A new species of *Pyrrhosphodrus* (Hemiptera: Heteroptera: Reduviidae) from the Caatinga ecosystem in Brazil, with notes on the genus

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Abstract

A new species of Reduviidae (Hemiptera: Heteroptera) from Caatinga ecosystem, *Pyrrhosphodrus caatingensis* Lapischies & Forero **sp. nov.**, is described. The new species is distinguished from its congeners by its overall reddish coloration with black areas; by the black legs, with femora with a subapical yellowish broad ring, tibiae with apical and subapical yellowish annuli; and genital characters. Comments about the biology, feeding habits, habitus, genitalic images, and a distribution map of the new species are given. In addition, the following synonymy is proposed: *Pyrrhosphodrus militaris* Stål, 1866 = *P. theresina* (Berg, 1879), **syn. nov.** A key to separate the known species of *Pyrrhosphodrus* Stål, 1866 is provided.

Key words: Assassin bug, dry forest, Harpactorinae, Harpactorini, Neotropical, semi-arid, synonymy

Introduction

With more than 2,800 described species within 320 genera, Harpactorinae is the largest subfamily of Reduviidae (Hemiptera: Heteroptera) (Weirauch *et al.* 2014). The tribal classification of Harpactorinae is not settled (Zhang *et al.* 2016), authors have proposed six or seven tribes for the subfamily (Davis 1969; Weirauch *et al.* 2014); two of which occur in the Neotropics: Apiomerini and Harpactorini (Forero 2011). Apiomerini, restricted to the Neotropical region, comprise 12 extant genera and one fossil genus (Putshkov & Putshkov 1985; Maldonado Capriles 1990; Maldonado Capriles *et al.* 1993; Bérenger 2006); whereas Harpactorini, with a worldwide distribution, comprise 53 genera in the Neotropical region (Forero *et al.* 2004; Forero 2011; McPherson & Ahmad 2011; Gil-Santana *et al.* 2017). Within Harpactorini, several genera of the subfamily are known only by the original description or by brief mentions in catalogs or faunistic checklists, with no modern treatments or revisionary works. Given the diversification of this group, and the amount of new species yet to be discovered, it is necessary to produce more accurate and fully documented taxonomic works (Ang *et al.* 2013).

Among Neotropical Harpactorini, *Pyrrhosphodrus* Stål, 1866 was proposed to accommodate two new species from Brazil: *P. militaris* Stål, 1866, and *P. amazonus* Stål, 1866. Later, Wygodzinsky (1947) transferred *Heniarthes theresina* Berg, 1879, described from Argentina, to *Pyrrhosphodrus*. Subsequently, Wygodzinsky (1949) transferred another species to *Pyrrhosphodrus*, *Velinus geraesensis* Fallou, 1887, described from Brazil, and fixed *P. amazonus* as the type species of the genus. Very little is known about species of *Pyrrhosphodrus*. *Pyrrhosphodrus militaris* was studied by Forattini & Serra (1950) who collected live specimens in Serra da Cantareira, São Paulo (Brazil), which were reared in laboratory and described the male genitalia, eggs, first and second instar nymphs. The remaining species of the genus are known only by their original descriptions, with no documentation of their genitalic characters or biological attributes.

Caatinga is an ecosystem in northeastern Brazil, characterized by semi-arid climate. Its peculiar vegetation shows a clearly seasonal pattern. Caatinga has a wet season, ranging from January to June, and a dry season during the rest of the year, when plants and animals, markedly insects, diminish their activities (Leal *et al.* 2003; Vasconcellos *et al.* 2010; Silva *et al.* 2018). Despite gaps in the knowledge of various groups, recent studies show high endemism rates of its fauna, due to the complex evolutionary history of Caatinga, with periods of intense biotic exchanges between neighboring ecosystems and periods of biotic isolation (Leal *et al.* 2003; Silva *et al.* 2018).

Based on material collected in Caatinga we describe a new species of *Pyrrhosphodrus*. We comment on the biology of the species and give a distribution map of the collecting sites where the species has been recorded. Furthermore, based on the original description and the examination of photographs we propose a new synonymy in *Pyrrhosphodrus*, and provide a key to the species of the genus.

Material and methods

We mostly followed Forero & Weirauch (2012) for dissections. The specimens were preserved in 70% ethanol. The pygophore was removed from specimens preserved in alcohol, washed in distilled water before being cleared in heated 10% potassium hydroxide (KOH) solution for three minutes and washed once more in distilled water. The phallus was removed from the pygophore through the posterior opening and expanded mechanically with help of thin forceps; original color was maintained. In females, the abdomen was cut at the level of seventh segment, softened in distilled water and in a cold 10% solution of KOH for about 10 minutes, then washed in distilled water and returned to KOH as needed, finally stained with Congo Red.

External morphology and genital terminology follow Davis (1966) and Forero & Weirauch (2012). Dissections and measurements were made under a stereomicroscope Nikon SMZ800. Photos were taken using a Nikon AZ100, equipped with NIS-Elements AR software. All measurements are in millimeters and represent mean values. Distribution map was made using QGIS software version 2.10.1, with *shapefiles* freely available from IBGE (2016). For image editing we used Adobe Photoshop software version CS5.1. The following abbreviations were used: **al**, apical lobe of endosoma; **ap**, anterior projection of gonapophysis 8; **cs**, central sclerite of endosoma; **dps**, dorsal phallosclerite; **ls**, lateral sclerotization of endosoma; **ml**, medial subapical lobe of endosoma; **mov**, median oviduct; **mpp**, medial process of pygophore; **pa**, paramere; **sf**, sclerotized folds of bursa.

The specimens corresponding to the new species are deposited in the collections of the Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Brazil (MCNZ) and CEMA Fauna—Universidade Federal do Vale do São Francisco (UNIVASF). Other examined specimens belong to the following collections: Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Brazil (MCTP); Museo Javeriano de Historia Natural, Pontifícia Universidad Javeriana, Bogotá, Colombia (MPUJ); Museu de Zoologia, Universidade de São Paulo, Brazil (MZSP); and Swedish Museum of Natural History (NHRS).

Pyrrhosphodrus caatingensis Lapischies & Forero sp. nov.

(Figs 1–10, 13–15)

Type material. Holotype. ♂. **BRAZIL.** Brejo Santo, Ceará [CE]. Açude Atalho—PMN11 (7°38'41.4"S 38°52'18.8"W); Col. Ativa 30/III/2015; R. P. Salomão leg. (MCNZ 182464). **Paratypes:** same data as the holotype: 1 ♂ (MCNZ 182465) and 3 ♀ (MCNZ 182466, 182467, 182468); 2 ♀ (UNIVASF); 3 ♀ and 2 ♂, Salgueiro, Pernambuco [PE]; PMN08; Col. Ativa 30/III/2015; F. C. Costa leg. (specimens preserved in alcohol, MCNZ number 182469).

Diagnosis. General coloration reddish with black markings. Body covered with short, erect, stiff setae, except on membrane of hemelytra. Hemelytra black, except base and distal third of corium and base of clavus which are reddish. Labium yellow; coxae reddish; trochanters darkened; femora black, each with a subapical yellowish broad ring with a very narrow, brown annulation; tibiae black with apical and subapical yellowish annuli. Connexivum visible in dorsal view.

Description. Male: Total length 12–14 mm.

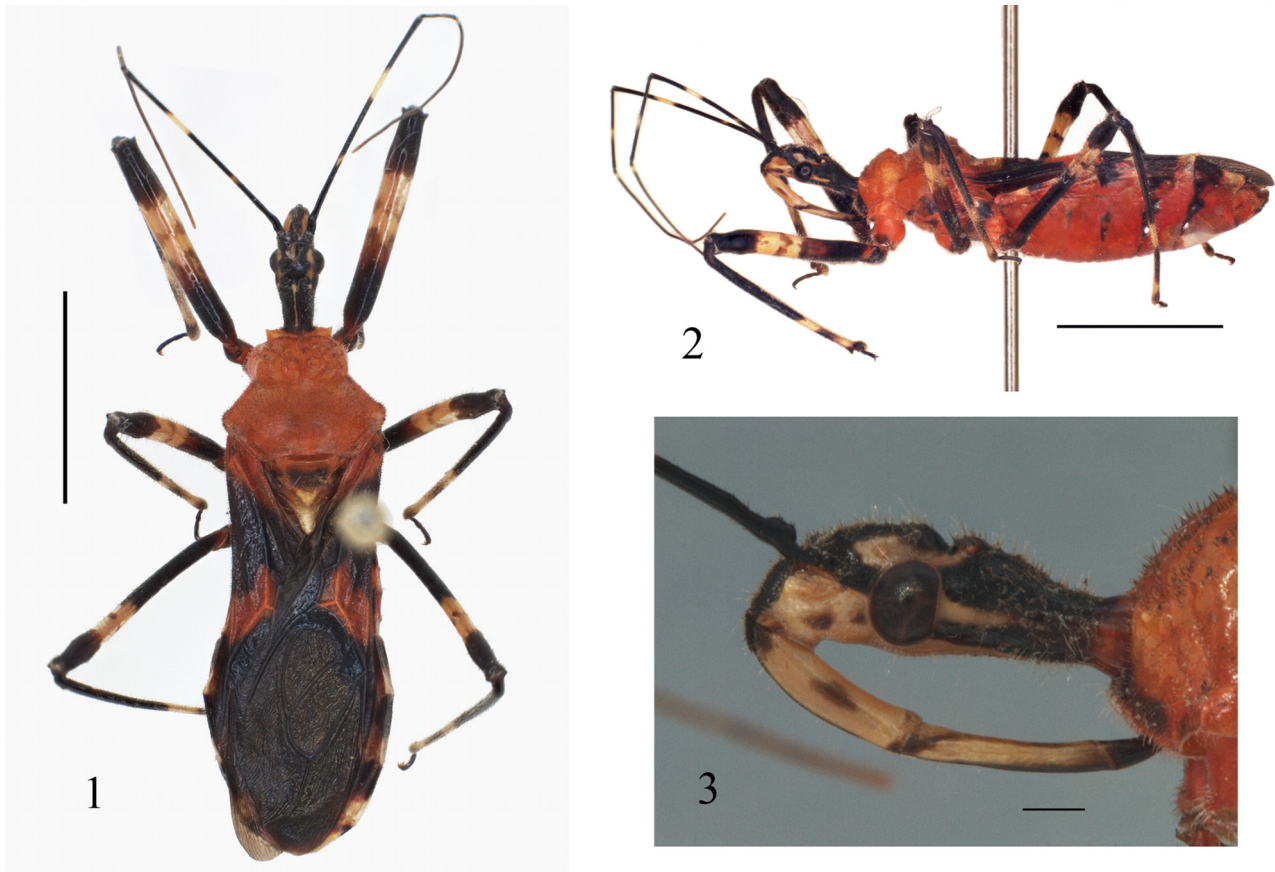


FIGURE 1–3. Habitus of *Pyrrhosphodrus caatingensis* sp. nov. 1, dorsal view; 2, lateral view; scale bars = 5 mm; 3, detail of head, lateral view; scale bars = 0.5 mm.

Head. Length 2.92 mm. Dorsal color black, with yellow marks: a dot between ocelli continued posteriorly by a mid-longitudinal stripe; paired spots on interocular area and one lateral stripe from eye up to middle of posterior lobe. Ventral surface yellow. Antenniferous tubercle with small protuberance. Antennal segments black; first segment with a very faint, narrow, yellow annulus at basal third, subapically on distal third with a broad yellow annulus; small protuberance basally on first segment; fourth segment paler than remaining. Antennal segments: 6; 2.5; 3.6; 2. Interocular area elevated; transverse sulcus deep. Postocular lobe 0.75 times as long as anterior lobe. Ocelli elevated. Labial segments yellowish, blotched with dark brown. First visible labial segment reaching posterior margin of eye; second segment slightly curved.

Thorax. Pronotum length 3.0 mm, anterior lobe about half of pronotum length. Anterior width 1.98 mm, posterior width 3.96 mm. Surface reddish, entirely covered with short, erect, stiff setae. Anterior pronotal lobe with paired protuberances on disc; medial longitudinal sulcus deeply impressed, not continuing into posterior lobe; anterior angles produced anteriorly as a tit-like projection. Humeral angles rounded and elevated. Posterior lobe slightly depressed medially. Scutellum reddish along basal and lateral margins; in middle, basally blackish with a yellow V-like central elevation, becoming lighter toward apex, which is almost white. Two dark stripes parallel to prosternal sulcus, almost reaching anterior margin of procoxal cavity. Legs black; femora each with a yellowish broad ring with a central very narrow brown annulation; forefemur thicker than mesofemur, and both thicker than metafemur. Tibiae with apical and subapical narrow yellowish annuli. Forewings reaching apex of abdomen; hemelytron shiny black, covered with small setae; corium basally, and apically on area from anterior region of quadrate cell to costal vein reddish; clavus on basal half reddish.

Abdomen. Venter mostly reddish, with whitish lateral dots, anterior margin of sternites V–VII darkened on dorsal half. Connexivum dorsally visible, segments on anterior half with black marks at anterolateral external angle, posterior half of each segment pale, posterolateral angle of each segment protruding.

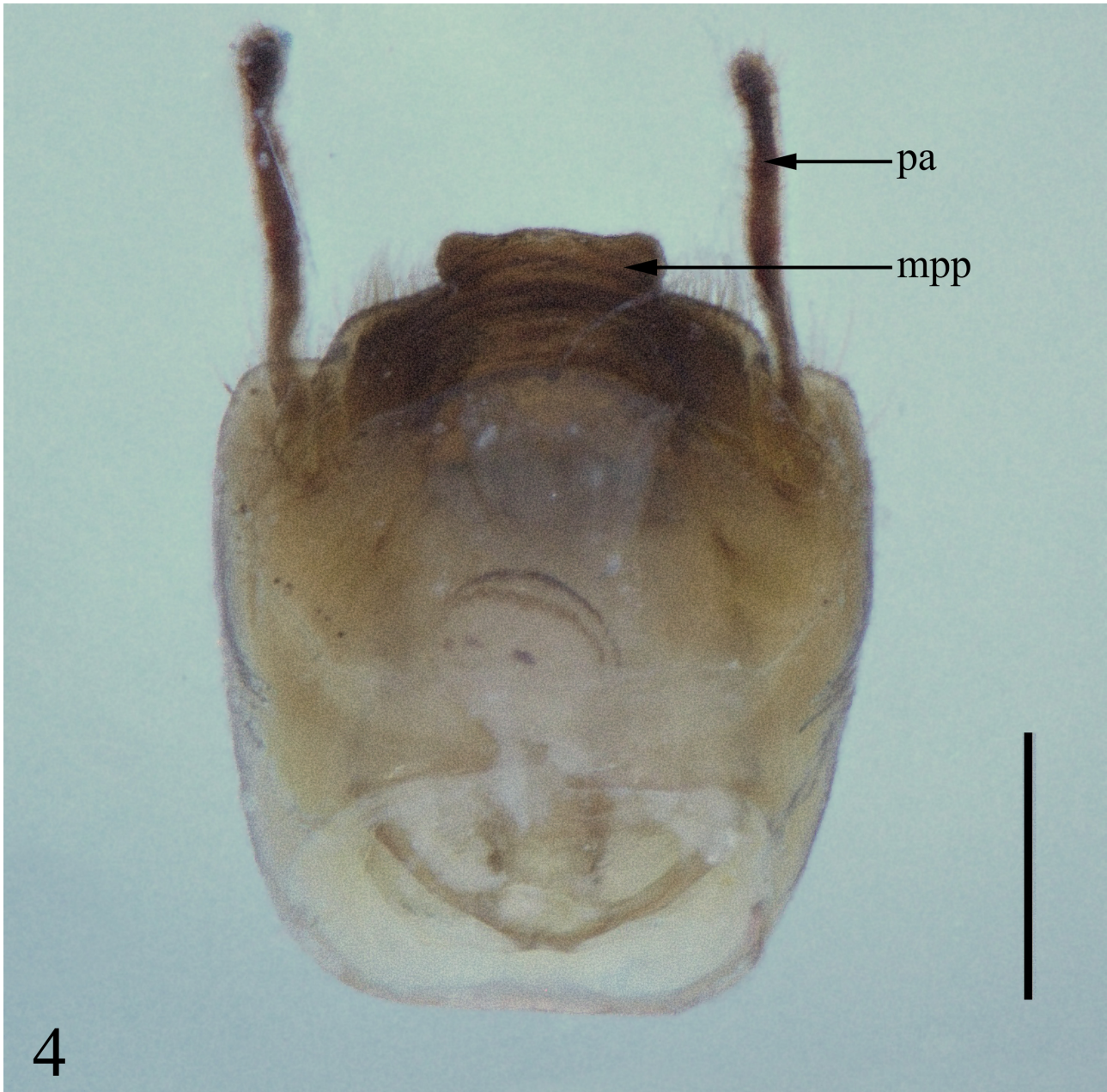


FIGURE 4. Pygophore of *Pyrrhosphodrus caatingensis* sp. nov.: dorsal view. mpp—medial process of pygophore, pa—paramere. Scale bar = 0.5 mm.

Genitalia. Pygophore ovoid in lateral view, subquadrate in dorsal view (Figs 4–5); medial process of pygophore directed caudad, in dorsal view broad, short, posterior margin sinuate, posterolateral angles broadly rounded (Fig 4, mpp), in caudal view strongly concave. Parameres (Figs 4–5, pa) 0.4 times as long as length of pygophore, diameter uniform, slightly sinuous in lateral view, rounded, slightly expanded, with setae at apex. *Phallus.* Basal plate subtriangular with bridge as long and thick as the arms of basal plate. Dorsal phallothecal sclerite (Figs 6–7, dps) wider basally, lateral margins sinuous, apically strongly curved dorsally, apex broadly rounded, with median small tooth on posterior margin. Endosoma with a distal dorsal lobe, apically with strongly sclerotized spicules (Figs 6–8, al); medial subapical lobe membranous (Fig 7, ml); lateral lobes strongly sclerotized (Figs 6–8, ls), very broad basally, tapering apically, with very fine denticles at apex. Medial lobe sclerotized (Fig 6, cs).

FEMALE. Total length 13.8–15.5 mm. General characters as described for male, except as follows.

Genitalia. Gonapophysis 8 setosae at apex (Fig 9). Bursa copulatrix membranous, trapezoid, wider anteriorly

(Fig 10); median oviduct (Fig 10, mov) connects to folded anterior medial portion of bursa copulatrix, which has slightly sclerotized folds (Fig 10, sf); ventral surface with anterior projections of gonapophysis 8 sclerotized, long, almost reaching sclerotized folds, tapering and curved medially on anterior end (Fig 10, ap).

Etymology. The epithet refers to Caatinga, an exclusively Brazilian ecosystem from which the species is known.

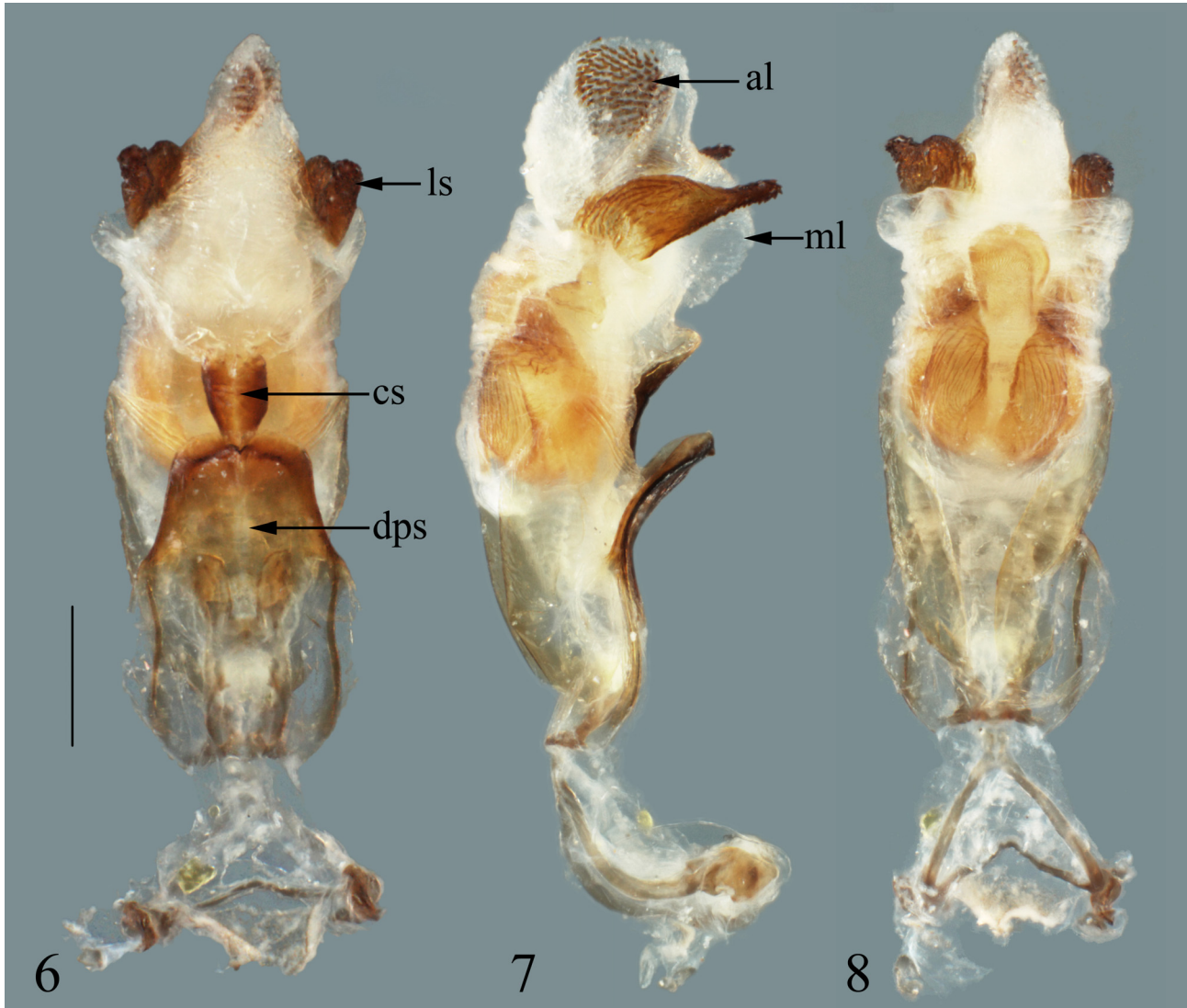


FIGURE 5. Pygophore of *Pyrrhosphodrus caatingensis* sp. nov., right lateral view. Scale bar = 0.5 mm.

Distribution and bionomics. The species was recorded at 23 of 24 monitoring points of the artificial transposition of the main course of São Francisco River (Fig 15), which is one of the longest Brazilian rivers, running through five states (Minas Gerais, Bahia, Pernambuco, Sergipe and Alagoas). Observed specimens were distributed in Caatinga vegetation and were active throughout the year. Specimens were usually collected on *Cleome spinosa* Jacq. (Cleomaceae), a species native to South America, which is found in open areas near rivers, lakes and ponds (Figs 11–12).

Pyrrhosphodrus belongs to a Neotropical clade that contains also the genera *Pselliopus* Bergroth, 1905 and *Cosmoclopius* Stål, 1866 (Zhang & Weirauch 2014), none of which possess sticky glands on the forefemur (Zhang & Weirauch 2013), which is congruent with previous observations of some species of *Pselliopus* and *Cosmoclopius* found on sticky plants such as *Cleome* (e.g., Cobben & Wygodzinsky 1975). Finding this new species of *Pyrrhosphodrus* associated with a sticky plant reinforces the idea that species lacking sticky glands on the forelegs might be associated with plant with glandular trichomes that aid in prey capture (Zhang & Weirauch 2013).

The species seems to be a generalist predator, because it was observed feeding on different insects that visit *C. spinosa*, such as Meliponini bees (Hymenoptera) (Fig 13) and Cicadellidae (Hemiptera). Mating was also recorded on *C. spinosa* (Fig 14).



FIGURES 6–8. Phallus partially expanded of *Pyrrhosphodrus caatingensis* sp. nov.: 6, dorsal view; 7, lateral view; 8, ventral view. al—apical lobe of the endosoma, cs—central sclerite of endosoma, dps—dorsal phallotecal sclerite, ls—lateral sclerotization of endosoma, ml—medial subapical lobe of endosoma. Scale bar = 0.5 mm

Discussion. *Pyrrhosphodrus caatingensis* sp. nov. is easily distinguished from all other species of *Pyrrhosphodrus* by the reddish pronotum and abdomen, and the mostly black legs. *Pyrrhosphodrus caatingensis* sp. nov. can be set apart from *P. amazonus* and *P. geraesensis* by the uniformly colored pronotum, whereas in these two species the pronotum has a black transverse band. *Pyrrhosphodrus caatingensis* sp. nov. is similar to *P. militaris* because of the uniformly colored pronotum. *Pyrrhosphodrus caatingensis* sp. nov. can be distinguished from *P. militaris* by the reddish pronotum, the paired protuberances on the disk of the anterior lobe of the pronotum, and by the mostly black legs. In *P. militaris* the pronotum is yellowish, the disk of the anterior pronotal lobe is flat, and the femora are yellowish with pale brown annuli and the tibiae are dark with a basal yellowish annulus.

Forattini & Serra (1950) presented schematic drawings for the pygophore and aedeagus of *P. militaris*. We document the female genitalia of *P. caatingensis* sp. nov., the first for any species of *Pyrrhosphodrus*. Despite not being able to compare in detail the genitalic structure of *P. caatingensis* sp. nov. with *P. militaris* or other species, we consider the former as a new species based on its morphology and its particular coloration pattern. Future studies might corroborate this hypothesis with additional data, including genitalic structures.



FIGURE 9. Genital plates of *Pyrrhosphodrus caatingensis* sp. nov., ventral view. Scale bar = 0.5 mm.

Pyrrhosphodrus militaris Stål, 1866

Pyrrhosphodrus militaris Stål (1866: 298) (new species); Stål (1872: 87) (diagnosis, distribution); Wygodzinsky (1949: 44) (checklist); Forattini & Serra (1950: 229) (redescription, biology); Putshkov & Putshkov (1988: 154) (catalog); Maldonado Capriles (1990: 269) (catalog).

Heniartes theresina Berg (1879: 156) (new species), **syn. nov.**

Pyrrhosphodrus theresina: Wygodzinsky (1947: 13) (new generic placement, photos of type); Wygodzinsky (1949: 44) (checklist); Putshkov & Putshkov (1988: 154) (catalog); Maldonado Capriles (1990: 269) (catalog), **syn. nov.**

Material studied: 1 ♂ **BRAZIL**, São Paulo, Ipiranga, 02/VII/1907, H. Luideswaldt leg., MZSP 72800, *Pyrrhosphodrus* sp. C. Campaner det 2002; 1 ♀ Rio Grande do Sul, São Francisco de Paula (Pro-Mata), 26/I/1998, C. Weirauch leg., *Pyrrhosphodrus theresina* C. Weirauch det. III/1993, MCTP 13724; 1 ♀ same locality as above, 8/III/1998, C. Weirauch leg., *Pyrrhosphodrus theresina* C. Weirauch det. III/1993, MCTP 13665. Photo of a female syntype of *P. militaris*, housed at NHRS, collection number 0359.

Distribution. *Pyrrhosphodrus militaris* was described from Brazil (Stål 1866) and later recorded from the state of São Paulo (Forattini & Serra 1950), now has its distribution broadened to south Brazil and Argentina.

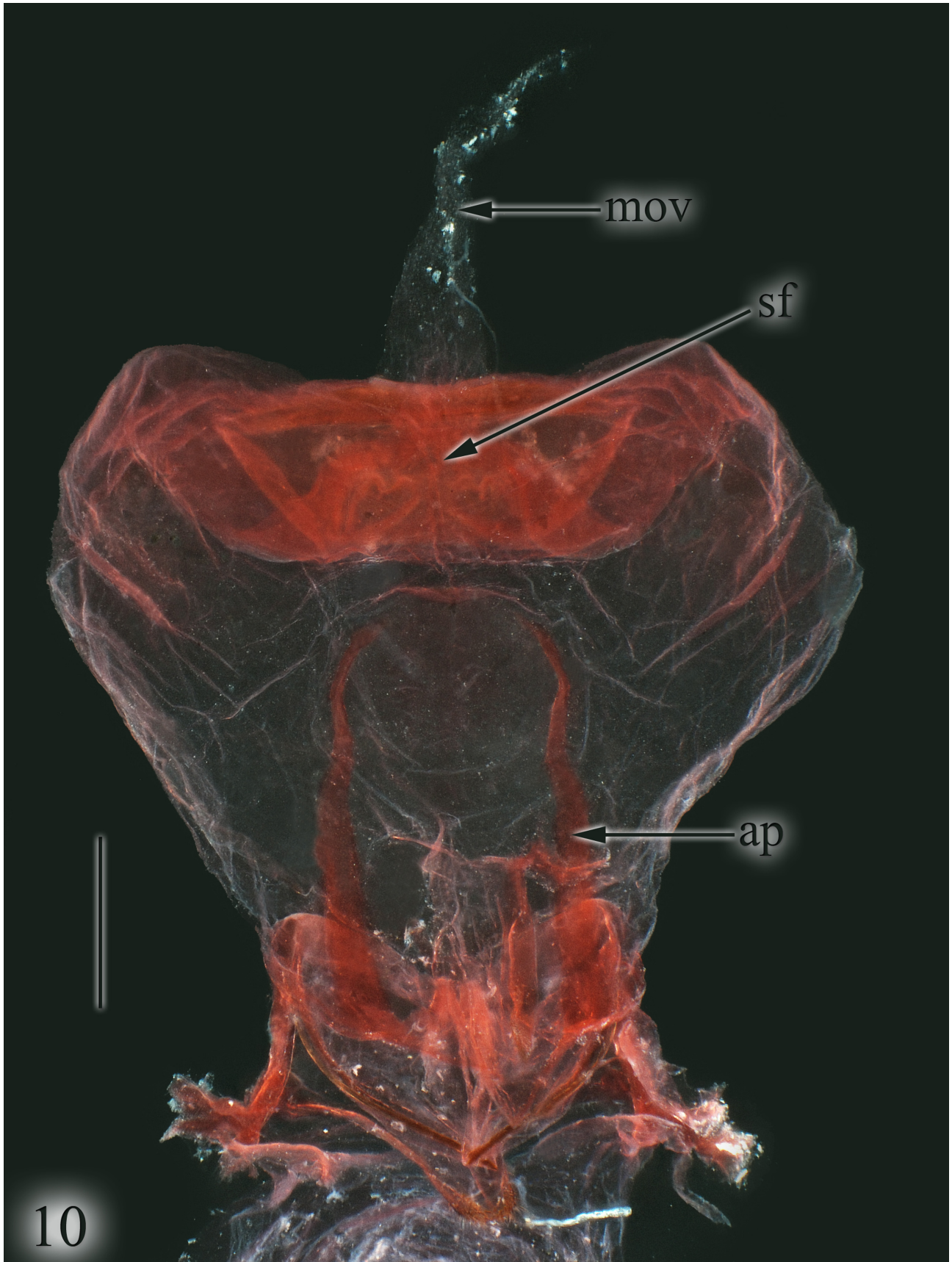
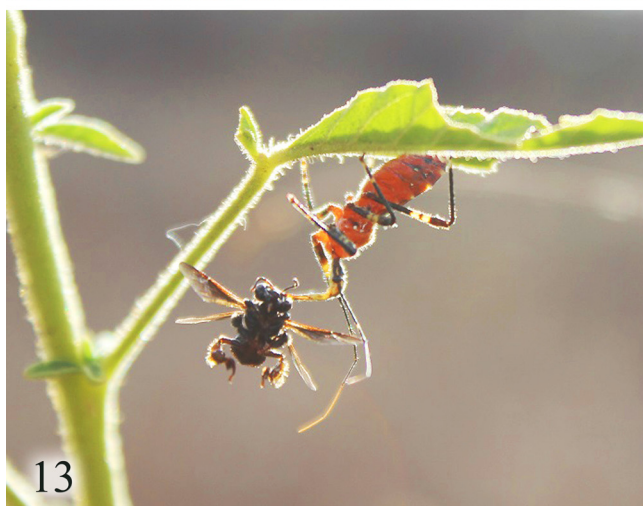


FIGURE 10. Bursa copulatrix of *Pyrrhosphodrus caatingensis* sp. nov., ventral view. ap—anterior projection of gonapophysis 8, mov—median oviduct, sf—sclerotized folds of bursa. Scale bar = 0.5 mm.

Discussion of the systematic decision. Stål (1866) described *P. militaris* as pale yellow with multiple annuli on the legs, and the abdomen with black and yellowish bands, but without indicating the relative width between the two. Berg (1879) described a very similar coloration pattern in *P. theresina*, without indicating the color of the abdomen. The examined specimen (photo) of the syntype series of *P. militaris* (Figs 16–18) has a mostly black abdomen with very faint pale yellowish areas. We tried to study the holotype of *Heniartes theresina* from “Corrientes” (Argentina) that is deposited at La Plata museum, but recent inquiries show that only the original labels are left, with no trace of the specimen described by Berg (P. M. Dellapé, *pers. communication*). Nonetheless, Wygodzinsky (1947) reproduced a photo of the holotype. With these photographs, in addition to some examined specimens that fit both descriptions, we conclude that the two names represent the same species. Both have characteristic leg color patterns, a mostly black abdomen, and an apically broad, pale yellow, upcurved scutellum. This combination of characters is not present in any of the known species of *Pyrrhosphodrus*; therefore, we consider these two names as synonyms, and *P. militaris* has priority.



FIGURES 11–14. Aspects of the habitat and biology of *Pyrrhosphodrus caatingensis* **sp. nov.**: 11, sampling site in the municipality of Floresta, state of Pernambuco, Brazil; 12, inflorescence of *Cleome spinosa*; 13, predation on a Meliponini (Hymenoptera). 14, a couple mating.

Pyrrhosphodrus amazonus Stål, 1866

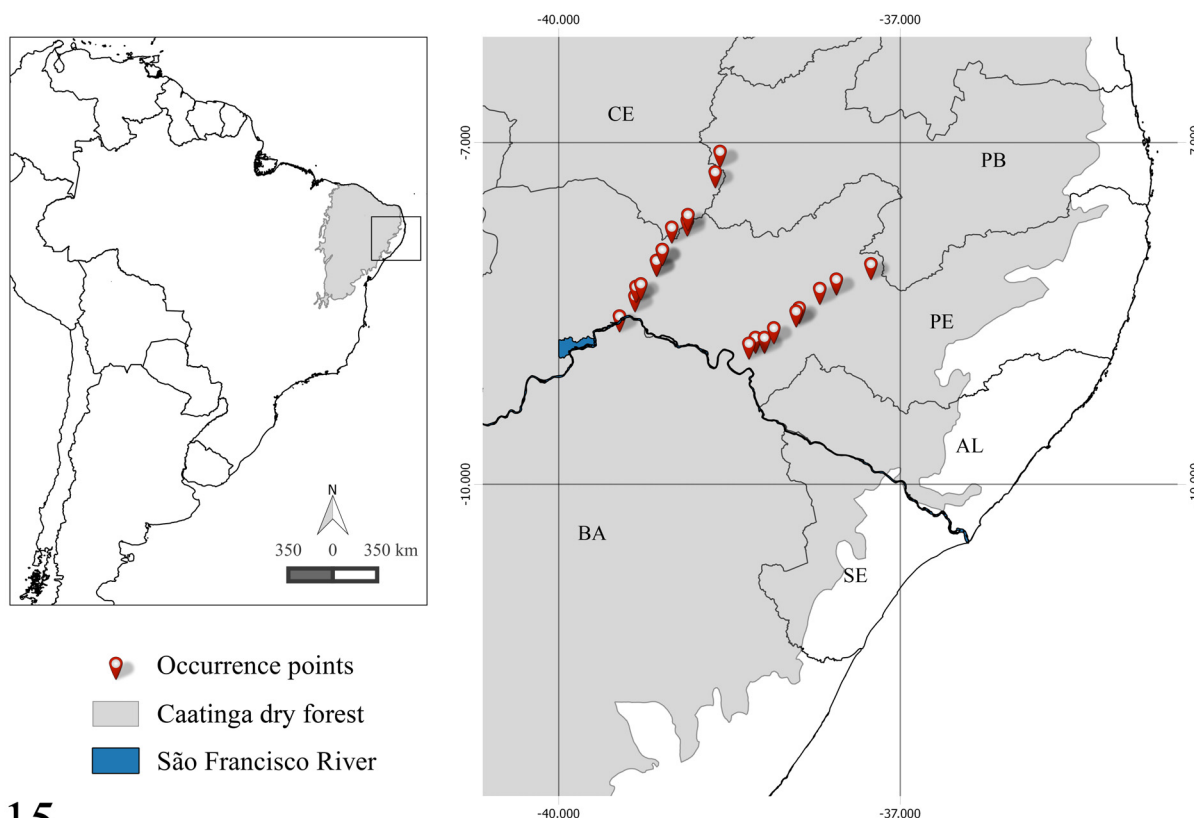
Pyrrhosphodrus amazonus Stål (1866: 298) (new species); Stål (1872: 87) (diagnosis, new variety, distribution); Wygodzinsky (1949: 44) (checklist); Putshkov & Putshkov (1988: 154) (catalog); Maldonado Capriles (1990: 269) (catalog).

Material studied: 1 ♀ **COLOMBIA**, Meta, San Martín, San Francisco, Hacienda Tocancipá, 330 m, 20/IV/2005,

Romero *et al.* leg. MPUJ_ENT 0011151 (MPUJ). Photo of a female syntype of *P. amazonus*, housed at NHRS, collection number 0358.

Distribution. *Pyrrhosphodrus amazonus* was described from Northern Brazil (Stål, 1866) and subsequently recorded from Colombia (Stål, 1872).

Discussion. Similarly to the situation with *P. militaris* (see above), *P. amazonus* and *P. geraesensis* share a common color pattern. We did not have access to the type specimen of *P. geraesensis*, however, based on the original description, it seems very similar to *P. amazonus* except by the characters mentioned in the key. Fallou (1887) ambiguously described leg coloration, leaving for interpretation the pattern of black annuli present on all the femora; thus we interpreted the description as indicated below in the key. Further examination of the type specimen of *P. geraesensis* might help decide if these two species really are synonyms.



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FIGURE 15. Sampling sites of *Pyrrhosphodrus caatingensis* sp. nov. in northeastern Brazil (AL—Alagoas, BA—Bahia, CE—Ceará, PB—Paraíba, PE—Pernambuco).

Key to *Pyrrhosphodrus* species

- | | | |
|--------|--|---------------------------------|
| 1 | Pronotum with a transverse black line between anterior and posterior lobes | 2 |
| 1' | Pronotum unicolor | 3 |
| 2 (1) | Scutellum black with a middle yellow spot; membrane of hemelytra bordered with black; all femora yellowish with black annuli | <i>P. geraesensis</i> |
| 2' | Scutellum not black; membrane of hemelytra not bordered with black; femora yellowish, apically black, hind femur in addition with medial black annuli | <i>P. amazonus</i> |
| 3 (1') | General color yellowish; fore- and mesofemora yellowish with obsolete annulations; prosternum unicolor; abdominal sternites mostly black with yellow bands | <i>P. militaris</i> |
| 3' | General color reddish; fore- and mesofemora black with conspicuous subapical pale brown annuli; two parallel dark stripes lateral to the prosternal sulcus; abdominal sternites reddish, anterior margin of segments V–VII darkened, with small whitish lateral dots | <i>P. caatingensis</i> sp. nov. |



FIGURE 16–18. Syntype of *Pyrrhosphodruss militaris* housed at NHRS: 16, dorsal view; 17, ventral view. Scale bar = 10 mm. 18; labels. Photos: Gunvi Lindberg.

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References

- Ang, Y., Wong, L.J. & Meier, R. (2013) Using seemingly unnecessary illustrations to improve the diagnostic usefulness of descriptions in taxonomy—a case study on *Perochaeta orientalis* (Diptera, Sepsidae). *ZooKeys*, 355, 9–27. <https://doi.org/10.3897/zookeys.355.6013>
- Berg, C. (1879) *Hemiptera Argentina enumeravit speciesque novas*. Pauli E. Coni ed., Buenos Aires, 316 pp. <https://doi.org/10.5962/bhl.title.36493>
- Bérenger, J.M. (2006) Un nouveau genre d’Apiomerini du Brésil (Heteroptera, Reduviidae, Harpactorinae). *Nouvelle Revue*

d'Entomologie, 22, 369–375.

- Cobben, R.H. & Wygodzinsky, P. (1975) The Heteroptera of the Netherlands Antilles—IX Reduviidae (Assassin bugs). *Studies on the Fauna of Curaçao and other Caribbean Islands*, 158, 1–62.
- Davis, N.T. (1966) Contributions to the morphology and phylogeny of the Reduivoidea (Hemiptera: Heteroptera). Part III. The male and female genitalia. *Annals of the Entomological Society of America*, 59, 911–924.
<https://doi.org/10.1093/aesa/59.5.911>
- Davis, N.T. (1969) Contribution to the morphology and phylogeny of the Reduivoidea. Part IV. The Harpactoroid complex. *Annals of the Entomological Society of America*, 62, 74–94.
<https://doi.org/10.1093/aesa/62.1.74>
- Fallou, C.F. (1887) Diagnoses d'Hémiptères nouveaux de Minas Geraes. *Le Naturaliste*, 2, 68.
- Forattini, O. & Serra, O. (1950) Contribuição ao conhecimento da morfologia e biologia de *Pyrrhosphodrus militaris* Stål, 1866 (Hemiptera, Harpactorinae). *Dusenía*, 1, 229–236.
- Forero, D., Weirauch, C. & Baena, M. (2004) Synonymy of the reduviid (Hemiptera: Heteroptera) genus *Torrealbaia* (Triatominae) with *Amphibolus* (Harpactorinae), with notes on *Amphibolus venator* (Klug, 1830). *Zootaxa*, 670 (1), 1–12.
<https://doi.org/10.11646/zootaxa.670.1.1>
- Forero, D. (2011) Classification of Harpactorinae assassin bugs (Hemiptera: Heteroptera: Reduviidae). *Boletín del Museo Entomológico Francisco Luis Gallego*, 3, 9–24. [ISSN 2027-4378]
- Forero, D. & Weirauch, C. (2012) Comparative genitalic morphology in the New World resin bugs Apiomerini (Hemiptera, Heteroptera, Reduviidae, Harpactorinae). *Deutsche Entomologische Zeitschrift*, 59, 5–41.
<https://doi.org/10.1002/mmnd.201200001>
- Gil-Santana, H., Salomão, A. & Oliveira, J. (2017) First description of the male and redescription of the female of *Parahiranetis salgadoi* Gil-Santana (Hemiptera, Reduviidae, Harpactorinae). *ZooKeys*, 671, 19–48.
<https://doi.org/10.3897/zookeys.671.11985>
- IBGE (2016) Available from: <ftp://geofp.ibge.gov.br/> (accessed 20 October 2016)
- Leal, I.R., Tabarelli, M. & Silva, J.M.C. (2003) *Ecologia e Conservação da Caatinga*. Editora Universitária UFPE, Recife, 822 pp.
- Maldonado Capriles, J. (1990) *Systematic catalogue of the Reduviidae of the World*. Caribbean Journal of Science, University of Puerto Rico, Mayagüez, 355 pp.
<https://doi.org/10.1093/aesa/85.4.532>
- Maldonado Capriles, J., Santiago-Blay, J.A. & Poinar, G.O. (1993) *Apicrenus fossilis* n. gen & n. sp. (Heteroptera: Reduviidae: Apiomerinae) from Dominican amber (lower Oligocene—upper Eocene). *Entomologica Scandinavica*, 24, 139–142.
<https://doi.org/10.1163/187631293X00244>
- McPherson, J.E. & Ahmad, I. (2011) *Parasinea*, a new genus of assassin bug, with description of a new species from Colombia (Hemiptera: Heteroptera: Reduviidae). *Annals of the Entomological Society of America*, 104, 1285–1291.
<https://doi.org/10.1603/AN11128>
- Putshkov, V.G. & Putshkov, P.V. (1985) A catalogue of assassin-bug genera of the World (Heteroptera, Reduviidae). Published by the authors, deposited in VINITI [All-Union Institute of Sci. & Techn. Information, No. 4738-B, 85 pp. [Russian preface, English main text], Kiev.
- Putshkov, V.G. & Putshkov, P.V. (1988) A catalogue of assassin-bugs of the World (Heteroptera, Reduviidae). III. Harpactorinae. Published by the authors, deposited in VINITI (All-Union Institute of Sci. & Techn. Information, No. 286-B), Moskva, 88 pp. [Russian preface, English main text]
- Silva, J.M.C., Leal, I.R. & Tabarelli, M. (2018) *Caatinga—the largest tropical dry forest region in South America*. Springer, Dordrecht, 482 pp.
<https://doi.org/10.1007/978-3-319-68339-3>
- Stål, C. (1866) Bidrag till Reduviidernas kannedom. Öfversigt af Kongliga Vetenskaps—Akademiens Förhandlingar, 9, 235–302.
- Vasconcellos, A., Andreazze, R., Almeida, A.M., Araujo, H.F.P., Oliveira, E.S. & Oliveira, U. (2010) Seasonality of insects in the semi-arid Caatinga of northeastern Brazil. *Revista Brasileira de Entomologia*, 54, 471–476.
<https://doi.org/10.1590/S0085-56262010000300019>
- Weirauch, C., Berenger, J.M., Berniker, L., Forero, D., Forthman, M., Frankenberg, S., Freedman, A., Gordon, E., Hoey-Chamberlain, R., Hwang, W.S., Marshall, S.A., Michael, A., Paiero, S.M., Udah, O., Watson, C., Yeo, M., Zhang, G. & Zhang, J. (2014) An illustrated identification key to assassin bug subfamilies and tribes. *Canadian Journal of Arthropod Identification*, 26, 1–115.
<https://doi.org/10.3752/cjai.2014.26>
- Wygodzinsky, P. (1947) Contribuição ao conhecimento do gênero *Heniartes* Spinola, 1837 (Apiomerinae, Reduviidae, Hemiptera). *Arquivos do Museu Nacional*, 41, 3–65.
- Wygodzinsky, P. (1949) *Elenco sistemático de los Reduiviformes Americanos*. Instituto de Medicina Regional, Tucumán, 102 pp.
- Zhang, G. & Weirauch, C. (2013) Sticky predators: a comparative study of sticky glands in harpactorine assassin bugs (Insecta: Hemiptera: Reduviidae). *Acta Zoologica*, 94, 1–10.
<https://doi.org/10.1111/j.1463-6395.2011.00522.x>

- Zhang, G. & Weirauch, C. (2014) Molecular phylogeny of Harpactorini (Insecta: Reduviidae): correlation of novel predation strategy with accelerated evolution of predatory leg morphology. *Cladistics*, 30, 339–351.
<https://doi.org/10.1111/cla.12049>
- Zhang, J., Weirauch, C., Zhang, G. & Forero, D. (2016) Molecular phylogeny of Harpactorinae and Bactrodinae uncovers complex evolution of sticky trap predation in assassin bugs (Heteroptera: Reduviidae). *Cladistics*, 32, 538–554.
<https://doi.org/10.1111/cla.12140>