

***Parahiranetis salgadoi*, a new genus and species
of Harpactorini (Hemiptera: Heteroptera: Reduviidae),
with a key to Neotropical wasp-mimicking
harpactorine genera**

Hélcio R. GIL-SANTANA

Laboratório de Díptera, Instituto Oswaldo Cruz, Av. Brasil, 4365, Manguinhos, 21040-360, Rio de Janeiro, Brazil; e-mails: helciogil@uol.com.br; helciogil@ioc.fiocruz.br

Abstract. *Parahiranetis salgadoi* gen. & sp. nov. (Hemiptera: Heteroptera: Reduviidae: Harpactorinae: Harpactorini) is described based on two females from Rio de Janeiro, Brazil. A revised key to Neotropical wasp-mimicking Harpactorini genera is presented.

Key words. Heteroptera, Reduviidae, aposematism, *Graptocleptes*, *Hiranetis*, Brazil, Neotropical Region

Introduction

The Harpactorinae is the largest subfamily of Reduviidae and is represented by the tribes Apiomerini and Harpactorini in the Neotropical Region (SCHUH & SLATER 1995). The Harpactorini is the richest group in species among the tribes of the Reduviidae with 52 recognized genera in the Neotropical Region (FORERO et al. 2008; MCPHERSON & AHMAD 2011; FORERO 2011, 2012; SWANSON 2012). The only and outdated key to American Harpactorini genera is that of STÅL (1872). MALDONADO & LOZADA (1992) however, presented a key to Neotropical wasp-mimetic Harpactorinae genera, which according to them helps to sort out specimens quickly from unidentified material, although it is a somewhat artificial way of grouping genera.

Among the reduviids, aposematic mimicry has been little studied (GIL-SANTANA et al. 2003). In the Neotropical Region, records have focused on mimicry of several species of *Zelurus* Hahn, 1826 (Reduviinae) with *Pepsis* spp. (Hymenoptera: Pompilidae) (COSTA LIMA 1940a,b; HOGUE 1993), as well as *Notocyrtus* spp. (Harpactorinae: Harpactorini) with Meliponini Bees (Hymenoptera: Apidae) (HAVILAND 1931, GIL-SANTANA 2008).

CHAMPION (1898) considered *Hiranetis* spp. resembling various Ichneumonidae and Braconidae (Hymenoptera), while HAVILAND (1931) recorded a Müllerian mimicry association among species of *Graptocleptes* Stål, 1866, and of *Xystonyttus* Kirkaldy, 1909 (Harpactorini)

with ichneumonid wasps. HOGUE (1993) affirmed the same among species of *Graptocleptes* and *Hiranetis* Spinola, 1840.

When describing *Coilopus* Elkins, 1969 as a 'genus of hemipteran wasp mimics', ELKINS (1969) argued that species of *Graptocleptes*, *Hiranetis*, *Neotropiconyttus* Kirkaldy, 1909 and *Xystonyttus* seemed to be ichneumon-mimic reduviids, while *Coilopus* apparently would be a wasp mimic.

MALDONADO & LOZADA (1992) considered six Neotropical Harpactorinae genera to be wasp-mimetic: *Acanthischium* Amyot & Serville, 1843, *Graptocleptes*, *Hiranetis*, *Myocoris* Burmeister, 1835, *Neotropiconyttus*, and *Xystonyttus*. They regarded *Neotropiconyttus* as resembling braconids, while all others somewhat resembling ichneumonid wasps. Although *Coilopus* was described as wasp mimicking genus (ELKINS 1969), MALDONADO & LOZADA (1992) considered it akin to bees and did not include this genus in their key.

In a revision of *Alabagrus* Enderlein, 1920 (Hymenoptera: Braconidae), LEATHERS & SHARKEY (2003) point to the fact that many species of this genus belong to a Neotropical, presumably mimetic complex, with thousands of other species composed of members of several orders of winged insects; including 1,300 species of Braconidae in other genera, more than 1,000 species of Ichneumonidae, at least 200 species of Symphyta, several hundred species of Reduviidae (e.g., *Hiranetis*), and unknown numbers of Diptera, Lepidoptera and Coleoptera, with the mimicry not constrained to color. Some of the Reduviidae, the 'braconiformes clade', have wings, shape, and physical proportions which are very similar to some braconids (LEATHERS & SHARKEY 2003). These authors present a photo of a specimen in lateral view, identified as *Hiranetis* nr. *braconiformis* (Burmeister, 1835) to illustrate their assertion.

HESPENHEIDE (2010) recorded examples of mimicry of braconids by *Agrilus* Curtis, 1825 (Coleoptera: Buprestidae). These share a braconid-like color pattern in Panama, in the orders Coleoptera, Diptera and Hymenoptera, and six species of Reduviidae, including *Hiranetis* nr. *braconiformis* and five other undetermined species.

Among the Neotropical Harpactorini, *Parahiranetis* gen. nov. is most similar to *Hiranetis*, while this latter has been considered close to *Graptocleptes* (STÅL 1872), both considered allied genera (CHAMPION 1898).

In this study, *Parahiranetis salgadoi* gen. nov., sp. nov. is described based on two females from Rio de Janeiro, Brazil. A revised key to Neotropical wasp-mimetic Harpactorinae genera is presented.

Material and methods

Specimens are deposited in the Entomological Collection of the National Museum of the Federal University of Rio de Janeiro (Museu Nacional da Universidade Federal do Rio de Janeiro), Rio de Janeiro, Brazil (MNRJ).

All measurements are in millimeters. The visible segments of the labium are numbered II to IV, given that the first segment is said to be lost or fused to the head capsule (WEIRAUCH 2008, SCHUH et al. 2009). The nomenclature for the female genitalia follows FORERO et al. (2008). In the list of material examined, our additional remarks are placed in [square brackets].

Taxonomy

Parahiranetis gen. nov.

Type species. *Parahiranetis salgadoi* sp. nov., by present designation.

Diagnosis. General appearance: wasp-mimetic. Head elongate, 1.6 to 1.8 times as long as wide across eyes. Postocular portion of head, in dorsal view, narrowing gradually to form collum, with a pubescence of long hairs on postocular portion, dorsally, and on gula, ventrally. Postantennal spines small, acute. Legs slender and elongate; fore femur subequally longer than head and pronotum together; femora thicker basally. Hemelytra long, surpassing abdomen by about a quarter of the length of the body.

Description. Head elongate, 1.6 to 1.8 times as long as wide across eyes; integument shiny, with sparse long and short, straight or somewhat curved blackish setae and hairs; these latter much denser, forming pubescence of long blackish hairs on postocular portion, dorsally, and ventrally on gula. Antecular portion slightly longer than postocular; the latter, in dorsal view, narrowing gradually to form collum. Clypeus straight. Antenna inserted at level of upper third of eye; antennal segments I and II [other absent] slender. Postantennal spines small, somewhat acute. Transversal (interocular) sulcus deep, well marked, curved laterally, reaching eyes approximately at distal third. Labium stout, curved, reaching prosternum at proximal or mid portion; segment II (first apparent), thickest, straight, reaching level of middle portion of eyes, slightly longer than segment III; segment III somewhat curved, reaching level of prosternum; segment IV shortest, triangular, tapering.

Thorax. Midlongitudinal sulcus shallow anteriorly, deep distally; transverse sulcus well defined; anterior margin of mesepisternum flat, without tubercle (i.e., 'plica'); stridulitrum attaining level of middle of fore coxa. Scutellum subtriangular, with median shallow depression.

Legs slender and elongate; coxae and specially trochanters with sparse long straight hairs and dense erect brush-like setae ventrally; fore and hind femora and tibiae straight; mid femora and tibiae somewhat curved in dorsal view; femora thickened basally in proportion of approximately 1.7 times the thickness on median portion of the segment; femora slightly dilated subapically too, with sparse long straight hairs and dense erect brush-like setae ventrally, which are quite longer on basal portion, and restricted to the latter on hind femur; fore tibiae somewhat enlarged at apex, with a small apical spur on anterior surface; mid tibiae with uniform thickness; hind tibiae somewhat enlarged on basal half and narrowing a little to apex; tarsi three-segmented.

Hemelytra long, surpassing abdomen by about half length of membrane and a quarter of length of body.

Abdomen elongate; spiracles rounded.

Female external genitalia. Spiracle 8 on paratergite 8; syntergite 9/10 nearly vertical; first gonocoxa wide; first gonapophysis narrowing to posterior margin, reaching basal fourth of first gonocoxa.

Etymology. The name of the new genus was given in reference to its general similarity to *Hiranetis*.

Parahiranetis salgadoi sp. nov.

(Figs 1–7)

Type locality. Brazil, Rio de Janeiro state, Rio de Janeiro municipality, Tijuca Forest.

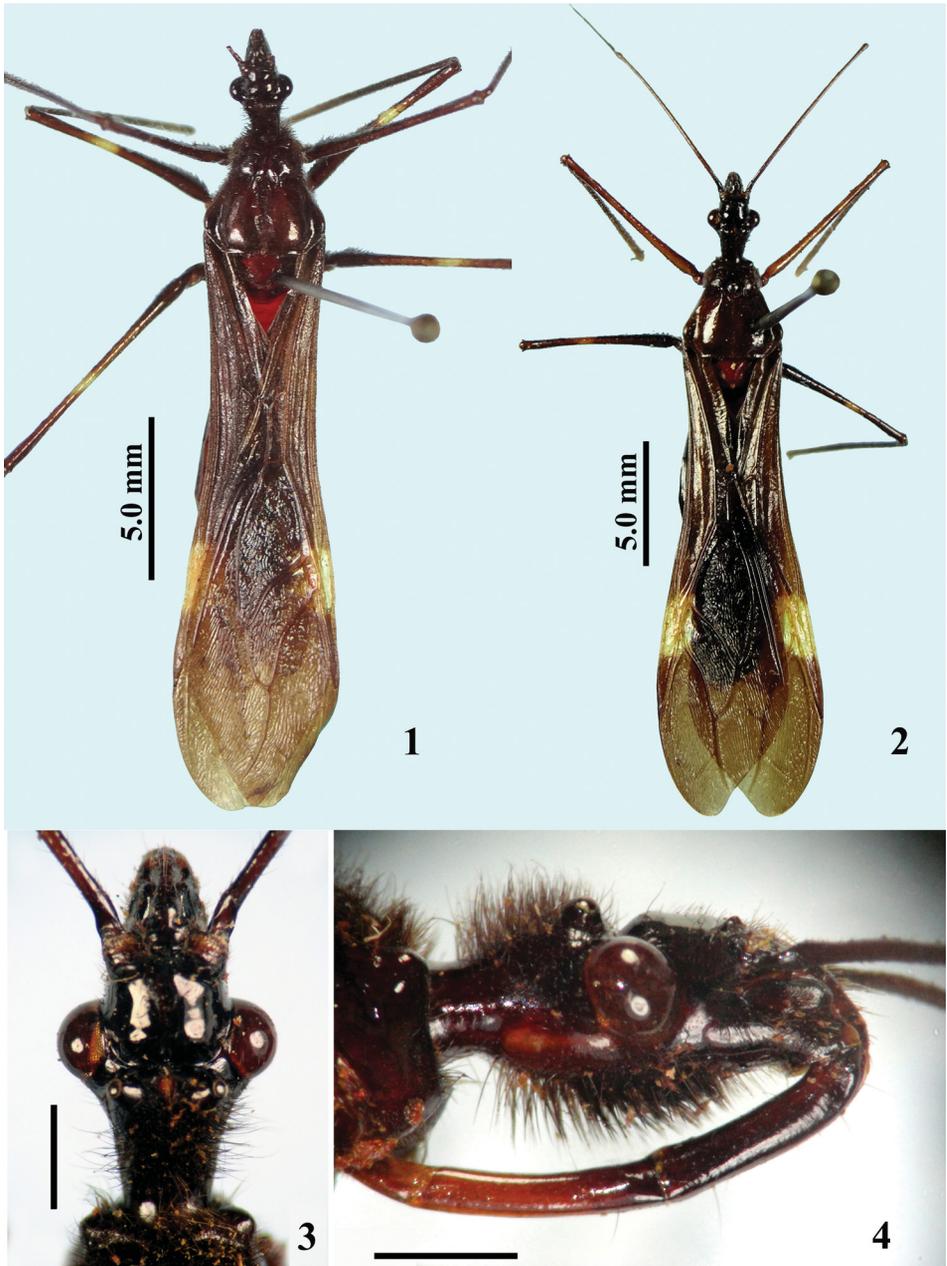
Type material. BRAZIL: RIO DE JANEIRO: RIO DE JANEIRO MUNICIPALITY. HOLOTYPE (MNRJ): ♀, 'Floresta da Tijuca [Tijuca Forest] / D[istrito] Federal [currently, RIO DE JANEIRO] / 31.x.1951 / C.A. Campos Seabra [leg.] // [ex] Coleção [Collection] Campos Seabra // 'XXXII'. PARATYPE: 1 ♀ (MNRJ): 'Rio de Janeiro / 20.ix.[19]36 / H. S. Lopes [leg.]'.

Diagnosis. General coloration black to brownish or reddish brown; scutellum reddish; hemelytra black or dark brown, with a yellowish spot on external and mid-distal portions of corium, reaching adjacent part of membrane, mainly in basal portion of distal cell of membrane; fore femur black to brownish, and with a very faint, small and almost imperceptible, incomplete yellowish middle annulus; mid and hind femora black, with a medial yellowish annulus (Figs 1–2).

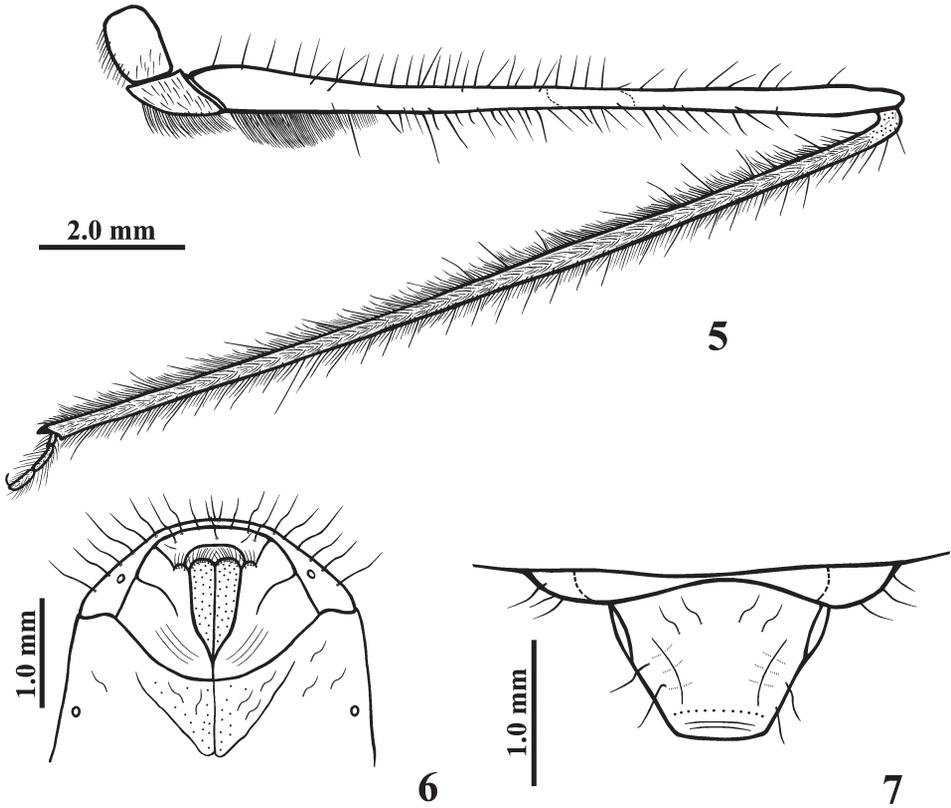
Description. *Female* (Figs 1–7). Measurements (in mm; holotype / paratype): Total length: to tip of abdomen: 19.5 / 19.1; to tip of hemelytra: 24.5 / 24.2; head: total length (including collum): 3.6 / 3.0; maximum width across eyes: 2.0 / 2.1; ante-ocular length: 1.4 / 1.4; post-ocular length: 1.2 / 1.2; interocular space: 1.1 / 1.0; antennal segments: I – absent / 7.2; II – abs. / 1.7; III–IV: abs. / abs.; labium segments: II [first visible] – 1.9 / 1.9; III – 1.8 / 1.8; IV – 0.6 / 0.6. Thorax: pronotum: fore lobe length: 1.2 / 1.3; hind lobe: length: 2.3 / 2.5; width at posterior margin: 3.9 / 4.0; scutellum: length: 1.2 / 1.3; width at base: 1.8 / 1.6. Legs: fore legs: femur: 7.2 / 7.2; tibia: 8.0 / 7.8; tarsus: absent / 0.9; middle legs: femur: 6.8 / 6.8; tibia: 8.3 / 8.1; tarsus: 0.9 / 0.9; hind legs: femur: 9.2 / abs.; tibia: 12.0 / abs.; tarsus: 0.95 / abs.; hemelytra length: 17.5 / 17.5. Abdomen: length: 10.5 / 11.0; maximum width: 4.2 / 4.0.

Coloration. General coloration black to brownish or reddish brown (Figs 1–2); head, including eyes and antennae black (Figs 3–4); scutellum reddish; hemelytra black or dark brown, with a yellowish spot on external and mid-distal portions of corium, reaching adjacent part of membrane, mainly in basal portion of distal cell of membrane (Figs 1–2); fore femur black to brownish, and with very faint, small, almost imperceptible, and incomplete yellowish middle annulus; mid and hind femora black, with medial yellowish annulus, which is approximately 1/8 as long as each femur, respectively; tibia and tarsi black. Abdomen: reddish on segments II–V, somewhat darkened on connexivum and distal segments, in holotype; in paratype, sternites II–III and lateral portion of IV, reddish-brown, the remaining darkened.

Structure and vestiture. Head (Figs 3–4): elongate, 1.6 to 1.8 times as long as wide across eyes; integument shiny, with sparse long and short, straight or somewhat curved blackish setae and hairs; these latter much denser, forming pubescence of long blackish hairs on postocular portion, dorsally, and ventrally on gula. Anteo-ocular portion slightly longer than postocular; the latter, in dorsal view, narrowing gradually to form collum. Antenna inserted at level of upper third of eye; antennal segments I and II [other absent] with straight or curved darkened sparse setae; first segment (scape) approximately two times as long as head and four times as long as second antennal segment, somewhat enlarged. Postantennal spines small, somewhat acute. Eyes globose, projecting laterally, somewhat prominent in dorsal view, reaching dorsal margin of head at interocular sulcus on approximately its mid portion; not reaching ventral margin of head, which is far from inferior margin of the eye. Ocelli elevated, much closer to eyes than to each other.



Figs 1–4. *Parahiranetis salgadoi* gen. nov., sp. nov. 1 – holotype, dorsal view. 2–4 – paratype: 2 – dorsal view, 3–4 – head (3 – dorsal view, 4 – lateral view). Scale bars = 1.0 mm.



Figs 5–7. *Parahiranetis salgadoi* gen. nov., sp. nov. 5 – hind leg, lateral view; 6–7 – apex of abdomen (6 – ventral view, 7 – posterior view).

Thorax with shiny integument; pronotum covered with dense, blackish hairs on anterior lobe; posterior lobe with sparse, short setae, forming a faint mid-longitudinal line in hind lobe, where these setae are clearer, yellowish to whitish; disc of posterior lobe smooth, with faint horizontal depression across humeral angle; propleura covered with darkened hairs in holotype and almost glabrous in paratype; meso- and metapleura with sparse long darkened hairs in holotype and almost glabrous in paratype; thoracic sterna with sparse long darkened hairs somewhat numerous on center of meso- and metasternum. Scutellum reddish, subtriangular, with median shallow depression; apex blunt in holotype, acute in paratype, with a few hairs on central portion, which are somewhat more numerous on lateral margins and apex.

Legs: slender and elongate; coxae and specially trochanters with sparse long straight blackish hairs and dense erect brush-like setae ventrally; fore and hind femora and tibiae straight (Fig. 5); mid femora and tibiae somewhat curved in dorsal view; femora thickened basally

in proportion of approximately 1.7 times the thickness on median portion of the segment; femora slightly dilated subapically too, with sparse long straight blackish hairs and dense erect brush-like setae ventrally, which are quite longer on basal portion, and restricted to the latter on hind femur (Fig. 5); fore tibiae somewhat enlarged at apex, with small apical spur on anterior surface of segment; mid tibiae with uniform thickness; hind tibiae (Fig. 5) somewhat enlarged in basal half and narrowing a little to apex; all tibiae with sparse long straight blackish hairs and shorter dense erect brush-like brownish setae much more numerous on ventral and lateral portions on fore and mid tibiae, and along all portions on hind tibiae (Fig. 5); short setae are present too; tarsi with brownish setae.

Hemelytra long, surpassing abdomen by about half length of membrane and quarter of length of body; corium covered with curved adpressed, brown to yellow-brownish, bristle-like setae; membrane glabrous (Figs 1–2).

Abdomen: elongate; spiracles rounded, somewhat clear; sternites with integument shiny with long sparse fine yellowish hairs; subtriangular patches of whitish minute short setae on mid-lateral portions of sternites III and IV.

Female external genitalia (Figs 6–7). Syntergite 9/10 with very long sparse strong blackish hairs; first gonapophysis with strong setae on anterior margin.

Etymology. The new species is named in honor of the entomologist Roberto da Rocha Salgado, because of his great interest and knowledge in entomology, particularly in Heteroptera.

Distribution. Brazil (Rio de Janeiro).

Discussion

Parahiranetis gen. nov. seems most similar to *Hiranetis*, and the latter genus has been considered close to *Graptocleptes* (STÅL 1872, CHAMPION 1898). The main characteristics that separate *Hiranetis*, *Graptocleptes*, and *Parahiranetis* gen. nov., according to SPINOLA (1840), STÅL (1866, 1872), MALDONADO & LOZADA (1992) and this work, are the following:

- 1) *Graptocleptes*: Head elongate, approximately 1.3 times as long as wide across eyes, sparsely pilose; legs thicker; fore femur shorter than head and pronotum together and of uniform thickness.
- 2) *Hiranetis*: Head gibbous, large, subequally as long as wide across eyes, densely pilose on ventral and post-ocular portions; legs elongated, slender; fore femur subequally longer than head and pronotum together, thicker basally.
- 3) *Parahiranetis* gen. nov.: Head elongate, 1.6 to 1.8 times as long as wide across eyes (Figs 3–4), densely pilose on ventral and post-ocular portions (Figs 3–4); legs elongated, slender; fore femur subequally longer than head and pronotum together, thicker basally.

Parahiranetis gen. nov. differs from *Hiranetis* in the shape of the head. While in this genus, the head is gibbous, large, subequally as long as wide across eyes, in *Parahiranetis* gen. nov. the head is elongate, 1.6 to 1.8 times as long as wide across eyes (Figs 3–4). In the new genus, the postocular portion of head narrows gradually to form collum, especially in dorsal view (Fig. 3), while in *Hiranetis*, the separation between these two portions is clearly defined, with a collum thin and distinct as described for this genus by SPINOLA (1840).

Although the difference between *Hiranetis* and *Parahiranetis* gen. nov. is restricted to the shape of head, in view of the current taxonomic arrangement of these and allied genera, this difference seems plausible to warrant a generic value.

Nevertheless, a revision of *Hiranetis*, *Graptocleptes* and other allied genera and their species needs to be done using a phylogenetic approach to confirm this proximity and/or clarify the systematics of the entire group.

Most if not all authors have only mentioned or considered the pattern of yellowish or straw-colored hemelytra with a median, transverse, black band regarding the alleged mimicry between Harpactorini and certain Ichneumonidae and Braconidae as models (CHAMPION 1898, HAVILAND 1931, MALDONADO & LOZADA 1992, HOGUE 1993, LEATHERS & SHARKEY 2003, HESPEHHEIDE 2010). On the other hand, other wasp-mimetic Harpactorini, like *Parahiranetis salgadoi* gen. & sp. nov., show a pattern of general darkened to reddish coloration with a yellowish 'pterostigmata' on hemelytra (Figs 1–2), similar to the coloration exhibited by several other species of Ichneumonidae and Braconidae as well. In a rapid survey, this pattern was also observed, e.g., in *Graptocleptes bicolor* (Burmeister, 1838), *G. haematogaster* (Stål, 1860) and *Hiranetis atra* Stål, 1872. In the latter, however, the yellowish markings on hemelytra are much smaller, appearing as simple dots.

Another common feature among these Harpactorini species, a yellowish band on femora, is also shown in other species with the same general coloration, but with the yellowish spot on hemelytra very small (*H. atra*) or absent (*Graptocleptes sanguiniventris* (Stål, 1862)). In future ecologic studies, observations must be done to know what species or groups of hymenopteran and other insects would be participating in mimetic complexes including the pattern of blackish to reddish coloration with yellowish 'pterostigmata' on wings and/or with yellowish markings on legs. On the other hand, the resemblance resulting from this mimicry has led to confusion between *Hiranetis* and *Graptocleptes*, as shown by GIL-SANTANA et al. (2013).

Thus, biological and/or ecological studies will not be complete without a precise species identification, including description of newly recognized taxa as the present case.

Key to the Neotropical genera of wasp-mimicking Harpactorini

(based on STÅL 1866, 1872; ELKINS 1961, 1969; and MALDONADO & LOZADA 1992)

- 1 Pronotum greatly inflated and covering scutellum posteriorly. *Coilopus* Elkins, 1969
- Pronotum not inflated; scutellum not covered by posterior portion of pronotum and visible from above. 2
- 2 Posterior pronotal lobe elevated on disc, and laterally bordered by spine-bearing carinae; fore trochanter with ventral spine in almost all species. *Acanthischium* Amyot & Serville, 1843
- Posterior pronotal lobe different; fore trochanter without spines. 3
- 3 Head very sparsely hairy to glabrous; fore femur thickened, curved in basal half. *Myocoris* Burmeister, 1835
- Head hairy to very densely hairy on ventral and post-ocular portions; fore femur slender or thickened basally. 4
- 4 Fore femur thicker basally. 5
- Fore femur with uniform thickness. 7

- 5 Postantennal spines long and directed forward; hind tibia basally thickened. *Neotropiconyttus* Kirkaldy, 1909
- Postantennal spines absent; sometimes with small postantennal tubercles; hind tibia not thickened basally, sometimes, somewhat swollen in median portion. 6
- 6 Head gibbous, swollen ventrally, subequally as long as wide across eyes; in dorsal view, postocular portion clearly separated from a distinct collum. *Hiranetis* Spinola, 1837
- Head elongate, not swollen ventrally, 1.6 to 1.8 times as long as wide across eyes; in dorsal view, postocular portion narrowing gradually to form collum. *Parahiranetis* gen. nov.
- 7 Postantennal spine straight, semivertical or as tubercle; head approximately 1.3 times as long as wide across eyes; fore tibia straight. *Graptocleptes* Stål, 1866
- Postantennal spine curved; head as long as wide across eyes; fore tibia curved at apex. *Xystonyttus* Kirkaldy, 1909

Acknowledgements

I thank Luiz A. A. Costa (MNRJ), for allowing me to examine the material under his care. I'm also very grateful to Dimitri Forero (Pontificia Universidad Javeriana, Bogotá, Colombia), and Guanyang Zhang (Arizona State University, USA), for their valuable comments and suggestions.

References

- BURMEISTER H. 1838: Some account of the genus *Myocoris*, of the family Reduviini. *Transactions of the Entomological Society of London* **2**: 102–107.
- CHAMPION G. C. 1898: Reduviidae. Pp. 162–296. In: GODMAN F. D. & SALVIN O. (eds.): *Biologia Centrali-Americana. Insecta Rhynchota. Hemiptera-Heteroptera, Vol. II*. Taylor & Francis, London, 385 + 22 pls.
- COSTA LIMA A. M. 1940a: Sobre as espécies de Spiniger (Hemiptera: Reduviidae). *Memórias do Instituto Oswaldo Cruz* **35**: 1–129.
- COSTA LIMA A. M. 1940b: *Insetos do Brasil. V.2, Hemipteros*. Escola Nacional de Agronomia, Rio de Janeiro, 351 pp.
- ELKINS J. C. 1961: A new species of *Acanthischium* Amyot & Serville, with a key to the species (Hemiptera: Reduviidae: Harpactorinae). *Proceedings of the Entomological Society of Washington* **63**: 20–21.
- ELKINS J. C. 1969: A new genus of hemipteran wasp mimics (Reduviidae, Harpactorinae). *Journal of the Kansas Entomological Society* **42**: 456–461.
- FORERO D. 2011: Classification of Harpactorinae, assassin bugs Hemiptera: Heteroptera: Reduviidae. *Boletín del Museo Entomológico Francisco Luis Gallego* **1**: 9–24.
- FORERO D. 2012: Pronozelus, a new Neotropical harpactorine genus and species from Colombia (Hemiptera: Heteroptera: Reduviidae: Harpactorinae). *Entomologica Americana* **118**: 278–284.
- FORERO D., GIL-SANTANA H. R. & DOESBURG P. H. VAN 2008: Redescription of the Neotropical genus *Aristathlus* (Heteroptera, Reduviidae, Harpactorinae). Pp. 85–103. In: GROZEVA S. & SIMOV N. (eds.): *Advances in Heteroptera Research. Festschrift in Honour of 80th Anniversary of Michail Josifov*. Pensoft Publishers, Sofia-Moscow, 417 pp.
- GIL-SANTANA H. R. 2008: New records, and nomenclatural and biological notes on Reduviidae (Hemiptera: Heteroptera) from Bolivia and Brazil. *Zootaxa* **1785**: 43–53.
- GIL-SANTANA H. R., COSTA L. A. A., FORERO D. & ZERAIK S. O. 2003: Sinopse dos Apiomerini, com chave ilustrada para os gêneros (Hemiptera-Heteroptera, Reduviidae, Harpactorinae). *Publicações Avulsas do Museu Nacional* **97**: 3–21.
- GIL-SANTANA H. R., DAVRANOLOUL -R. & NEVES J. A. 2013: A new synonym of *Graptocleptes bicolor* (Burmeister), with taxonomical notes (Hemiptera: Heteroptera: Reduviidae: Harpactorini). *Zootaxa* **3700**: 348–360.

- HAVILAND M. D. 1931: The Reduviidae of Kartabo, Bartica District, British Guiana. *Zoologica* **7**: 129–154.
- HERRICH-SCHÄFFER G. A. W. 1848: *Die wanzenartigen Insekten*. Lotzbeck, Nürnberg, 130 pp.
- HESPENHEIDE H. A. 2010: New Agrilus Curtis (Coleoptera: Buprestidae) from México and Costa Rica mimicking parasitic wasps. *Zootaxa* **2545**: 39–46.
- HOGUE C. L. 1993: *Latin American Insects and Entomology*. University of California Press, Los Angeles, 536 pp.
- LEATHERS J. W. & SHARKEY M. J. 2003: Costa Rican Alabagrus (Hymenoptera: Braconidae), with a key to World species. *Contributions in Science* **497**: 1–78.
- MALDONADO C. J. 1990: *Systematic catalogue of the Reduviidae of the World*. University of Puerto Rico, Mayagüez, Puerto Rico, Caribbean Journal of Science, Special publication No. 1, 694 pp.
- MALDONADO C. J. & LOZADA R. P. W. 1992: Key to the group of Neotropical wasp-mimetic Harpactorine genera and the description of a new species (Hemiptera: Reduviidae). *Proceedings of the Entomological Society of Washington* **94**: 162–165.
- 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.
- SCHUH R. T. & SLATER J. A. 1995: *True Bugs of the World (Hemiptera: Heteroptera). Classification and natural history*. Cornell University Press, Ithaca, NY, 336 pp.
- SCHUH R. T., WEIRAUCH C. & WHEELER W. C. 2009: Phylogenetic relationships within the Cimicomorpha (Hemiptera: Heteroptera): a total-evidence analysis. *Systematic Entomology* **34**: 15–48.
- SPINOLA M. 1840: *Essai sur les Insectes Hémiptères Rhyngotes ou Hétéroptères*. Chez J.-B. Baillière, Paris, 383 pp.
- STÅL C. 1866: Bidrag till Reduviidernas kännedom. *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar* **23**: 235–302.
- STÅL C. 1872: Enumeratio Reduviinorum Americae. In: Enumeratio Hemipterorum. *Kongliga Svenska Vetenskaps-Akademiens Handlingar* **10**: 66–128.
- SWANSON D. R. 2012: A new synonym in the Harpactorinae of the New World (Heteroptera: Reduviidae). *Proceedings of the Entomological Society of Washington* **114**: 250–254.
- WEIRAUCH C. 2008: From four- to three- segmented labium in Reduviidae (Hemiptera: Heteroptera). *Acta Entomologica Musei Nationalis Pragae* **48**: 331–344.