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Research article

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On the genus *Hamma* Buckton, 1905 (Hemiptera: Auchenorrhyncha) in Equatorial Africa, with descriptions of three new species

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Abstract. As part of the classification of Membracidae from Gabon and Equatorial Guinea, a new species group of the genus *Hamma* Buckton, 1905 is proposed, and three new species are described: *Hamma nigrum* sp. nov., *Hamma spinellii* sp. nov. and *Hamma caneparii* sp. nov. An updated checklist and key to the genus *Hamma* are provided.

Keywords. Membracidae, *Hamma*, new taxa, Gabon, Equatorial Guinea.

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Introduction

As already stated by Bayendi Loudit *et al.* (2014), new species in the genus *Hamma* Buckton, 1905 will probably continue to be found for many years. The present study is the third on the family Membracidae Rafinesque, 1815, specifically dealing with the genus *Hamma* in Gabon.

Gabon represents one of the most well-conserved natural areas in Sub-Saharan Africa and a sanctuary for equatorial forests. Its wildlife conservation policy is encouraging and promotes research and conservation. The MSNS (Museo di Storia naturale del Salento, Italy) pursues a research strategy in agreement with the local authorities to provide the necessary tools for wildlife preservation.

In the present paper we follow Capener (1968) and Wallace & Deitz (2004) in placing the genus *Hamma* in the tribe Centrotini Amyot & Serville, 1843. Previous studies of Centrotinae Amyot & Serville, 1843 in Africa and the genus *Hamma* in particular are summarized in the works of Stål (1866), Goding (1932), Capener (1968, 1972), Boulard (1968, 1969), Bayendi Loudit *et al.* (2014) and Durante &

Susini (2017). The overall classification of the African Centrotinae is also summarized in the works of Funkhouser (1950), Metcalf & Wade (1965) and McKamey (1998), as noted by Wallace & Deitz (2004), who published the most recent genus-level revision of the subfamily.

In their recent paper on the genus *Hamma* (Durante & Susini 2017), the current authors raised the number of species in the genus to 19 in Africa as a whole and 9 in Gabon alone. Thanks to new research, they discovered new material which appears to belong to three new species.

The objective of the zoological studies of the MSNS on the Membracidae includes examination of hundreds of specimens collected in Gabon from 2010 until 2019, with subsequent publication of the relevant results. Unfortunately, it will remain a long-term objective as the financial resources of the MSNS are very sparse and are mainly based on private generosity.

Material and methods

The examined material is part of the MSNS and Antonio Susini's private collections. The collections of the RMCA (Royal Museum for Central Africa, Tervuren, Belgium) and MNHN (Muséum national d'histoire naturelle, Paris, France) were also checked.

The specimens were collected in Batouala in Ogooué Ivindo Province, Gabon, close to Mount Sassamongo at about 660 m above sea level; in Inzambò (a small village on Mount Iboundji at 427 m above sea level) in Ogooué Lolo Province, Gabon, during a survey in 2012; and in Mossumu in Equatorial Guinea in 2015.

Collection was conducted at night, using a 500-watt blended light lamp suspended in front of a white cotton sheet against a wall, collecting actively from 7 pm to about midnight and irregularly until sunrise.

According to the literature (Funkhouser 1950; Capener 1962), treehoppers should usually be collected during the daytime. However, subsequent studies (Kopp & Yonke 1973) demonstrated that Centrotinae are attracted to light, albeit unreliably in terms of quantity. There are well-documented occurrences of massive collection of Membracidae that are attracted to light at night (including other genera not yet studied; see also Bayendi Loudit *et al.* 2014).

Some specimens were killed using ethyl acetate vapours and dried for storage; they were briefly dipped in warm water (for about 30 sec at 60°–70°C) prior to study. Other specimens, after killing in ethyl acetate, were stored in 70% ethanol; they needed no wetting procedure. In both cases the specimens were pinned with micropins from the underside between the second pair of legs. Usually, it was preferred not to pierce the scutellum, avoiding possible breakage. The specimens were placed in the groove of a specially-built spreading board (Bayendi Loudit *et al.* 2014), and their right wings were spread. After drying (twice for ten minutes in the oven at 50°C) the micropins were better joined to the thorax by means of water-soluble glue; afterwards, the specimens were mounted on a plastozote cube. This preparation, very unusual in the Membracidae collections and described in Bayendi Loudit *et al.* (2014), allows the examiner to quickly observe the wing pattern and the lateral and dorsal abdomen morphology. The genitalia were not examined in order to preserve the limited number of collected specimens and also because the body's external characters are distinctive enough.

The investigated habitats ranged from secondary forest to deforested lands and crops around the equator. Here, both Gabon and Equatorial Guinea present in very general terms two dry seasons (December–January, and May–August) and two rainy seasons (February–April, and September–November) with many exceptions. Our surveys cover a period during the rainy seasons.

With regard to the Gabonese locations, the forests there presents transitional characteristics between the Western Congolese forest with Atlantic influences and the true Congolese forest, without a clear line of demarcation (Vande Weghe 2010).

The Guinean location (the village of Mossumu, near Nyefang) presents a mosaic of secondary forest, from quite degraded to well preserved.

Morphological terms are from Funkhouser (1950), Capener (1962, 1968), Deitz (1975), Dietrich *et al.* (2001) and Wallace & Deitz (2004).

In the species descriptions the following conventions are used: vertex width is the distance between the compound eyes measured along the centro-ocular line; vertex height is the distance measured from the ventral margin to the upper margin, perpendicular to the centro-ocular line (see Bayendi Loudit *et al.* 2014: fig. 4). The total length of the body is measured laterally from the head to the apex of the abdomen; the pronotal length is measured from the anterior profile of the pronotum to the apex of the posterior process; the tegminal length is measured from the costa base to the apex of the spread wing.

Abbreviations

l/w = length/width ratio

w/h = width/height ratio

Museum acronyms (follow Evenhuis 2020)

ANPN	=	Agence nationale des Parcs nationaux (Gabon)
CENAREST	=	Centre national de la Recherche scientifique et technologique, Libreville, Gabon
IRAF	=	Institut de Recherches agronomiques et forestières, Libreville, Gabon
IRET	=	Institut de Recherche en Écologie tropicale, Libreville, Gabon
MNHN	=	Muséum national d'histoire naturelle, Paris, France
MSNS	=	Museo di Storia naturale del Salento (Natural History Museum of the Salento), Italy
RMCA	=	Royal Museum for Central Africa, Tervuren, Belgium

Results

Class Insecta Linnaeus, 1758
 Order Hemiptera Linnaeus, 1758
 Family Membracidae Rafinesque, 1815
 Subfamily Centrotinae Amyot & Serville, 1843

Genus *Hamma* Buckton, 1905

The description of three proposed new species is here reported. They were discovered in Gabon and Equatorial Guinea by the third author. The following checklist and keys include the new entries since 2014 (Durante & Susini 2017, plus present data).

Check-list of the species belonging to the genus Hamma

1. *Hamma boulandi* Bayendi Loudit, Durante & Susini, 2014
Hamma boulandi Bayendi Loudit, Durante & Susini, 2014: 323–346, fig. 9
2. *Hamma brevicornis* Boulard, 1968
Hamma brevicornis Boulard, 1968: 942–944, figs 3, 10–11
3. *Hamma caneparii* sp. nov.
4. *Hamma capeneri* Boulard, 1968
Hamma capeneri Boulard, 1968: 938–941, figs 1, 8, 16

5. *Hamma carlini* Bayendi Loudit, Durante & Susini, 2014
Hamma carlini Bayendi Loudit, Durante & Susini, 2014: 323–346, fig. 12
6. *Hamma cinnameus* Boulard, 1969
Hamma cinnameus Boulard, 1969: 106–107, figs 3–5
7. *Hamma cupreum* Durante & Susini, 2017
Hamma cupreum Durante & Susini, 2017: 3–8, fig. 5
8. *Hamma fabulosum* Boulard, 1968
Hamma fabulosum Boulard, 1968: 945–946, figs 5, 14–15
9. *Hamma franciscae* Bayendi Loudit, Durante & Susini, 2014
Hamma franciscae Bayendi Loudit, Durante & Susini, 2014: 323–346, fig. 14
10. *Hamma grahami* (Distant, 1916)
Amitrochates grahami Distant, 1916b: 328
Hamma mabirensis China, 1923: 463–465; synonymized by Funkhouser 1927
Hamma grahami (Distant) – Capener 1955: 376
11. *Hamma heimi* Boulard, 1968
Hamma heimi Boulard, 1968: 944–945, figs 4, 12–13
12. *Hamma nigrum* sp. nov.
13. *Hamma nodosum* Buckton, 1905
Hamma nodosum Buckton, 1905: 330, pl 21 fig. 3
Hamma nodosa Buckton, 1905: 330; incorrect subsequent spelling for *H. nodosum*
14. *Hamma pattersoni* Distant, 1916
Hamma pattersoni Distant, 1916a: 157–158
15. *Hamma pygmaeum* Capener, 1972
Hamma pygmaeum Capener, 1972: 50–51, figs 198–200
16. *Hamma rectum* (Vignon, 1930)
Amitrochates rectus Vignon, 1930: 408–409, fig. 673
Hamma kilossae Dlabola, 1945: 155–156, synonymized by Metcalf & Wade 1965: 506
Hamma recta – Metcalf & Wade 1965: 506
Hamma rectum – Capener 1968: 108
Hamma rectum – Boulard, 1968: 946–948 [new description], figs 6–7
17. *Hamma robustum* Capener, 1971
Hamma robustum Capener, 1971: 28–29, figs 23–25
18. *Hamma sandrinei* Durante & Susini, 2017
Hamma sandrinei Durante & Susini, 2017: 3–8, figs 2–3
19. *Hamma simplex* Boulard, 1968
Hamma simplex Boulard, 1968: 941–942, figs 2, 9
20. *Hamma spinellii* sp. nov.
21. *Hamma spinosum* Capener, 1971
Hamma spinosum Capener, 1971: 25–27, figs 17–19
22. *Hamma ugandensis* Capener, 1971
Hamma ugandensis Capener, 1971: 27–28, figs 20–22

Key to species of the genus *Hamma* (updated after Bayendi Loudit et al. 2014)

1. Posterior pronotal process without terminal spine (Bayendi Loudit et al. 2014: figs 12, 14) 2
– Posterior pronotal process with a terminal spine 3
2. Pronotum with reddish brown blunt tubercles (Bayendi Loudit et al. 2014: fig. 14)
..... *Hamma franciscae* Bayendi Loudit, Durante & Susini, 2014
– Pronotum with black thorn-like tubercles (Bayendi Loudit et al. 2014: fig. 12)
..... *Hamma carlini* Bayendi Loudit, Durante & Susini, 2014

3. Suprahumeral horns prominent, ending in a thorn (Bayendi Loudit <i>et al.</i> 2014: fig. 6)	4
– Suprahumeral horns absent or not prominent, apex blunt (Durante & Susini 2017: fig. 2)	18
4. Posterior pronotal process quite slender in lateral view without evident nodes	5
– Posterior pronotal process in lateral view with evident nodes	6
5. Suprahumeral horns globose (more clearly visible in frontal view) (Boulard 1969: fig. 3)	
..... <i>Hamma cinnameus</i> Boulard, 1969	
– Suprahumeral horns conical	7
6. Suprahumeral horns very large, posterior process heart-shaped in dorsal view (Boulard 1968: figs 14–15)	<i>Hamma fabulosum</i> Boulard, 1968
– Suprahumeral horns smaller, posterior process not heart-shaped in dorsal view	8
7. Pterostigma twice as long as broad (Boulard 1968: figs 8, 16)	<i>Hamma capeneri</i> Boulard, 1968
– Pterostigma three times as long as broad (Durante & Susini 2017: fig. 2)	
..... <i>Hamma cupreum</i> Durante & Susini, 2017	
8. Pronotum tuberculate with reddish tubercles (Buckton 1905: pl. 21 fig. 3)	
..... <i>Hamma nodosum</i> Buckton, 1905	
– Pronotum smooth or tuberculate with black tubercles	9
9. Suprahumeral horns upturned (Boulard 1968: figs 10–11)	<i>Hamma brevicornis</i> Boulard, 1968
– Suprahumeral horns laterad	10
10. Posterior process with terminal node large and clearly rounded in dorsal view	11
– Posterior process with terminal node quite slender, not rounded in dorsal view (Capener 1971: fig. 25)	<i>Hamma robustum</i> Capener, 1971
11. Suprahumeral horns about half as long as pronotal width (dorsal view) (Bayendi Loudit <i>et al.</i> 2014: fig. 7)	12
– Suprahumeral horns about ¼ to ½ as long as pronotal width (dorsal view) (Bayendi Loudit <i>et al.</i> 2014: fig. 9)	17
12. Posterior process V-shaped in lateral view between second and fourth node (Fig. 1)	13
– Posterior process straight in lateral view between second and fourth node (Vignon 1930: fig. 673)	
..... <i>Hamma rectum</i> (Vignon, 1930)	
13. Thorax entirely black	14
– Thorax predominantly brown	16
14. Suprahumeral horns straight in dorsal view	15
– Suprahumeral horns curved backwards in dorsal view (Boulard 1968: fig. 13)	
..... <i>Hamma heimi</i> Boulard, 1968	
15. Pterostigma as long as broad (Distant 1916b: fig. page 328)	<i>Hamma grahami</i> (Distant, 1916)
– Pterostigma about three times as long as broad (Fig. 1)	<i>Hamma nigrum</i> sp. nov.
16. Caudal node of the posterior process half the width of the head in dorsal view (Fig. 2)	
..... <i>Hamma spinellii</i> sp. nov.	
– Caudal node of the posterior process ⅔ the width of the head in dorsal view (Fig. 3)	
..... <i>Hamma caneparii</i> sp. nov.	

17. Posterior process shorter than the tegmina, suprahumeral horns with short, stout terminal spine (Bayendi Loudit *et al.* 2014: fig. 9) *Hamma bouldardi* Bayendi Loudit, Durante & Susini, 2014
– Posterior process as long as the tegmina, suprahumeral horns with slender terminal spine (Capener 1971: figs 17–19) *Hamma spinosum* Capener, 1971
18. Posterior process in dorsal view with large terminal node 19
– Posterior process in dorsal view with very small terminal node 20
19. Posterior process heart-shaped, almost as large as the metopidium in dorsal view (Capener 1971: fig. 22) *Hamma ugandensis* Capener, 1971
– Posterior process roundish, about half as large as the metopidium in dorsal view (Durante & Susini 2017: fig. 2) *Hamma sandrinei* Durante & Susini 2017
20. Posterior process slender in lateral view 21
– Posterior process quite strong in lateral view (Distant 1916a: fig. page 158)
..... *Hamma pattersoni* Distant, 1916
21. Flanks of the pronotal helmet and thoracic pleurae covered in white hairs; posterior process with lateral carinae (Boulard 1968: figs 2, 9) *Hamma simplex* Boulard, 1968
– No presence of white hairs; posterior process without lateral carinae (Capener 1972: figs 198–200)
..... *Hamma pygmaeum* Capener, 1972

The following species are here considered to be part of a well-defined group, characterized by a similar exterior morphology (especially well-pronounced suprahumeral horns; pronotal posterior process with four nodes; third node of the posterior process anchor-shaped in dorsal view; well-developed terminal spine on the posterior process; wings with dark pattern). We include also *Hamma heimi* Boulard, 1968.

Description of the new species

***Hamma nigrum* sp. nov.**

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Figs 1, 4B, 5B

Diagnosis

Species belonging to the genus *Hamma* with the thorax entirely black and pronotum smooth; suprahumeral horns with a laterally pointing thorn; a posterior process with four nodes, V-shaped in lateral view between the second and fourth nodes; last node roundish in dorsal view, ending in a well-developed terminal spine. Pterostigma about three times as long as broad.

Differential diagnosis

The general black colour clearly distinguishes this species from the following two (i.e., *spinellii* sp. nov. and *caneparii* sp. nov.), although not from *Hamma heimi*. The roughly triangular shape of the supraocular callosity (Fig. 4B) is also diagnostic with respect to all other species in the group.

The anchor-like third node (Fig. 5B) of the posterior process clearly distinguishes it from all other species in the group, being rhomboidal in dorsal view, whereas it is roughly circular in *heimi*, and truly anchor-like in *spinellii* sp. nov. and in *caneparii* sp. nov.

Other diagnostic characters with respect to *spinellii* sp. nov. and *caneparii* sp. nov. include:

- upper margin of the head (Fig. 4B) roughly circular (roughly square in *spinellii* sp. nov. and *caneparii* sp. nov.);
- metopidium (Fig. 4B) smooth (tuberculate in *spinellii* sp. nov. and *caneparii* sp. nov.);
- suprahumeral horns (Fig. 4B) with a robust thorn slightly curving dorsally in frontal view (straight in *spinellii* sp. nov. and *caneparii* sp. nov.);
- pterostigma (Fig. 5B) diagnostic only with respect to *caneparii* sp. nov.: l/w ratio 2.95 in *nigrum* sp. nov. (mean value); 2.4 in *caneparii* sp. nov.

Diagnostic characters with respect to *heimi* include:

- upper margin of the head more arcuate than in *heimi*;
- punctation on the pronotum finer than in *heimi*;
- first (proximal) node of the posterior process roughly circular in lateral view, dome-shaped in *heimi*.

Etymology

The species takes its name from the Latin adjective '*nigrus*', meaning 'black', in the neuter form in accordance with the grammatical gender.

Material examined

Holotype

GABON • ♀; Ogooué Ivindo, Mont Sassamongo, Batouala; 1 Dec. 2012; A. Susini leg.; MSNS.

Paratypes

EQUATORIAL GUINEA • 1 ♀; Nyefang, Mossumu; 5 Oct. 2015; A. Susini leg.; MSNS • 1 ♀; same collection data as for preceding; coll. Susini.

Description

MEASUREMENTS. Holotype total length: 5.2 mm, average total length: 4.5 mm; holotype pronotal length: 5 mm; average pronotal length: 4.7 mm; holotype tegminal length: 4.2 mm, average tegminal length: 4.2 mm.

HEAD. Brilliant black, convex, punctate, with very small and sparse setae; vertex almost twice as wide as high; shallow concavity between the ocelli; upper margin arcuate, rounded, slightly sinuate; ventral margin W-shaped with the lower parts not very pronounced; ocelli clearly above the centro-ocular line. Frontoclypeus pear-shaped, lateral lobes completely fused to frontoclypeus with margins barely distinguishable; rostrum dark brown; antennae light brown.

PRONOTUM. Brilliant black, punctate, almost completely naked; metopidium smooth, almost twice as wide as high, median carina percurrent, unpunctate, straight until the base of the posterior process and subsequently sinuate, supraocular callosities barely noticeable, small and unpunctate, roughly triangular; humeral angles prominent and blunt; suprahumeral horns well developed, with a tower-shaped base (width/height ratio: 1.48), slightly tuberculate, sometimes with dorsal tip reddish-brown, with a robust brown thorn projecting outwards and curving upwards slightly in frontal view. Posterior process brilliant black, punctate, emerging posteriorly from the pronotum and continuously from the posterior margin; sinuate in lateral view, with four nodes, the first of which (proximal) almost spherical; second node small, dome-shaped in lateral view (flattened in dorsal view) with four to eight small spines dorsally; third node anchor-like in dorsal view with one to three spines at the end of the lateral arms; fourth node subspherical, almost twice as big as the first, with many spines and a robust terminal spine at the caudal end; dorsal and ventral carinae discontinuous, black, in some parts tending to brown. A few spines



Fig. 1. *Hamma nigrum* sp. nov., holotype, ♀, Gabon, Ogouè Ivindo, Batuala, 1 Dec. 2012, A. Susini leg. (MSNS).

dorsally and ventrally along the trunk of the posterior process between the third and fourth nodes. Each spine bears a very thin light apical seta.

SCUTELLUM (Fig. 5). Entirely black, punctate, with the base longer than the height, emarginate, with scutellar apices acute with a few translucent setae; base swollen except for the corners, with one ogival tubercle on each side of the swelling, each tubercle with a tuft of small whitish setae.

FOREWING. Almost three times as long as wide (l/w ratio 2.94, mean value), hyaline; basally sclerotized, punctate, dark brown-black in colour. Pterostigma sub-triangular with very rounded corners, blackish in colour; venation black to brown; a large sub-pentagonal brown patch extending from costa to inner margin in the median area; a Y-shaped brown patch extending from costa to anal angle, connected with the previous patch at the level of the second discoidal cell.

LEGS. Ochreous yellow, praetarsi brown.

ABDOMEN. Urites black with punctation (in one specimen with white suffusion), and thin brown caudal border.

***Hamma spinellii* sp. nov.**

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Figs 2, 4C, 5C

Diagnosis

Species belonging to the genus *Hamma* with thorax eminently brown, pronotum smooth and metopidium not densely tuberculate; suprahumeral horns with a laterally pointing thorn; a posterior process with four nodes, V-shaped in lateral view between the second and fourth nodes; last node roundish in dorsal view, ending in a well-developed terminal spine. Pterostigma almost three times longer than broad.

Differential diagnosis

The general light brown colour is diagnostic, *heimi* and *nigrum* sp. nov. being black, and *caneparii* sp. nov. having a mosaic of russet brown and black.

Other diagnostic characters with respect to *caneparii* sp. nov. are:

- the similarity of the width and height of the basal element of the suprahumeral horns (frontal view) (Fig. 4C): in *spinellii* sp. nov. the w/h ratio is 1; in *caneparii* sp. nov. the w/h ratio is 0.66;
- caudal node of the posterior process half the width of the head in *spinellii* sp. nov.; $\frac{2}{3}$ the width in *caneparii* sp. nov. (dorsal view);
- anchor-like third node (Fig. 5C) thinner than in *caneparii* sp. nov. (dorsal view);
- length of the posterior process clearly exceeding abdominal length in *spinellii* sp. nov.; not exceeding the abdominal terminalia in *caneparii* sp. nov. (lateral view);
- pterostigma (Fig. 5C) longer in *spinellii* sp. nov.: l/w ratio 3.4 in *spinellii* sp. nov.; 2.4 in *caneparii* sp. nov.

Other diagnostic characters with respect to *heimi* and *nigrum* sp. nov. include:

- upper margin of the head roughly square (Fig. 4C);
- metopidium (Fig. 4C) tuberculate;
- suprahumeral horns (Fig. 4C) with a robust straight thorn, not curving upwards in frontal view;
- anchor-like third node (Fig. 5C) posteriorly prolonged (dorsal view); rhomboidal or roughly circular in *nigrum* sp. nov. and *heimi*.

Etymology

The species is dedicated to Dr Matteo Spinelli, Milano.

Material examined

Holotype

GABON • ♀; Ogooué Ivindo, Mont Sassamongo, Batouala; 30 Nov. 2012; A. Susini leg.; MSNS.

Description

MEASUREMENTS. Holotype total length: 3.8 mm; pronotal length: 4.4 mm; tegminal length: 4.3 mm.

HEAD. Black with brown suffusion along the margins and at the centre, convex, punctate, with small white setae; vertex width one and a half times the height; shallow concavity between the ocelli; carina present; upper margin arcuate but roughly square with two evident corners, one directly above each ocellus; ventral margin W-shaped with the lower parts not very pronounced; ocelli slightly above the centro-ocular line. Frontoclypeus pear-shaped, lateral lobes completely fused to frontoclypeus with margins barely distinguishable; rostrum and antennae light brown.

PRONOTUM. Light brown with one triangular black patch on the metopidium on each side of the carina, punctate, almost completely naked; metopidium tuberculate in its dorsal region, twice as wide as high, median carina percurrent, unpunctate, straight, with some swelling, supraocular callosities bean-like, slightly or not at all punctate, with a small club-shaped darker formation inside them, shallow and very finely punctate; humeral angles prominent and blunt; suprahumeral horns well developed, with a tower-shaped base, tuberculate, with a robust brown and black-tipped thorn pointing laterally? Posterior process light brown, punctate, emerging posteriorly from the pronotum and continuously from the posterior margin; sinuate in lateral view, with four nodes, the first of which (proximal) almost spherical; second node small, dome-shaped in lateral view (flattened in dorsal view) with seven-eight small spines latero-dorsally; third node anchor-like in dorsal view with one (left) or two (right) small spines at the end of the lateral arms; fourth node subspherical, almost one and a half times larger than the first, with many spines and a robust terminal spine at the caudal end; dorsal and ventral carinae continuous, of the same colour. A few spines along the dorsal carina, and dorsally and ventrally along the trunk of the posterior process between the third and fourth nodes. Each spine bears a very thin light apical seta.

SCUTELLUM (Fig. 5). Entirely brown, punctate, with the base longer than the height, emarginate with scutellar apices acute with a few translucent setae; base with a triangular swelling except at the corners; lateral corners of the swelling with a tuft of small shiny ochraceous setae.

FOREWING. Length about two and a half times width (l/w ratio 2.56), hyaline; basally sclerotized, punctate, grey-brown in colour with three to four brown stripes distally. Pterostigma sub-triangular with very rounded corners, blackish in colour; venation grey-brown; large brown shaded trapezoidal patch extending from costa to inner margin in the median area; I-shaped patch extending from costa to anal angle with light grey-brown anterior half and dark grey-brown posterior half.

LEGS. Ochreous yellow, praetarsi brown.

ABDOMEN. Tergites grey-brown with black punctation and lighter caudal borders; sternites brown, as are the borders, and covered in translucent setae.

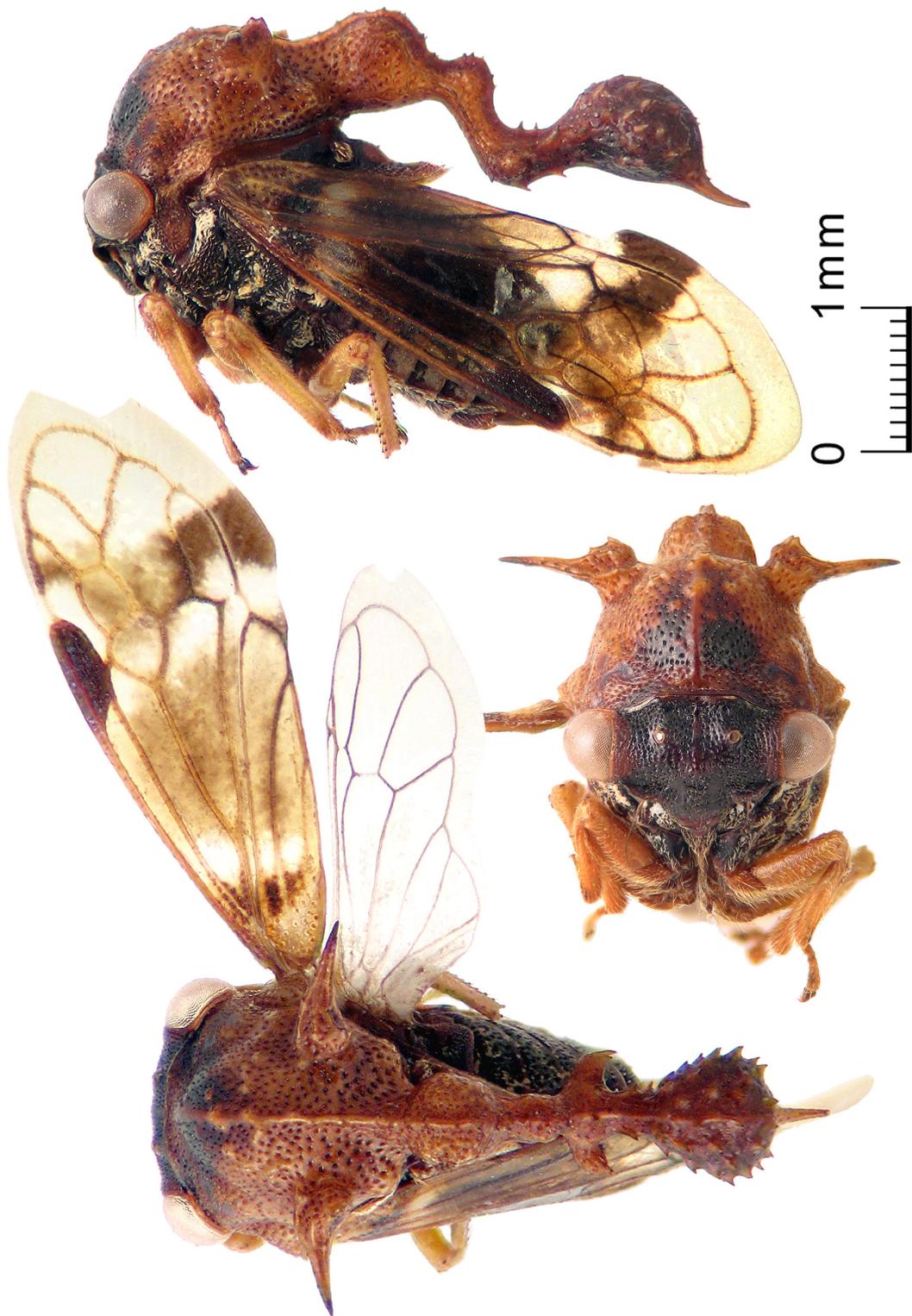


Fig. 2. *Hamma spinellii* sp. nov., holotype, ♀, Gabon, Ogoûé Ivindo, Mont Sassamongou, Batouala, 30 Nov. 2012, A. Susini leg. (MSNS).

***Hamma caneparii* sp. nov.**

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Figs 3, 4D, 5D

Diagnosis

Species belonging to the genus *Hamma* with thorax a mosaic of russet brown and black, pronotum smooth and metopidium not densely tuberculate; suprahumeral horns with a laterally pointing thorn; a posterior process with four nodes, V-shaped in lateral view between the second and fourth nodes; last node roundish in dorsal view, ending in a well-developed terminal spine. Pterostigma twice as long as broad.

Differential diagnosis

The general colour (a mosaic of russet brown and black) is diagnostic, *heimi* and *nigrum* sp. nov. being black, and *spinellii* n. sp. being light brown.

Other diagnostic characters with respect to *spinellii* sp. nov. are:

- the narrow width relative to height of the basal element of the suprahumeral horns (frontal view) (Fig. 4D): in *caneparii* sp. nov. the w/h ratio is 0.66; in *spinellii* sp. nov. the w/h ratio is 1;
- caudal node of the posterior process $\frac{2}{3}$ of the head width in *caneparii* sp. nov.; half the head width in *spinellii* sp. nov. (dorsal view);
- anchor-like third node (Fig. 5D) broader than in *spinellii* sp. nov. (dorsal view);
- length of the posterior process not exceeding the abdominal terminalia in *caneparii* sp. nov.; clearly exceeding abdominal length in *spinellii* sp. nov. (lateral view);
- pterostigma (Fig. 5D) larger in *caneparii* sp. nov.: l/w ratio 2.4 in *caneparii* sp. nov.; 3.4 in *spinellii* sp. nov.

Other diagnostic characters with respect to *heimi* and *nigrum* sp. nov. are:

- upper margin of the head (Fig. 4D) roughly square;
- metopidium (Fig. 4D) tuberculate;
- suprahumeral horns (Fig. 4D) with a robust straight thorn, not curving upwards in frontal view;
- anchor-like third node posteriorly prolonged; rhomboidal or roughly circular in *nigrum* sp. nov. and *heimi*.

Etymology

The species is dedicated to our friend Claudio Canepari, Milano, a specialist in Coccinellidae.

Material examined

Holotype

GABON • ♀; Ogooué Lolo, Inzambò (Iboundji); 0.1°6'21.7" S, 0.11°51'17.8" E; 427 m a.s.l.; 24 Nov. 2012; A. Susini leg.; MSNS.

Description

MEASUREMENTS. Holotype total length: 4.6 mm; pronotal length: 4.6 mm; tegminal length: 4.1 mm.

HEAD. Entirely black, convex, punctate; vertex almost twice as wide as high; carina not distinguishable; shallow concavity medially above the ocelli; upper margin sinuate; ventral margin W-shaped with lower parts not very pronounced; ocelli slightly above the centro-ocular line. Frontoclypeus russet and pear-



Fig. 3. *Hamma caneparii* sp. nov., holotype, ♀, Gabon, Ogooué Lolo, Inzambò (Iboundji), m 427, 0.1°6'21.7" S, 0.11°51'17.8" E, 24 Nov. 2012, A. Susini leg. (MSNS).

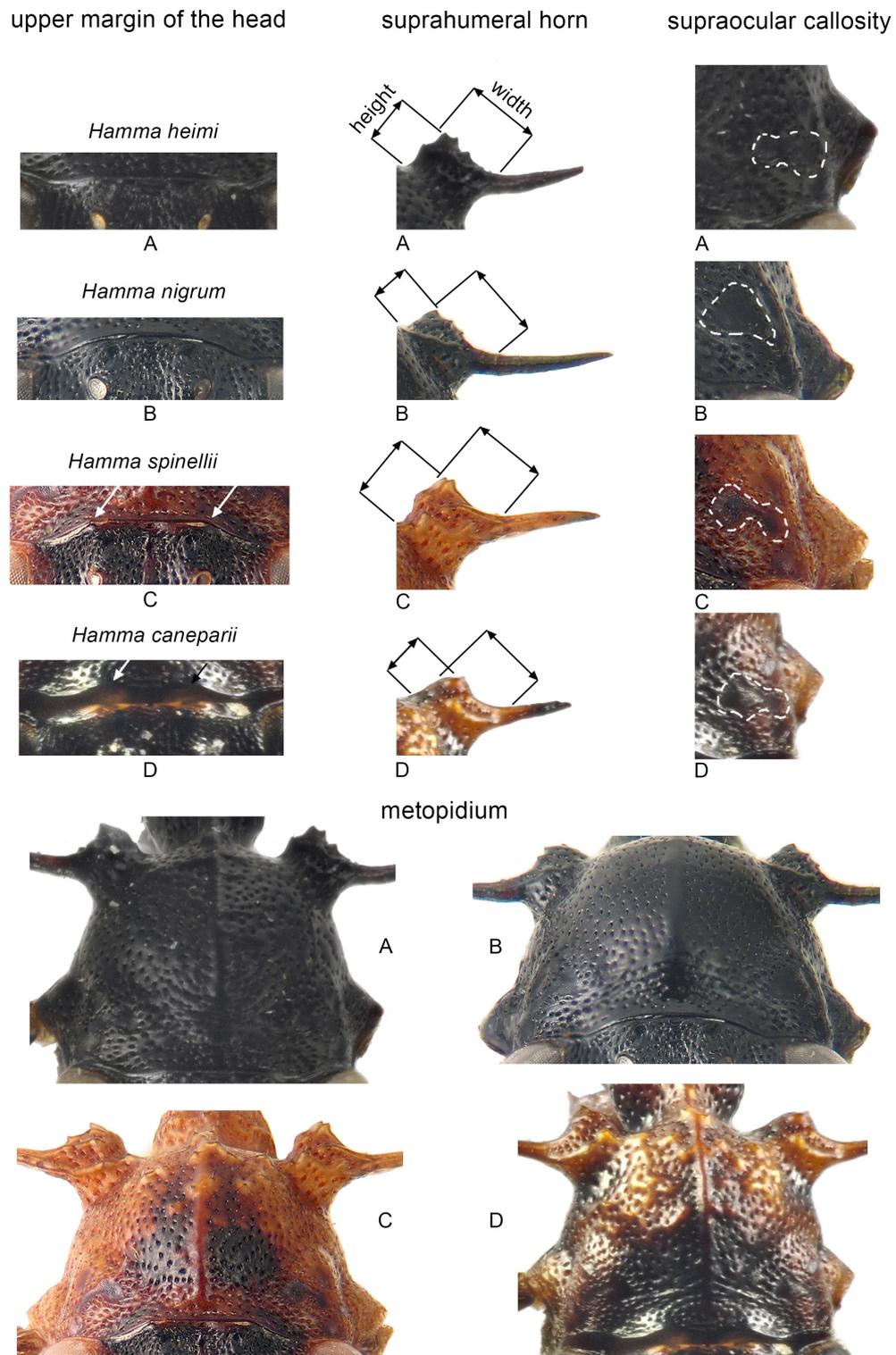


Fig. 4. Morphology. Left suprahumeral horn and left supraocular callosity, frontal view. **A.** *Hamma heimi* Boulard, 1968. **B.** *Hamma nigrum* sp. nov. **C.** *Hamma spinellii* sp. nov. **D.** *Hamma caneparii* sp. nov. Figures are not to scale.

shaped, lateral lobes completely fused to frontoclypeus with margins not distinguishable; rostrum and antennae ochraceous.

PRONOTUM. Mosaic of russet brown patches with one triangular black area at the base of the metopidium and black areas behind the suprahumeral horns; punctate, naked; ochraceous tuberculate areas at the dorsal border of the metopidium; metopidium one and a half times wider than high, median carina percurrent and unpunctate, straight; elongated supraocular callosities, slightly arcuate, not punctate; humeral angles prominent and blunt; suprahumeral horns well developed, with a tower-shaped base (shorter than in *spinellii* sp. nov.), tuberculate, with a robust brown, black-tipped thorn pointing outwards. Posterior process patchy, black and russet in colour, punctate, emerging posteriorly from the pronotum and continuously from the posterior margin; sinuate in lateral view, with four nodes, the first of which (proximal) almost spherical, elongated posteriorly in dorsal view; second node small, dome-shaped in lateral view (flattened in dorsal view) with four small dorsal spines; third node anchor-like in dorsal view with two (left) or one (right) small spines at the end of the lateral arms; fourth node subspherical, slightly larger than the first, with many spines and a strong terminal spine at the caudal end; dorsal and ventral carinae continuous, of the same colour. A few spines along the dorsal carina and dorsally and ventrally along the trunk of the posterior process between the third and fourth nodes, some of which bearing a very thin light apical seta.

SCUTELLUM (Fig. 5). Same colour as the pronotum, punctate, with the base longer than the height, emarginate with scutellar apices light, acute with a few translucent setae; base with a triangular swelling except at the corners; lateral corners of the swelling with a tuft of small brilliant whitish setae.

FOREWING. About two and a half times as long as wide (l/w ratio 2.57), hyaline; basally sclerotized, punctate, amber and brown in colour. Pterostigma trapezoidal with rounded corners, dark brown in colour; venation amber except for the median, cubital and anal veins in the median area, which are brown; large brown shaded trapezoidal patch extending from costa to inner margin in the median area; S-shaped patch extending from costa to anal angle with light grey-brown anterior half and brown posterior half. Presence in the right forewing of a small supplementary discoidal cell between the second apical cell and the first discoidal cell.

LEGS. Ochreous yellow, praetarsi brown.

ABDOMEN. Tergites black and brown with punctation and lighter caudal borders; sternites brown with borders of the same colour covered by translucent setae.

Discussion

This third paper on the genus *Hamma* in Gabon raises the number of known species to 22 in Africa as a whole and to 12 in Gabon alone. Regarding the latter, it should be emphasized that 8 new species have been described since 2014, based on collections made every year from 2010 until 2019, with few specimens collected for each species. This observation coincides with many others made by the authors regarding other orders of Insects, such as Coleoptera, Lepidoptera, Orthoptera and so on, and suggests that Gabon is a very significant centre of endemism. In quite a few cases, many specimens belonging to a small number of species are collected, whereas other species are represented by few specimens or only one, collected during several field trips over ten years. This is the case, for instance, of the Afrotropical genus *Tumiola* Wallengren, 1863 (Lepidoptera), unrecorded in Gabon until now, and recently discovered together with eight as-yet undescribed species, all of which are represented by very few specimens (Durante & Apinda Legnouo 2020). The same trend has been observed in Membracidae genera, based on a preliminary classification into different species. This indicates that the vast majority of species from tropical and equatorial regions described in the past two centuries are in fact composed of a small

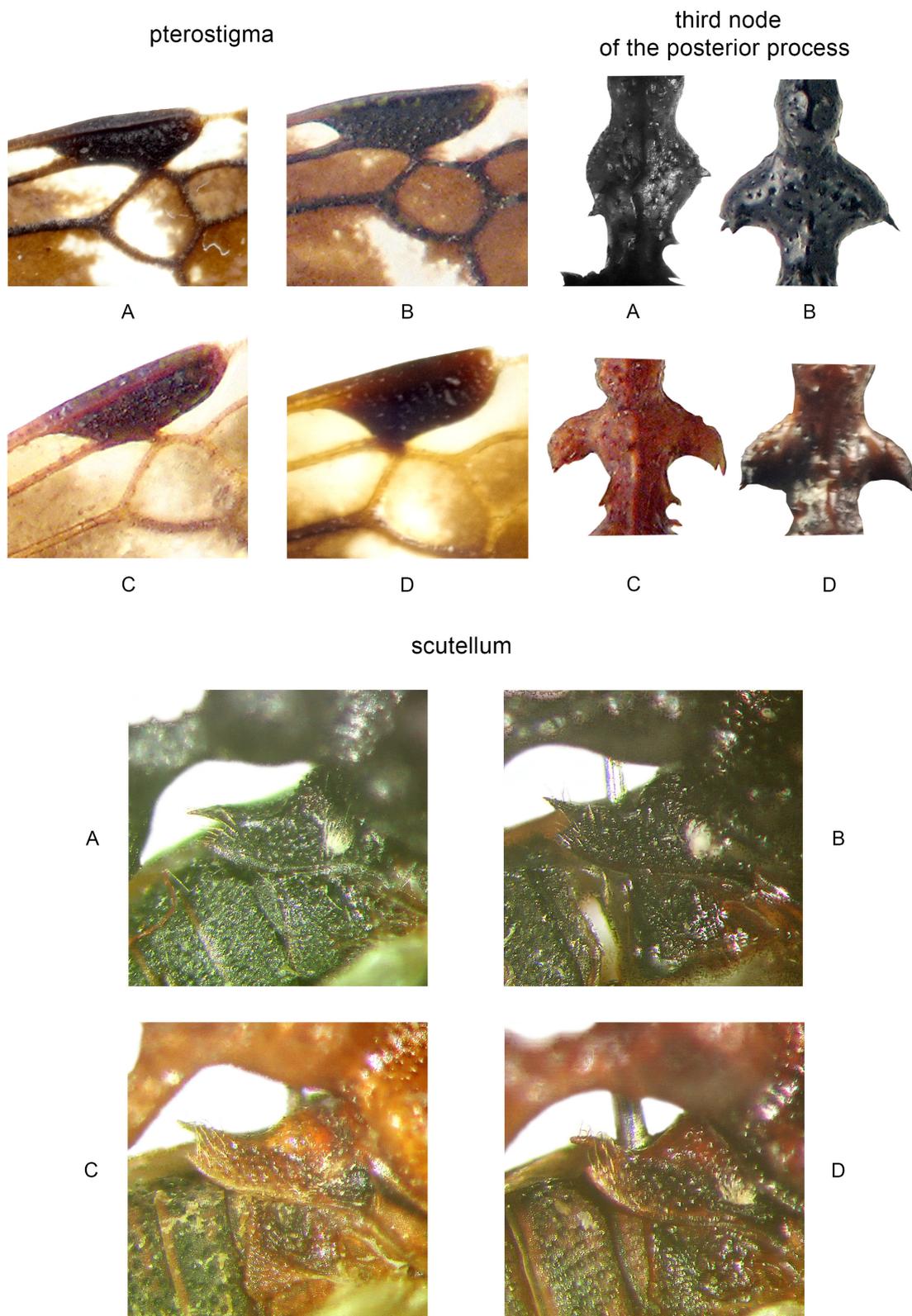


Fig. 5. Morphology. Pterostigma of right wing in dorsal view; third node of the posterior process in dorsal view; scutellum in lateral right view. **A.** *Hamma heimi* Boulard, 1968. **B.** *Hamma nigrum* sp. nov. **C.** *Hamma spinellii* sp. nov. **D.** *Hamma caneparii* sp. nov. Figures are not to scale.

number of individuals spread over such a large range that it is extremely difficult to collect them in large numbers. On the contrary, until now the most accepted conclusion has been that the small numbers are due to the inadequacy of research and collection methods. Although the latter view undoubtedly has merit, due to the objective difficulties in terms of logistics and obtaining collection permits in tropical countries, the authors stress that many species are indeed composed of very low density populations with respect to the high complexity of tropical environments and the wideness of their range (as shown by the relation between population density and trap collection of insects – see Petrovskii *et al.* 2012). They also argue that many species are probably composed of very few populations or only one, confined to a small area. The latter observation is supported by the fact that specimens of certain species are often found in only one specific location, even when the area around it is well explored (Durante pers. obs.).

The case of *H. nigrum* sp. nov. (its disjunct distribution) could be thought of as an example of a species that once had a large distribution that was subsequently fragmented and reduced, or, alternatively, as a concrete case of shallow investigation in its range. The third hypothesis is that the Guinean specimens are morphologically identical to the Gabonese ones (a case of convergence), but they belong to a separate species, and this would confirm the punctiform (single-area) distributional hypothesis. The genitalia of the *H. nigrum* sp. nov. specimens were not dissected due to the scarcity of the material.

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