Culicoides baniwa sp.nov. from the Brazilian Amazon Region with a synopsis of the hylas species group (Diptera: Ceratopogonidae)

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A new species of the Culicoides (Hoffmania) hylas species group, Culicoides baniwa Felippe-Bauer is described and illustrated based on a female specimen from the state of Amazonas, Brazil. A systematic key, wing photographs, diagramme of the legs pattern, table with numerical characters of females and a synopsis of the 11 species of the C. hylas group are presented. This paper further presents a new record of Culicoides pseudoheliconiae Felippe-Bauer out of the previously defined geographic distribution of the hylas species group, in the province of Misiones, Argentina.

Key words: Amazon - Brazil - Culicoides baniwa sp.nov. - Culicoides hylas group - neotropical bloodsucking midges - new record

Wirth and Blanton (1956) re-described and keyed out the three species of the subgenus Hoffmania Fox of Culicoides Latreille previously related to Culicoides hylas Macfie and first recognized the hylas species group. In their 1956 paper, they treated Culicoides contubernalis Ortiz & León as a variety of Culicoides rozeboomii Barbosa and considered it to be a junior synonym of Culicoides verecundus Macfie. Wirth and Blanton (1968) reviewed the species group, describing three more species and establishing that they occur between Veracruz in Mexico through Central and South America to Ecuador and the Amazon Region of Brazil, Colombia and Peru. Recently, Felippe-Bauer et al. (2008) described Culicoides pseudoheliconiae Felippe-Bauer from Peruvian Amazon and re-established C. contubernalis as an autonomous species. Finally, Spinelli et al. (2009) described Culicoides antioquiensis Spinelli from Colombia. Currently, the hylas species group is known to contain 10 species, half of which (Culicoides aitkeni Wirth & Blanton, Culicoides heliconiae Fox & Hoffmann, Culicoides hylas Macfie, Culicoides palpis Macfie, Culicoides polytopi Wirth & Blanton and C. verecundus Macfie) inhabit the Brazilian Amazon Region.

In the present paper, we describe and illustrate a new species from the Amazon Basin of Brazil and provide a key, a table of numerical characters, a diagramme of the leg pattern of female specimens and a synopsis of the 11 species actually belonging to the hylas species group. We also report the presence of C. pseudoheliconiae Felippe-Bauer in the Misiones province in Argentina, a subtropical forest area situated south of the Amazon Region. This report represents an extension of the previously described southern limit of the geographic distribution of the hylas species group.

MATERIAL AND METHODS

The specimen described herein as a new species was collected while it was biting a human during an entomological survey in São Gabriel da Cachoeira, Amazonas (AM), Brazil. The specimen was mounted in phenol-balsam in the manner described by Wirth and Marston (1968) and has been deposited in the Invertebrate Collection of the Instituto Nacional de Pesquisas da Amazônia (INPA), AM, Brazil. Specimens of the other studied species were deposited in the Ceratopogonidae Collection of the Instituto Oswaldo Cruz and in the Collection of the Museo de La Plata (MLP), Argentina. Diagnostic characters were illustrated using a camera lucida attached to an Olympus BH-2 microscope. Microphotographies of the wings were taken with a Nikon Eclipse E-800; brightness and contrast of images were adjusted using Adobe Photoshop CS2.

In this paper, we follow the terminology established in Culicoides papers by Spinelli et al. (2005) and Felippe-Bauer et al. (2008). Therms of wing veins follow the system of the Manual of Neartic Diptera (MacAlpine et al. 1981) with modifications proposed by Szadziewski (1996). All measurements are in micrometres, except those of the wings which are in millimetres.

Culicoides hylas group

Diagnosis: medium to large sized species belonging to subgenus Hoffmania Fox with dark brown to blackish colour and wings with very distinct pale spots. Wing (Figs 1-10, 17) with second radial cell included in a single or subdivided pale spot; base of cell cu1, dark where it borders the bases of veins CuA1 and CuA2; cell r1 shows a pale spot usually present anterior to base of vein M1; apices of veins M1 and M2 pale; apices of veins CuA1 and CuA2 with or without pale spot, depending on the species. Mesonotum dark brown to black with a prominent

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pattern of large pale or pruinose areas. Eyes contiguous, bare. Antenna long and slender, segments with bases conspicuously pale; proximal flagellomeres not greatly shortened, sensilla coeloconica present on flagellomeres 1, 9-13. Palpus slender; third palpal segment slender, cylindrical to spindleshaped, usually with scattered sensilla, palpal ratio varies between 2.7-6.0. Legs dark brown with distinct pale bands characteristic of each species; hind tibial comb shows six spines, the longest of which is the second from the spur. Two spermathecae usually with short, slender necks plus a rudimentary third and sclerotized ring. Male tergite 9 rounded posteriorly, without conspicuous apicolateral processes; postemeral-dial margin with distinctive lobe or processes; sternite 9 with shallow postemeral excavation, the ventral membrane not spiculate. Gonocoxite slender, dorsal and ventral root not developed; gonostylus curved and slender with moderately sharp pointed tip. Aedeagus narrow with very short basal arch, the anterior margin with distinct sclerotized band; distal portion with internal sclerotized projection, ending in a rounded papilla. Parameres fused at base usually for about half of total length, separate portion abruptly tapered to slender terminal filaments with very fine distal fringing hairs.

**Key to the species of the Culicoides hylas group**

1. Hind femur dark to tip (Figs 13-16) .......................... 2
   - Hind femur with subapical pale band (Figs 11, 12) ... 7

2. Mid femur dark to tip (Fig. 16), a double distal pale spot in \( r_5 \) pale spot absent in front of base of M1 (Fig. 17) .......................................................... *baniwa* Felippe-Bauer sp.nov.
   - Mid femur various, a single distal pale spot in \( r_5 \) pale spot present in front of base of vein M1 .......................... 3

3. Mid femur with subapical pale band (mid knee dark; Fig. 15); 3rd palpal segment with irregular sensory pit .................................................. *hylas* Macfie
   - Mid femur with apical pale band (mid knee pale; Figs 13, 14); 3rd palpal segment without sensory pit, with scattered sensilla on surface of 3rd segment .......................... 4

4. Wing markings diffuse, dark and pale spots not brightly contrasting; pale spot that crosses second radial cell subdivided in two separate spots (Fig. 8) .............. ......................................... *pseudoheliconica* Felippe-Bauer
   - Wing with contrasting pattern of dark and pale spots; pale spot that crosses the second radial cell, single .......................... 5

5. Distal pale spot in \( r_5 \) narrow and transverse; apices of CuA\(_1\) and CuA\(_2\) pale (Fig. 4) .......................................................... *helonica* Fox & Hoffman
   - Distal pale spot in cell \( r_5 \) large; apices of CuA\(_1\) and CuA\(_2\) various .......................................................... 6

6. Apices of CuA\(_1\) and CuA\(_2\) dark (Fig. 6) .............. .................................................. *palpalis* Macfie
   - Apices of CuA\(_1\) pale and CuA\(_2\) dark (Fig. 2) .............. .................................................. *antioquiensis* Spinelli

7. Pale spot absent in front of base of M1 (Fig. 10); flagellomeres 2-8 with prominent four or five-branched hyaline sensory filamentsbate *xfijfer* Wirth & Blanton
   - Pale spot present in front of base of M1, flagellom-eres 2-8 with simple hyaline sensory filament .................. 8

8. Apices of CuA\(_1\) and CuA\(_2\) pale (Figs 1, 3) .................. 9
   - Apices of CuA\(_1\) and CuA\(_2\) dark (Figs 7, 9) .................. 10

9. Large species, wing length 1.50 mm, P.R. 6.0, A.R. 1.26, P/H ratio 1.38 .................. *aitkeni* Wirth & Blanton
   - Smaller species, wing length 1.30-1.35 mm, P.R. 3.8-4.3, A.R. 1.09-1.14, P/H ratio 1.14-1.18 .................. *contubernalis* Ortiz & Leon

10. Mid femur with subapical pale band (Fig. 11) ............................................................................. *polyborus* Wirth & Blanton
    - Mid femur with apical pale band (Fig. 12) .............................................................................. *verecondus* Macfie

**C. aitkeni** Wirth & Blanton
(Figs 1, 11)


**Diagnosis:** the female of the species possesses the following combination of characters: third palpal segment with scattered sensilla; wing length 1.50 mm, \( r_5 \) with pale spot present anterior to base of M, and in apices of CuA\(_1\) and CuA\(_2\), a single pale spot crossing second radial cell; mid and hind femur with subapical pale band; spermathecae with short, slender necks.

**Male:** unknown.

**Distribution:** Trinidad and Tobago, Brazil [Pará (PA)].

**C. antioquiensis** Spinelli
(Figs 2, 13)

*C. antioquiensis* Spinelli (in Spinelli et al. 2009): 82 (male, female, Colombia)

**Diagnosis:** the species possesses the following combination of characters: third palpal segment with scattered sensilla; mid femur with apical pale band, hind femur dark to tip; wing with apices of CuA\(_1\) pale and apex of CuA\(_2\) dark, \( r_5 \) with pale spot present anterior to base of M, a single pale spot crosses the second radial cell and wing pattern most similar to *C. hylas*; spermathecae without sclerotized necks. Male tergite 9 somewhat truncated; gonostylus with subapical tooth; fused portion of the parameres 1.5 broader than long, separate portion V-shaped at base.

**Distribution:** Colombia.

**C. baniwa** Felippe-Bauer, sp.nov.
(Figs 16-22)

**Diagnosis:** this species is easily distinguished from the other species of the *hylas* group by the presence of double pale spots in \( r_5 \), one crossing second radial cell and the other in distal portion of \( r_5 \), by the absence of pale spot in front of base of M1 and by the mid femur dark to tip.
Male: unknown.

Female: wing length 1.32 mm; breadth 0.54 mm.

Head: dark brown. Eyes contiguous, bare. Pedicel dark brown. Flagellum (Fig. 18) brown, with base of flagellomeres conspicuously pale; flagellomeres with mean lengths of 75-107-107-107-107-107-107-85-91-139 µm; antennal ratio 1.05; sensilla coeloconia on flagellomeres 1, 9-13, three on 1, one on 9-13. Palpus (Fig. 21) brown, apices of the segments 1-4 pale, base of the third segment pale, fifth segment entirely pale; lengths of segments 27-128-149-53-53 µm; third segment slender, subcylindrical, without sensory pit, with scattered sensilla on surface; palpal ratio 4.7. Proboscis brown, P/H ratio 1.48; mandible with 27 teeth.

Thorax: dark brown; scutum, scutellum, postscutellum, pleuron dark brown. Legs mostly dark brown; fore femur with apical pale band, mid and hind femur entirely dark; mid knee dark; tibiae with sub basal pale bands; hind tibiae pale apically (Figs 16, 22); hind tibial comb with six spines, the second from de spur longest (Fig. 20). Tarsi pale, first
Culicoides from Brazilian Amazon Region • Maria Luiza Felippe-Bauer et al.

Abdomen: brown. Two unequal sized ovoid spermathecae (Fig. 19) without necks, measuring 48 by 37 µm and 37 by 32 µm, respectively. Rudimentary third spermathecae, short sclerotized ring present.

Distribution - Brazil (AM).

Type data and depository - Holotype female, Comunidade de Assunção, Rio Içana, São Gabriel da Cachoeira (01°03'44,5''N 67°35'36,0''W), AM, Brazil, 25.XI.2007, biting human, 6:60 h, Damasceno col. Deposited in Invertebrates Collection of INPA (INPA/LETEP 6301), AM, Brazil.

Etymology - This species is named in honour of the Baniwa Indians who live in location where the specimen was found.

Taxonomic discussion - C. baniwa sp.nov. is a typical member of the subgenus Hoffmania and, as outlined in the key and in the Table, may be distinguished from other species of the hylas group by the double distal pale spot in r₃, the absence of the pale spot in front of base of M₁, the long proboscis and by the entirely dark mid femur and pale fifth palpal segment.

C. contubernalis Ortiz & Leon (Figs 3, 11)

### TABLE
Numerical characters of females of the *Culicoides hylas* Group

<table>
<thead>
<tr>
<th>Species</th>
<th>Wing length (mm)</th>
<th>Costal ratio</th>
<th>Antennal ratio</th>
<th>Palpal ratio</th>
<th>P/H ratio</th>
</tr>
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<tbody>
<tr>
<td>aitkeni</td>
<td>1.50</td>
<td>0.70</td>
<td>1.26</td>
<td>6.0</td>
<td>1.38</td>
</tr>
<tr>
<td>antioquiensis</td>
<td>1.40</td>
<td>0.67</td>
<td>1.00</td>
<td>4.1</td>
<td>1.23</td>
</tr>
<tr>
<td>baniwa sp.nov.</td>
<td>1.32</td>
<td>0.69</td>
<td>1.05</td>
<td>4.7</td>
<td>1.48</td>
</tr>
<tr>
<td>contubernalis</td>
<td>1.30-1.35</td>
<td>0.66-0.69</td>
<td>1.09-1.14</td>
<td>3.8-4.3</td>
<td>1.14-1.18</td>
</tr>
<tr>
<td>heliconiae</td>
<td>1.29-1.69</td>
<td>0.66-0.75</td>
<td>0.99-1.12</td>
<td>3.1-4.6</td>
<td>1.33</td>
</tr>
<tr>
<td>hylas</td>
<td>0.99-1.29</td>
<td>0.67-0.72</td>
<td>1.03-1.16</td>
<td>2.7-4.0</td>
<td>1.15</td>
</tr>
<tr>
<td>palpalis</td>
<td>1.38-1.59</td>
<td>0.65-0.74</td>
<td>1.07-1.20</td>
<td>4.2-6.0</td>
<td>1.32</td>
</tr>
<tr>
<td>polypror</td>
<td>1.25-1.59</td>
<td>0.68-0.72</td>
<td>1.09-1.28</td>
<td>3.4-5.6</td>
<td>1.20</td>
</tr>
<tr>
<td>pseudoheliconiae</td>
<td>1.22-1.27</td>
<td>0.67-0.70</td>
<td>1.01-1.03</td>
<td>3.7-4.3</td>
<td>1.08-1.09</td>
</tr>
<tr>
<td>verecundus</td>
<td>1.35-1.56</td>
<td>0.65-0.72</td>
<td>1.01-1.09</td>
<td>4.6-5.9</td>
<td>1.40</td>
</tr>
<tr>
<td>xanfer</td>
<td>1.29-1.50</td>
<td>0.66-0.72</td>
<td>0.97-1.06</td>
<td>4.0-6.0</td>
<td>1.25</td>
</tr>
</tbody>
</table>

* a: arranged alphabetically.


**C. hylas** Macfie
(Figs 5, 15)


**Diagnosis:** the only species of the *hylas* group with an irregular sensory pit in the third palpal segment. Species also shows mid femur with subapical pale band, hind femur dark to tip; wing with radial pale spot present anterior to base of vein M1, a single pale spot crossing the second radial cell, apices of CuA1 and CuA2 pale; spermathecae with short, slender necks. Male tergite 9 with small median papilliform process on posterior margin; fused portion of the parameres nearly as broad as long, separate portion slender, U-shaped at base.

**Distribution:** Mexico to Peru, Brazil (PA).

**C. palpalis** Macfie
(Figs 6, 13)


**Diagnosis:** species shows the following combination of characters: third palpal segment with scattered sensilla; apical pale band on mid femur, hind femur dark to tip; wing with distal pale spot in r, narrow and transverse, r, with pale spot present anterior to base of M1, a single pale spot crosses the second radial cell, apices of CuA1 and CuA2 pale; spermathecae with short, slender necks. Male tergite 9 with posteromedial margin slightly pronounced, rounded, sometimes, slightly bilobed; fused portion of the parameres slightly broader than long, separate portion long and V-shaped at base.

**Distribution:** - Belize to Ecuador, Venezuela, Brazil (AM, PA), Grenada, Trinidad and Tobago.
**C. polypori** Wirth & Blanton
(Figs 7, 11)


**Diagnosis**: species shows the following combination of characters: third palpal segment with scattered sensilla; mid and hind femur with subapical pale band; r with pale spot present anterior to base of M, a single pale spot crosses the second radial cell, apices of CuA, and CuA, dark; spermathecae with short, slender necks. Male tergite 9 with a bilobed process on posterior margin; fused portion of the parameres slightly longer than basal width.

**Distribution**: Honduras to Colombia, Brazil (AM).

**C. pseudoheliciconiae** Felippe-Bauer
(Figs 8, 14)

*C. pseudoheliciconiae* Felippe-Bauer (in Felippe-Bauer et al., 2008): 260 (female; Peru).

**Diagnosis**: this is the only species of the *hylas* group with pale wing markings that are diffuse, rather than brightly contrasting; r with pale spot present anterior to base of M, pale spot that crosses the second radial cell subdivided in two separate spots, apices of CuA, and CuA, dark; third palpal segment with scattered sensilla; mid femur with apical pale band, hind femur dark to tip; spermathecae with short, slender necks.

**Male**: unknown.

**Distribution**: Peru (Madre de Dios, San Martin), Argentina (Misiones province).


**C. verecundus** Macfie
(Figs 9, 12)

*C. verecundus* Macfie, 1948: 76 (male, female; Mexico; wing photo), Wirth & Blanton, 1956: 98 (male, female; palpalis, *contubernalis* var. of *rozeboomi* as syn.; Figs), Forattini, 1957: 248 (in neotropical catalogue; palpalis as syn.), Wirth & Blanton, 1959: 278 (redescript., Figs; palpalis as syn.).

**Diagnosis**: the species shows the following combination of characters: third palpal segment with scattered sensilla; mid femur with apical pale band, hind femur dark to tip; r shows a pale spot present anterior to base of M, a single pale spot crosses the second radial cell, apices of CuA, and CuA, dark; spermathecae with short, slender necks. Male tergite 9 with very small papilliform process on posterior margin; fused portion of the parameres shows a width to length ratio of 1.75.

**Distribution**: Mexico to Peru, Brazil (Amazon records).
**Diagnosis:** species shows the following combination of characters: third palpal segment contains scattered sensilla; mid femur with apical and hind femur with subapical pale band; r with pale spot present anterior to base of M₁, a single pale spot crossing second radial cell, apices of Cu₁A, and Cu₂A dark; spermathecae with short, slender necks. Male tergite 9 with a prominent papilliform process on posterior margin; fused portion of the parameres longer than width; separate portion long and V-shaped at base.

**Distribution** - Mexico to Panama, Brazil (AM, PA). Specimens from Ecuador previously considered to be *C. verecundus* were restored from synonymy by Felippe-Bauer et al. (2008) and are now known as *C. contubernalis* Ortiz & Leon.

*C. xanifer* Wirth & Blanton (Figs 10, 12)


**Diagnosis:** only species of the hylas group with four or five-branched hyaline sensory filaments on flagellomeres 2-8; third palpal segment with scattered sensilla; mid femur with apical and hind femur with subapical pale band; r without pale spot anterior to base of M₁, a single pale spot crosses the second radial cell, apices of Cu₁A, and Cu₂A dark; spermathecae with short, slender necks. Male tergite 9 with a prominent papilliform process on posterior margin; fused portion of the parameres nearly as broad as long, separate portion slender, U-shaped at base.

**Distribution** - Honduras to Panama.

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