

Two New *Culicoides* of the *paraensis* Species Group (Diptera: Ceratopogonidae) from the Amazonian Region of Peru

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Two new species of the Culicoides paraensis species group, C. diversus Felipe-Bauer and C. peruvianus Felipe-Bauer, are described and illustrated based on female specimens from Amazonian region of Peru. A systematic key, table with numerical characters of females, and distribution of species of the C. paraensis group are given.

Key words: Neotropical bloodsucking midges - *Culicoides diversus* sp.n. - *Culicoides peruvianus* sp.n. - *Culicoides paraensis* group - Amazonian region - Peru

During an epidemiological study of Oropouche in the Departments of Amazonas and Loreto, Peru, specimens of *Culicoides* were collected while biting humans. These specimens, belonging to the *paraensis* species group of the subgenus *Haematomyidium* Goeldi, were given to the first author for determination. The purpose of this work is to describe and illustrate two new species of this species group and provide a key for separation of closely species of the *paraensis* species group. *Culicoides paraensis* (Goeldi, 1905) is a widespread species in the New World and its distribution is shown in Fig. 23. The distribution of the other five Neotropical species of this group is presented in Fig. 24.

The terminology used is that employed in *Culicoides* papers by Wirth and Blanton for Panama (1959), the Amazon Basin (1973), and the West Indies (1974), and the atlas of wing photographs of Neotropical species by Wirth et al. (1988). A summary of information about Oropouche and Mansonellosis transmitted to humans by *C. paraensis*, plus a key and diagnostic characters of the species in the *C. paraensis* group can be found in Wirth and Felipe-Bauer (1989).

KEY TO THE SPECIES OF THE *CULICOIDES PARAENSIS* GROUP

1. Second radial cell included in a very dark spot; cell r5 with three or four small pale spots, the two poststigmatic pale spots sometimes fused; subapical pale spot in cell r5 usually transverse, rarely attaining wing margin; cell m₂ with only one pale spot distal to level of mediocubital fork; two functional spermathecae with 3rd rudimentary spermatheca and sclerotized ring present; sensilla coeloconica present on flagellomeres 1,6-8, occasionally

on flagellomeres 2-5 (subgenus *Haematomyidium*)2
 - Without the above combination of characters other subgenera of *Culicoides*

2. Cell m₁ with one or two pale spots *debilipalpis* group
 - Cell m₁ with three pale spots (*paraensis* group) 3

3. Third palpal segment without sensory pit, the sensoria scattered on surface of 3rd segment; spermathecae very unequal sized, the smaller one pyriform.....*diversus* sp.n.
 - Third palpal segment with sensory pit; spermathecae equal or unequal sized.....4

4. Distal pale spot in cell r5 gradually extending towards subapical pale spot, sometimes spots coalesce; spermathecae equal sized*peruvianus* sp.n.
 - Distal pale spot distinctly separated from the subapical pale spot; spermathecae unequal sized.....5

5. Small pale spot present lying anterior to base of mediocubital stem; smaller spermatheca with long threadlike duct, sclerotized ring short and cylindrical; eyes narrowly separated; wing with marginal pale spots large and distinct.....*filiductus* Wirth
 - No pale spot anterior to base of mediocubital stem; smaller spermatheca with duct stouter, not thread like; sclerotized ring, eye separation, and wing spots various.....6

6. Third palpal segment broad (PR 1.7) with pit broad and shallow, rarely deep and opening by a smaller pore; spermathecae very unequal sized; eyes narrowly separated above, contiguous below, the interocular space wedge-shaped; male 9th tergum with short, angulate apicolateral processes; parameres sinuate without ventral lobe; aedeagus with low basal arch*quasiparaensis* Clastrier
 - Third palpal segment slender to broad with pit deep and narrow, opening by a smaller pore; spermathecae variable; eyes broadly separated; male 9th tergum with

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slender apicolateral processes; parameres with or without ventral lobe; aedeagus with high basal arch7

7. Third palpal segment short and stout (PR 1.7); sclerotized ring short; 3rd rudimentary spermatheca greatly elongate; paramere with definite broad ventral swelling, without elongate lobe*neoparaensis* Tavares & Souza
 - Third palpal segment longer and more slender (PR 2.1-2.8); sclerotized ring long and curved; 3rd rudimentary spermatheca shorter; paramere uniformly slender in midportion, with elongate lobe*paraensis* (Goeldi)

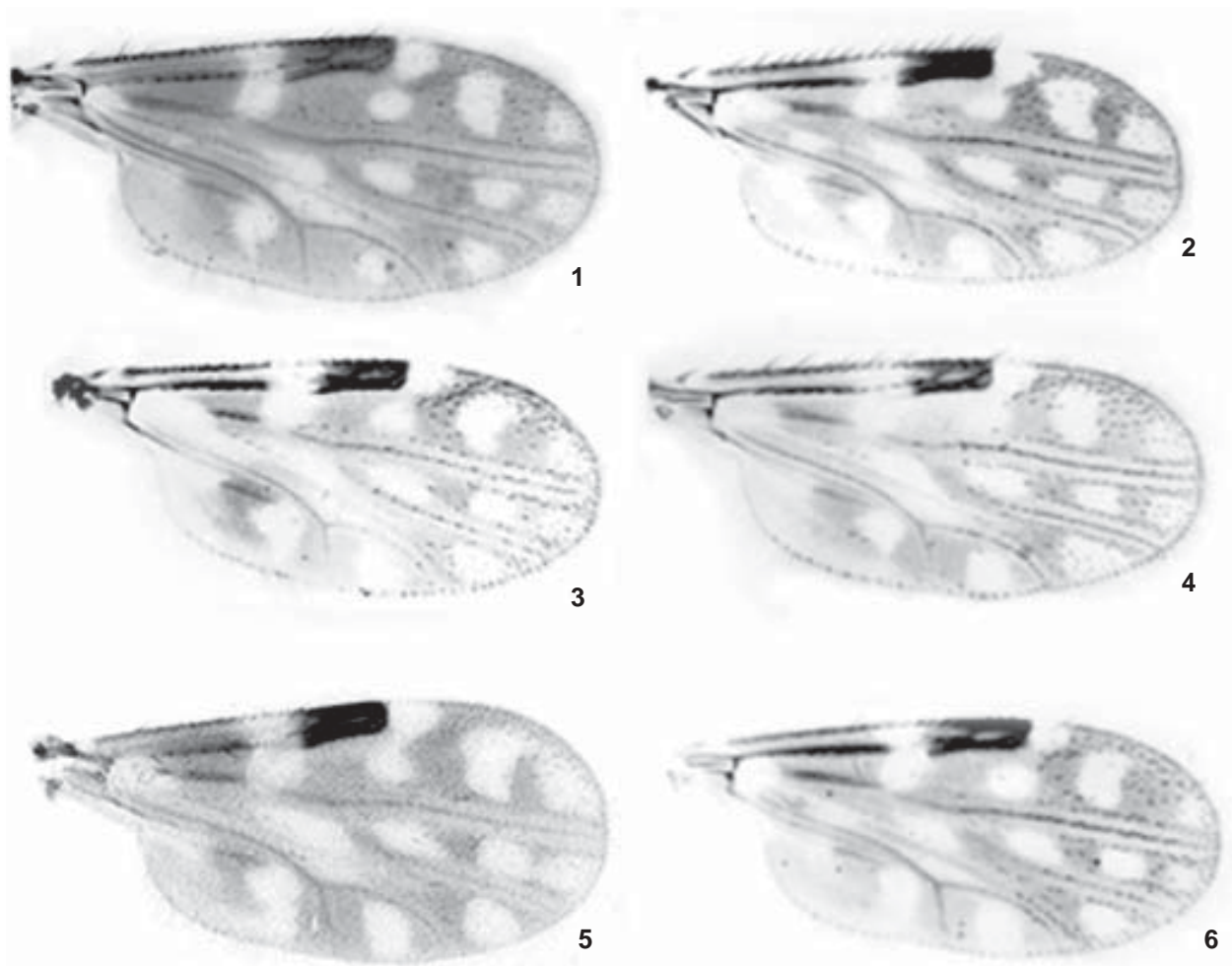
Culicoides diversus Felipe-Bauer, new species
 (Figs 1, 7-13, 24)

Diagnosis - This large sized species of the *paraensis* group is distinguished by the following combination of characters: wing length 0.89-0.92 mm; AR 0.64-0.68; flagellum sensillar pattern 1,6-8; mandible with 18 teeth; palpus brown without sensory pit, sensoria scattered on the surface of segment; PR 2.3-2.5; P/H ratio 0.67-0.68; CR 0.59; halter pale; two very unequal sized spermathecae, the smaller one pyriform, plus a long rudimentary third and a short sclerotized ring.

Female - Wing length 0.89-0.92 (0.91, n = 2) mm; breadth 0.45-0.47 (0.46, n = 2) mm.

Head - Brown. Eyes (Fig. 7) pubescent, broadly separated by distance of 1.0-1.5 ommatidia. Flagellum (Fig. 12) brown, with proximal 2/3 of flagellomeres 2-6, paler; flagellomeres with means of lengths of 48-43-43-43-43-45-43-43-37-37-40-40-72 μ m (n = 2); antennal ratio 0.64-0.68 (0.66, n = 2); sensilla coeloconica on flagellomeres 1,6-8, two on 1, 6-7, three on 8. Palpus (Fig. 8) brown; lengths of segments of 13-40-61-19-19 μ m; 3rd segment moderately swollen, without sensory pit, sensoria scattered on the surface of segment; palpal ratio 2.3-2.5 (2.4, n = 2). Proboscis short; P/H ratio 0.67-0.68 (0.67, n = 2); mandible with 18 teeth.

Thorax - Brown; without definite pattern in slide mounted specimens. Legs (Fig. 10) mostly brown; fore, mid femora with subapical, tibiae with subbasal pale bands; hind tibia apically pale; hind tibial comb (Fig. 9) with four spines, the two nearest spur longest. Tarsi (Fig. 11) pale, first tarsomere darkest. Wing (Fig. 1) with pattern typical of *paraensis* group: cell r5 with four small separated spots, two poststigmatic pale spots well separated, the posterior one located slightly proximad of the other, subapical



Photographs of female wings of *Culicoides* of the *paraensis* group. Fig. 1: *C. diversus*. Fig. 2: *C. filiductus*. Fig. 3: *C. neoparaensis*. Fig. 4: *C. paraensis*. Fig. 5: *C. peruvianus*. Fig. 6: *C. quasiparaensis*

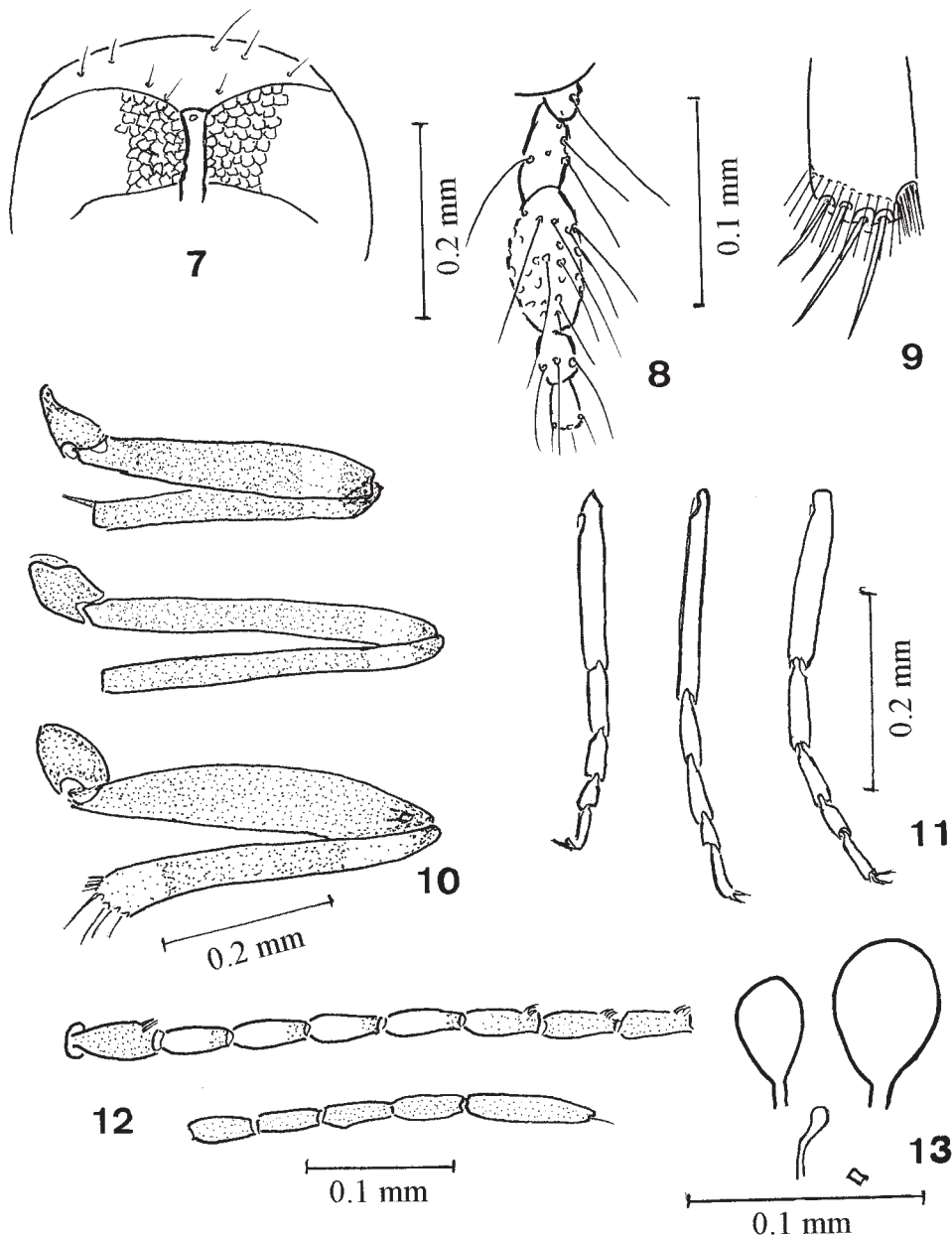
spot slightly elongated, narrow not reaching costal and an apical small spot; a narrow pale spot over r-m crossvein extending from vein M to costal margin; cell m_1 with three rounded spots, distal one near wing margin; cell m_2 with three spots, one proximal to medial fork, 2nd one distal to mediocubital fork, 3rd spot rounded, in distal part of cell at wing margin; cell m_4 with small, round, pale spot near wing margin; anal cell with one pale spot anterior of mediocubital fork, not reaching wing margin; base of wing without pale spot; veins M_1 and M_2 , M_{3+4} and Cu_1 dark; macrotrichia sparse on distal half of wing, a few in base of cell m_2 and anal cell; second radial cell with distinct lumen; costal ratio 0.59 ($n = 2$). Halter pale, base of knob brownish. *Abdomen* - Brown. Two unequal sized spermathecae (Fig.

13), larger ovoid with long, stout neck, smaller pyriform with long, slender neck, measuring 0.048 by 0.043 mm and 0.037 by 0.021 mm ($n = 2$) respectively; long rudimentary 3rd spermatheca and short sclerotized ring also present. *Male* - Unknown.

Distribution (Fig. 24) - Peru (Department of Loreto).

Types - Holotype ♀ (Dip.Cer.378), paratype ♀ (Dip.Cer.379). Fundo Majambo, Distrito de Yurimaguas, Provincia de Alto Amazonas, Departamento de Loreto, PERU, 02.III. 2001, Augusto R. Garcia col., biting human. Deposited in Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.

Etymology - The specific name is based on this new species obvious differences from other species of the *paraensis* group.

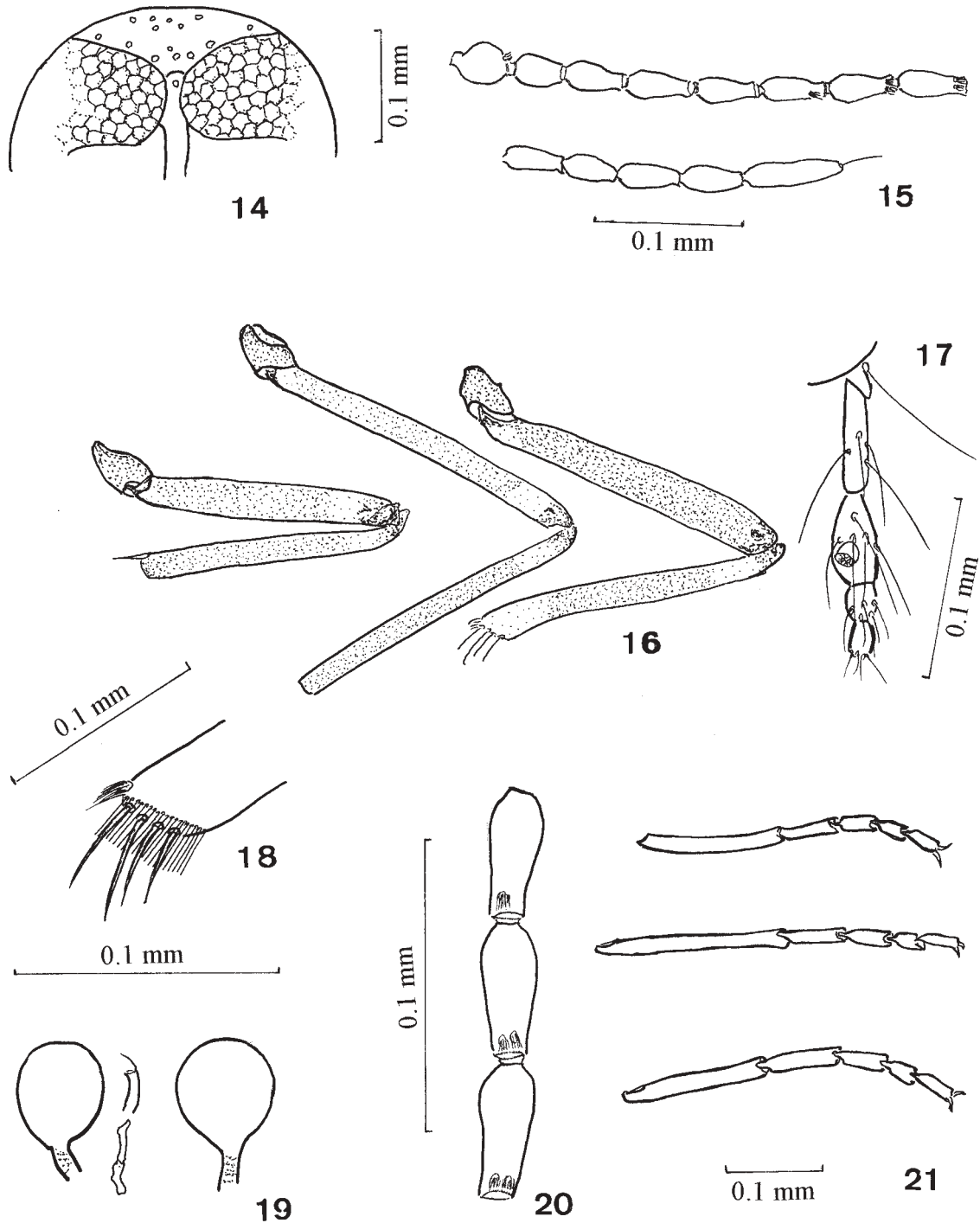


Culicoides diversus sp.n., female. Fig. 7: dorsal portion of head capsule, in anterior view. Fig. 8: palpus. Fig. 9: hind tibial comb. Fig. 10: legs (top to bottom) fore, mid, and hind. Fig. 11: tarsi (left to right) fore, mid, and hind. Fig. 12: antenna. Fig. 13: spermathecae

Discussion - *C. diversus* is a typical member of the subgenus *Haematomyidium* and as outlined in the key and in the Table, may be distinguished from the other species of the *paraensis* group by its slightly longer wing, small antennal and P/H ratio, by the absence of a sensory pit on the 3rd palpal segment with sensoria scattered on the surface of the segment and the very unequal sized spermathecae with the smaller one pyriform.

Culicoides peruvianus Felipe-Bauer, new species
(Figs 5, 14-22, 24)

Diagnosis - This new species of the *paraensis* group is distinguished by the following combination of characters: wing length 0.73-0.86 mm; AR 0.68-0.78; sensillar pattern 1,6-8; mandible with 18 teeth; palpus brown with sensory pit; PR 2.0-2.4; P/H ratio 0.74-0.90; CR 0.53-0.60; halter pale; two sub-spherical, equal sized spermathecae, plus a



Culicoides peruvianus sp.n., female. Fig. 14: dorsal portion of head capsule, in anterior view. Fig. 15: antenna. Fig. 16: legs (left to right) fore, mid, and hind. Fig. 17: palpus. Fig. 18: hind tibial comb. Fig. 19: spermathecae. Fig. 20: flagellomeres 6-8. Fig. 21: tarsi (top to bottom) fore, mid, and hind

TABLE
Mean values of numerical characters of females of the *Culicoides paraensis* group

Species	Wing length (mm)	Costal ratio	Antennal ratio	Antennal sensillar pattern	Palpal ratio	P/H ratio
<i>diversus</i>	0.91	0.59	0.66	1,6-8	2.4	0.67
<i>filiductus</i>	0.87	0.60	0.72	1,6-8	2.8	0.73
<i>neoparaensis</i>	0.90	0.62	0.86	1,(5),6-8	1.7	0.71
<i>paraensis</i>	0.78	0.59	0.77	1,6-8	2.1	0.82
<i>peruvianus</i>	0.80	0.56	0.73	1,6-8	2.1	0.84
<i>quasiparaensis</i>	0.83	0.61	0.80	1,6-8	1.7	0.75

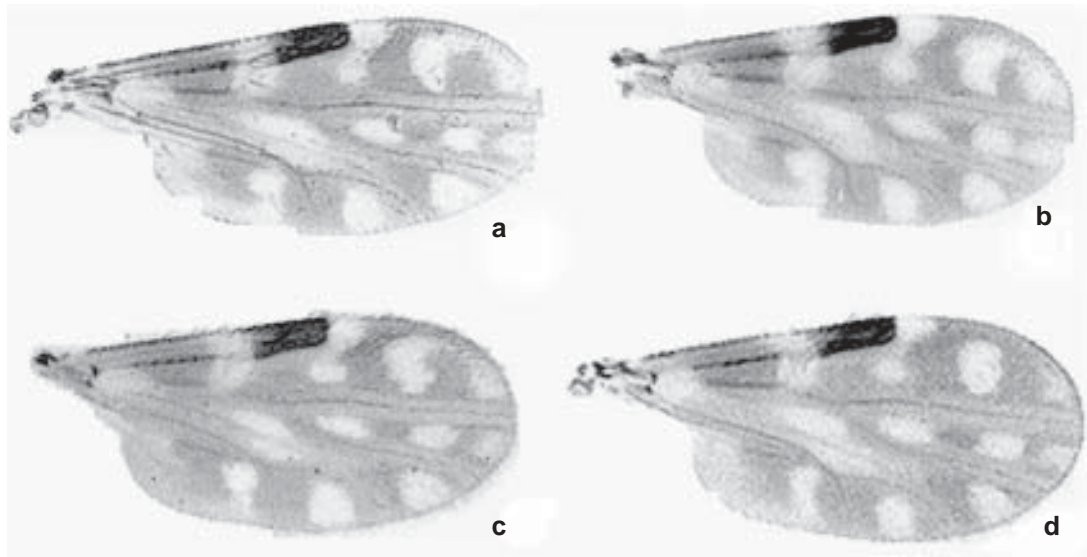


Fig. 22 a-d: variation in the wing pattern of *Culicoides peruvianus* sp.n.

long rudimentary third and sclerotized ring.

Female - Wing length 0.73-0.86 (0.80, n = 16) mm; breadth 0.38-0.43 (0.42, n = 16) mm.

Head - Brown. Eyes (Fig. 14) pubescent, separated by distance of one ommatidia. Flagellum (Fig. 15) brown, flagellomeres with means of lengths of 35-27-32-35-35-37-37-37-35-35-37-37-59 μ m (n = 16); antennal ratio 0.68-0.78 (0.73, n = 12); sensilla coeloconica present on flagellomeres 1,6-8, two, rarely one on six (Fig. 20). Palpus (Fig. 17) brown; lengths of segments 16-42-45-19-21 μ m; 3rd segment slightly swollen with small, deep, sensory pit; palpal ratio 2.0-2.4 (2.1, n = 14). Proboscis brown, moderately long; P/H ratio 0.74-0.90 (0.84, n = 16); mandible with 18 teeth.

Thorax - Brown; without definite pattern in slide mounted specimens. Legs (Fig. 16) mostly brown; fore, mid femora with subapical, tibiae with subbasal pale bands; hind tibia apically pale; hind tibial comb (Fig. 18) with four spines, the two nearest spur longest. Tarsi (Fig. 21) pale, first tarsomere darkest. Wing (Figs 5, 22) with pattern typical for *paraensis* group: cell r5 with four spots, two post-stigmatic pale spots well separated, the posterior one located slightly proximad of the other, subapical spot large, often crescent-shaped, connected to apical large pale spot (Fig. 22 a,b) or the subapical pale spot can be only slightly connected to apical spot (Fig. 22 c), or, well separated

from it (Fig. 22 d); a narrow pale spot over r-m crossvein extending from vein M to costal margin; cell m₁ with three rounded spots, distal one near wing margin, sometimes the two distal pale spots are connected (Fig. 22 b); cell m₂ with three spots, one proximal to medial fork, 2nd one distal to mediocubital fork, 3rd spot rounded, in distal part of cell at wing margin; cell m₄ with round pale spot near wing margin; anal cell with one pale spot anterior of mediocubital fork, reaching wing margin; base of wing with pale spot, extending from arculus to anal cell (Fig. 22 a, b, d); veins M₁ and M₂, M₃₊₄ and Cu₁ dark; macrotrichia sparse on distal half of wing; second radial cell with distinct lumen; costal ratio 0.53-0.60 (0.56, n = 16). Halter pale.

Abdomen - Brown. Two sub-spherical, equal sized spermathecae (Fig. 19), measuring 0.037 (0.035-0.043, n = 11) by 0.029 (0.027-0.032, n = 11) mm, with long, stout, sclerotized neck (0.011 mm); long rudimentary third (0.032 mm) and sclerotized ring present.

Male - Unknown.

Distribution (Fig. 24) - Peru (Department of Amazonas). **Types** - Holotype ♀, San Antonio, Distrito de Cajaruro, Provincia de Utcubamba, Departamento de Amazonas, PERU, 22.IV.2001, A. Gonzales-Perez col., biting human. Paratypes ♀♀ as follows: 5 ♀♀, same data as holotype; 10 ♀♀, same data as holotype except 15.VIII.2000,

13.V.2001, 05.VI.2001, 14.VII.2001 and 22.IX.2001; 1 ♀, Platana, Distrito de Cumba, Provincia de Utcubamba, Departamento de Amazonas, PERU, 30-31.I.2001, A.G.Caceres col., CDC light trap; 2 ♀♀ Yungasuyo, Distrito de Lonya Grande, Provincia de Utcubamba, Departamento de Amazonas, PERU, VII.2001, A. Gonzales-Perez col., biting human; 20 ♀♀, Aserradero, Distrito de Jamalca, Provincia de Utcubamba, Departamento de Amazonas, PERU, 01.V.2001, 13.V.2001, 04.VI.2001, 05.VI.2001, 16.VII.2001, 14.VIII.2001 and 16.IX.2001, A. Gonzales-

Perez col., biting human [Holotype (Dip.Cer.380) and 32 paratypes (Dip.Cer.381-412) deposited in Instituto Oswaldo Cruz (IOC), Rio de Janeiro, Brazil; 3 ♀♀ same locality as holotype in Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, Brazil and 3 ♀♀ (2 from San Antonio and 1 from Aserradero) deposited in Museo de La Plata, Argentina].

Additional material examined - After determination of the type material we have received additional specimens, preserved in alcohol 70%. These 273 ♀♀ were deposited



Fig. 23: distribution of *Culicoides paraensis* (Goeldi, 1905)

in IOC, as follows: 90 ♀♀, same data as holotype except 23.IV.2001, 05.VI.2001, 11.VIII.2001, 12.VIII.2001, 22.IX.2001, 13.X.2001, 14.X.2001, 22.II.2002, and 20.IV.2002; 123 ♀♀, Aserradero, Distrito de Jamalca, Provincia de Utcubamba, Departamento de Amazonas, PERU, 01.V.2001, 13.V.2001, 04.VI.2001, 05.VI.2001, 19.VIII.2001 and 16.IX.2001, A. Gonzales-Perez col., biting human; 5 ♀♀, Yungasuyo, Distrito de Lonya Grande, Provincia de Utcubamba, Departamento de Amazonas, PERU, VII.2001, A. Gonzales-Perez col., biting human; 8 ♀♀, Santa Cruz, Distrito de Jamalca, Provincia de Utcubamba, Departamento de Amazonas, PERU, VII.2001, A. Gonzales-Perez col., biting human; 47 ♀♀, El Aliso, Distrito de Cajaruro, Provincia de Utcubamba, Departamento de Amazonas, PERU, 03.XI.2001, A. Gonzales-Perez col., biting human.

Etymology - This species is after the country Peru, where the species was collected.

Discussion - *C. peruvianus* is a typical member of the subgenus *Haematomyidium* and, as outlined in the key, can be distinguished from the other species of the *paraensis* group, by the distal pale spot in cell r5, which gradually extend towards the subapical pale spot and is often joined with it. Also, the equal sized spermathecae with long, stout necks and the high P/H ratio (0.84) are all characteristics of the *paraensis* species group.

DISCUSSION

The discovery of two new species from the upper reaches of the Amazon basin that are pests of humans suggests that many more species of *Culicoides* remain to

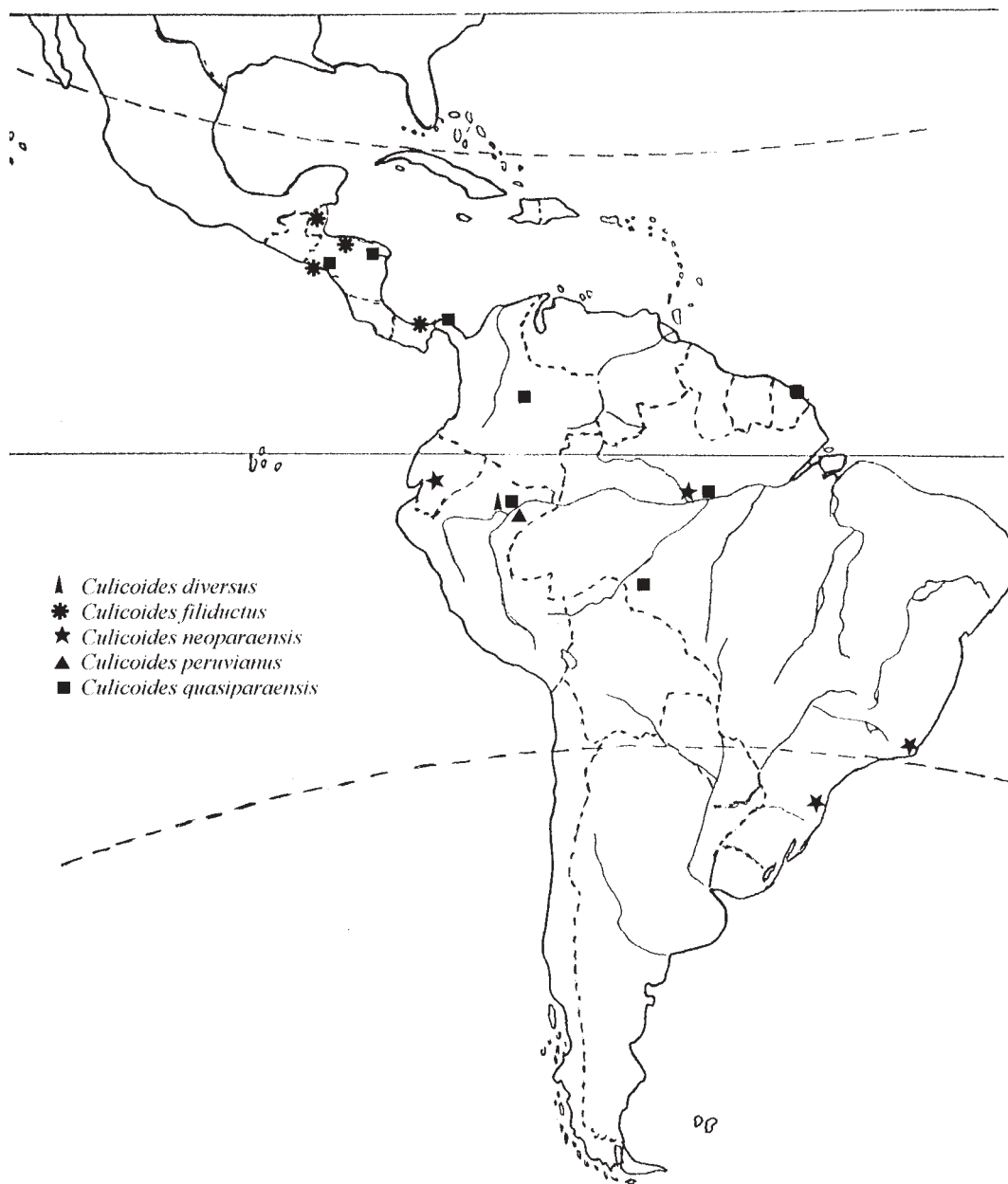


Fig. 24: distribution of *Culicoides diversus*, *C. filiductus*, *C. neoparaensis*, *C. peruvianus*, and *C. quasiparaensis* in the Neotropical region

be described from the Neotropical Region. Numerous areas are poorly collected and it is important that *Culicoides*, and other genera of Ceratopogonidae, be sampled to obtain a better understanding of the diversity of our region. Furthermore, within the *paraensis* species group, only the larva and pupa of *C. paraensis* (Murphree & Mullen 1991, Lamberson et al. 1992) and pupa of *C. filiductus* (Vitale et al. 1981) are known and the immatures of the remaining species need to be investigated. In addition, species in the *paraensis* species group all appear to be restricted to lower elevations, suggesting that their speciation has also occurred at these lower altitudes.

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