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SHORT COMMUNICATION

Species diversity and seasonal abundance of *Culicoides* biting midges in northwestern Argentina

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Abstract. The species diversity and seasonal abundance of biting midges of the genus *Culicoides* (Diptera: Ceratopogonidae) were studied in northwestern Argentina during the period 2003–2005. A total of 5437 *Culicoides* specimens were collected using CDC light traps in three areas of the mountainous rainforest area. The most common species were *Culicoides paraensis* (Goeldi) and *C. insignis* Lutz, *Culicoides lahillei* (Iches), *C. venezuelensis* Ortiz & Mirsa, *C. debilipalpis* Lutz and *C. crescentis* Wirth & Blanton were also collected. *Culicoides paraensis* was abundant during the summer, and *C. insignis* and *C. lahillei* during late summer and early fall. Accumulated rainfall was the climatic variable most related to fluctuation in abundance of *C. paraensis*.

Key words. Biting midges, filariasis, seasonal abundance.

The females of only four species out of the 109 known genera of biting midges (Diptera: Ceratopogonidae) take bloodmeals from vertebrates: *Austroconops* Wirth & Lee, endemic to Australia the cosmopolitan *Leptoconops* Skuse, *Forcipomyia* Meigen (only species in the subgenus *Lasiohelea* Kieffer) and *Culicoides* Latreille.

The importance of *Culicoides* spp. in the transmission of a variety of parasites causing diseases in the Neotropics was recently summarized by Borkent & Spinelli (2007). In addition, their bites may cause allergic reactions and skin irritation (Ronderos *et al*., 2003b).

Culicoides species in northwestern Argentina are considered to be vectors of filarioid nematodes (Taranto & Castelli, 1988; Shelley & Coscaron, 2001). *Culicoides paraensis* (Goeldi) was first reported by Biglieri & Aráoz (1915) and was first shown to be the vector of *Mansonella ozzardi* (Manson) by Romaña & Wygodzinsky (1950). Taranto & Castelli (1988) studied a focus of filariasis by *M. ozzardi* in the province of Salta, and Shelley & Coscaron (2001) found that *C. lahillei* (Iches) and *C. paraensis* were the primary and secondary vectors of the parasite, respectively.

Ecological studies and assessment of *Culicoides* population dynamics in Argentina are scarce (Spinelli & Balseiro, 1982; Spinelli *et al*., 1989; Ronderos *et al*., 2003a), and deal primarily with the fauna of the Buenos Aires, Misiones and Corrientes provinces. The aim of the present study was to provide a basis for further ecological investigations on this important group of biting flies in northwestern Argentina.

Adult *Culicoides* were collected with CDC miniature light traps from January 2003 to November 2005 in three areas of Tucumán province: Sargento Moya (27°11′ S, 65°38′ W; 458 m a.s.l.), La Florida (27°13′ 10.5′ S, 65°37′ 56.7′ W; 452 m a.s.l.) and Capitán Cáceres (27°11′ 23.2′ S, 65°36′ 18.3′ W; 414 m a.s.l.). The traps were placed in the montane subtropical rainforests (Yungas) as well as near riverbanks and sugar cane crops. Sampling was carried out monthly from dusk until early evening (16.00–23.00 hours). Collected material was transported to the laboratory and preserved in 70% ethanol. Voucher specimens were prepared according to the procedure of Wirth & Marston (1968) and identified using the key of Spinelli *et al.* (2005).

Monthly measures of mean temperature, relative humidity, wind speed and accumulated rainfall were provided by the Pueblo Viejo Weather Station (27°12′ S, 65°37′ W). Relationships between species abundance and climatic variables were analysed with correlation analysis (Statsoft, 2001).

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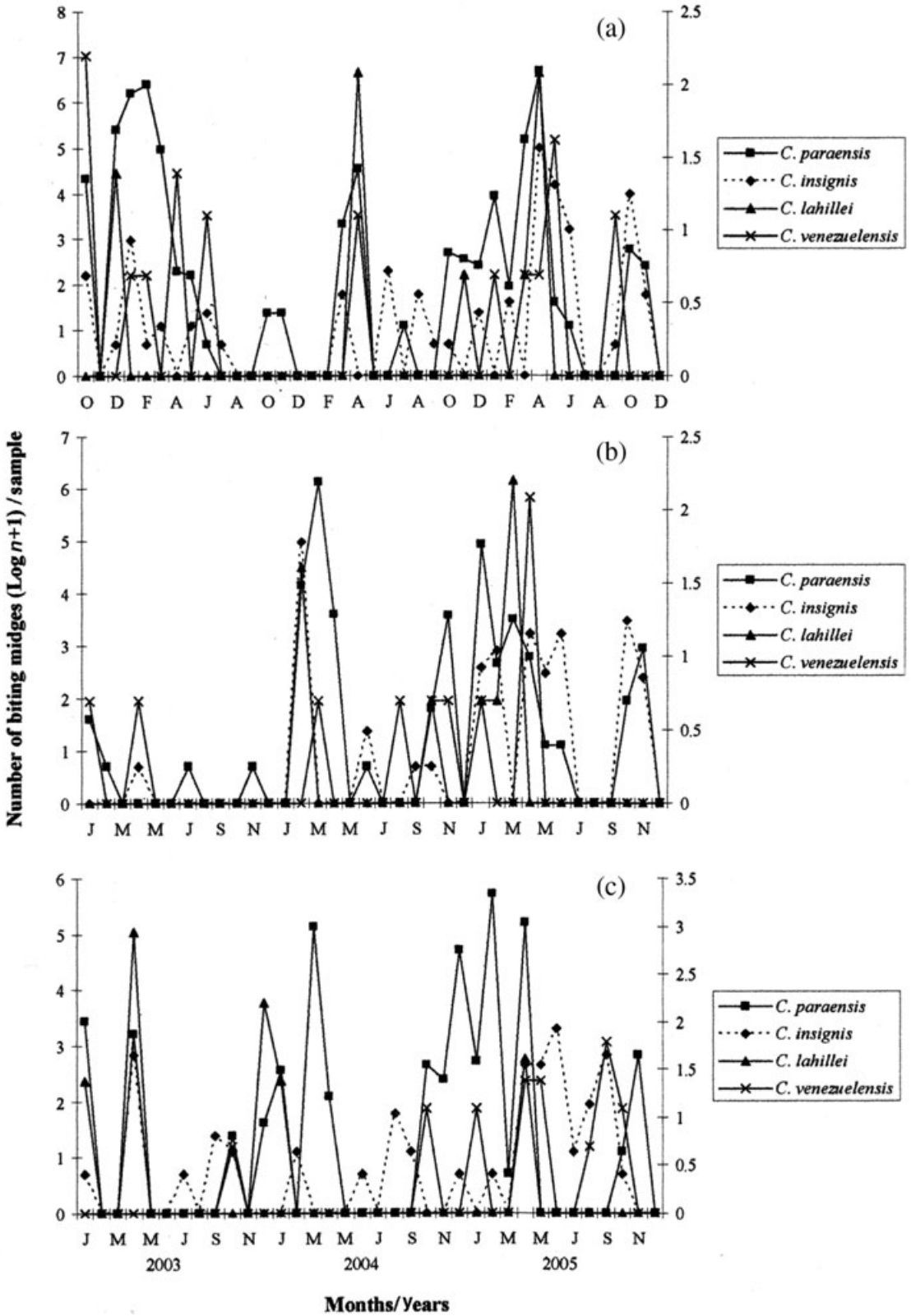

Fig. 1. Seasonal abundance of *Culicoides* species in Sargento Moya (a), Capitán Cáceres (b) and La Florida (c), Tucumán Province, between 2003 and 2005.

Table 1. Total number (N) and percentage (%) of *Culicoides* species collected in localities of northwestern Argentina between 2003 and 2005.

	Sargento moya		La florida		Capitán Cáceres		Total	
Species localities	N	%	N	%	N	%	N	%
C. paraensis	2755	86.7%	897	81.2%	831	71.9%	4483	82.4%
C. insignis	359	11.3%	112	10.1%	278	24%	749	13.8%
C. venezuelensis	26	0.8%	19	1.7%	14	1.2%	59	1.1%
C. lahillei	19	0.6%	36	3.3%	15	1.3%	70	1.3%
C. debilipalpis	14	0.4%	23	2.1%	9	0.8%	46	0.8%
C. crescentis	0	0	1	0.1%	1	0.1%	2	0.1%
C. spp.	4	0.2%	16	1.5%	8	0.7%	28	0.5%
Total	**3177**	**100%**	**1104**	**100%**	**1156**	**100%**	**5437**	**100%**

A total of 5437 specimens *Culicoides* were collected. Six species were identified, *C. paraensis* (82.4%, $n = 4483$), *C. insignis* Lutz (13.8%, $n = 749$), *C. lahillei* (1.3%, $n = 70$), *C. venezuelensis* Ortiz & Mirsa (1.1%, $n = 59$), *C. debilipalpis* Lutz (0.8%, $n = 46$) and *C. crescentis* Wirth & Blanton (0.1%, $n = 2$) (Table 1).

Culicoides paraensis was abundant during the summer (December–March) or rainy season. This is similar to the report by Santos Da Silva *et al*. (2001) in Rio de Janeiro, where the greatest abundance of the species is during May, one of the rainiest months. Similar results were found by Sherlock & Guitton (1964) in Bahía, Brazil, who determined that the highest abundance coincided with the rainy and cool periods. By contrast, *C. insignis* and *C. lahillei* were prevalent in late summer and early fall (March–June), and *C. venezuelensis* was collected during all the sampling periods, with peaks in fall and spring (Fig. 1).

Relationships between collection sites and climatic variables revealed that in Sargento Moya increased rainfall was related to an increase in the abundance of *C. debilipalpis* ($r = 0.32$, $P < 0.05$). In La Florida, increased rainfall was also associated with an increase in the numbers of *C. paraensis* ($r = 0.46$, $P < 0.005$). *Culicoides insignis* collections were influenced by the mean temperature ($r = -0.36$, $P < 0.05$), *C. venezuelenzis* by the relative humidity ($r = -0.41$, $P < 0.05$), and the wind speed was significant not only for *C. debilipalpis*, but also for *C.lahillei* ($r = 0.48$, $P < 0.002$ and $r = 0.47$, $P < 0.009$ respectively). Finally, in Capitán Cáceres increased rainfall was related to an increase in the abundance of *C. paraensis* ($r = 0.33$, $P < 0.05$), *C. debilipalpis* ($r = 0.55$, $P < 0.005$) and *C. lahillei* ($r = 0.42$, $P < 0.05$).

With regard to distributional data, *Culicoides insignis*, *C. venezuelensis* and *C. crescentis*, previously reported from northeastern and central Argentina (Spinelli & Wirth, 1986), are herein recorded for the first time from the Argentinian Yungas. *Culicoides insignis* is not only the most abundant, but also the most widespread species in the country (Ronderos *et al*., 2003a, b), and it was incriminated in the transmission of the Bluetongue Virus (BTV) in Corrientes and Misiones provinces (Lager *et al*., 2004). In contrast, nothing is yet known about the vectorial potential of *C. venezuelensis* and *C. crescentis*.

This first report of diversity and seasonal abundance of the *Culicoides* species of northwestern Argentina and their relation to climatic variables provides a better understanding of their behaviour in this region.

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