

Triatomines Involved in Domestic and Wild *Trypanosoma cruzi* Transmission in Concepción, Corrientes, Argentina

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An entomological and serological survey was performed in three localities of the Department of Concepción, Province of Corrientes, Argentina in 1998 and 1999, to identify triatomines species involved in domestic and wild transmission of Chagas disease. Triatomines were collected by man/hour capture in 32 houses randomly selected and 44 nearby outdoor ecotopes. *Trypanosoma cruzi* infection in triatomines was assessed by direct microscopic observation (400x) of feces and polymerase chain reaction. Serological techniques used for people were Indirect Hemagglutination Test and Indirect Fluorescent Test. Triatomines were collected in 28.1% of the houses and 31.8% of the wild biotopes. *Triatoma infestans* (Klug 1834) was exclusively found indoors and *T. cruzi* infected 60% of them. *Triatoma sordida* (Stål 1859) was mainly found in extradomestic ecotopes where trypanosome infection rate reached 12.7%. Serological study of 98 local people showed that 29.6% were seroreactive; most of their houses were closed to wild biotopes colonized by *T. sordida*.

Results indicate that there is an active *T. infestans* mediated transmission of Chagas disease in this zone that yields important human prevalence and that the populations of *T. sordida* in wild biotopes not only sustain the wild *T. cruzi* cycle but also represent an actual risk for people living in the area.

Key words: *Triatoma infestans* - *Triatoma sordida* - infestation - infection - seroprevalence - Argentina

In rural areas of Corrientes Province, *Triatoma infestans* (Klug 1834) is mainly found indoors and is also present in peridomestic premises (Bar et al. 1992, 1996b, 1997).

T. sordida (Stål 1859) colonizes wild biotopes (Bar et al. 1996a) as well as artificial ecotopes in peridomestic areas, sometimes coexisting with *T. infestans* and even established inside a rural house (Bar et al. 1992, 1996b). In Corrientes city it frequently invades houses and a large colony was captured in an urban ecotope (Bar et al. 1993).

Although intradomestic colonies of *T. infestans* have been eliminated from some areas of Corrientes province, *T. sordida* may replace it as a domestic vector. Integration of extradomestic triatomines to domestic transmission cycles has been occasionally reported in Minas Gerais, Brazil (Diotaiuti et al. 1993).

Anthropic environmental modification, mainly the replacement of natural forest by cultivated land, harvesting of wood and uncontrolled grazing may produce a concentration of wild mammals and triatomines in the peridomicile, generating local transmission cycles of *Trypanosoma cruzi*. Those foci can provide invading vectors to the domicile that can eventually carry trypanosomes (Wisnivesky-Colli et al. 1993). The peridomicile may represent a transition environment for triatomines coming from the wild and facilitate their domiciliation process (Gajate et al. 1996).

An important flood affected Corrientes Province in 1998, as a consequence of the El Niño phenomenon, which made the owners of the dwellings leave them temporarily. Most of the houses were rebuilt afterwards.

This entire situation contributed to the increase of the environmental disturbance.

In order to increase our knowledge on the ecology of domestic and wild triatomines, an entomological and serological survey was carried out in rural settlements of the Department of Concepción, Corrientes.

MATERIALS AND METHODS

Study area - The study area was situated in the localities of Santa Rosa, Colonia Tabay and Colonia Tata Cuá of the Department of Concepción, Corrientes, Argentina (27° to 28°S and 57° to 58°W). Biogeographically the area belongs to the oriental district of the Chaco region (Cabrera & Willink 1973).

Socioeconomic characteristics - Most of the houses were built with materials obtained from the environment. Wood walls and sheet metal or cardboard roofs were observed in 62.5% of the households, the remainder had mud stick walls and thatched roofs. Similar materials were used to built the storerooms and kitchens.

Domestic animals were present in 97% of the households, of which 80.5% were dogs, 55% cats and 53% hens.

Peridomestic ecotopes were open structures made with sticks or wood, partially covered or not by a roof, 5-20 m far from the domiciles.

The main activities are agricultural production directed to the family subsistence and temporary employment in cattle rearing or in the sawmills.

Field work - Houses were selected at random and nearby outdoor premises like hen and pigeon houses, pens, kennels and wild biotopes (piled trunks, palms, bird nests) were examined. Triatomines were collected by man/hour capture (Wisnivesky-Colli et al. 1987) using dislodging substances ("Neopynamin": tetramethrin 0.2%). The study was carried out during four seasons: spring (1998) and summer, autumn and winter (1999), after the "El Niño" phenomenon.

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Laboratory work - Triatomines were taxonomically determined and classified by sex and instars (Lent & Wygodzinsky 1979, Carcavallo et al. 1997). Trypanosome infection in collected triatomines was initially assessed by direct microscopic observation of feces (400x). Observed parasites were identified as *T. cruzi* by PCR of DNA from feces dried on Whatman paper no.1 (Russomando et al. 1996). One pair of specific TCZ primers were used (Mozer et al. 1989).

Human blood was collected from voluntary residents by venipuncture. Diagnosis of Chagas disease infection was performed combining Indirect Hemagglutination Test and Indirect Fluorescent Test. Individuals were considered positive if they were simultaneously reactive in both tests at serum dilution $\geq 1:32$. Of 163 residents in this area, 98 people were studied, considering a previous estimated 30% prevalence of infection and a 90% confidence interval.

RESULTS

Entomological survey - From a total of 32 houses and 44 outdoor biotopes searched, triatomines were found in 28.1 and 31.8% respectively. *T. cruzi* infection was recorded in 60% of *T. infestans* and in 12.7% of *T. sordida* individuals.

Total triatomines collected according to stages, species and seasons are recorded in Table I.

Winter - Eight houses and nine peridomestic premises were searched but no triatomine was found. Two out of three wild biotopes were infested by *T. sordida* nymphs (N = 9) and *Psammolestes coreodes* adults (N = 3). None of them was infected by *T. cruzi*.

Spring - Seven houses were searched and three were infested by *T. infestans* (N = 19). One out of three collected adults was infected by *T. cruzi*. Entomological searches were performed in seven peridomestic premises and three wild biotopes. The 12.5% of captured triatomines were infected. One infected *T. sordida* female was found in a pigeon. In two wild biotopes we collected 29 *T. sordida*, mainly nymphs of fifth instar.

Summer - In three infested houses from seven examined, we found 28 *T. infestans* bugs including *T. cruzi* in-

fecting adults. Hatched *T. sordida* eggs were found inside a bed. In one peridomicile, numerous fecal streaks of triatomines were recorded.

In 75% of eight examined wild biotopes a total of 27 *T. sordida* insects were collected. *T. cruzi* was detected in 17.4% of collected wild triatomines.

Autumn - Ten houses resulted to be not infested by live triatomines, however hatched eggs were found in two of them. All of the ten peridomiciles examined rendered negative results.

T. sordida nymphs (N = 13) were collected in two wild biotopes and *T. cruzi* infection was confirmed in 1 fifth instar nymph.

Serological survey - We studied men and women from 1-96 years old that were permanent residents of both infested and non-infested dwellings. The overall prevalence rate of infection by *T. cruzi* in the analyzed population was 29.6% (Table II). Our data documented a seroprevalence of 12.2% in children up to 10 years old. Meanwhile the infection rate observed in the following age group was approximately four times greater. Half of all people older than 30 years (9/18) were seroreactive. No significative difference was observed between sexes ($\chi^2 = 0,36$, $p = 0,56$).

TABLE II

Human population serologically analyzed for diagnosis of Chagas infection, Concepción, Corrientes, Argentina, 1998-1999

Age (years)	Analyzed population		Infected population		
	Females	Males	Females	Males	Total No. (%)
0 - 10	25	24	3	3	6 (12.2)
11 - 20	11	7	3	5	8 (44.4)
21 - 30	10	3	4	2	6 (46.1)
31 - 40	4	1	2	1	3
41 - 50	0	2	0	1	1
> 50	5	6	3	2	5 (45.4)
Total	55	43	15	14	29 (29.6)

TABLE I

Triatomines collected in different ecotopes and seasons, according to species and stages, Concepción, Corrientes, Argentina, 1998-1999

Season	Ecotope	Species	Age structure								Total
			E	I	II	III	IV	V	F	M	
Winter	Wild	<i>T. sordida</i>	0	0	0	2	2	5	0	0	9
		<i>P. coreodes</i>	0	0	0	0	0	0	1	2	3
	Peridomestic and domestic	-	0	0	0	0	0	0	0	0	0
										12	
Spring	Peridomestic and wild	<i>T. sordida</i>	0	3	2	7	3	11	1	3	30
	Domestic	<i>T. infestans</i>	16	0	0	0	0	0	2	1	19
										49	
Summer	Wild	<i>T. sordida</i>	0	9	4	0	4	4	1	5	27
	Domestic	<i>T. infestans</i>	21	5	0	0	0	0	1	1	28
	Peridomestic	-	0	0	0	0	0	0	0	0	0
										55	
Fall	Wild	<i>T. sordida</i>	0	6	0	2	2	3	0	0	13
	Peridomestic and domestic	-	0	0	0	0	0	0	0	0	0
										13	

E: eggs; I-V: nymphs; F: females; M: males; *T*: *Triatoma*; *P*: *Psammolestes*

DISCUSSION

The study area has undergone a strong environmental impact due to man-made practices like replacement of natural vegetation by citrus crops, *Pinus* sp. and *Eucalyptus* sp. forestation and timber extraction.

Although the 1998 flood destroyed primitive mud-bricked dwellings and new wooden houses were built instead, colonies of *T. infestans* were present indoors. The finding of eggs, first instar nymphs and adults in these new houses indicated a recent infestation. The insects could have arrived from the old houses with clothes and furnitures or from neighboring ecotopes.

A high proportion of wild biotopes was infested and harbored infected vectors. This fact was not observed in peridomestic areas, which is in concordance with those results verified in other localities (Bar et al. 1996b). The epidemiological situation in peridomestic areas is not similar to other Argentinian and Brazilian regions where the levels of peridomicilies infestation are very high (Diotaiuti et al. 1994, Gajate et al. 1996).

At a settlement in Colonia Tabay, located near those wild foci, we observed a high domiciliary colonization of infected *T. infestans*. Besides, *T. sordida* was frequently found in the wild environment and showed a high natural infection index by *T. cruzi*. Under those circumstances, interaction among wild and domestic cycles may be possible and mediated by an interchange of parasites between mammals and vectors in their respective habitats. In Concepción the infestation index was similar to the one in Empedrado (Bar et al. 1997) and lower than those of other areas of the province of Corrientes (Bar et al. 1992, 1996b).

In spite of the insecticidal action carried out in the past, neither the rural health agents nor the Chagas Provincial Service followed any systematic actions. It could be concluded that these campaigns did not have enough success considering the infection and infestation results obtained in this study. A systematic residual insecticide spraying program should be applied in order to control the recovery of the vector population.

Peridomestic habitat lacked adequate structural conditions to facilitate triatomine colonization. Nevertheless the question about the ability of *T. sordida* to replace *T. infestans* inside houses still remains.

The highest densities of *T. sordida*, the most important wild vector in the studied area, were registered in spring and summer, when mainly older nymphs and adults were collected. The small number of collected females could result from early dispersion after molting probably to colonize other biotopes.

This is the first citation of *T. sordida* and *P. coreodes* in the Department of Concepcion and involves a widening of their present geographic distribution.

The seropositivity rate among the age group of higher transmission risk (0-10 years old) was similar to that reported for San Miguel (Bar et al. 1996b). However, the seroreactivity obtained in the remaining age groups revealed that humans in Concepcion show the highest rates in relation with populations from other localities (Bar et al. 1992, 1996b, 1997). The serological increasing trend was similar to those from highly endemic areas located in the western dry area of the Chaco region (Wisnivesky-Colli et al. 1989).

The infection profile of the inhabitants suggests the existence of a strong past and a moderate present trans-

mission of *T. cruzi*. This control probably reflects the anti vectorial activities of the Southern Cone Initiative to eliminate *T. infestans* (Schofield & Dias 1999), and call special attention to the necessity to continuous this program, under the risk to revert the actual situation to the original one, with high indexes of transmission.

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