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DISPERSIVE FLIGHT AND HOUSE INVASION BY *TRIATOMA GUASAYANA* AND *TRIATOMA SORDIDA* IN ARGENTINA

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Flight activity and invasion of houses by Triatoma sordida *and* T. guasayana *were studied in the Province of Santiago del Estero, Argentina. Spontaneous findings of both species in houses were recorded from 1982 to 1989. Light trap collections were performed in 1982, 1983 and 1984, at the woods surrounding the settlements of Amamá (43 houses) and Trinidad (19 houses). Most of the 101 triatomines collected, were unfed and negative for* Trypanosoma cruzi. T. guasayana *predominated over* T. sordida, *and both appeared on the lighted screens between 19-31 min (mean 24) after dusk and the catch time was 30-45 min.*

Although entomological evaluation of 41 houses at Amamá performed in September 1985, just before insecticidal spraying, showed that Triatoma infestans *predominated, adults of* T. guasayana *were collected in sleeping places, in 7 houses (17%). Most triatomines invading houses from then up to 1990 were flying* T. guasayana *(20/27) and females outnumbered males. Three non-infected* T. guasayana *females were fed on man and two* T. guasayana *males positive for* "T. cruzi *like" trypanosomes were unfed. Therefore, visiting hungry adults could transmit* T. cruzi *to people and introduce wild parasites to the domestic cycle.*

T. guasayana *stands as the main potential substitute of* T. infestans *in the studied area, and it might play there the same role as* T. sordida *in Brazil.*

Key words: *Triatoma sordida* – *Triatoma guasayana* – *Trypanosoma cruzi* – dispersive flight – Argentina

Triatoma sordida Stål, and *T. guasayana* Wygodzinsky & Abalos are closely resembling triatomines belonging to the same species complex and their immature stages are hard to discriminate. *T. sordida* is endemic of the Cerrado, in Central Brazil from where dispersion towards the southwest took place (Forattini, 1980), and is now widely distributed throughout the Chaco region to central Argentina.

T. guasayana is found in central and northern Argentina and also cited for Bolivia and Paraguay (Lent & Wygodzinsky, 1979). Although the distribution areas of both species overlap, *T. sordida* predominates in eastern Chaco whereas *T. guasayana* is more abundant in the drier western Chaco (Abalos & Wygodzinsky, 1950). In the xerophytic "quebracho" woods in Santiago del Estero, both species are found among dried fallen logs, in wood crevices, in opossum lodges and in dried cacti (Wisnivesky-Colli, 1990). They are also found in peridomestic premises like goat pens, along with *T. infestans*.

Triatoma sordida has gained increasing epidemiological importance due to its tendency to invade houses, in areas where *T. infestans* has been controlled. It is nowadays the most frequently collected species in Brazil, specially in the southeastern and centralwestern states (Dias, 1988). In the state of São Paulo, *T. sordida* represented 79.8% of the triatomines

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collected by the Local Control Agency, during 1985-86, and it was found mostly in peridomestic premises. Outstandingly, 22.6% of the insects were collected indoors (Wanderley, 1991).

In Bolivia, *T. sordida* and *T. infestans* have been found simultaneously inside houses of several localities of Santa Cruz (De Muynck et al., 1978; Salcedo et al., 1980), while in Beni, where *T. infestans* is not present, only *T. sordida* is collected.

In the city of Corrientes, northeastern Argentina, (Bar, personal communication), colonies of *T. sordida* were recently found in 22 houses placed 300-2700 m from a heavily infested pigeon house.

T. guasayana has received less epidemiological attention than *T. sordida,* although Carcavallo & Martínez (1985) mentioned the presence of *T. guasayana* in a settlement where *T. infestans* had been controlled by carbamate spraying.

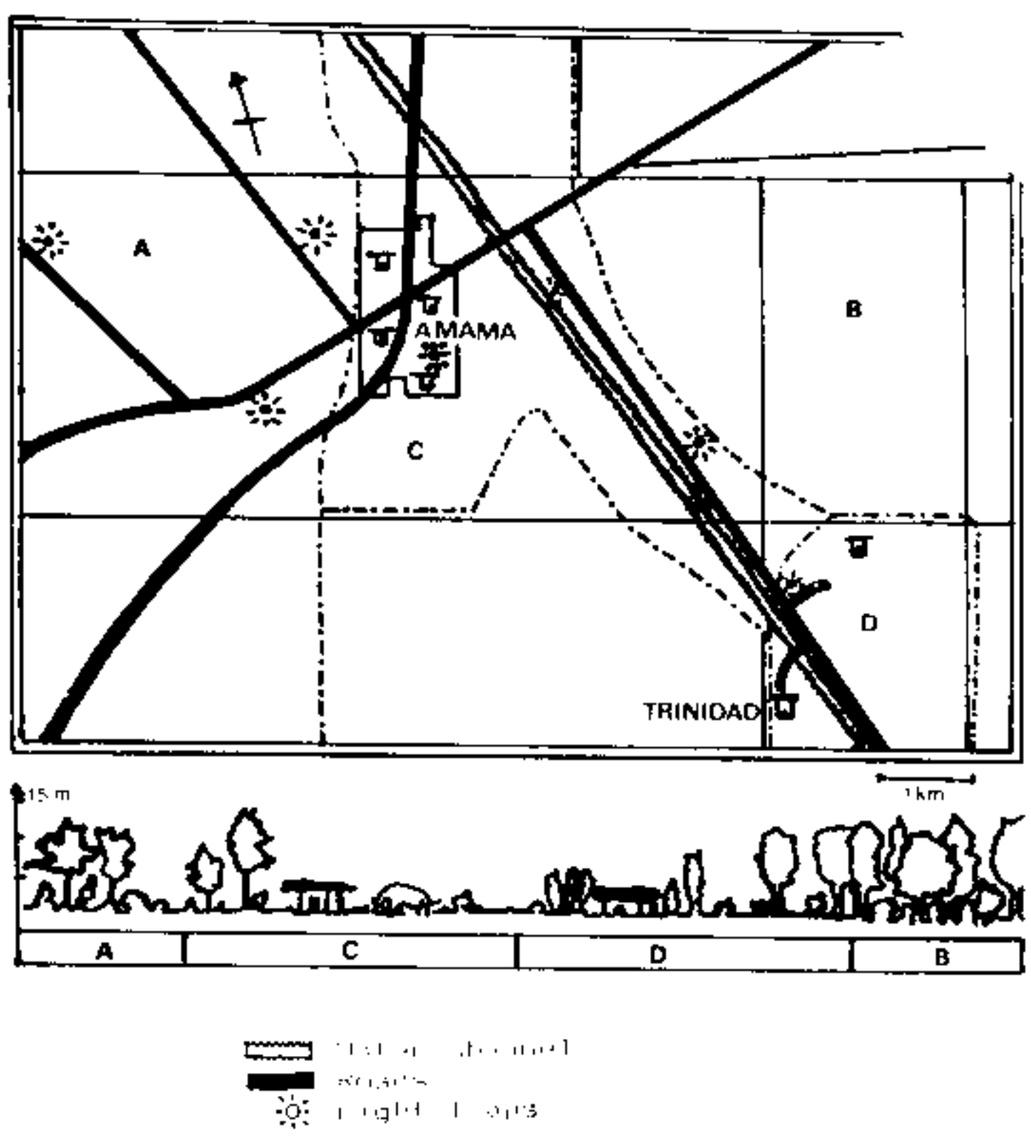
In November 1982, a female *T. guasayana* was collected inside a bed at the study area. Moreover, we observed several flying *T. guasayana* attracted to the gas lights, that began biting as soon as they landed on us. Prompted by those observations we decided to evaluate flight activity and invasion of houses by these wild triatomines.

MATERIALS AND METHODS

Study area – The study was performed at the settlements of Amamá and Trinidad, Department of Moreno, Province of Santiago del Estero, Argentina, (27°12'30"S, 63°02'30"W) located in the phytogeographic Chaqueña region (Cabrera, 1980). Climate is semiarid and there is marked seasonality, with a dry season between May and October, and a rainy one the rest of the year. Mean annual precipitations range between 550-600 mm, (medium RH 55-68%), and mean annual temperature is 21-22 °C, with a mean value of 28.5 °C in the warmest month and 5.5 °C in the coldest one (Anonymous, 1982). The primary forest of hardwood "quebracho" trees (*Schinopsis lorentzii* and *Aspidosperma quebracho blanco*) was intensively exploited for timber production and cattle raising at the beginning of the 20th century. Most of the herbaceous stratum was destroyed and replaced by thorn shrubs, resulting in a secondary forest of young trees, shrubs, cacti and bromeliads.

Amamá, composed of 43 houses, is located in an area that has been highly modified for agricultural practice and cattle raising. Modification of landscape increased since 1986, and at present only patches of woods remain where the forest was continuous. The village had never been included in the Chagas' disease Control Programme until September 1985, when indoor spraying with deltamethrin was performed by the National Control Agency.

Trinidad is placed 9 km appart from Amamá and it has 19 houses surrounded by a forest of high trees, few bushes and abundant cactaceous plants. Most of the inhabitants made their living hunting wild animals. The houses were highly infested by *T. infestans* and had never been treated with insecticides.



Localization of light traps in the surroundings of Amamá and Trinidad, Department of Moreno, Province of Santiago del Estero, Argentina, 1982-1986.

Light trap collection – Each light trap consisted of a vertical white cloth (1 x 2 m) illuminated by a portable 25 cm fluorescent light. Two light traps placed 100 m apart operated from sunset to 1 hr after the last catch, in five successive nights in 1983 (October 19 to 23), in six opportunities in 1984 (November 20 to 22 and 26 to 28), and in eight occasions from December 2 to 7 in 1986. Light traps were placed in different parts of the forest, as indi-

cated in the Figure. Two persons inspected the illuminated screen while acting as baits for triatomines. Time elapsed between the catch of the first and the last triatomine (catch time) was recorded.

Data on sunset times at Amamá, in those days when light traps operated were provided by the Observatorio Naval (Navy Observatory) of the Ministerio de Defensa.

Triatomine collection inside houses – As already reported elsewhere (Wisnivesky-Colli et al., 1987), "Maria" sensor boxes to detect triatomines had been tested during August 1985, and entomological evaluation of the houses at Amamá was performed in September just before deltamethrin treatment of the village. Timed collection of vectors (1 man-hour) inside houses were made by two men simultaneously working during 30 min each. In addition to this, any specimen of *T. guasayana* or *T. sordida* caught inside houses by us and/or local people at Amamá and Trinidad between 1986 and 1990 was included in this study.

At the field, triatomines collected at light traps or houses were placed in labelled plastic bags containing pleated absorbent paper and stored at 10 °C for a few days.

Laboratory studies on collected triatomines – Triatomines were determined using appropriate keys (Lent & Wygodzinsky, 1979) and adults were sexed. Nymphal stages were assigned to the *T. sordida* – *T. guasayana* Complex, due to the impossibility to discriminate them further. The presence of "*T. cruzi*-like" trypanosomes as well as the identification of blood meal sources were studied as previously described (Wisnivesky-Colli et al., 1982).

RESULTS

A total of 101 triatomines were collected at the light traps in Amamá from 1982 to 1984 (Table I), no triatomine came to the screen in 1986. The highest catches (71 insects) were obtained in 1983, even when the capture effort in 1984 was greater than in 1983. The number of triatomines attracted to light traps always

TABLE I

Triatomines collected on light traps, Amamá, Moreno, Santiago del Estero, Argentina, 1982-1984

Date (m-d-y)	Dusk time	Lapse (min) dusk-1st arrival	Catch time[a] (minutes)	*T. guasayana* ♂	*T. guasayana* ♀	*T. sordida* ♂
10/20 – 10/22/82[b]	7.22	13	45	3	6	
Subtotal 82				3	6	
10/19/83	7.21	19	45	4	9	
10/20/83	7.21	24	45	18	19	
10/21/83	7.22	23	30	2	7	1
10/28/83	7.24	19	37	5	4	
10/24/83[b]	7.24	21	45	1	1	
Subtotal 83				30	40	1
11/20/84	7.44	26	45	8	3	
11/21/84	7.44	28	41	1	2	
11/22/84	7.45	25	45	1		
11/26/84	7.49	26	45		3	
11/27/84	7.50	23	42		1	
11/28/84	7.50	25	45			2
Subtotal 84				10	9	2
Total[c]				43	55	3

a: time elapsed between the catch of the first and the last triatomine flying towards the screen.
b: light traps placed in the peridomestic area of a house at Amamá.
c: all insects showed empty intestines or blood traces and feedings could not be identified. They were not infected with "*T. cruzi* like" trypanosomes.

TABLE II

Domestic collection of triatomines of *Triatoma sordida – Triatoma guasayana* Complex, Moreno, Santiago del Estero, Argentina, 1982-90

Collection site	No. of houses	*T. guasayana* ♀*a*	*T. guasayana* ○	*T. sordida* ♀	*T. sordida* ♂	Nymphs N4	Nymphs N5
Bedroom	8	7	3				
Gallery	10	5	4*b*	2	1		1
Peridomestic premises	5	4	1		2	2	8
Totals	23	16	8	2	3	2	9
		24		5			
			29			11	
Total collection			40				

a: three females fed on man, one from bedroom and two from gallery.
b: two infected with "*T. cruzi*-like" trypanosomes.

reached a maximum 24-48 hr before storms (as in October 20, 1983). The first triatomine came to the light trap, 19-24 min and 23-28 min after dusk, in 1983 and 1984 respectively (Table I). In all occasions dispersive flight towards the lighted screen (catch time in Table I) extended during 30-45 min. Most triatomines came within the first 20-25 min. Since in 1983, none reached the screen from 8.30 pm to midnight, the expecting time was extended to only one hour after the last capture on the following year.

In light captures *T. guasayana* predominated on *T. sordida,* as only three males of the latter were caught. Although some nights one sex outnumbered the other in *T. guasayana* captures, females were slightly more numerous than males in overall figures. All triatomines trapped by light were not infected with trypanosomes and unfed.

Although *T. infestans* prevailed in collections performed in Amamá prior to deltamethrin treatment, adults of *T. guasayana* were found in sleeping places (bedrooms and galleries), in 7/43 houses (17%). The presence of *T. guasayana* in houses was first recorded in 1982, when a female insect fed upon man was found inside a bed, and repeatedly verified up to 1990 (Table II). Most triatomines caught when landing near house lights were *T. guasayana* (20/27) and females outnumbered males (Table II). All nymphs were found in peridomestic areas except for one fifth nymph of *T. sordida* collected on the wall of a gallery. In two houses, at Trinidad, *T. guasayana* females were picked up after domestic application of BHC tablets inside bedrooms.

Though many insects were starved and others were dead under reception, any trace of blood meal was analyzed. Identified feeding on man was recorded in three non-infected *T. guasayana* females, one of which showed a double feeding on man and chicken. On the other hand, two *T. guasayana* males found positive for "*T. cruzi*-like" trypanosomes had empty intestines. The *T. sordida* nymph found in the gallery was not infected, and had a double feeding on man and dog.

DISCUSSION

Most of our results refer to *T. guasayana* due to its numeric superiority over *T. sordida.* Although only three specimens of *T. sordida* came to the light traps, both species seem to fly within the same time period, soon after sunset. *T. guasayana* appeared in the lighted screens approximately 24 min after dusk, when it was already dark, and the catch time was less than one hour. In agreement, Schofield et al. (1991), stated that adults of *T. sordida* experimentally released in January, in the salt flats of Cordoba, Argentina, initiated flight 20 min after sundown. Stimulation of flight by decreasing light intensity in warm evenings seems to be a common fact among triatomines (Sjogren & Ryckman, 1966; Tonn et al., 1978; Ekkens, 1981; Schweigmann et al., 1988). In southwestern USA, it has been shown that 80% of the triatomines came to the light during the first hour after dark (O lux) (Sjorgen & Ryckman, 1966; Ekkens, 1981).

These facts contrast with observations made by us on nocturnal flights of *T. infestans* in San Juan, Argentina (Schweigmann et al., 1988). In January 1987, we collected 7 *T. infestans* attracted to a light trap between 21.25 and 01.45 hr. This longer flying period could be related to a high air temperature, since dispersive flight stops below 20 °C, (Ekkens, 1981). Whereas in the Department of Moreno, temperature rapidly falls down 1-2 hr after sunset, in San Juan in summer nights temperature is fairly above 30 °C.

A rather unusual windy and rainy weather on December 1986 could partly explain the lack of light captures, since even if environmental temperatures were higher than 20 °C, strong air movements could stop flight activity (Ekkens, 1981).

Triatomines coming to the light were unfed, confirming literature data pointing that dispersive flight is initiated by starving adults and possibly caused by the absence and/or inaccessibility of blood sources (Sjorgen & Ryckman, 1966; Ekkens 1981; Lehane & Schofield, 1982; Schweigmann et al., 1988).

Along seven years we confirmed the invasion of houses by adult triatomines, from October to April. Since there was not a systematic recording of triatomines, probably the number of dispersing triatomines has been underestimated. Some houses were repeatedly invaded and in others, adults were found indoors in one opportunity and in peridomestic sites in another.

Although data on feeding profile of invasive triatomines are scarce, the fact that the three identified feeds include man indicate that visiting adults could transmit *T. cruzi* to people and even introduce wild parasites to the domestic cycle.

Light captures and house records would suggest that T. guasayana is dominant over *T. sordida* in the area, as pointed out by Abalos & Wygodzinsky (1950). However, it is difficult to assess whether *T. guasayana* is actually more abundant or has a greater flying capacity than *T. sordida.*

Some interesting questions arise regarding the taxonomic relationship between *T. guasayana* and *T. sordida.* From 1983 to 1991, in the woods surrounding Amamá and Trinidad, we have systematically collected over 400 nymphs that on morphological grounds could be assigned to *T. guasayana* and/or *T. sordida,* as well as some adults showing characters of both species. They were mainly found in cacti (*Opuntia quimilo*), bromeliads and hollow trees, apparently sharing the same ecotopes. Considering that there is not absolute reproductive isolation between both species, could they remain as separate entities in the above mentioned situation? This question can be only solved through multidisciplinary studies of well differentiated and intermediate fenotypes, involving cytogenetics, isoenzyme analysis, detailed studies on male genitalia structure and intercrossing experiments.

In São Paulo (Wanderley, 1991) *T. sordida* has been found mainly in the peridomicile, but adult invasion into houses was frequent, most of the insects being inseminated females, able to form indoor colonies.

Schofield et al. (1991) suggest that *T. sordida* has much greater propensity to fly and tends to fly greater distances than *T. infestans.* According to them if *T. sordida* were able to establish domestic populations it would have a greater capacity than *T. infestans* to spread from one house to the other. In our study many records of adult *T. guasayana* flying into houses were made while only once or twice we could confirm invasive flights by *T. infestans* in the same period. After indoor spraying of deltamethrin in Amamá in 1985, both species could potentially invade houses from the peridomicile and establish colonies there. Only colonies of *T. infestans,* however, were found in the ongoing years (Gürtler et al., 1991), suggesting that *T. infestans* outcompete *T. guasayana* in the domestic arena, a fact experimentally shown by Bar et al. (1991) with the *T. infestans-T. sordida* pair.

Our findings place *T. guasayana* as the main potential substitute of *T. infestans* if control measures ensure intra and peridomestic elimination of the latter in the area under study, and suggest that *T. guasayana* could play the same role as *T. sordida* in Brazil.

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