Feeding and Defaecation Behaviour of *Triatoma patagonica* (Del Ponte, 1929) (Hemiptera: Reduviidae)

Julieta Nattero+, Liliana B Crocco, Claudia S Rodríguez

Cátedra de Introducción a la Biología, Facultad de Ciencias Exactas Físicas y Naturales, Universidad Nacional de Córdoba, Vélez Sarsfield 299, 5000 Córdoba, Argentina

Among the vectors of Chagas disease, Triatoma patagonica *is a species in the process of adaptation to the human environment being recently registered in urban and suburban zones. However, its importance as a vector of Chagas disease is unknown. The aim of this work was to evaluate two aspects of vectorial competence: the feeding behaviour and the defaecation pattern. These processes were studied in females of* T. patagonica *fed ad libitum on a restrained pigeon. The results showed that the blood meal size was negatively correlated with the time of first defaecation (r = -0.42). The first defaecation was emitted before the first 10 min and defaecations during feeding were frequent. A total of 73% of females, defaecated during the first 30 min post-feeding. These results suggest that if this species subsequently colonizes the domicile, it would be capable of transmitting* Trypanosoma cruzi.

Key words: *Triatoma patagonica* - feeding - defecation - peridomestic - Chagas disease vector - Argentina

Among the peridomestic species of Chagas disease vectors, *Triatoma patagonica* (Del Ponte, 1929) has the most southerly distribution. It is only to be found in Argentina (Lent & Wygodzinsky 1979), 20º to 50º southern latitude and 750 m of altitude (Carcavallo et al. 1999).

It was found naturally infected by *Trypanosoma cruzi* (Chagas 1909) (Lent & Wygodzinsky 1979) and in Río Colorado (province of Río Negro) it was the only peridomestic species found in houses both in urban and suburban areas (Ferrero et al. 1999). These last records, added to the permanence in the peridomicile, point the need to determine how competent *T. patagonica* is as a vector of Chagas disease, especially in aspects related to feeding and defaecation.

These two processes (feeding and defaecation) have been thoroughly analyzed in triatomines as they are closely related to the development and transmission of *T. cruzi* (Mello 1980, Kirk & Schofield 1987, Trumper & Gorla 1991, Crocco & Catalá 1996). These processes are well known in domestic species like *T. infestans* (Klug, 1934) (Forattini et al. 1982, Friend & Smith 1985, Trumper & Gorla 1991) and *Rhodnius prolixus* (Stal, 1859) (Forattini et al. 1982, Friend & Smith 1985). Nevertheless, very little is known about peridomestic species including *T. patagonica* (Del Ponte, 1929) about which only facts relating to its life cycle and habitats are known (Martínez et al. 1985, Carcavallo et al. 1998).

From an epidemiological point of view, it is very important to have knowledge related to feeding and defaecation, the aim of this work is to evaluate the feeding pattern and the defaecation behaviour in adults of *T. patagonica*.

This work received financial support from Secyt (Argentina).
+Corresponding author. Fax: +54-351-433.1056
E-mail: jnattero@efn.uncor.edu
Received 10 January 2002
Accepted 22 July 2002

MATERIALS AND METHODS

This work was carried out with 29 adult females of *T. patagonica*. These were obtained as fifth instar nymphs by the Servicio Nacional de Chagas (Argentina). The insects were maintained under laboratory conditions at 26ºC ± 1ºC and at 60-70% humidity. After moulting, the insects were weighed and marked with acryllic paint following predetermined codes and were starved for 15 days (after moulting). After fasting, they were fed ad libitum on a restrained pigeon. For each feeding the following variables were determinated:

Blood meal size - This was determined by the difference in weight before and after feeding.

Feeding time - This was obtained by recording the time (in minutes) since the rostrum of the insect came into contact with the skin of the host until it detached itself.

Number of defaecations during feeding - This was registered by direct observation of the insect while feeding on the pigeon.

Number of defaecations emitted during the first 30 min after feeding - This was registered by direct observation of the insect while it was on the host and during 30 min after feeding.

All weights were measured using a Mettler Balance with a precision of 0.001 mg. The t-test for samples with dependent variables for comparing variables of the different groups, was used as statistic treatment. To verify the homogeneity of variance the Levenne test was used (Ferrán Aranaz 2001).

RESULTS

In Table I, the variables analyzed concerning feeding behaviour of females of *T. patagonica* are shown. The data were obtained from the repletion feeding of 29 females of *T. patagonica*, the average time recorded to complete an ad libitum ingest was approximately 15 min (SD = 5.34) although this time was not related to the blood meal size, which varied between 17 to 158 mg.

In order to establish if the nutritional state of the insect (weight before each feeding) affected the size of each

blood meal ingestion, the analysis of correlation between the initial weight (mg) and the blood meal size (mg) was carried out (Fig. 1). These analysis showed a negative linear correlation ($r = -0.38$, $n = 172$, $p < 0.0500$), with higher weight insects ingesting less, for example on insects with an initial weight of 57.5 mg (minimum registered) will take a medium ingest of 104.56 mg.

On the other hand the defaecating behaviour was analysed from 158 ingest ad libitum. These feedings began 15 days after moulting to adults and during all the insect life. It was observed that from the total number of feedings, there were excretions in a 73% of the cases ($n = 121$). Significant differences in the size of the ingest were registered between females that defaecated ($x = 89.86$ mg) and those that did not defaecate ($x = 45.26$ mg) ($p < 0.0500$).

In terms of the number of defaecations, an average number was obtained of 1.00, 1.46 and 1.63 defaecations per insect during the feeding and at 10 and 30 min post ingestion, and at 10 min they were registered up to 3 defaecations. The average time for the first defaecation was at 3.05 min ± 4.90 and the second one occurred within 10 min (Table II). The accumulated percentage of defaecations per insects was analyzed at different time. For the total of insects that defaecated during the first 30 min post ingest. In Fig. 2 it can be observed that at 2.5 min post ingestion, close to 50% of the females had emitted excretions and at 10 min post ingest the value recorded was 80%.

In order to determinate if the time of the first defaecation depends on the size of the ingestion (blood meal size) a correlation analyzed using both variables was carried out. A negative correlation was found ($r = -0.42$, $n = 121$, $p < 0.0500$), the larger the ingest the shorter the time for the first excretion. For an ingest of 60 mg, the time recorded for the first excretion was 4.8 min (y: 8.2672-0.0583.x) (Fig. 3).

DISCUSSION

The results obtained show that females *T. patagonica* require approximately 15 min to feed ad libitum. The size of this ingest was variable ($x = 78.19$ mg) but in general did not exceed the insect weight.

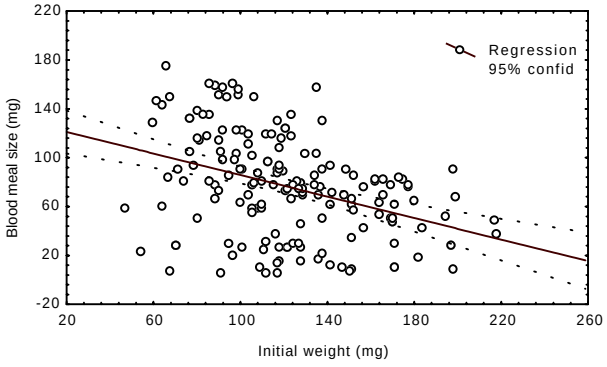


Fig. 1: relationship between insect weight before feeding (mg) and blood meal size (mg) (n = 121 feedings) of *Triatoma patagonica* (Del Ponte, 1929) y: 129.88 - 0.4404x.

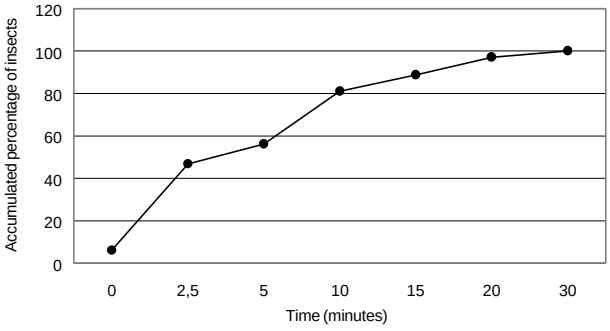


Fig. 2: accumulated percentage of insects which defaecated during feeding (time 0) and at different times afterwards by 29 females of *Triatoma patagonica* (Del Ponte 1929).

TABLE I

Feeding behaviour of 29 females of *Triatoma patagonica* (Del Ponte, 1929)

	Initial weight (mg)			Blood meal size (mg)		Time of feeding (min)	
	n	x	SD (min.-max.)	x	SD (min.-max.)	x	SD (min.-max.)
Females	29	120.86	26.53 (57.50 ± 171)	78.58	24.94 (17 ± 158)	15.31	5.34 (6.73±38)

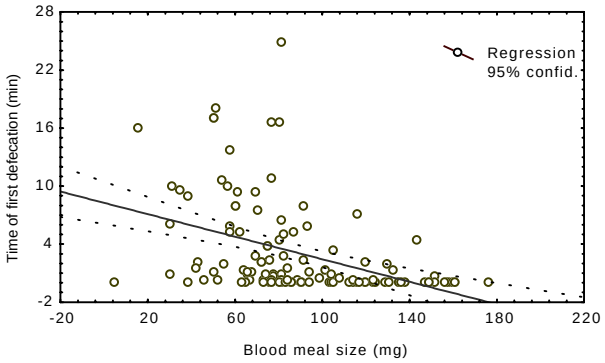
x: average; SD: standard deviation

TABLE II

First defecation time and number of excretes emitted by insects during the feedings and up to 30 min post-feeding in 29 females of *Triatoma patagonica* (Del Ponte, 1929)

				No. of defaecations per insect					
No. of insects	No. of feedings	Time first defaecation (min)		During feeding		10 min		30 min	
		x	SD	x	SD	x	SD	x	SD
		3.05	4.90	1	0	1.46	0.55	1.63	0.65
29	121	n = 121		n = 9		n = 111		n = 121	

x: average, SD: standard deviation



(TFDEFECATION) – Time of first defaecation: 8,2672 min; Blood meal size: -, 0583; Correlation: r = -, 4214

Fig. 3: relationship between blood meal size (mg) and time of first defaecation (min) (n = 121 feedings) in females of *Triatoma patagonica* (Del Ponte 1929) y: 8.2672 - 0.0583x.

A comparison with *T. infestans* and the peridomestic species *T. sordida* (Stal, 1859) using the index of relative ingest (IIR), revels that the capacity of *T. patagonica* (0.6) is smaller than that of *T. infestans* (1.1) (Perlowagora 1973) and *T. sordida* (1.3) (Crocco & Catalá 1996).

On the other hand it can be observed that defaecating behaviour depends on the size of the ingest. The larger the ingest, the shorter the time between the begin of the feeding and the first defaecation. The minimum ingest required to induce defaecation during the first 10 min was approximately 20 mg. This relationship between the defaecation time and the size of the ingest were also registered in *T. infestans* (Trumper & Gorla 1991) and in *T. sordida* (Crocco & Catalá 1996). In triatomines when the ingestions are abundant, they must to emit the excretions quickly, because the blood have too much water (Friend & Smith 1985). *T. patagonica*, not only defecaeted quickly on the host after ingestion, some insects defaecated during the feeding time. To defecaete during the feeding time, *T. patagonica* needs a minimum ingest of 130 mg, more than that required by *T. sordida* (80 mg).

When compared the percentage of insects that defecaete at 10 min after feeding, the time considered by Zeledón (1975) to offer the highest risk for the transmission of *T. cruzi*, it can observed that *T. patagonica* presents a similar pattern to those shown by *T. infestans* and *T. sordida*. At 10 min after feeding the percentage of females of *T. patagonica* that defaecaeted was approximately 80% while for *T. infestans* it was 92% (Zeledón et al. 1977) and for *T. sordida* approximately 97% (Crocco & Catalá 1996).

It was registered that in *T. patagonica* the nutritional state of the insect in the moment of feeding affects the blood meal size. In *T. sordida*, studies carried out by Schofield et al. (1991), demonstrated that the nutritional state of the insect influences the dispersion of the species, given that the proportion of adults that start to fly is lower when the nutritional state is higher. If we translate these data to *T. patagonica* it suggests that insects with a low nutritional state will have more capacity to disperse, making it possible to colonize new ecotopes. Moreover, insect with a lower nutritional state ingest, a greater quantity of blood increasing the possibility of defecation during the feeding.

Finally, it can be concluded that the result obtained here suggest that if *T. patagonica* were really to colonize the domiciles, it would be capable of transmission of *T. cruzi*, because it is a species that has the characteristic of defaecating immediately after as well as during feeding.

ACKNOWLEDGMENT

To the Servicio Nacional de Chagas for supplying insects.

REFERENCES

Carcavallo RU, Giron IG, Jurberg J, Lent H 1998. Habitats and related fauna. In RU Carcavallo, J Galindez Giron, J Juberg, H Lent (eds) *Atlas of Chagas Disease Vectors in the Americas*, Fiocruz, Rio de Janeiro, p. 561-621.

Carcavallo RU, Curto de Casas S, Sherlock IA, Galindez Giron J, Jurberg J, Galvão C, Menca Segura CA, Moireau F 1999. Geographical distribution and altitudinal and latitudinal dispersion. In RU Carcavallo, J Galindez Giron, J Juberg, H Lent (eds), *Atlas of Chagas Disease Vectors in the Americas*, Fiocruz, Rio de Janeiro, Vol. III, p. 747-792

Crocco LB, Catalá SS 1996. Feeding and defecation patterns in *Triatoma sordida*. *Mem Inst Oswaldo Cruz 91*: 409-413.

Ferrán Aranaz M 2001. SPSS para windows. Análisis estadístico. Mc Graw-Hill, España, p. 19-28, 110-115.

Ferrero AA, Visciarelli EC, Torno O, Costamagna SR 1999. Presencia de *Triatoma patagonica* en viviendas humanas en la ciudad de Río Colorado, Provincia de Río Negro. *Rev Soc Entomol Arg 58*: 79-84.

Forattini OP, Soares Barata JM, Ferreira Santos JL, Silveira AC 1982. Hábitos alimentares, infecção natural e distribuição de triatomíneos domiciliados na região central do Brasil. *Rev Saúde Púb São Paulo 16*: 171-204.

Friend WG, Smith JJ 1985. La fisiología de los triatominos con especial referencia a la alimentación por sangre. In *Factores Biológicos y Ecológicos en la Enfermedad de Chagas*, Organización Panamericana de Salud, Buenos Aires, p. 59-72.

Kirk ML, Schofield CJ 1987. Density-dependent timing of defecation by *Rhodnius prolixus*, and its implication for the transmission of *Trypanosoma cruzi*. *Trans R Soc Trop Med Hyg 81*: 348-349.

Lent H, Wygodzinsky P 1979. Revision of the triatominae (Hemiptera, Reduviidae), and their significance as vectors of Chagas' disease. *Bull Am Mus of Nat Hist 163*: 286-288.

Martínez A, Carcavallo RU, Cichero JA 1985. República Argentina. In *Factores Biológicos y Ecológicos de la Enfermedad de Chagas*, Organización Panamericana de Salud, Buenos Aires, p. 345-362.

Mello DA 1980. Algunos aspectos de hábitos alimenticios en condiciones de laboratorio de *Triatoma sordida* y *Rhodnius neglectus*. *Rev Brasil Biol 40*: 323-326.

Perlowagora-Szumlewicz A 1973. Species and stage interaction in the feeding behaviour of vectors of Chagas' disease. *Rev Inst Med Trop São Paulo 15*: 139-150.

Schofield CJ, Lehane MJ, Mc Ewan P, Catalá SS, Gorla D 1991. Dispersive flight by *Triatoma sordida*. *Trans R Soc Trop Med Hyg 85*: 676- 678.

Trumper EV, Gorla DE 1991. Density-dependent timing of defecation by *Triatoma infestans*. *Trans R Soc Trop Med Hyg 85*: 800-802.

Zeledón R 1975. Effects of triatomine behavior on trypanosome transmission. *PAHO Sc Pub 318*: 326-329.

Zeledón R, Alvarado R, Jiron LF 1977. Observation of the feeding and defecation of three Triatominae species (Hemiptera, Reduviidae). *Acta Trop 34*: 65-77.