

SHORT COMMUNICATION

Experimental Evidence for a Demographic Cline in *Panstrongylus megistus* Populations

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The population biology of three populations of Panstrongylus megistus was compared to determine possible influence on the behaviour and epidemiological importance of this species. The results demonstrated differences in terms of egg eclosion time, nymphal mortality and development rates, and feeding and defaecation rates. These differences appeared to follow a geographical cline, primarily reflecting different degrees of adaptation to domestic habitats.

Key words: *Panstrongylus megistus* - populations - biological characterization

Panstrongylus megistus (Burmeister, 1835) (Hemiptera, Reduviidae) is currently considered the principal vector of *Trypanosoma cruzi* in the eastern, southern and some northeastern states of Brasil. In Bahia, it is well adapted to living in houses and peridomestic habitats but its existence in sylvatic foci has not been proven. By contrast, in the southeastern states it can be found in sylvatic and domestic habitats, while in the south it is predominantly sylvatic (Pessoa 1962, Forattini 1980, Schofield 1994). Because of these differences, Pessoa (1962) proposed the existence of two subspecies of *P. megistus*, one sylvatic and the other domestic, but there is no further evidence to support such an idea (Dórea et al. 1982, Barbosa et al. 1998). Barbosa et al. (1999) found differences in the electrophoretic profiles of the salivary proteins of different *P. megistus* populations, but suggested that such differences had no genetic base because other characters of these populations showed no relationship with their sylvatic or domestic origin (Barbosa et al. 1998).

It is possible that *P. megistus* originated as a sylvatic species in the original Atlantic forest regions of Brasil (Forattini 1980) with domestic

populations arising through colonization of early post-colonial settlements. A similar process may have occurred in the northeast, with the original sylvatic populations subsequently eliminated by agricultural development, or it may be that the domestic northeastern populations were transported from the south in association with human migrations. Either way, a series of population adaptations may be expected, associated with the transition from sylvatic to domestic habitats (Schofield 1988), whereby the domestic populations may be expected to be more efficient in resource utilization compared to their sylvatic conspecifics (Schofield et al. 1999). The present work was designed to examine this hypothesis, by comparing the life-cycle and feeding dynamics of *P. megistus* populations originating from different areas.

Specimens of *P. megistus* were collected from Campo Formosa, Bahia (BA – peridomiciliary populations), from Florianópolis, Santa Catarina (SC – peridomiciliary populations), and from Belo Horizonte, Minas Gerais (MG – intradomiciliary populations). They were maintained under constant conditions in the insectary (27°C and 60% RH +10%) and allowed to feed on anaesthetised albino mice (SwissWebster) for 1h twice per week. Eggs were collected, and after eclosion 80 1st instar nymphs of each of the three populations were maintained for comparative cohort studies. Blood ingestion and the rate of defaecation per instar was estimated separately using batches of 30 nymphs of each instar from each colony.

Under these conditions, egg development time differed significantly between the populations, with those of BA averaging 21 days compared to an 18

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day average for the MG and SC populations. Overall, the SC populations developed most rapidly, completing their egg-to-adult development in a mean of 138 days, compared to 168 days for the BA population and 201 days for the MG population (Table I). However, overall mortality was higher in the SC and MG populations (13.8% and 11.1%, respectively) compared to the BA population (2.5%). During development, insects of the BA population took an average of 15 bloodmeals

with an overall weight gain of 12.2 times initial weight. In contrast, insects of the MG population took an average of 16 bloodmeals with an overall weight gain of 11.5 times, and the SC population took an average of 18 bloodmeals with an overall weight gain of 10.9 times (Tables II, III). The defaecation rate followed a similar pattern, with the BA insects showing an average of eight faecal drops after each meal, followed by the MG insects with seven and the SC with six (Table IV).

TABLE I

Mean time (days) that triatomines of populations of Minas Gerais, Bahia and Santa Catarina remained in each developmental phase before reaching the adult stage (27°C, 60 ± 10%RH)

Developmental phase	Minas Gerais			Bahia			Santa Catarina		
	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$
Egg	17	22	18.3 ± 0.9 (72)	12	23	20.6 ± 2.2 (79)	9	21	18.0 ± 1.5 (80)
First	12	82	26.2 ± 14.7 (72)	11	83	20.4 ± 9.3 (79)	12	36	18.3 ± 4.8 (80)
Second	13	78	33.5 ± 16.7 (71)	12	46	22.8 ± 8.2 (78)	10	34	16.6 ± 4.4 (75)
Third	15	106	31.0 ± 16.5 (68)	15	91	27.0 ± 11.3 (77)	13	36	18.9 ± 3.9 (74)
Fourth	19	91	34.8 ± 15.4 (67)	15	147	33.8 ± 18.5 (77)	15	49	25.2 ± 6.4 (74)
Fifth	25	122	56.8 ± 20.9 (64)	18	94	43.5 ± 10.8 (77)	22	69	40.8 ± 8.3 (69)
First-adult	127	316	201.2 ± 45.7	129	298	168.1 ± 34.8	100	174	137.9 ± 14.5

Values in parentheses represent the number of insects in each phase of development.

TABLE II

Weight increase of *Panstrongylus megistus* in relation to the initial weight, following the first blood meal and after the final moult (27°C, 60 ± 10%RH)

Developmental stage (n=30)	Minas Gerais			Bahia			Santa Catarina		
	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$
First	0.7	5.7	3.1 ± 1.3	0.8	7.6	4.1 ± 1.9	0.4	6.7	2.8 ± 1.6
Second	1.0	6.5	3.2 ± 1.3	0.4	6.8	2.9 ± 1.6	0.5	7.3	3.1 ± 1.3
Third	0.5	4.1	2.1 ± 0.9	0.6	5.0	2.5 ± 0.9	0.3	6.1	2.2 ± 1.4
Fourth	0.4	3.4	1.6 ± 0.8	0.3	4.1	1.5 ± 0.9	0.5	3.2	1.7 ± 0.7
Fifth	0.3	2.7	1.5 ± 0.7	0.2	3.5	1.3 ± 0.9	0.1	2.3	1.1 ± 0.6
Females	7.6	14.6	11.5 ± 2.4	7.1	17.6	12.0 ± 3.6	7.1	20.4	10.9 ± 3.2
Males	8.4	16.0	11.6 ± 2.2	6.0	19.3	12.4 ± 3.0	7.3	18.6	10.9 ± 3.4
Total	7.6	16.0	11.5 ± 2.2	6.0	19.3	12.2 ± 3.2	7.1	20.4	10.9 ± 3.2

Ratio: final weight/initial weight

TABLE III

Number of blood meals taken per stage during throughout the life cycle of three population of *Panstrongylus megistus* (27°C, 60 ± 10%RH)

Developmental stage (n=30)	Minas Gerais			Bahia			Santa Catarina		
	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$
First	1	4	1.5 ± 0.7	1	3	1.5 ± 0.6	1	3	1.8 ± 0.6
Second	1	5	2.4 ± 1.0	1	3	2.0 ± 0.7	2	5	3.1 ± 0.9
Third	2	5	3.0 ± 0.9	2	4	2.6 ± 0.7	2	5	3.2 ± 0.9
Fourth	2	7	3.9 ± 1.2	2	6	3.5 ± 1.1	2	8	4.2 ± 1.6
Fifth	2	10	5.2 ± 2.1	3	7	5.3 ± 1.2	2	9	5.9 ± 1.4
Total	11	27	16.0 ± 3.5	10	18	14.9 ± 2.0	15	23	18.1 ± 1.9

TABLE IV
Number of defaecations immediately after blood meal intake for the different nymphal instars of three populations of *Panstrongylus megistus* (27°C and 60 ± 10%RH)

Instar	Mean of defaecations per engorged insect								
	Minas Gerais			Bahia			Santa Catarina		
	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$	Min	Max	$\bar{X} \pm S$
First	-	2	0.9 ± 0.7	-	2	0.9 ± 0.6	-	2	0.4 ± 0.5
Second	-	3	1.0 ± 0.9	-	2	1.1 ± 0.9	-	2	0.7 ± 0.7
Third	-	3	1.4 ± 0.9	-	4	1.3 ± 0.9	-	2	1.3 ± 0.7
Fourth	-	4	2.1 ± 1.1	-	5	1.9 ± 1.2	-	4	2.0 ± 1.0
Fifth	-	5	1.9 ± 1.4	-	5	2.5 ± 1.2	-	4	1.9 ± 1.1
Total	-	14	7.3 ± 2.2	-	11	7.8 ± 2.0	-	11	6.4 ± 1.8

These results, although preliminary, are suggestive of a geographical cline. The population of southernmost origin (SC) developed faster but required more bloodmeals and suffered higher mortality in the process. The northernmost population (BA) developed more slowly but required fewer bloodmeals and suffered least mortality. The geographically intermediate MG population was also intermediate in most of the measured parameters, except for overall development time. In terms of resource utilization, the BA population can be seen to be the most efficient of the three, followed by the MG and SC populations. Of particular interest therefore, is the average weight gain of the BA population, which was significantly greater than that of the other two populations. Morphometric analysis reflects this pattern, with the BA populations generally showing larger females that lay larger and heavier eggs than the other two (Barbosa 1998). Such results can be interpreted as revealing different demographic strategies (*sensu* Rabinovich 1974) with the BA populations showing strongest *K*-selection, compared to weaker *K*-selection in the SC populations and intermediate *K*-selection in the MG populations.

Although the apparent demographic cline reflects the geographical origin of the three populations along a N-S axis, it also reflects their different levels of adaptation to domestic habitats. The most *K*-selected population (BA) was from a region where sylvatic populations are unknown; the intermediate (MG) population originated from an area where sylvatic, peridomestic, and domestic populations are known, whereas the SC population came from an area where fully domestic populations have not been reported. This experimental study thus provides evidence in support of the idea that domestication in Triatominae can lead to increased *K*-selection associated with greater efficiency in resource utilization (Schofield et al. 1999).

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