

## Genetic Variability in Brazilian Triatomines and the Risk of Domiciliation

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Among the 126 Brazilian members of the sub-family Triatominae, those of greatest epidemiological importance include *Triatoma infestans*, passively introduced into this country from Bolivia through human migrations; *Panstrongylus megistus*, with a wide distribution in humid forest areas; *T. brasiliensis*, indigenous to areas of caatinga scrub and with a great capacity to invade houses; *T. pseudomaculata*, also associated with caatinga areas but with predominantly peridomiciliar behaviour; and *T. sordida*, originally from areas of cerrado, and also mainly peridomiciliar (Forattini 1980, Alencar 1987).

Following the recent elimination of domestic populations of *T. infestans* by the Chagas Disease Control Programme (Dias & Schofield 1999), the accelerated rate of environmental modification by man has meant that several other species once considered to be of secondary or even tertiary importance in the transmission of *Trypanosoma cruzi* to humans are beginning to be found relatively frequently and at surprisingly high densities in man-made habitats, with a corresponding risk of new foci of transmission becoming established (FNS 1998). It is hoped that the study of genetic characteristics of triatomines will facilitate identification of those species or populations with the greatest capacity for adaptation to different habitats, providing a valuable tool for epidemiological vigilance that allows us to determine which areas have the highest risk of domiciliation by the insects. In addition, the genetic characterization of triatomine populations will also allow us to determine what role the sylvatic insects play in the recolonization of areas treated with insecticide. In Bolivia,

Dujardin and Cassini (1995) used morphometric comparisons of sylvatic *T. infestans* populations with domestic populations before and after residual spraying with insecticide to demonstrate that insects captured after treatment were survivors of the original population and not invaders from the surrounding wild habitat. This knowledge can be used to determine flaws in existing control measures and permit their improvement.

The recent constitution of a network of studies on the genetics and control of triatomines (Eclat) fosters interactions among groups of researchers, making available diverse techniques for characterization of the insects, such as isoenzyme analysis, RAPD-PCR, cytogenetic analysis, characterization of saliva and comparative morphology (Schofield et al. 1995). From this perspective, in our laboratory we have characterized several species and populations of triatomines, of which the most noteworthy are *T. infestans* and *P. megistus* because of their epidemiological importance, ecological characteristics and behaviour in response to chemical control measures. We are also able to present here preliminary results of a recently initiated study of *T. pseudomaculata*.

### *T. infestans*

*T. infestans* has great importance in the transmission of *T. cruzi*, because of its close association with man and its wide distribution in South America (Forattini 1980).

Comparisons based on isoenzymatic studies and morphology of the male genitalia of a *T. infestans* population from northern Minas Gerais with one from Cochabamba (presumed centre of endemicity for this species, this population being the standard against which others have been differentiated by genetic selection) showed the Brazilian colony to be more homogenous (Pires 1995). The Brazilian population was monomorphic for the enzymes studied, whereas the Bolivian one presented two different isoenzymatic profiles for

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PGM, one of them present in 77.5% of the insects tested and the other in 22.5%. With regard to the morphology of the male genitalia, variations were observed especially in the endosomic process, which in the Brazilian colony presented a greater number of spines (Pires et al. 1997).

Cytogenetic studies revealed important differences between these populations with regard to the distribution of band C, amount of heterochromatin and quantity of DNA, which can be up to five times greater in the Bolivian population (Pires 1995).

We are currently researching the biological significance of these genetic variations. In the laboratory no difference was observed in the development time of the colonies or in their levels of susceptibility to the pyrethroid insecticide deltamethrin, but mortality among the insects of the Brazilian colony was greater, which may indicate its deterioration. Our hypothesis, based on the idea that domiciliation involves the phenomenon of genetic simplification (Schofield 1994, Dujardin 1998), is that in Brazil *T. infestans* populations have already passed through a process of extreme simplification, including the loss of genetic material, which left them highly susceptible to chemical control and easy to eliminate, as borne out by the results of the Chagas Disease Control Programme. This hypothesis is being tested further in studies of other populations from Rio Grande do Sul, Uruguay and Argentina, where *T. infestans* frequently colonizes the peridomicile and has proved very difficult to eliminate.

### *P. megistus*

*P. megistus* is a very important vector of *T. cruzi* in Brazil, due to its wide geographical distribution and considerable potential for colonization and domiciliation. According to Forattini (1980), this species is associated with the habitats in the tropical Atlantic region, characterized by high levels of humidity. *P. megistus* occurs in all types of Brazilian forest except those of the Amazon, its distribution being limited only by climatic factors (Aragão 1961).

Barbosa (1998) compared three populations of *P. megistus*: one originating in Bahia, where the species is predominantly intradomiciliary, one from Minas Gerais where it is present in several types of habitat and the third from Santa Catarina, where it is predominantly sylvatic and rarely colonizes man-made habitats. The different biological parameters studied were insufficient to permit characterization of these populations. In the morphological studies, differences were observed for the weight and dimensions of the eggs, although no differences were observed in the morphology of the exo-

chorion. Morphology of the male genitalia could not be used to characterize the populations, nor was it possible to distinguish the populations by cytogenetic studies and  $\alpha$ -GPD activity.

Morphometric analysis and patterns of the antennal sensillae could however be used to differentiate the three populations, especially that of Santa Catarina in relation to those of Bahia and Minas Gerais. PGM was the only enzyme that showed polymorphism among the 13 enzymatic systems used. Two patterns were observed, of which both were present in the populations from Bahia and Minas Gerais and only one in that from Santa Catarina. Phenetic analysis of the electrophoretic pattern of the saliva revealed distinctions among the populations, with the formation of two distinct groups consisting of insects from Bahia and Santa Catarina, with those from Minas Gerais occupying an intermediate position, albeit somewhat closer to those of Santa Catarina.

According to Forattini et al. (1978) the State of São Paulo represents a transitional area for *P. megistus* populations, those occurring to the north presenting a greater capacity to colonize artificial ecotopes than those from the south. It is thought that the greatest biological potential of the species, manifested by greater genotypic variation (Pires et al. 1998), occurs in its centres of endemism (Forattini 1980). Our results indicate that the State of Minas Gerais also formed part of the area of origin of *P. megistus*, from where it probably dispersed across the wooded areas with which it is associated throughout the country. This would explain the greater difficulties encountered in the control of this triatomine in its centre of endemism, where there is strong reinfestation pressure by adults from surrounding wild habitats. Proof of this hypothesis obviously requires further studies, which we are presently carrying out using other populations of *P. megistus*.

### *T. pseudomaculata*

This species is widely distributed in the north-eastern states of Brazil and has been captured at high densities in man-made habitats. Because of its peridomiciliary and predominantly ornithophilic behaviour (it being closely associated with chickens), it is not considered to be a species of primary importance in the transmission of *T. cruzi* to man. Nevertheless the FNS (Souza et al. 1999) has just published two unexpected findings with regard to *T. pseudomaculata* in Brazil: one concerns the existence of a large focus of intradomiciliary infestation by this species; the second is that this focus is located in a shanty town or "favela" in the periurban area of Sobral, Ceará. The neighbourhood is densely populated, the inhabitants living in poor

conditions of hygiene. The housing units have practically no peridomiciliary area that would normally be occupied by this triatomine since the houses are constructed with no space between them. The favela is adjacent to an area of caatinga scrub, natural habitat of this species.

These findings were very surprising and show how little is known about the capacity of triatomines to adapt to new ecological situations. We undoubtedly have much to commemorate with respect to the advances made in the control of *T. cruzi* vectors in Brazil (Dias & Schofield 1999) and congratulate the FNS for their successes. Nevertheless we cannot agree that control programmes and research on triatomines be dismantled once Chagas disease ceases to be considered a public health priority. As discussed above, there is always the risk that other species will surprise us by becoming involved in *T. cruzi* transmission.

Preliminary comparisons of *T. pseudomaculata* specimens collected in houses of the Sobral focus with those from a typical peridomiciliary population from Independência (Ceará) revealed some differences in the electrophoretic pattern of the saliva of the insects. According to Pereira et al. (1998), the characteristics of triatomine saliva determine their interaction with their hosts by regulating the quantity of blood that can be taken and consequently the density of insects in houses (Schofield 1986). Studies of the DNA profile and feeding behaviour of different populations of *T. pseudomaculata* are presently being carried out that may help understand the factors favouring the adaptation of this species to intradomiciliary conditions in Sobral.

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