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The use of live-bait traps for the study of sylvatic *Rhodnius* populations (Hemiptera: Reduviidae) in palm trees

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Chagas disease is a major public health challenge for most Latin American countries. An initiative for the coordinated control of Chagas disease transmission throughout the Andean countries was launched in 1997. Since the early 1990s, control measures based on elimination of domestic/peridomestic triatomine colonies and screening of donor blood by serological testing have resulted in a reduction in incidence of ~70% in the Southern Cone countries (WHO, 1991; Dias & Schofield, 1999; Moncayo, 1999; WHO/CTD, 2000).

Various *Rhodnius* species are among the most important vectors of *Trypanosoma cruzi,* the causative agent of Chagas disease, in different countries of continental South and Central America. All of them have been reported to breed in arboreal habitats and many of them in palm trees of different genera (Whitlaw & Chaniotis, 1978; Lent & Wygodzinsky, 1979; Miles *et al.,* 1983; Pizarro & Romaña, 1998). The study of the ecological traits and behavioral trends of sylvatic populations is a key to the understanding of the processes leading to the initial colonization of human dwellings by *Rhodnius* species, and recolonization following vector control interventions (Dujardin *et al.,* 1991; Costa, 1999).

R. ecuadoriensis is a major vector of Chagas disease in Ecuador, and is able to colonize human-related habitats by migration from sylvatic ecotopes (Lent & Wygodzinsky, 1979; Romaña *et al.,* 1994; Schofield, 1994; Aguilar *et al.,* 1999). Sylvatic populations of *R. ecuadoriensis* have been reported to occur in central and northern coastal regions, in palm trees of the genus *Phytelephas* (locally known as *palma de tagua,* used for handicraft manufacture and frequently maintained in the peridomicile) (Avilés *et al.,* 1995; Borchsenius *et al.,* 1998). Here we report preliminary results of the use of live bait traps in the study of sylvatic *Rhodnius* populations in Ecuador.

The direct collection of sylvatic Triatominae is time consuming and logistically difficult. Results are usually scarce, even when dissection of natural ecotopes (e.g., palm trees) is undertaken (Miles *et al.,* 1981; Pizarro & Romaña, 1998). Light trapping is also of limited value, as only starved adults of few species fly readily to light traps. Several authors have reported the use of animal-baited traps for triatomines (Rabinovich *et al.,* 1976; Tonn *et al.,* 1976; Carcavallo, 1985), all as yet with poor results. Recently, Noireau *et al.* (1999, 2000) described a simple trapping system that produced excellent results in the study of sylvatic *Triatoma* (*T. sordida, T. guasayana,* and *T. infestans* dark morph) inhabiting hollow trees in the Bolivian Chaco. The system consists of a small plastic bottle containing a mouse as bait and covered with double-coated adhesive tape. We have applied this method, introducing several modifications aimed to improve its performance and the welfare of the mouse, to study sylvatic *Rhodnius* populations in palm trees in Ecuador.

The study area, nearby the locality of Alluriquín (province of Pichincha), is located on the western slope of the Andes (700–800 m above sea level; approximately 79°00' W, 00°20' S). The area comprises very humid subtropical forest (Cañadas, 1983). *Phytelephas aequatorialis* Spruce, a palm tree endemic to the Ecuadorian western slope of the Andes (Borchsenius *et al.,* 1998), is abundant in the zone, and was suspected of being a favored ecotope for *Rhodnius* insects. Our modified traps consisted of a plastic container, larger (~ 15 × 9 cm) than those used by Noireau *et al.* (1999), in which a mouse was contained together with a small quantity of wood shavings and food (aiming to protect the animal from low night temperatures and starvation). Small holes were made in the lower side of the bottles so that water from rain could not accumulate within. Containers were closed with 1 mm-aperture wire mesh and wrapped around with double-coated adhesive tape. They were located in different parts of the palm trees (among epiphytes growing around stems, or directly in the angle between palm fronds and the stem). Our objectives were: (i) to test the performance of modified live-bait traps in palm trees, and with *Rhodnius* species; (ii) to detect positive palm trees for further studies; and (iii) to capture some live specimens for laboratory studies. We initially studied 11 *P. aequatorialis* palm trees by direct searches for insects in their crowns. In a second attempt, we investigated 34 palm trees using the modified traps (placed overnight on the palms). We used a total of 56 trap-nights on these palms. We also undertook a manual capture of insects in the organic matter and epiphytes present around the trunk of 1 palm tree. Part of these materials were cut down and examined on a white sheet (4 people searching during 3 h). Finally, we dissected another palm by cutting it down and systematically inspecting it on a larger white sheet (4 people, 3 h). These 2 palms were already known to be positive (triatomines were captured previously in live-bait traps).

Direct searches in palm crowns yielded negative results. By live-bait trapping, 12 out of 34 palm trees were found to be positive (infestation index 35.3%) for the presence of *Rhodnius* breeding colonies (nymphs captured, colonisation index 100%) [insects were preliminarily identified as *R. ecuadoriensis* as described by Lent & Wygodzinsky (1979); molecular taxonomy studies are ongoing]. Of 56 trap-nights, 27 (48%) were found to be positive (containing triatomine bugs adhered to the tape) when checked the following morning. The average number of insects per positive trap-night was 4.9, with a maximum of 14 individuals in a single trap-night. We captured a total of 141 *Rhodnius* insects. The crowding index (average number of insects per positive palm) was 11.75, and the density index (insects captured/palms examined) was 4.15. Of the total number, 139 bugs (99%) were nymphs of different stages, with just 2 adults (1 female and 1 male) (adults/nymphs index 0.014). Seven nymphs were captured in 2 positive palms by other means, with just 1 fifth-instar nymph captured by complete dissection of 1 of these palms. No other triatomine species was found.

The performance of modified live-bait traps in this study is notably better than reported in 1999 and 2000 by Noireau *et al.* (48% positive against 27% and 21.9% positive, respectively); these differences maybe related to the distinct triatomines and ecotopes studied (thus not necessarily to a superior trap design), but clearly reveal that this method yields excellent results in palms inhabited by *Rhodnius*. We recently captured 50 *Rhodnius* individuals (*R. pictipes* and *R. robustus*) in a single trap-night in a *P. tenuicaulis* palm in the Ecuadorian Amazon (F. S. Palomeque *et al.,* unpublished). Regarding palm dissection, in 25 published studies (cf. Pizarro & Romaña, 1998) 1,390 palms were cut down and 10,564 *Rhodnius* were captured (an average of 7.6 insects/palm); our results in Pichincha (4.15 insects/palm, this report), and more widely in Ecuador (6.3 insects/palm by live-bait trapping plus direct searches in palm crowns, F. Abad-Franch *et al.*, unpublished) question the necessity of indiscriminately cutting down and dissecting palms for this kind of study. The adults/nymphs index we found is very low (0.014), we speculate that adult insects may be able to escape from the adhesive tape, but a lower number of adults in sylvatic colonies — compared to that of immature individuals — may also be a reason. Previous studies (conducted by palm dissection, thus probably biased towards bigger insects) report an average adults/nymphs index of 0.7, range 0–2.6 (cf. Pizarro & Romaña, 1998). With the live-bait traps, no mouse mortality was recorded, and animals spending the night inside the modified traps were found to be in perfect condition (except for 1 mouse, which was attacked by small ants, avoidable by covering the wire mesh with finer cloth).

Our results strongly suggest that live-bait traps with adhesive tape could be extremely helpful in the study of sylvatic populations of different *Rhodnius* and other Triatominae species associated with palm trees in the wild. This method provides a quick and inexpensive way to readily detect positive palm trees, and could be also of value for disease transmission control purposes, as the presence of triatomines in peridomestic palms may be easily monitored using live-bait traps. The ecological impact of cutting down and dissecting palm trees to study wild triatomines could be reduced to the minimum (and, in many cases, avoided), as could the effort required for such studies. Additionally, it is possible to recover sufficient live specimens to establish laboratory colonies and enlarge reference collections for further studies and comparisons.

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