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The finding of *Rhodnius pallescens* Barber, 1932 (Reduviidae: Triatominae) in palm trees (*Attalea butyracea*) in north Costa Rica

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A total of 167 nymphs and adults of *Rhodnius pallescens* was collected from the basal parts of dead fronds of two palm trees (*Attalea butyracea*) in the town of Los Chiles, province of Alajuela, Costa Rica, close to the Nicaraguan border. Previous records of this species in the same habitat come from Panama and Colombia. A group of 32 insects examined for *Trypanosoma cruzi* revealed that all were infected. By examining their hemolymph, none of 24 of the insects was found infected with *T. rangeli.* Balb/c mice inoculated with the *T. cruzi* strain from infected insects showed a typical acute myocarditis reaction with numerous groups of parasites among the heart fibers at autopsy. The geographical distribution of *R. pallescens* as well as its possible presence in other Central American countries and in Mexico where it is still unknown, coinciding with the distribution of the same species of palm tree, is discussed. Likewise, the potential of *R. pallescens* in becoming adapted to domestic environments is analyzed in light of recent information, and the epidemiological implications of the phenomenon are also discussed.

Key words: *Rhodnius pallescens*, palm trees, *Attalea butyracea*, *Trypanosoma cruzi*, Costa Rica.

INTRODUCTION

Triatomine bugs can be divided into those that have become adapted to live in human dwellings, after a long domestication process, and those that still remain entirely sylvatic. Between these two extremes are species that can periodically visit man-made ecotopes, becoming or not adapted to domiciliary or peridomiciliary areas, sometimes reaching a certain degree of domestication when they are able to succeed in this process of adaptation (Zeledón, 1974).

The efforts to systematically control the domestic populations of these bugs have been implemented and coordinated in specific programs in the different regions of Latin America under the name of "Initiatives". These programs have witnessed the new invasion of dwellings by species of bugs different from the domestic ones, particularly when previous niches become available, as a consequence of insecticide spraying campaigns for control. These invasions or reinvasions of households by different species or by the same species of bug, when they are well represented in wild habitats or remain in residual foci after spraying, constitute a new problem that has to be faced in the efforts to control vectorial transmission of Chagas disease (Dias *et al.*, 2002).

Another condition is presented by those places in which homes are being visited frequently, for the first time, by adult insects of a particular species of bug that has a wild habitat in the surroundings (Zeledón, 2003).

The above pose new challenges to control campaigns and demand more detailed study of the natural habitat and behavior of those species of triatomines that are partially adapted or are new visitors to human dwellings.

We report here for the first time the finding of *Rhodnius pallescens* in palm trees in Costa Rica, a species whose adults have been found visiting but not colonizing households in certain areas of the country (Marín & Vargas, 1986; Zeledón, 2003).

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MATERIAL AND METHODS

Los Chiles county, Alajuela province, is located at 11º 11' 51'' N and 84º 42' 56'' W, about 6 km from the Nicaraguan border. It is at 43 m above sea level and its climate is warm and humid (Tropical rain forest) with a mean temperature of 26ºC (21-31ºC) and a mean annual rainfall of 2627 mm and three months of reduced precipitation (February to April).

A small patch of secondary forest about 200 m long and 50 m wide in a new settlement in the town of Los Chiles, 400 m N of the local hospital, was chosen for the search of *R. pallescens* in April, 2004. Palm trees, locally called "corozo" (*Attalea butyracea*) are common in this forest and two adult specimens of *Rhodnius* had been caught in one of the neighboring houses by Dr. Dennis Méndez, a microbiologist who works at the hospital.

Two palm trees located about 15 m from each other, 10 and 13 m high respectively, were selected and cut down on separate days, with the help of a 14 inch gasoline chain saw (McCulloch, Model CS38EM). The remains of the lower dry fronds were carefully dissected to the upper ones without examining the green crown. By cutting the fronds at their proximal end and examining the inside portions, we were able to expose the fibrous tissue found in the narrow spaces formed by the base of the frond and the trunk where the insects were concealed.

A group of 32 insects (9 adults and 23 nymphs) found living in these trees, was examined for *Trypanosoma cruzi*, by observing a drop of feces in saline solution (0.9 %) under the microscope, and 8 adults and 16 nymphs of this group were studied for *T. rangeli*, by examining a drop of their hemolymph. Three Balb/c mice were injected subcutaneously with a suspension of feces in saline solution from 10 positive insects. Blood from infected mice was used to maintain the strain in new Balb/c mice. The hearts of the first three were used to prepare sections that were stained with hematoxilin-eosin for observation of parasites and pathological reaction.

RESULTS

A total of 167 *R. pallescens* was captured from the fronds of the two trees. In the first tree, 35 insects were collected at heights between 2.5 m and 3.8 m from the ground. In the second tree, 132 bugs were found in the frond bases located 5 to 8 m in height. The number and stages of insects found on each tree are shown in Table I.

The sample of adults and larger nymphs (2 females, 7 males, 5 V instar, 14 IV instar and 4 III instar) from tree Nº 2 examined for *T. cruzi* yielded positive results in 100 % of them. No flagellates were found in the hemolymph of the insects examined, indicating that *T. rangeli* was not present.

The infected mice showed few trypanosomes two to three weeks after inoculation and remained with low parasitemias. The first three died about three to four weeks after infection. In the animals where the strain is being maintained, the parasitemia was always low and most of the animals died within one month. The sacrificed animals showed a clear diffuse mononuclear infiltration process with degeneration and necrosis of myocardial fibers in two of them and the presence of moderate to numerous pseudocysts with amastogote forms of the parasite.

DISCUSSION

Rhodnius pallescens was described from Panamanian specimens in 1932 and later it was reported in Colombia and Belize (Lent & Wygodzinsky, 1979). There is a mention of its presence in the

Table I. Distribution of adult and nymph instar of *R. pallescens* found in two palm trees in Costa Rica

Tree Nº	Adults		Nymphs					Total
	♀♀	♂♂	I	II	III	IV	V	
1	2	3	14	4	4	3	5	35
2	2	13	25	57	15	14	6	132
Total	4	16	39	61	19	17	11	167

Amazon Federal Territory of Venezuela (Ramírez-Pérez, 1987) and adult specimens were found visiting houses in the provinces of Alajuela and Limón in Costa Rica (Marín & Vargas, 1986). These areas of Costa Rica where the presence of the insect has been confirmed by using light traps, correspond to the Humid and Very Humid Tropical Forest according to Holdridge's life zones in the northen and Caribbean lowlands of the country (Zeledón *et al.*, 2001). The visitation phenomenon by *R. pallescens* has also been observed in Nicaragua, Department of Rio San Juan, near the Costa Rican border, in at least 37 localities (Marín, 2003). A previous report of its presence in Nicaragua attributed to Del Ponte, as well as its presence in Mexico attributed to Romaña (Pizarro-Novoa & Romaña, 1998) could not be corroborated and we consider them as mistaken records.

Of the 16 species of *Rhodnius* that have been described, 12 are found living in palm trees, including *R. pallescens* (Dujardin *et al.*, 2002; Galvão *et al.*, 2003). The palms comprising its natural habitat, in chronological order are: *Attalea butyracea*, reported as *Scheelea zonensis*, in Panama (Whitlaw & Chaniotis, 1978; Christensen *et al.*, 1980); in Colombia the first record was in *Jessenia bataua* (Moreno-Mejía *et al.*, 1992a), and then *A. butyracea*, *Cocos nucifera*, *Copernicia tectorum* and *Elaeis oleifera* (Moreno & Jaramillo, 1996; Romaña *et al.*, 1999; Jaramillo *et al.*, 2000).

The marked preference for the palm *A. butyracea* seems to be well supported in those places where the insect has been found. In Panama, 90 to 100 % of the palms of this species are infested (Whitlaw & Chaniotis, 1978; Jabin, 2002) and in Colombia from 82 to 91 % have *R. pallescens* (Pizarro-Novoa & Romaña, 1998; Jaramillo *et al.*, 2000). The selection of this natural ecotope is probably explained by the typical structure of the basal portions of the old fronds of this palm allowing the formation of a space which produces a microclimate suitable for the bug. *R. pallescens* requires ambient relative humidities above 60% (Zeledón, 1974; Jurberg & Rangel, 1984). Furthermore, this type of palm tree is most adequate for small and medium sized mammals and for some birds that rest or nest in it, creating a very convenient biocenosis for the bug. Pizarro-Novoa & Romaña (1998) believe that two generations can be produced in one year under these natural conditions. In fact, in the laboratory the life cycle of the species tends to be rather short ranging from 102 to 209 days (Jurberg & Rangel, 1984) with a mean of 111 days (Moreno-Mejía *et al.*, 1992b).

The number of *R. pallescens* found in *A. butyracea* varies from 1 to 101 per tree in Panama (Whitlaw & Chaniotis, 1978) and in Colombia the mean was 19.5 insects with a maximum of 104 per palm (Pizarro-Novoa & Romaña, 1998).

The close association of *R. pallescens* with *A. butyracea* suggests that its geographical distribution might correspond to the distribution of this palm, i.e. Middle America including parts of Mexico and northern South America down to Bolivia (Henderson *et al.*, 1995).

The finding of this bug in palm trees of this species in northern Costa Rica implies that it probably lives in the same species of palm in Nicaragua, Honduras, Guatemala, Belize and Mexico, particularly in the Caribbean basin of these countries.

Rhodnius pallescens adults are markedly attracted to electric lights and can probably fly into human dwellings from palm trees as now observed in Colombia, Panama and Costa Rica. In Central Panama the species has been found colonizing huts, particularly those with palm thatched roofs (Pipkin, 1968; Sousa & Johnson, 1973) and has shown a preference for human blood even though it behaves as an eclectic insect in this respect (Christensen & Vásquez, 1981). Recent observations indicate that at least in some areas of Panama, house colonization is disappearing; this is most probably due to social progress leading to house improvement (Jabin, 2002; Vásquez *et al.*, 2004). In Colombia, in places such as Antioquia, domiciliary and peridomiciliary cycles have been observed even though the species tends to be essentially wild (Moreno-Mejía *et al.*, 1992c; Moreno & Jaramillo, 1996). Jaramillo *et al.* (2000) suggested that *R. pallescens* in that country is capable not only of colonizing human habitations, but that it could also invade houses when a primary vector such as *R. prolixus* is eliminated.

Rhodnius pallescens has been found infected with *T. cruzi* and *T. rangeli* in Panama (Sousa & Johnson, 1973) and in Colombia (Moreno-Mejía *et al.*, 1992c), and now with the former parasite in Costa Rica. Some authors in Colombia consider it as

efficient a vector of *T. cruzi* as is *R. prolixus* (Moreno & Jaramillo, 1996; Jaramillo *et al.*, 2000) but Pipkin (1968) in Panama, while comparing these two species in the laboratory, concluded that *R. pallescens* is a tardy defecator relative to *R. prolixus*, suggesting that it is a lesser vector. This difference in the literature awaits an explanation and genetic studies of populations from different geographical areas could throw some light on this important matter.

It is evident that the species has succeeded in its domiciliation trends in some areas and has been implicated as a vector of Chagas disease in Panama and Colombia (Sousa & Johnson, 1973; Moreno & Jaramillo, 1996). The potential for colonization of newly settled houses, in areas where *A. butyracea* trees are common, is a fact that sanitary authorities should keep in mind.

Attention should also be paid to the possibility of transmission by visiting adult insects in certain geographical areas, as suggested by recent serological surveys in children in Panama "despite the apparent absence of insect domiciliation" (Jabin, 2002).

Hallazgo de *Rhodnius pallescens* Barber, 1932 (Reduviidae: Triatominae) en Palmeras (*Attalea butyracea*) en el norte de Costa Rica

RESUMEN

En la población de Los Chiles. Provincia de Alajuela, Costa Rica, cerca de la frontera con Nicaragua, se recolectó un total de 167 ejemplares (ninfas y adultos) de *Rhodnius pallensces*, encontrados en la base de las hojas muertas de dos palmeras (*Attalea butyracea*). La especie había sido reportada previamente de Panama y Colombia colonizando la misma palmera. El examen de 32 insectos reveló que todos estaban infectados con *Trypanosoma cruzi* y no fue posible demostrar la presencia de *T. rangeli* en la hemolinfa de 24 insectos. La inoculación en ratones Balb/c con heces de los insectos infectados, mostró una moderada parasitemia y una típica miocarditis aguda con numerosos grupos de parásitos en las fibras cardíacas. Se analiza la distribución geográfica de *R. pallescens*, así como su posible presencia en los países centroamericanos y en México, en donde la especie es aún desconocida, en coincidencia con la distribución de la misma especie de palmera. Asimismo, se discute el potencial de *R. pallescens* de adaptarse a ecotopos domésticos y las implicaciones epidemiológicas del fenómeno.

Palabras clave: *Rhodnius pallescens*, palmeras, *Attalea butyracea*, *Trypanosoma cruzi*, Costa Rica.

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