

RELATIONSHIP BETWEEN PARTAMONA (HYM., APIDAE) AND  
CONSTRUCTOTERMES (ISOP., TERMITIDAE) IN THE SEMIARID  
REGION OF PARAÍBA STATE, BRAZIL

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#### ABSTRACT

Cupiras are stingless bees that build nests in termitaria, inhabited or not by termites. The cupiras of the semiarid region of Paraíba belong to the genus *Partamona* and their associated termites, to *Constrictotermes*. In normal nests, the termite queens are located at the central part, and around them commonly there are many eggs and nymphs. When there are cupiras and termites in the same termitary, the bees are also established in the central part, in a large cavity, rounded by tunnels for communication. It is supposed that this cavity system is built by the bees themselves, as it is not found in normal termite nests. The cavities are covered by batumen, isolating the two species of insects. In this relationship, we suppose that only cupiras are benefitted, as the termites are finally banished from the nests.

**Keywords:** Cupira, stingless bee, *Partamona*, termite, *Constrictotermes*, semiarid region, Paraíba State.

**Descritores:** Cupira, *Partamona*, térmitas, *Constrictotermes*, região semi-árida, Estado da Paraíba.

#### INTRODUCTION

The Trigonini bee group *Partamona* is Neotropical and contains approximately 40 known species (CRANE, 1992; ROUBIK, 1983). In the semiarid region of São João do Cariri, Paraíba, there is a species of *Partamona* that nests associated with arboricole termitaria of *Constrictotermes*. This is an endemic genus of South American termites, that has up to now three known species, all of them constructing arboricole nests. *Constrictotermes cyphergaster* is a common species in cerrado vegetation of central Brazil (MATHEWS, 1977), and the other ones are found in rain forests (ARAUJO, 1977).

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CAMARGO (1970, 1980) reported several nests of *Partamona* often built in large terrestrial termite mounds, clearly linked to the termite nest habitats. CAMARGO (1980) considered also that the nesting site and the kind of host apparently are species related: there are species of cupiras nesting only in subterranean termitaria, others nesting only in surface (epigeic) termitaria and others, in arboricole termitaria. Associations between stingless bees and termites, in any event, are not well understood: for some species, it is an occasional event; for others, it is a regular or invariable relationship (WILLE and MICHENER, 1973).

Dependence relationships between termites and bees are characteristic of some stingless bees. The requirements for nest defense, the indirect benefits of nesting near aggressive colonies and the utilization of a suitable nest substratum or system of cavities constitute deciding factors in nest location (ROUBIK, 1989).

The question about the cavities occupied by cupiras seems controversial. ROUBIK (1989) reported that the cavities are preexisting and the bees do not enlarge them or make holes necessary to enter in, being entirely dependent on their natural occurrence. According to SMITH (1952), *Meliplebeia nabalata* and *M. denoiti* enter subterranean termite nests. Some other species of *Trigona* build nests inside intact nests of termites; for example, *Scaura latitarsis* regularly uses *Nasutitermes*' nests. Such bees must dig their own cavities in the substratum of the termitaria. *Trigona latitarsis*, in tropical America, seems to establish colonies by constructing typical-looking nest entrance tubes on the surface of an arboricole *Nasutitermes*' nest. Then, presumably the bees work their way into the termitaria, gradually displacing the termites, excavating and walling off a cavity suitable for them (WILLE and MICHENER, 1973). The bees make this probably to gain protection for themselves against their natural enemies.

Here, we intend to determine whether the relationship between *Partamona* and *Constrictotermes* of the semiarid region of Paraíba is or is not a mutualistic one, or at least if the two kind of insects share peacefully the nests. Further, we wish to clarify if the bees use preexisting cavities in the termitaria, or if the cavities are made by them.

In brief, the question is why termites accept the invasion of the bees, suggesting the following hypotheses: a) termites and bees constitute a mutualistic association; b) the bees' occurrence does not affect the colonies of termites; c) termites are not able to turn out the bees, which occupy an important space of the termitaria.

## MATERIAL AND METHODS

This research was carried out in the municipality of São João do Cariri (Lat. 6°58'54" S and Long. 35°43'47" W GR), located in the semiarid region of the state of Paraíba, northeast of Brazil, during January to March, 1994.

Previously, it was observed that the cupiras, *Partamona* aff. *nigrrior*, of the semiarid region nested only in arboricole termitaria of one termite species. The termites belonged to *Constrictotermes*, a new species to be described elsewhere.

The nests of *Constrictotermes* sp. n. were attached to shrubs, at 50 cm to 1 m above the ground. They were oval, being approximately 50 cm high and 40 cm in diameter. The external part of the nests was hard, built with dark-red mud (local ground color), with low organic content; the central part was darker and softer than the surface, rich in organic matter, with characteristic cells, inter-linked by orifices approximately 2 mm diameter, where workers and soldiers of termites passed through.

We took at random 22 termitaria, 10 of them inhabited by termites only, six inhabited by bees only and six were inhabited by termites and bees. The termitaria were opened by a hatchet to observe the existence of reproducers, eggs and nymphs of termites, as well as the characteristics of the occupation.

When we opened termitaria having bees, with a cavity in the center, we recorded its dimensions. Each nest protected by cerumen was transferred to a wooden box 25 x 13 x 27 cm size, walls 2 cm thickness. Additional pieces of termitaria with tunnels containing bees were also added to the boxes. The back and front walls of the boxes were made by mud, trying to simulate the termitaria conditions. The honey was collected, but the pots were replaced. The intact pollen pots remained at the colony.

Boxes with colonies of bees were moved to a stingless bee site at the Experimental Station of São João do Cariri, belonging to the Agronomy Center of the Federal University of Paraíba, about 15 km far away from the place where the nests were collected. Each 15 days, the boxes were observed and, when the blossoms became scarce, the bees' diet was supplemented with honey of *Apis mellifera* and water (50% w/v).

## RESULTS AND DISCUSSION

All termitaria inhabited only by *Constrictotermes* sp. n. contained primary queens (one per nest), many eggs and nymphs, the last in different stages of development. All these forms lived in the central part of the nests, rich in organic matter. Only workers and soldiers occupied the periphery of the nests.

MATHEWS (1977) found stingless bees associated with nests of *Constrictotermes cyphergaster* in cerrado vegetation of Mato Grosso, Brazil, but the bees were not identified. One termitary was hollowed out and housed by a parakeet nest. He does not say if the nests containing bees or parakeet were or were not inhabited yet by the termites and which castes were found.

In São João do Cariri, under ordinary conditions, reproducers and immatures of termites always exhibited preference for the central part of the nests. Every time that we found *Partamona* aff. *nigrior*, they also occupied the central part of the nests, being populated only by bees or together with termites. The cupiras settled themselves in characteristic cavities, not found in normal nests and such cavities were well centralized (Fig. 1). When there were only cupiras in the nests, the cavities measured about 21 cm high and 14 cm in diameter, conforming to the shape of the nests. When there were cupiras and termites, the cavities were a little smaller (Tab. 1). Some other smaller cavities irradiated from the larger one, in the form of tunnels,

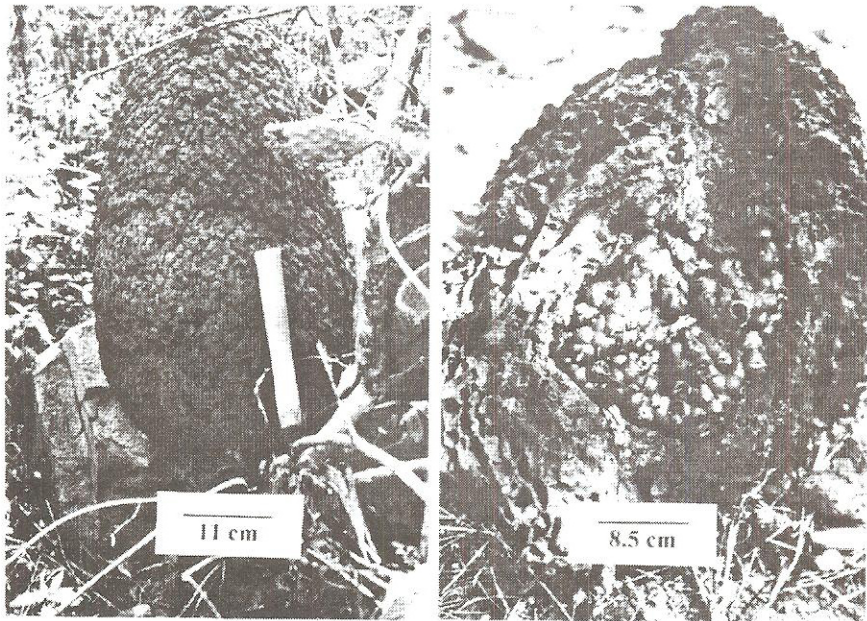


FIGURE 1 – On the left, a normal nest of termites, *Constrictotermes* sp. n., attached to a shrub, a few centimeters above the ground; on the right, a nest of *Constrictotermes* sp. n. with a colony (in the middle) of cupiras, *Partamona* aff. *nigrior*, in a semiarid region of Paraíba state, Brazil.

always having bees inside them. We think that such cavities, not found in nests without cupiras, had been hollowed out by the bees themselves, and subsequently covered by batumen (material produced with propolis), that isolate the cupira colonies from the termite colonies (SMITH, 1952). Besides, KERR *et al.* (1967), WILLE and MICHENER (1973), ROUBIK (1983), NATES and CEPEDA (1983) and CAMARGO (1984) considered that cupiras possibly make use of mandibular gland products, as allomones, thus limiting the physical and behavioral defenses of the termites. In these colonies, it is common to find many inquilines, suggesting that termites firstly accept them.

TABLE 1 – Data about the colonies of termites, *Constrictotermes* sp. n., and cupiras bees, *Partamona* aff. *nigrior*, in a semiarid region of Paraíba state, Brazil.

Number of termitaria opened	22
Only termites in the termitaria	10
Position of the queen's cell	In the center
Only bees in the termitaria	06
Medium size of the cavities	21 x 14 cm
Termites + bees in the termitaria	06
Medium size of the cavities	18 x 12 cm
With primary queens (termite)	02
Without queens (termite)	04
Position of the queen's cell	Lateral

In two out of six nests that contained termites and cupiras, there were primary termite queens. The queens, as well as the other castes of termites, were found in the nests just 2-3 cm from the cavities of the bees. The colonies were separated by batumen.

In the other four nests containing termites and cupiras, there were no primary termite queens, but we found eggs and nymphs, indicating reproductive activity. By the continuous increasing of the cavities, the primary queens of termites may have been effectively banished, as their physiogastric development in effect confines them to their cells. In these cases, the primary queens were replaced by nymphoid females (neotronics), capable of moving to different parts of the nests. However, we consider that, when the cavities of bees were present and proportionately large, they must completely have eliminated the termites, probably because termite eggs and juveniles only succeed in surviving in the center of the nests, where the fluctuations of temperature and humidity were probably of less amplitude than in the periphery of the nests (GARCIA and BECKER, 1975; MISHRA and SINGH, 1978).

When nests containing termites and bees were opened, we found that the termites attacked ferociously the bees, killing some of them. Nevertheless, repressed by the sunlight, after 10-15 minutes they began hiding, stopping the offensive. Although populations of termites were always much bigger than those of bees, during the attack there was no significant reduction of bees.

The cupiras from the semiarid region of the state of Paraíba are not aggressive. No special clothing is necessary for the management of their colonies, as is the case for cupiras from other regions. ROUBIK (1989) had seen termites invading nests of the small stingless bees *Trigonisca alomaria* and *Melipona fasciata*. CALLAN (1977) observed this behaviour in *Centris* sp. and GERLING *et al.* (1983) observed in *Xylocopa sulcatipes*. Most of the stingless bee species are unaggressive towards intruders. However, species of *Partamona* and *Ptilotrigona* are extremely aggressive and nest only in termitaria. Despite these cases, the bees had been regarded as mutualistic with the termites (ROUBIK, 1989).

In our observations, the relationship between cupiras and termites from São João do Cariri is without doubt not mutualistic and perhaps negative. We do not know how it begins, and it appears that cupiras (the guests) are the only beneficiaries, as the termites are displaced to the periphery of the nests and ultimately completely eliminated.

It is possible that cupiras can survive for long time in nests without termites. The six colonies found in such a situation did not show differences in population size or stocked food (although we did not make accurate measurements of these parameters), confronted with that also inhabited by termites. In any way, we believe that this relationship must be specific, as already was found by CAMARGO (1980) in other Brazilian regions.

There was no loss of entire colonies immediately after they had being transferred from termitaria to boxes of wood. The colonies soon had put in order their new residences. Nevertheless, after some time, 11 out of 12 colonies gradually became weakened and were lost, even after receiving a good food supply. Six colonies were decimated in 10 months after being transferred from termitaria to wooden boxes; four supported four months, and two could not stand more than two months. One colony was still alive three years and a half after the management.

We consider fundamental the identification of the limiting factors involving the survival of *Partamona* aff. *nigrior* in boxes. In this research, it became evident that the change of site of the colonies of cupiras could be the most limiting factor to be considered in the survival of the colonies.

## CONCLUSIONS

1 – The relationship involving the termite *Constrictotermes* sp. n. and the bee *Partamona* aff. *nigrior* from the semiarid region of Paraíba state showed to be specific, but it seemed that only cupiras are benefitted, as the termites are banished from the nests after some time.

2 – The nests of *Constrictotermes* sp. n., active or not, must present essential conditions for the survival of *Partamona* aff. *nigrior*. These conditions probably are related to temperature, humidity and physical protection.

3 – The cavities where the cupiras are found are made by themselves, as they are not found in ordinary nests, having only termites, and they are bigger in nests having only cupiras, after the termites had being banished.

4 – The short survival of the cupiras in the wooden boxes was an indication that the ordinary boxes are not appropriate for this particular species of bees.

5 – A detailed architectural study of the nests of *Constrictotermes* sp. n., involving dynamic of temperature and humidity, mainly in the cavities occupied by the bees in natural conditions, seems to be necessary in order to find out the way to construct a suitable box for the management of this species of *Partamona*.

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