

SHORT COMMUNICATION

Army Ant Attacks by *Eciton hamatum* and *E. rapax* (Hymenoptera: Formicidae) on Nests of the Amazonian Bumble Bee, *Bombus transversalis* (Hymenoptera: Apidae)

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ABSTRACT: This report contains details of the attack by army ants of the genus *Eciton* on colonies of the Amazonian bumble bee, *Bombus transversalis*. Attacks were made on two colonies in different regions of Amazonia by two different species, *E. rapax* on a colony in the Tambopata River area of Peru, and *E. hamatum* near the Javarí River in Brazil. Observations of the Peru raid include descriptions of the time-course of the raid and subsequent defense strategy of the colony, which successfully repelled the attack, in part because of its impregnable nest canopy and defending workers. The second attack was made on a defenseless colony (guards and foragers removed), destroyed by *E. hamatum*. Both the structure of the nest and a defense force come into play to withstand a raid. Ant-repellant substance(s) may be employed and should be investigated.

RESUMEN: En el presente trabajo se describen ataques de hormigas legionarias del género *Eciton* en colonias del abejorro amazónico, *Bombus transversalis*. Los ataques fueron observados en dos colonias salvajes encontradas en regiones distintas de la cuenca Amazónica. En una ocasión, una correría de *E. rapax* fue observada atacando una colonia localizada cerca al río Tambopata, Peru. En otras ocasión, una correría de *E. hamatum* fue observada atacando una colonia encontrada en el área del río Javarí, Brasil. Las observaciones realizadas en Perú incluyen la descripción sucesiva de los eventos del ataque, así como las estrategias de defensa empleadas por la colonia de *B. transversalis*, la cual logró repeler exitosamente el ataque, en parte debido a la cubierta de hojas del nido y a la presencia de las obreras defensoras. En el ataque registrado en Brasil, las obreras forrajeras y defensoras habían sido removidas previamente de la colonia, la cual fue destruida completamente. Tanto la estructura del nido como la facción de obreras defensoras parecen jugar un papel predominante en la defensa de *B. transversalis*. Adicionalmente, es posible que repelente(s) químico(s) de hormigas sean empleados en la defensa de la colonia, sin embargo su eventual utilización debe ser investigada.

The Amazonian bumble bee, *Bombus (Fervidobombus) transversalis* (Olivier), is restricted to lowland tropical rain forests of the Amazon Basin and its tributaries (Moure and Sakagami, 1962). This distribution is unusual as most species of *Bombus* evolved in temperate regions (Michener, 1979) and are thus well adapted to living in cool, mesic conditions (Sakagami, 1976). A significant feature in the survival of *B. transversalis* in tropical rain forest appears to be its unusual nest structure. Mature nests are fashioned with an outer waterproof envelope (canopy) composed of a dense mass of cut leaf fragments and rootlets, shaped roughly in the form of an inverted cone, 10–15 cm thick (Dias, 1958; Oleson, 1989; Cameron *et al.*, 1999). The canopy, which surrounds the brood comb and contains a 5–10 cm air space between its internal wall and the brood, assists in maintaining the colony's temperature and moisture balance (Taylor and Cameron, in press). Besides the climatic contingencies of life in the rain forest, *B. transversalis* must also contend with a major insect predator of the New World tropics—the army ant of the genus *Eciton* Latreille. *Eciton* raids are sufficiently common in the lowland tropics of Central and South America that any 100 m² patch of forest floor has a 0.5 predicted probability of being raided within a 240-day period (Franks and Bossert, 1983). *B. transversalis*, with its large nests constructed on the ground surface would appear to be particularly vulnerable to these raids. However, the available data on this subject suggest that colonies are able to defend themselves against *Eciton* attacks (Cameron *et al.*, 1999). Yet these data are fragmentary, and no detailed descriptions of raids have been made to date. In fact, bumble bees are not listed as prey items at all in a recent work on army ants (Gotwald, 1995). In this report we describe two occasions in

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which *B. transversalis* colonies were attacked by army ants. One was an attempted raid by *E. rapax* Smith on a strong colony with many workers; the other was an attack by *E. hamatum* (Fabricius) on a colony weakened from collecting a fraction of its workforce. These observations were made between May and August 2000 during a study of the nest architecture and nesting behavior of *B. transversalis*.

Observations

During the mid-dry season (Aug 2000) in tropical lowland rain forest in the Tambopata River region of southern Peru (12°50.26S, 69°27.74W), one of us (S.R.) witnessed an attack of a *B. transversalis* colony by the army ant species *E. rapax*. The colony was located in a second growth forest about 1 km from the river. During routine observations on the colony, an *E. rapax* column was spotted as it approached the nest from 5–7 m away. When first seen (1000 hr), the ant column (approximately 3 m in width, 8 m in length) was moving toward the nest in an uneven zigzag pattern. At 1020 hr the first ants climbed on to the nest canopy, and over the following 6 min approximately 60 army ants clustered on top of the canopy. The remainder of the column continued to move around the periphery of the nest during this period. The impression was that the raid was stopped in their advancement onto the nest, except for the original 60 or so individuals, which had begun to move frenetically over the canopy but were unable to penetrate it. The colony response to the ant raid was not overwhelming despite the fact that it contained a large number of workers (>400). As the first ants moved onto the nest, eight individuals, that up to that time had been manipulating leaf material on the outside canopy, responded to the disturbance by flying low over the canopy in a small cloud during the entire period of disturbance by the ants.

At 1027 hr, approximately 15 army ants congregated at the single nest entrance (19 cm long, 4 cm wide), located at the ground level of the canopy. Although several ants went some distance into the entrance tunnel (the exact distance was not measurable under the circumstances of observation), visual inspection of the first several cm inside revealed that none of them succeeded in reaching the brood. Some of these ants chased foragers as they flew in and out of the nest entrance, and several bees were seized in the ant's mandibles but escaped. Some bees escaped by biting the ants with their mandibles. By 1040 hr the ants in front of the entrance began to move away, and at 1047 hr the entire raid abandoned the nest site and departed in the same direction it was heading when it encountered the nest. During the raid, the bees killed five army ants but no bees were killed.

On a different occasion, S.A.C. witnessed an after attack on a *B. transversalis* colony located near the Palmari Reserve in Brazil (4°17'77"S, 70°17'33"W). This is situated on the Javari River, close to the borders of Colombia and Peru. The attack occurred sometime between 1800 hr on 22 May and 0600 on 23 May (rainy season) after 112 workers were aerial netted near the nest and maintained in a container at 4°C. The collected bees would have included mostly guards, as well as foragers returning to the nest at dusk. After collecting the bees, the nest was left untouched until its dissection the following morning. Teasing open the nest envelope revealed a seething mass of *E. hamatum*, which had destroyed much of the brood and comb. No adult bees or brood were found, and only remnants of torn brood comb were left. We do not know precisely how large this colony was in terms of adult worker and brood cell number, but infer from the number of guards that attacked during the aerial netting, and from foraging activity, that it was an active colony with a substantial workforce.

Voucher specimens of workers of *B. transversalis*, *E. hamatum* and *E. rapax* were deposited in the entomological collections of the Illinois Natural History Survey, University of Illinois, Urbana-Champaign.

Discussion

These observations confirm that army ants are a natural enemy of *B. transversalis*. They also suggest that the nest envelope can serve as a first line of defense against ant raids. The colony in Peru survived an attack by *E. rapax* with no loss of workers, in part because of its impregnable canopy thatching. The single nest entrance appeared to be well guarded since none of the ants that crossed the entrance threshold removed brood. In contrast, observations of army ant (*Eciton burchelli*) raids on wasp colonies (e.g., *Polistes erythrocephalus* Latreille) (Hymenoptera: Vespidae) have shown brood mortality of 100% among the attacked colonies (Young, 1979). Rather than staying to do battle against an ant raid, the wasp colony absconds, leaving the old nest and brood behind, and begins a new nest elsewhere. To our knowledge, there are no cases of absconding behavior in bumble bees.

After collecting the 112 guards and foragers from the Brazil colony, the nest was attacked by army ants within 12 hr. While we cannot be sure that the colony would have survived the invasion if these workers had not been removed, it is probable that their absence accounts for the success of the raid. A question arises as to the mechanism(s) *B. transversalis* workers might employ in defending the nest from ant attacks. In the absence of sufficient data to answer this question, we propose two (not necessarily exclusive) hypotheses: 1) a physical blockade set up by defending guards is employed to prevent entry inside the nest; 2) secretion of an ant repellent is laid down in the entrance tunnel, and perhaps elsewhere around the nest, to deter entry. Some Neotropical wasps employ the latter strategy against non-*Eciton* ants by applying ant-repellant substances on the nest pedicel and/or

surrounding branches (Jeanne, 1970; Jeanne, 1975; West-Eberhard, 1989), and it has been proposed, though not tested, that stingless bees and orchid bees permeate their nests with skatole as a deterrent against army ants (Roubik, 1989). Further observations and experiments would shed light on the exact defense system employed by *B. transversalis*.

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