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SHORT COMMUNICATION

Preliminary observations on gravid queen protection in *Oecophylla smaragdina*: Evacuation and retinue function

Joost Van Itterbeeck[1*], Niane Sivongxay[2], Bounthob Praxaysombath[2] and Arnold van Huis[1]

[1]Laboratory of Entomology, Department of Plant Sciences, Wageningen University, Droevendaalsesteeg 1, 6708 PB Wageningen, the Netherlands
[2]Department of Biology, Faculty of Science, National University of Laos, Ban Dongdok, Vientiane, PO Box 7322

[*]Corresponding author's email: joostvanitterbeeck@hotmail.com

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INTRODUCTION

Weaver ants (*Oecophylla smaragdina*) are well-known for their leaf nests, large colony sizes, polydomy, and territoriality (Crozier *et al*. 2009). Weaver ant colonies can be attacked, and killed, by a conspecific colony or an antagonistic ant species. Over most of its distribution, *O. smaragdina* is monogynous with polygyny only reported for the Australian Northern Territory (Peng *et al*. 1998a; Schlüns *et al*. 2009). In monogynous colonies, such as in Laos (Van Itterbeeck 2014), the survival of the *O. smaragdina* colony seems to be determined by the survival of the queen as queen turnover, i.e., the replacement of an old queen with a new queen (Heinze & Keller 2000), has not been observed (Van Itterbeeck 2014). Weaver ants employ various defence mechanisms including morphological, chemical, behavioural, and structural adaptations, and these are well understood (Bradshaw *et al*. 1979; Hölldobler & Wilson 1978; Hölldobler 1983). However, as the gravid queen is a "vital organ" (Franks & Sendova-Franks 1999), specific queen defence mechanisms can be expected to exist, and these are not well understood. We noticed the existence of such mechanisms when we caused a lot of disturbance to colonies during fieldwork (Van Itterbeeck 2014). Here we report preliminary observations on the evacuation behaviour of an *O. smaragdina* queen when under threat. In addition, we made preliminary observations on a previously unreported protective function of the retinue of worker ants that covers the queen. Observations were made in Sanghouabor village, Xaythani district, Vientiane Municipality, Laos, in February and March 2013. We conducted one experiment on queen evacuation behaviour, and one experiment on the protective function of the retinue.

QUEEN EVACUATION

We used five mature colonies that were located along the edges of dry dipterocarp forest and in isolated clusters of trees amid paddy fields. The total number of nests per colony ranged from nine to 16. The total number of trees per colony ranged from two to three. These trees were not taller than three meters, which facilitated access to and visibility of all the nests. The queen nest was identified following Peng *et al.* (1998b). In each of our five colonies, the queen nest was a small nest which was located near the top of the tallest tree. The queen nest had a larger nest entrance and had more major workers patrolling its exterior than any other nest. We applied two treatments in order to detect a difference in queen evacuation behaviour with a varying degree of disturbance in the colony's territory. In treatment No. 1, we simulated a direct threat to the queen by tapping the queen nest exterior with a stick (low disturbance of the colony). In treatment No. 2, we simulated the intrusion of a predator into a colony's territory and a direct threat to the queen by penetrating each nest with a stick or tapping their exterior with a stick, starting with the nest farthest from the queen nest (high disturbance of the colony). Both treatments were applied to each of the five colonies in a randomized sequence and with a two week interval between two treatments: three colonies received treatment No. 1 before No. 2, and two colonies received treatment No. 1 after No. 2. When we tapped the exterior of the queen nest in treatment No. 1, the queen, tightly covered by worker ants (retinue), quickly evacuated. As soon as the queen had exited the nest entrance, we stopped tapping the nest and the queen and retinue quickly returned inside the nest. After the queen had returned inside her nest, we tapped the nest exterior again with a stick and elicited queen evacuation but this time we continued tapping the nest. This caused the queen and retinue to walk along the supporting branch until they reached leaves that were not used in nest construction. The queen and retinue positioned themselves between these leaves. The ants forming the retinue then pulled the leaves close so that the queen and retinue were covered (Fig. 1). In treatment No. 2, the queen remained inside her nest after all the non-queen nests were disturbed. When we then disturbed the queen nest, she again quickly evacuated, confirming that only a direct threat to the queen nest elicits queen evacuation. Once again, the queen quickly returned to her nest after we stopped tapping her nest, whereas the behaviour depicted in Fig. 1 occurred when we continued tapping her nest. *Oecophylla smaragdina* queen evacuation seems to be a last resort. This is probably due to the risk of evacuating the queen and the difficulty of finding a safer location than the queen nest.

In both treatments we stopped tapping the queen nest when the leaves had been pulled over the queen and retinue. The following day, we returned to the colonies and identified the queen's location. In nine out of the ten cases in total (five per treatment), the queen had returned to her original nest, while in one case, a new queen nest was constructed on the opposing side of the tree crown. This indicates that the leaves used to cover the evacuated queen serve as an 'emergency bivouac' only.

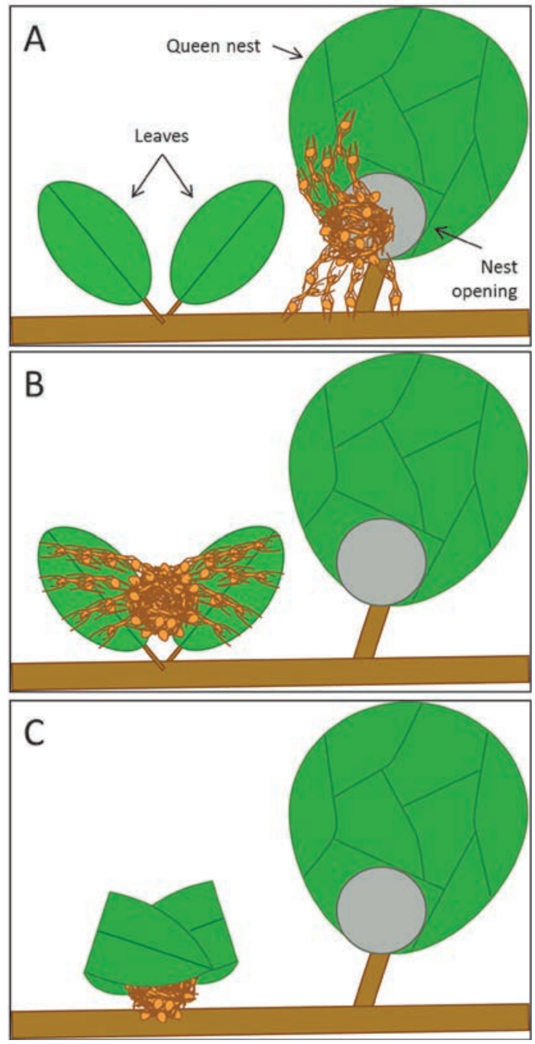

Fig. 1. Graphic depiction of the observed evacuation behaviour of the *O. smaragdina* queen and retinue under continuous tapping of the queen nest. (A) the queen evacuates while being tightly covered with worker ants (retinue), (B) worker ants that form the retinue hold on to each other and to nearby leaves and twigs, and (C) the leaves are pulled to cover the retinue and queen.

ADDITIONAL RETINUE FUNCTION

The retinue, comprised of particularly major workers, probably aids to fend off predators as many of the workers raised their gaster in a defensive posture (Hölldobler & Wilson 1983). In addition, we observed a previously unreported function of the retinue: it protects against the queen falling to the ground. These observations were made with five additional colonies, sampled as described above. After queen evacuation was elicited, we made the queen and retinue fall from their position by rapid jerking (the retinue holds on firmly) of the branch on which the queen and retinue walked. A tight ball of worker ants of about 2–3 cm in diameter with the queen in its centre (comprising a fraction of the retinue) was thus induced to fall. The queen and retinue did not fall directly to the ground: the ants forming the retinue managed to hold on to leaves, twigs, and branches which they hit during the fall. We continued jerking branches until the queen and retinue finally fell to the ground. We then examined the queen for injuries. None of the five queens showed any sign of injuries. In contrast, we observed a burst in the intersegmental membrane of one queen's enlarged gaster after we accidentally dropped her to the ground, suggesting that worker presence may have a protective effect (Fig. 2).

We also observed that the queen does not seem to be able to climb vertically (e.g., on a tree trunk) in absence of a retinue. This is probably due to: (1) the weight of the enlarged gaster, and (2) the reduced development or lack of arolia (adhesive pads on the tarsi; the queen does not partake in nest construction or in foraging and therefore the arolia do not need to be as developed as they are in worker ants; Endlein and Federle 2013). The *O. smaragdina* queen thus probably requires the assistance of worker ants when she is outside her nest to prevent her from falling, besides to fend off predators.

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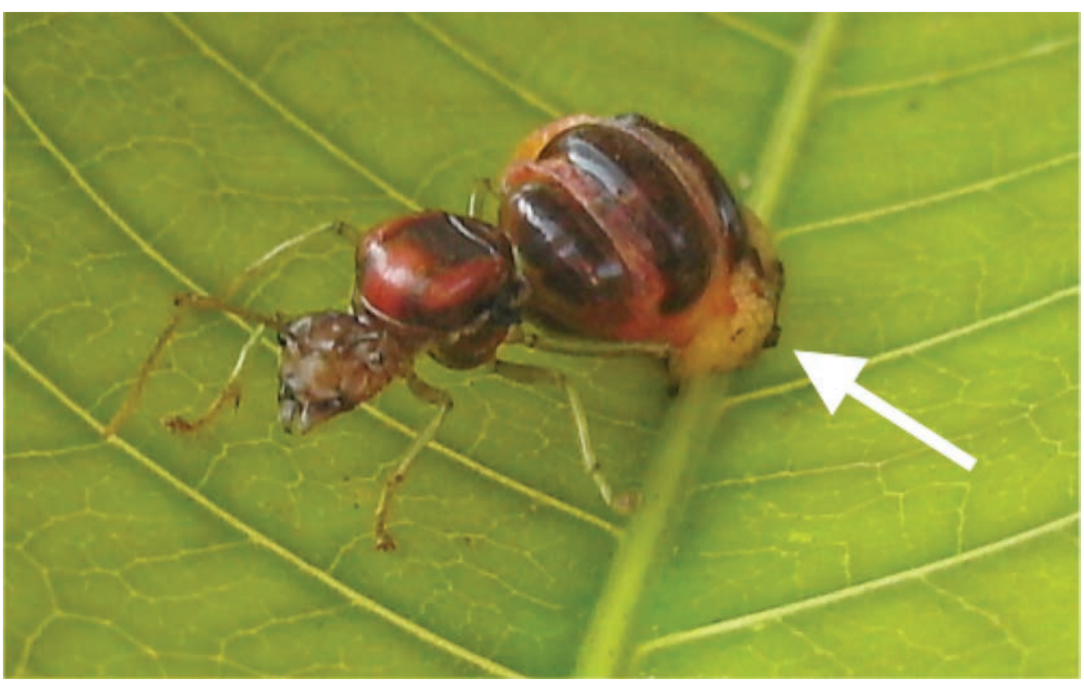

Fig. 2. The intersegmental membrane of an *O. smaragdina* gravid queen's gaster had burst, thereby exposing the ovarioles, after she fell to the ground without a retinue.

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