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SWARMING BEHAVIOUR IN *POLYBIOIDES TABIDA* (HYMENOPTERA, VESPIDAE)

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Summary: *Polybioides* is a genus of polistine wasps which lives in the tropical region of the Old World. In these wasps a new nest is founded by a swarm composed of some gynes followed by several workers.

In some experiments performed in Cameroun, during a study on *Polybioides tabida*, we induced swarming of two colonies after transplanting their nests (collected in the field and inevitably in part destroyed) into plastic boxes. The various phases of this collective behaviour were recorded from the time when the boxes were opened until the entire colony settled on their new nesting site and nest construction was initiated. During swarming, some individuals were observed dragging their abdomens on plant leaves on their way from the box to the nesting site. Our observations indicate that recruitment and trail pheromones also exist in this species of still little known genus of swarming polistine. This is similar to what has been observed in species of the south and central american swarming Polistinae.

Key words: *Vespidae, Polistinae, Polybioides, swarming behaviour.*

Résumé: Comportement d' essaimage de *Polybioides tabida* (Hymenoptera, Vespidae).

Polybioides est un genre de guêpes polistines qui vit dans les régions tropicales de l'Ancien Monde. Chez ces guêpes, la fondation d'un nouveau nid est réalisée par un essaim composé de quelques femelles accompagnées de plusieurs ouvrières.

Au cours d'expériences réalisée au Cameroun, lors d'un étude sur *Polybioides tabida*, nous avons induit l'essaimage de deux colonies après avoir transplanté leurs nids (récoltés en nature et inévitablement détruits en partie) dans de boîtes en plastique. Les différentes phases de ce comportament colletif ont été enregistrées, depuis l'ouverture de ces boîtes jusqu'à ce que toute la colonie soit installée dans son nouveau site de nidification et que la construction du nid soit initiée. Au cours de l'essaimage, certains individus ont été observés traînant leur abdomen sur les feuilles des plantes situées sur leur trajet entre la boîte et le site de nidification. Nos observations indiquent qu'un recrutement et des phéromones de piste existent également chez cette espéce appartenant à un genre encore peu connu de polistines essaimantes. Ceci est tout à fait comparable à ce qui a pu être observé chez des espéces de Polistinae essaimantes d'Amérique Centrale et du Sud.

Mots-clés: *Vespidae, Polistinae, comportement d'essaimage.*

INTRODUCTION

Swarm-founding Polistinae are a group of social vespids limited to the tropics. Their main characteristics are:

- a high number of individuals per colony (from hundred to over a thousand adults);
- large sized nests consisting of several combs protected by an envelope;

- new colonies founded by a queen accompanied by a swarm of workers, (JEANNE, 1980).

When they swarm, the wasps move to their new nesting site in a coordinated fashion by means of a communication mechanism based on trail pheromones (CHADAB & RETTENMEYER, 1979; JEANNE, 1981; WEST EBERHARD, 1982). This kind of communication is well known among the social insects and was first described in wasps by Naumann (1975) and Jeanne (1975). Observing various species of seven different genera of neotropical wasps, these authors noted that after leaving their old nest some individuals stroked their abdominal sternites over various types of substrates on their way to the new nesting site. Other individuals stopped on the scented trail, but did not mark it, and followed it through the vegetation. Jeanne (1981) confirmed experimentally that *Polybia sericea* uses chemical communication to migrate to a new nest. This species produces a particular substance in the Richards' gland (RICHARDS 1971, 1978) (situated on the anterior half of the 5th gastral sternite) which is applied during dragging behaviour (when the wasp rubs its abdomen over the substrate as it walks).

The genus *Polybioides* and some species of the genus *Ropalidia* are the only swarm-founding polistine wasps to live in the Old World tropics; *Polybiodides tabida* is found in the tropical forests of west Africa. In his description of the species, Bequaert (1918) states that new colonies are probably founded by swarming. Richards (1969) also analyzed 5 colonies of *P. tabida* and supplied data on the percentage of queens and workers as well as on nest architecture, whilst Van der Vecht (1966) described the typical disposition of the brood in the nest combs in his revision of east Asiatic and Indo-australian species. However, apart from the limited information from Darchen (1976) on colony foundation in *P. tabida*, the biology of this genus is still mostly unknown.

In this work we describe the swarming behaviour of *P. tabida* which was induced in two colonies.

MATERIALS AND METHODS

The experiments were conducted at Yaoundé (Cameroon) on 5th, 7th and 9th of February, 1992. Colonies of *P. tabida* were collected from the forest and taken to the study area, a garden in the town. The nests and their inhabitants were each kept in a small plastic cage (cm 20 X 30 X 20) for approximately two days. The wasps were fed on honey and meat and given water. One nest (N 1) only contained eggs whilst the others contained eggs, larvae and pupae (N 2 and N 3). Some individuals never returned to their nests during captivity. In nest N 1 the wasps devoured all the eggs, and some of the larvae from the cells in nest N 2. Just before the experiments, the cages containing the nests were placed in the centre of the study area (a bare clearing surrounded by trees) where a number of small shrubs were aligned to form a sort of "pathway" in a SW direction in continuation with the line of trees. The experiments began with the opening of the cage doors and the behaviour of the wasps was recorded with a portable videocamera.

RESULTS

Cluster formation

In the first and second experiments (N 1 and N 2), the cages were opened at 09.00 hours. Many individuals began to leave immediately and then, after a few short flights, they returned to the cage door. After a few minutes, the wasps clustered outside the cage in the shade.

More and more individuals joined the original cluster as they left the cage; then the cluster divided into two or three groups with an incessant exchange of wasps between

them.

The following behaviours were observed in the wasps arriving and leaving the periphery of the cluster:

- frequent grooming of wings and abdomen;
- exchange of liquids between individuals;
- antennation between individuals;
- defence position (with raised antennae).

In the middle of the cluster, many of the wasps were heaped one on top of the other and were apparently inactive. Aggressive interactions were never observed, and none of the individuals were seen rubbing their abdomens over the substrate near the cluster.

In this phase the wasps showed no aggression at all towards the observer.

The third experiment (N 3) was held at 15.52. The wasps never formed a true cluster, most of them stayed inside the cage, whilst others gathered outside in small groups of 5-6 individuals.

Swarming

In the first experiment, the wasps began swarming at approximately 10.30 (one and a half hours after the cage door had been opened) and stopped at 12.30. In the second experiment the wasps began swarming around 16.00 (7 hours after the start of the experiment) and stopped at 18.00. The third experiment was interrupted (when the cage door was shut) shortly before sunset, by which time the wasps had not given any signs of swarming.

Dragging behaviour

In the first and second experiments, after cluster formation and the initial orientation flights, some wasps were seen alighting on the leaves of the first shrubs forming the pathway and rubbing their last abdominal sternites in a particular fashion along the edges of the leaves, after which they flew on to the next bushes (Fig. 1). Other individuals flew around the marked leaves. There did not seem to be any special points which the wasps marked more than once.

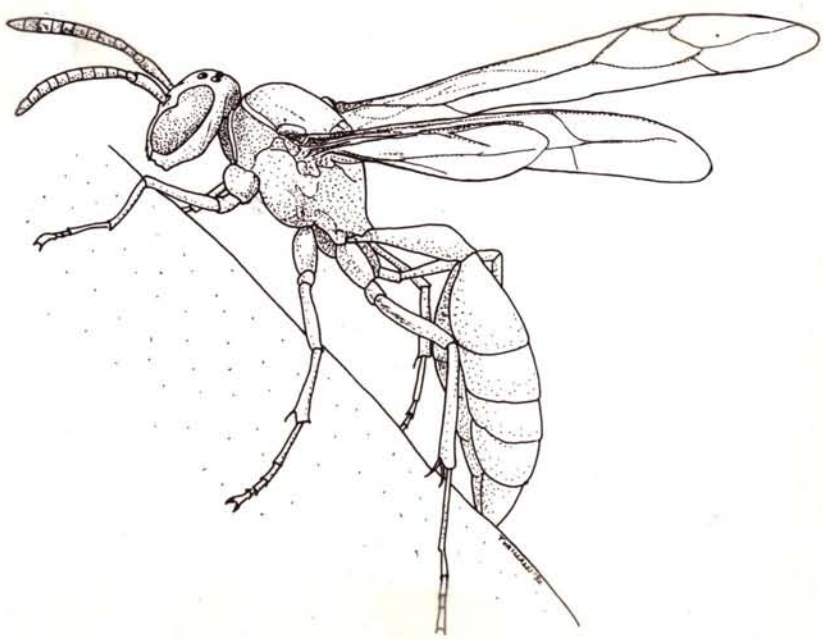

Figure 1. *Femelle de Polybioides tabida en train de traîner son abdomen sur le bord d'une feuille, au cours de l'essaimage.*

Figure 1. *A female of Polybioides tabida while dragging its abdomen over the edge of a leaf during swarming.*

Migration

Swarm migration was progressive: every now and then groups of individuals headed in the direction of the "pathway" following the leaves marked by their companions. In the first experiment (N 1), one marked female which had been followed along the "pathway" returned to the cluster for a few moments, thus confirming the impression that some individuals continue to ply between the new clustering site and the old one. The number of wasps engaged in abdomen stroking then gradually fell as more and more of their companions left the cluster in flight and followed the trail on the shrubs.

When a new aggregation was found (in experiments 1 and 2), the majority of wasps had already left the cluster. Even after the last wasps had left the cage, others still continued to return to inspect it.

In the first experiment, the aggregation (which would eventually have led to the foundation of a new nest since the beginnings of the first comb were already visible by the afternoon) was situated on a palm leaf about 3 metres above ground level and approximately 20 metres from the release point. In the second experiment, nest construction began on the branch of an euphorbia tree, about 2,50 metres above the ground and approximately 13 metres from the release point, and not more than 6 metres from the nest in the first experiment (Fig. 2).

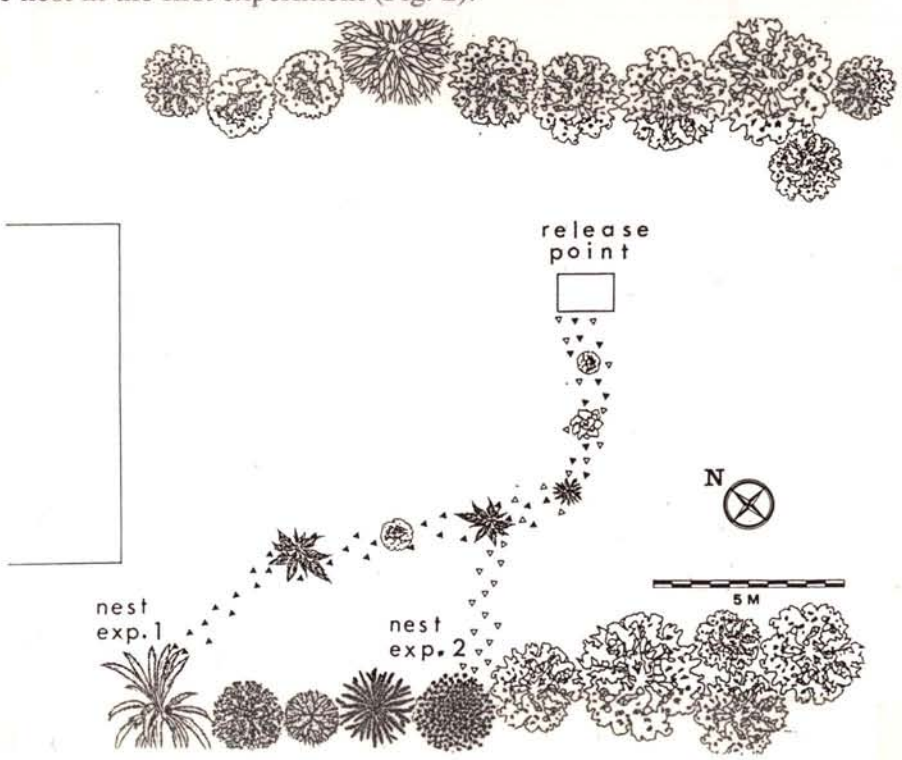

Figure 2. *Pistes suivies par les guêpes essaimantes lors de l'expérience 1 (triangles noirs) et de l'experiences 2 (triangles blancs).*

Figure 2. *Trails followed by the swarming wasps in experience 1 (black triangles) and in experience 2 (white triangles).*

CONCLUSIONS

Swarming in wasp colonies can occur after the departure of some of the queens and workers to found a new colony (reproductive swarm) or because the nest has been

damaged or disturbed by predators or for some other reason (absconding swarm) (RICHARDS & RICHARDS, 1951; WEST EBERHARD, 1982). Although these two types of swarms differ in some important aspects, it is believed that in both cases the wasps use the same mechanisms of communication (WEST EBERHARD, 1982).

The swarming behaviour observed in *Polybioides tabida* is similar to that described in species of neotropical swarming Polistinae (NAUMANN, 1975; JEANNE, 1975; FORSYTH, 1978). In *Polybia sericea*, for example, once the scout workers have found a suitable nesting site, they mark the trail for the rest of the colony by stroking their abdomen over various types of substrate and depositing small amounts of secretion produced by glands on the 5th gastral sternite (Richards glands) (JEANNE, 1981).

Evidently, individuals of *Polybioides* must also migrate by following the trail left by their companions. However, in *P. tabida* the anterior half of the 5th sternite is not modified in any way (see also JEANNE et al., 1983), nor does it bear Richards' glands (unpublished observations), thus the marking behaviour observed in this species probably triggers the release of a secretion produced by some other abdominal glands (perhaps the Dufour's gland).

One other difference that we observed in the swarming behaviour of *P. tabida* with respect to that described in *P. sericea* was the absence of marking behaviour in individuals clustering on the cage walls. The formation of these clusters, however, suggests that *Polybioides* also emit assembly pheromones.

Why the colony in the third experiment (N 3) did not swarm is not clear. In our opinion, the most plausible explanation is that the experiment took place too late in the day, giving the scout wasps only two hours before sunset to find a suitable nesting site. *P. sericea* takes 1-2 days to complete swarming (JEANNE, 1981).

These preliminary data suggest that some form of chemical communication also lies at the base of swarming behaviour in a species belonging to one of the two genera of swarming Polistinae found in the Old World. We hope that confirmation of these observations, future appropriate experiments and morpho-histological studies will help clarify the mechanisms and the origin of this behaviour as well as its relationship to similar manifestation described in neotropical swarm founding Polistinae.

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