Colony Defensive Behavior by the Social Wasp *Polybia (Trichothorax) sericea* (Hymenoptera, Vespidae)

by

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**ABSTRACT**

This work aimed at evaluating the aggressive response of *Polybia sericea*, incited by mechanical means, as well as collecting information on the biological and population parameters of this species in Caatinga environments. There were positive correlations (P < 0.05) between the number of aggressors and the number of eggs, larvae and adults present in the nests. These results showed that the magnitude of the defense response exhibited by *P. sericea* is proportional to the energetic investment carried out by the colony in making young forms. The positive significant correlation between the number of aggressors and the total number of adults of the colony corroborates the hypothesis that colonies with a large population of adults have greater potential to perform what is called defensive altruism.

**INTRODUCTION**

In response to the selective pressure caused by predators, prey show different defense mechanisms. On the other hand, the evolution of such defense mechanisms acts as a selective pressure favoring the predators that are more apt to overcome them. In social insects the defense strategies are focused mainly on colony defense, often to the detriment of the defense of the individual itself (Wilson 1971).

The development of specific behaviors by social wasps, such as swarm making or the presence of more than one queen in the foundation of new colonies, allowed the development of larger colonies, which can house big Populations (Ross & Matthews 1991). Such colonies became a very attractive source of resources to predators and parasites, especially for housing large populations.

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of immature forms (larvae and pupae). The action of these natural enemies exerts selective pressure for the evolution of the defense mechanisms of these insects, having caused, for instance, the development of the sting (Star, 1985; Macalintal & Starr 1996).

Among the several aspects involved in colony defense by social wasps, some of them stand out: the choice of the nesting spot, nest structure and architecture (Jeanne, 1975; Santos & Gobbi, 1998; O'donnell & Jeanne, 2002); mechanisms for recognizing the individuals of the colony, alarm and recruiting to attack (Castellón 1981; Jeanne 1981, 1982; Post et al. 1984; Overal 1985); and especially the use of venom and sting autotomy (Hermann 1971; Overal et al. 1981; Strassmann et al. 1990; Manzoli-Palma & Gobbi 1994; MacAlintal & Starr 1996; Manzoli-Palma et al. 1997; O'donnell et al. 1997).

The aim of this work was to study some aspects of the defensive behavior of Polybia sericea in the conditions of Bahia's semiarid region.

MATERIALS AND METHODS

The aggressiveness level showed by the colonies of Polybia sericea was tested using the methodology described by Storr (1974) to quantify the aggressiveness in bees (Apis mellifera), adapted by Overal et al. (1981) and Manzoli-Palma & Gobbi (1994) in order to be used in social wasps. The main purpose of the method is the visual recognition of the aggressor and the capacity of autotomy of the sting by the aggressors.

The tests were carried out in six colonies of Polybia sericea, four of them placed in the campus of Universidade Estadual de Feira de Santana (12° 16' LS; 38° 58' WG) and the other two in the city of Ipirá, (12° 09' LS; 39° 44' LW). The height of the nest from the ground ranged from 2 to 5 m. The nesting spots were mainly thorny bushes, cactuses and woody plants.

As a safety measure, the observers wore bee suits every time they approached the nests. Colony collecting was performed right after the conclusion of the tests, using plastic bags to wrap the nests. The adults present were cold-anesthetized at about -5°C (Santos et al. 1994), or anesthetized with ethyl acetate.

Black chamois targets, of about 5 cm in diameter, fastened to the tip of a 3.5 m long stem by a transparent nylon line, were set up hanging 15 cm from the nest entrance, for one minute, while sudden movements were made at the
target so as to cause alarm situations at the nests. This procedure was repeated six consecutive times in each colony, with five-minute intervals between each repetition, using a new target in each test.

At the end of each test the targets were collected along with the self-amputated stings and the aggressors present on the target, and the sequence they displayed was identified. Once the six repetitions were accomplished, the colonies were wholly collected for population analyses.

The task of counting the number of stings in each target, as well as the number of aggressors captured and number of adult individuals present in the nest was done in laboratory. Afterwards, the colony population analysis was carried out, in order to record data concerning the number of eggs, larvae, pupae, cells and meconium present.

The aggressiveness was evaluated by counting the number of stings stuck in the targets. Sperman's rank correlation coefficient was calculated to verify the degree of associativity between the number of stings found in the targets and the different variables observed at the moment of the test (number of eggs, larvae, pupae, adults, cells, meconium and honeycombs).

RESULTS AND DISCUSSION

During the period this work was carried out, workers of *P. sericea* did not attack the observer without being stimulated, even at very short distances from the nest (up to 50cm). However, once they were stimulated, whether by showing the chamois targets, striking the nest supporting substratum or by whistling, the wasps happened to attack the observer in some situations, and chased him for distances greater than 15m away from the nest.

Table 1 displays the population data, along with the results concerning the number of aggressors that attacked the targets in each of the six tests, for every colony studied. It is possible to observe that colonies in different stages of development were used, with adult populations ranging from 172 in the second colony to 1,291 in the sixth colony.

The results of the analysis of correlation between the number of aggressors and the colony population data showed there are positive significant correlations ($P < 0.05$) between the number of aggressors and the number of eggs ($r=0.94; P<0.05$), larvae ($r=0.95; P<0.05$), pupae ($r=0.77; P<0.05$) and adults ($r=0.95; P<0.05$) present in the nests at the moment of the tests (Table 1).
Table 1. Number of aggressors that attack the targets and population data of each of the six colonies of *Polybia sericea* submitted to the aggressiveness tests.

<table>
<thead>
<tr>
<th>Colony</th>
<th>Total Aggressors</th>
<th>Number of aggressors per repetition</th>
<th>Population data of the colonies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>i</td>
<td>ii</td>
<td>iii</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>77</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>122</td>
<td>11</td>
<td>44</td>
</tr>
<tr>
<td>5</td>
<td>39</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>419</td>
<td>68</td>
<td>50</td>
</tr>
<tr>
<td>TOTAL</td>
<td>672</td>
<td>117</td>
<td>120</td>
</tr>
</tbody>
</table>

Such results demonstrate that the internal factors of the colony influenced the magnitude of the defensive response exhibited by *P. sericea*.

The results obtained from the correlation analyses between the number of aggressors and the number of eggs \( (r=0.94; P<0.05) \), larvae \( (r=0.95; P<0.05) \) and pupae \( (r=0.77; P<0.05) \) present in the nest at the moment of the test strengthens the hypothesis that the magnitude of the defensive response of social wasps, particularly of *P. sericea*, is proportional to the energetic investment made by the colony in rearing juveniles. Similar results were obtained for *Polybia paulista* by Manzoli-Palma & Gobbi, (1994).

The positive significant correlation between the number of aggressors and the number of adults present in the nest \( (r=0.95; P<0.05) \) showed that the colony size also has an influence on the magnitude of the defensive response of *P. sericea*. Similar results were verified in *Polybia rejecta* by por Overal et al. (1981) and in *Polybia paulista* by Manzoli_Palma & Gobbi (1994). These results support the hypothesis that colonies with large adult populations have greater potential to make use of defensive altruism as a defense strategy (Manzoli-Palma & Gobbi, 1994). In this case, the population size would be determinant in the defense method efficiency degree as well as in the effect of the number of individuals sacrificed for the colony survival.

On the other hand, in this work it was noticed that there is no correlation between the number of aggressors and the amount of meconium, and that there is a strong negative correlation \( (r=-0.71; P<0.05) \) with the number of nest cells, which led us to conclude that the aggressiveness has no correlation
with the colony age, but only with its stage of development at the moment of the aggression.

REFERENCES


