Survey of *Neodohrniphora* spp. (Diptera: Phoridae) at colonies of *Atta sexdens rubropilosa* (FOREL) and specificity of attack behaviour in relation to their hosts

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Abstract

*Atta sexdens rubropilosa* is a leaf-cutting ant that is a significant agricultural and forestry pest in the Neotropical region. This ant is parasitized by flies from the genera *Neodohrniphora* spp., *Apocephalus* spp. and *Myrmosicarius* spp. This study was carried out to determine which species of *Neodohrniphora* spp. are found near foraging trails of *Atta sexdens rubropilosa* and to evaluate the specificity of attack behaviour of these parasitoids. From May 2002 to April 2004, we sampled *Neodohrniphora* spp. hovering over foraging trails of *Atta sexdens rubropilosa* between 8:00 and 11:00 h and between 15:00 and 18:00 h. To investigate the attacking behaviour against the ants, flies were released individually inside an observation chamber containing a single leaf-cutting ant worker. Each parasitoid was confronted successively with a worker ant of *A. sexdens rubropilosa*, *A. laevigata* Smith, *Acromyrmex crassispinus* Forel and *Acromyrmex subterraneus molestans* Santschi. Phorids of three species were identified: *Neodohrniphora elongata* Brown, *Neodohrniphora declinata* Borgmeier and *Neodohrniphora tonhascai* Brown. The three phorid species were active throughout the year and often along the same foraging trails, but *N. elongata* was the most frequent species. In the laboratory assay, *N. elongata*, *N. declinata* and *N. tonhascai* attacked workers of *A. sexdens rubropilosa*, *A. laevigata* and *A. crassispinus*, but not of *A. subterraneus molestans*.

Keywords: *Acromyrmex* spp., *Atta* spp., phorids, attack behaviour, parasitism

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of work reported here, we surveyed the occurrence of species (N. elongata A. sexdens rubropilosa A. laevigata A. crassispinus A. subterraneus molestans N. declinata (N. tonhascai 204 V.S.G. Silva

Table 1. Attacking bouts (A.bouts) and attacks (means ± s.e) carried out by three phorid species in four species of the leaf-cutting ants.

<table>
<thead>
<tr>
<th>Phorid species</th>
<th>A. sexdens rubropilosa</th>
<th>A. laevigata</th>
<th>A. crassispinus</th>
<th>A. subterraneus molestans</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>A.bouts</td>
<td>Attacks</td>
<td>n</td>
</tr>
<tr>
<td>N. elongata (n = 12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1.7 ±0.9</td>
<td>1.0 ±0.3</td>
<td>9</td>
<td>2.1 ±0.8</td>
</tr>
<tr>
<td>N. declinata (n = 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1.3 ±1.4</td>
<td>1.5 ±0.5</td>
<td>4</td>
<td>1.3 ±0.5</td>
</tr>
<tr>
<td>N. tonhascai (n = 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.5 ±1.2</td>
<td>1.3 ±0.5</td>
<td>2</td>
<td>3.2 ±0.6</td>
</tr>
</tbody>
</table>

Fig. 1. Daily mean number of individuals of three Neodohrniphora species in Viçosa, Brazil (N. tonhascai; N. declinata; N. elongata).

(50 × 50 × 50 cm) containing a single worker ant and filmed for five minutes. Four ant species were tested consecutively with each phorid: A. sexdens rubropilosa, Atta laevigata, Acromyrmex crassispinus and Acromyrmex subterraneus molestans. The phorids that showed no response to the four ant species were not used in the analysis. The order of ant species in the test was randomized for each phorid tested (n = 20). After the tests, the flies were killed and identified at the species level. The tapes were analyzed with help of the software, The Observer, version 4.1 (Noldus Information Technolology). We considered three behavioural acts associated with host attack: inspection flights, attacking bouts and attacks (Orr, 1992; Feener & Brown, 1993; Silva et al., 2007). Inspection flight was considered when the phorid hovered at no more than 5 cm above a host. Attacking bouts are when the phorids make contact with any body part of the host without ovipositor penetration. Finally, attacks are contacts with ovipositor penetration in the posterodorsal extremity of the ant’s head.

Results

We collected 303 flies of the genus Neodohrniphora. Fifteen were males and, therefore, could not be identified at the species level. These numbers underestimated the actual abundance of phorid because the rate of capture was about 60% (phorids captured/phorids pursued × 100).

The phorids females (288 individuals) belonged to three species: Neodohrniphora elongata Brown (54% of individuals), Neodohrniphora declinata Borgmeier (31%) and Neodohrniphora tonhascai Brown (15%). Individuals of each phorid species were observed attacking ants of A. sexdens rubropilosa in the foraging trails.

The three phorid species were found throughout the year and did not differ in seasonal patterns of activity (fig. 1), but the mean daily number of N. elongata (3.32 ±0.34) was higher
than for \( N. \text{declinata} \) (1.77 ± 0.30) and \( N. \text{tonhascai} \) (0.87 ± 0.14) \((\chi^2 = 14.60; \ P < 0.001)\). The number of phorids captured did not differ significantly between the two years nor among bimesters \((P > 0.05)\).

The three \textit{Neodohrniphora} species were found together at 37% of the samplings. They were found during both sampling times (in the morning and in the afternoon). Two species were found at 36% of samplings (23% \( N. \text{elongata} \) and \( N. \text{declinata} \); 12% \( N. \text{elongata} \) and \( N. \text{tonhascai} \); 1% \( N. \text{declinata} \) and \( N. \text{tonhascai} \)). \( N. \text{elongata} \) was found alone in 19% of the samplings, \( N. \text{declinata} \) in 7%, and \( N. \text{tonhascai} \) in 1%.

In laboratory tests, inspection flights were observed for the three phorid species with the four ant species. The mean duration and the 95% confidence interval of the inspection flights of \( N. \text{elongata} \), \( N. \text{declinata} \) and \( N. \text{tonhascai} \) were 60.47 s (45.29–75.65 s) \((n = 50)\), 46.49 s (28.01–64.98 s) \((n = 16)\), and 67.86 s (32.07–103.65 s) \((n = 14)\), respectively. Except for \textit{A. subterraneus molestans}, all ant species were attacked by the three phorid species (table 1). The mean frequency of attacking bouts and attacks on ants were 1.18 ± 0.25 \((n = 80)\) and 0.76 ± 0.10 \((n = 80)\), respectively. The mean duration and the 95% confidence intervals of attacking bouts and attacks were 0.32 s (0.18–0.47 s) \((n = 80)\) and 0.92 s (0.58–1.26 s) \((n = 80)\), respectively.

Discussion

Differences in the frequencies of phorids were not detected over the year. However, the largest numbers were captured in September–October, which represents the onset of the rainy season. Erthal (1999) found this seasonality for \textit{N. elongata}, \textit{N. declinata}, and \textit{N. tonhascai} also have behavioural plasticity to attack other non-host ants, including other genera. This plasticity of attack behaviour of \textit{Neodohrniphora} spp. has also been reported by Bragança et al. (2002), who verified, in laboratory conditions, parasitism of \textit{N. tonhascai} on \textit{A. laevigata} with phorids collected from \textit{A. sexdens rubropilosa} trails. However, in these situations, it is difficult to suggest a host-parasitoid relationship because the attacks were only observed in a laboratory in a no choice situation, and we do not know if these phorids find the same ants in the field (Porter, 1998; Orr et al., 2001).

The data presented in this paper demonstrate that \( N. \text{declinata} \), as well as \( N. \text{elongata} \) and \( N. \text{tonhascai} \), was present all year long over foraging trails of \textit{A. sexdens rubropilosa} and attacks this ant in laboratory and field conditions. Further investigations must be carried out to determine if such attacks of \( N. \text{declinata} \) also produce a new generation of phorid flies in order to prove a host-parasitoid relationship.

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References


