DIURNAL PATTERNS OF OVIPOSITIONAL ACTIVITY IN TWO *PSEUDACTEON* FLY PARASITOIDS (DIPTERA: PHORIDAE) OF *SOLENOPSIS* FIRE ANTS (HYMENOPTERA: FORMICIDAE)

M. A. PESQUERO[1], S. CAMPIOLO[2], H. G. FOWLER[2] AND S. D. PORTER[3]
[1]Instituto de Biociencias, Universidade Estadual Paulista, 18610 Botucatu, Sao Paulo, Brazil

[2]Instituto de Biociencias, Universidade Estadual Paulista, 13500 Rio Claro, Sao Paulo, Brazil

[3]Center for Medical, Agricultural, and Veterinary Entomology, USDA-ARS, P.O. Box 14565, Gainesville, FL 32604

At least 18 species of *Pseudacteon* phorid parasitoids attack fire ants in the *Solenopsis saevissima* complex (Williams & Banks 1987, Pesquero et al. 1993, Disney 1994, Porter et al. 1995a, 1995b). The high species richness of these phorid parasitoids, and the behaviors exhibited by fire ants in their presence (Porter et al. 1995a) suggest a long evolutionary history. The absence of natural enemies, such as phorids, may explain why exotic North American populations of fire ants (*Solenopsis invicta* Buren) have much higher densities than those found in their native Brazil (Porter et al. 1992).

In spite of the high species richness of phorids recorded on fire ants in South America, little is known about their behavior and coexistence. Some species of phorids attack different sized workers than others (Campiolo et al. 1994), but are there also other ways they partition their host resource? Here, we document diurnal activity patterns of two common species of *Pseudacteon* attacking the fire ant *Solenopsis saevissima* (Fr. Smith), a close relative of *S. invicta* (Trager 1991), in sub-tropical Brazil.

Studies were conducted on the new campus of the Universidade Estadual Paulista in Rio Claro, SP, Brazil (23°S). Colonies of *S. saevissima* were maintained in petri dish observation nests in Fluon®-coated plastic trays (35 × 40 × 5 cm). Every month for a year (with the exception of November and December) two colony trays were taken to the field to attract phorids. These trays were agitated to elicit activity of the ants and placed 30 m apart in the shade on a lawn. During a 3 h period once a week, aspirator collections of all phorids present at trays were performed, alternating 10 min periods between trays. Collections were made from 600-1800 hours, such that at the end of the month each 3-h segment of the day was covered. Observations were not made at night because the flies were not active after dark. At the beginning and end of each sample period, a digital thermometer was used to register air temperature in the shade, and a sling psychrometer was used to determine relative humidity. Phorids were identified under a dissecting microscope using a key to neotropical species (Borgmeier 1969).

Seven species of *Pseudacteon* occurred at colonies exposed in trays throughout the year, and collected individuals were deposited in the collection of H.G.F. Of the 492 females collected, *P. tricuspis* Borgmeier was the most abundant species (73%) followed by *P. litoralis* Borgmeier (17%), *P. obtusus* Borgmeier (4%), *P. curvatus* Borgmeier (3%), *P. pradei* Borgmeier (1.6%), *P. solenopsidis* Schmitz (1.2%), and *P. wasmanni* Schmitz (0.2%). Both *P. tricuspis* and *P. litoralis* were collected consistently throughout the year, unlike most of the other species (Pesquero et al. 1995).

The proportion of all female *Pseudacteon* flies collected in hourly periods from sunrise (Fig. 1) demonstrates that *P. litoralis* is active during early morning and late

evening, while *P. tricuspis* is more active during mid-day. Consequently, the abundances of these were significantly negatively correlated (r = -0.991, Pearson r is reported here and subsequently). The logarithm of the number of *P. tricuspis* females captured was significantly related to air temperature (r = 0.646, P < 0.001), soil temperature (r = 0.668, P < 0.001), and humidity (r = -0.423, P = 0.028), but none of these were significantly correlated with the logarithm of females for *P. litoralis* (r = -0.055, r = -0.188, and r = -0.101, respectively).

Differences in activity patterns may reflect physiological limitations; however, the weak correlations found between measured environmental variables and the abundance of *P. litoralis* suggest that other factors are probably responsible for establishing observed diel patterns of abundance and activity. It is very likely that light intensity is used as a cue to regulate activity in this species. This does not discount the influence of light intensity, however, on the activity patterns of *P. tricuspis*. Unfortunately, light intensity was not measured during our studies.

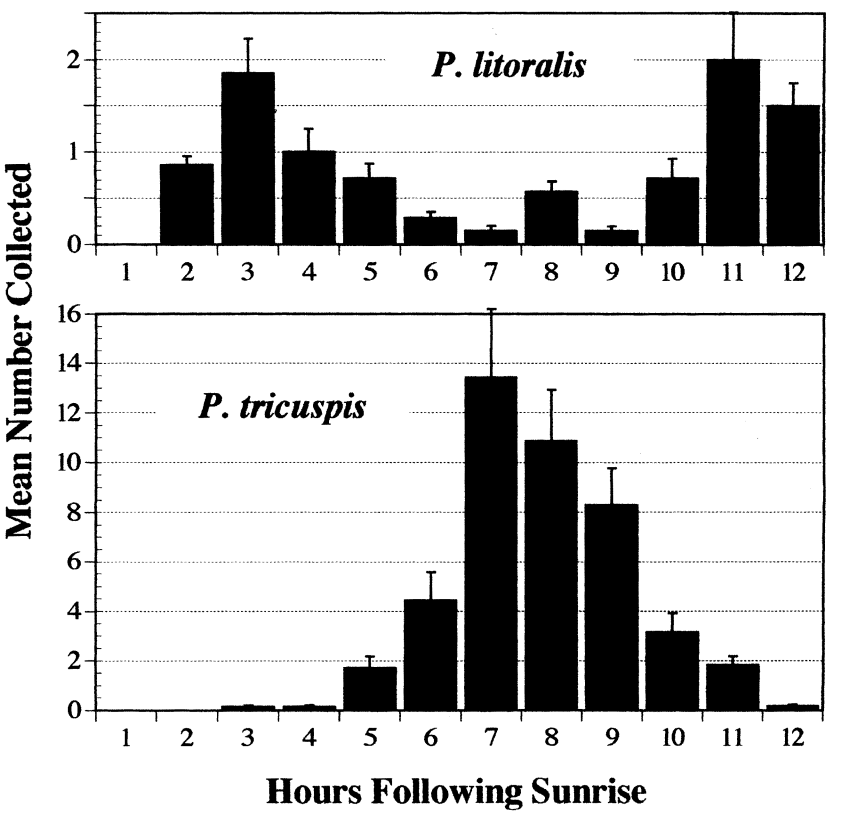

Fig. 1. Daily activity patterns of *Pseudacteon litoralis* and *P. tricuspis* flies collected attacking fire ants during 10 months of observations in Rio Claro, São Paulo, Brazil. Note different scales on y-axes. Hourly means are shown ±SEM (n = 7 for hours 1-9 and n = 6 for hours 10-12.

These observations on daily patterning of activity by two sympatric species of *Pseudacteon* parasitoids of fire ants suggest that more than one species may be needed for introduction in biological control programs. Furthermore, variation in daily patterning of ovipositional activity and worker-size selection may explain, in part, how a number of *Pseudacteon* species coexist as parasitoids of the same ant host.

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Summary

Two phorid parasitoids of *Solenopsis* fire ants in Brazil were active at different times of the day. *Pseudacteon litoralis* was most active in the early morning and evening while *P. tricuspis* was most active during the afternoon.

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