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SHORT NOTE

Laboratory Rearing and Niche Resources of *Pseudacteon* spp. Coquillett (Diptera: Phoridae) Parasitoids of *Solenopsis saevissima* (Smith) (Hymenoptera: Formicidae)

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Abstract

Solenopsis saevissima (Smith) is associated with a group of nine *Pseudacteon* Coquillett species in Brazil. Adult female flies of *Pseudacteon affinis* Borgmeier, *Pseudacteon dentiger* Borgmeier and *Pseudacteon disneyi* Pesquero were created in a laboratory from parasitized workers of *S. saevissima*. The initial development of *Pseudacteon cultellatus* Borgmeier was faster than the other phorid species, taking 12 days to kill the host workers. Similar to the group of phorid species parasitizing *Solenopsis invicta* Buren, the daily period of activity and body size are important factors to be considered in the use of these natural enemies in future programs of biological control of *S. saevissima*.

The fire ants *Solenopsis invicta* Buren and *Solenopsis saevissima* (Smith) have wide distribution in South America (Trager, 1991). The workers of these species are aggressive and have a painful sting, with the colonies located on the surface of the soil, thus increasing the chances of accidents with people. After the inadvertent introduction in the United States, *S. invicta* has victimized thousands of people, including records of deaths from anaphylactic shock (Caldwell et al., 1999). The geographical distribution in the central region of South America may have reduced the risk of dispersal of *S. saevissima* to other countries via sea transport, as was probably the case with *S. invicta* from northern Argentina in the United States (Caldera et al., 2008). However, urban areas infested with *S. saevissima* were reported in the Amazon region (Brazil, 2008), suggesting the possibility of this species becoming a pest, and previous efforts to establish control strategies are important in preventing damage, whether it be economic, ecological or health related. In Brazil, nine parasitoids species of *Pseudacteon* Coquillett are associated with *S. saevissima* (Pesquero & Dias, 2011). Confirmation of parasitism by these species is important for future biological

control programs of *S. saevissima*, but it still remains unknown for many *Pseudacteon* species. Thus, the aim of this study was to describe seasonality and body size distribution for understanding the *Pseudacteon* community structure associated with *S. saevissima* and to prove the parasitism in a laboratory.

This study was conducted in the municipalities of Goiânia and Morrinhos, Goiás, Brazil, in the region originally occupied by Cerrado and dominated by cattle and soybean. Data on the abundance of parasitoids and air temperature were obtained monthly in one-hour intervals throughout the day period, from Sep/2010 to Aug/2011, in eight sites surrounding the urban area. All the mounds of the fire ants were counted and disturbed to attract parasitoids which were collected, identified (Porter & Pesquero, 2001) and transferred for closed trays containing 5g of workers of *S. saevissima* maintained in quarantine for 45 days. A maximum of five individuals of the same species were transferred per tray for two hours, totaling up to 30 individuals of each *Pseudacteon* species. These trays with parasitized ants were later taken to the laboratory and kept in a climatic chamber under con-



trolled temperature (24 °C), photoperiod (12:12 h) and humidity (40-60%). The trays were checked daily to record the development of parasitoids. A maximum of 30 individuals of each parasitoid species were sacrificed for size measurements (length of hind tibia).

The density of fire ant mounds, all identified as *S. saevissima*, was 37.5 ± 3.0 mounds/ha ($n = 8$). We captured 314 female flies on the 56 fire ant mounds identified as *P. affinis* (26.75%), *P. cultellatus* (24.52%), *P. disneyi* (16.56%), *P. dentiger* (14.65%), *P. nudicornis* (7%), the small biotype *P. tricuspis* (4.14%), *P. fowleri* (1.91%) and *P. lenkoi* (1.27%). Ten individuals (3.18%) of *P. solenopsidis* were observed attacking workers on fire ant trails. The five most abundant species occurred in the eight sites of the two municipalities; *P. lenkoi* and *P. solenopsidis* occurred in two sites of the two municipalities; *P. fowleri* occurred in one site of the two municipalities and *P. tricuspis* small biotype occurred in three sites of Goiânia. The four most abundant species were seasonally constant throughout the year. With the exception of *P. dentiger* that has been active in the hottest hours of the day (32.44 ± 0.41 °C, $n = 46$) ($\chi^2 = 19.58$, $df = 2$, $P < 0.00001$), *P. affinis* and *P. disneyi* were more active during the last hours of the day ($\chi^2 = 23.74$ and $\chi^2 = 23.65$, $df = 2$, $P < 0.00001$, respectively), and *P. cultellatus* was more active during the first hours of the day ($\chi^2 = 33.26$, $df = 2$, $P < 0.000001$) (Fig 1). Daily activity patterns have been previously described (Pesquero et al., 1996), suggesting the importance that physical factors have on the niche dimension and coexistence of this group of insects.

Similarly, the gradient body size of worker ants seems to be an important resource to be shared among *Pseudacteon* species (Fowler, 1997). The body size of the four most abundant species differ significantly (Table 1), and *P. affinis* parasitized larger workers ants compared with *P. disneyi* (Mann-Whitney test, $z = -4.54$, $P < 0.00001$) and *P. cultellatus* (Mann-Whitney test, $z = -3.06$, $P < 0.005$) (Table 1). However, the worker ants parasitized by *P. disneyi* and *P.*

cultellatus did not differ statistically. The low relative abundance and the small body size of *P. tricuspis* (Table 1) differ from the observations of Fowler (1977) in southeastern Brazil, and these differences suggest the presence of two different species (Kronforst et al., 2007).

With the exception of *P. solenopsidis* all species of parasitoids found in the study sites attacked workers of *S. saevissima* in the trays. However, only one individual of *P. affinis*, *P. dentiger* and *P. disneyi* completed the development in the laboratory resulting in adults. It is likely that the high mortality of larvae and pupae was a result of the low rearing conditions (temperature of 24°C and humidity of 40-60%) compared with other studies (Folgarait et al., 2005). The larval development time from the adult phorid flies attack to the ant host death was two days faster for *P. cultellatus* (12 days) compared with *P. affinis* (Mann-Whitney test, $z = -3.40$, $P < 0.001$) and *P. disneyi* (Mann-Whitney test, $z = -3.72$, $P < 0.001$) (Table 1). The larval development period observed for the latter two species (14 days) is similar to that observed for *P. obtusus* on *S. richteri* (14,6 days) (Folgarait et al., 2005).

Evidence of parasitism for only three of the nine species of *Pseudacteon* associated with *S. saevissima* is a technical problem. The elevation of temperature and hu-

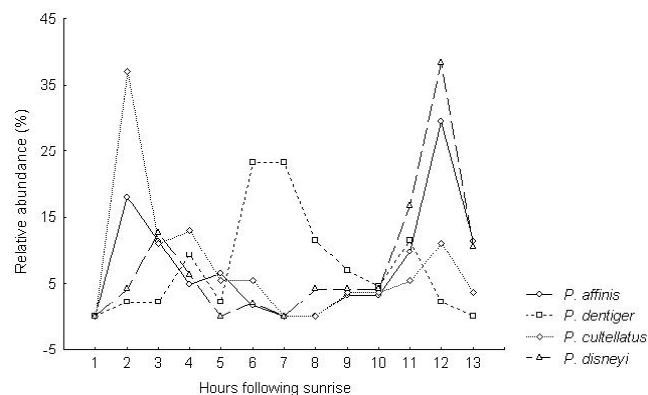


Fig 1. Daily seasonality of the four most abundant *Pseudacteon* species associated with *Solenopsis saevissima*.

Table 1. Tibia length of *Pseudacteon* species; head width of *Solenopsis saevissima* and lifetime worker ant after parasitoid attack. Only species with $n > 30$ were used in the analysis. Means followed by the same letter are not statistically different ($F = 121.82$, $df = 168$, $P < 0.01$. Tukey, $P < 0.01$).

<i>Pseudacteon</i>	Tibia length (mm) mean±SD	N	Head width of parasitized ants (mm) mean ± SD	N	Lifetime ant after parasitoid attack (days)	N
<i>tricuspis</i> *	0.266 ± 0.0223	12	-	-	-	-
<i>nudicornis</i>	0.296 ± 0.0202	17	-	-	-	-
<i>disneyi</i>	0.296 ± 0.0293 a	30	0.810 ± 0.101	31	14.161 ± 2.238	31
<i>cultellatus</i>	0.339 ± 0.0401 b	30	0.841 ± 0.116	29	12.310 ± 1.366	29
<i>fowleri</i>	0.392 ± 0.0314	06	-	-	-	-
<i>affinis</i>	0.426 ± 0.0561 c	30	0.967 ± 0.184	48	14.104 ± 3.019	48
<i>solenopsidis</i>	0.433 ± 0.0258	10	-	-	-	-
<i>dentiger</i>	0.471 ± 0.0403 d	30	-	-	-	-
<i>lenkoi</i>	0.477 ± 0.0252	04	-	-	-	-

* small biotype

midity in the chambers of creation should result in greater reproductive success and extend the proof of parasitism for other species as well. Similar to the group of phorid species parasitizing *S. invicta*, the daily period of activity and body size are important factors to be considered in the use of these natural enemies in future programs of biological control of *S. saevissima*.

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