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SURVEY OF EVANIID WASPS (HYMENOPTERA: EVANIIDAE) AND THEIR COCKROACH HOSTS (BLATTODEA) IN A NATURAL FLORIDA HABITAT

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ABSTRACT

Over a 3-year period 1,359 evaniids, representing four species, were collected in a mature sand pine habitat at the Archbold Biological Station in south-central Florida. All species fly for at least six months of the year and show annual fluctuations in abundance. Seventeen species of cockroaches occur at the ABS; the most probable hosts for evaniids are members of the genera *Parcoblatta*, *Ischnoptera*, and *Cariblatta*.

Key Words: Parasitoids, ecology, behavior, population density.

RESUMEN

Durante un período de 3 años, 1,359 evanídeos, representando 4 especies, se colectaron en un habitat de pino de arena en la Estación Biológica Archbold (EBA) en el centro de la Florida. Todas las especies vuelan durante por lo menos 6 meses del año y muestran fluctuaciones anuales en abundancia. Dieciséis especies de cucarachas ocurren en la EBA. Las hospederas probables de los evanídeos son miembros de los generos *Parcoblatta*, *Ischnoptera* y *Cariblatta*.

Evaniid wasps are a small group of specialized solitary parasitoids, living only in egg cases of cockroaches. What little is known about host relationships (see Townes 1949, Roth & Willis 1960) suggests that each species of evaniid is specialized to attack egg cases of a particular size, sometimes those of a genus or closely related genera of cockroaches. This is not surprising, as different cockroaches deposit their egg cases in different situations, and the egg cases themselves differ in size and structure. It is difficult to get direct information on hosts and general ecology of evaniids because they

breed in deliberately concealed hosts, and they are inconspicuous insects that spend much of their time crawling about in dense vegetation. A survey of cockroaches and evaniids, combined with a study of seasonal flight patterns of the latter, has provided new biological information, including indirect information on hosts.

MATERIALS AND METHODS

The study site is on the Archbold Biological Station (Highlands County), located at the southern end of the Lake Wales Ridge in south-central Florida. The site is in a transitional zone between warm and subtropical zones. Winters are mild and dry, with temperatures during some years falling below 0° C for a few hours. Sheltered microhabitats are frost-free. Summers are warm and humid, with daytime temperatures over 25° C.

The vegetation of the study site is a thin canopy of sand pine (*Pinus clausa* Chapman), with a thick 1.5-3.5 m understory of scrub oaks (*Quercus* spp.), staggerbush (*Lyonia* spp.), silk bay (*Persea humilis* Nash), scrub pawpaw (*Asimina obovata* Nash), and scrub hickory (*Carya floridana* Sargent). The paths through this thick brush appeared to act as flight corridors for insects.

Evaniids were collected in 2 small Townes traps (Townes 1972) that were set up across 2 east-west paths. The traps were kept in place and continuously monitored from May 1983 through December 1986. Each trap was annually replaced with an identical trap to forestall the effects of wear. Specimens were collected 3 times a week. Cockroaches were collected by Townes traps, pitfall traps and searching litter, rotten wood, and under bark. The evaniids and cockroaches were identified by the authors. Specimens of all species are in the collection of the Archbold Biological Station.

RESULTS AND DISCUSSION

In the seasonal flight study, we collected 1,359 evaniid specimens, representing the species *Evaniella semaeoda* Bradley, *Hyptia floridana* Ashmead, *H. reticulata* (Say), and *H. thoracica* (Blanchard). The numerical results are summarized in Fig. 1. From these results we infer the following:

1. Every species has a flight period extending over at least seven months. These flight periods are all longer than those reported by Townes (1949), and imply that hosts are breeding over much of the year.
2. There is no evidence of niche partitioning on the basis of seasonality.
3. The time required for development is not known for any of the four evaniid species. For the introduced peridomestic evaniid *Prosevania punctata* (Brullé) developmental time ranges from 40-127 days (Roth & Willis 1960). Considering the warm temperatures in the study site between April and October, it seems likely that all species would have time for more than one generation within the flight period, the latter presumably synchronized with host availability.
4. There appear to be notable variations in abundance and seasonality from year to year. This is best seen in *H. reticulata* and *H. thoracica*, which were collected in relatively large numbers.

The survey of cockroaches is presented in Table 1. From the combined surveys of cockroaches and evaniids we can infer the following.

1. The exotic *Evania appendigaster* (L.), which attacks *Periplaneta* spp. in Florida (Stange 1978), was not collected in our traps; *Periplaneta* spp. at the

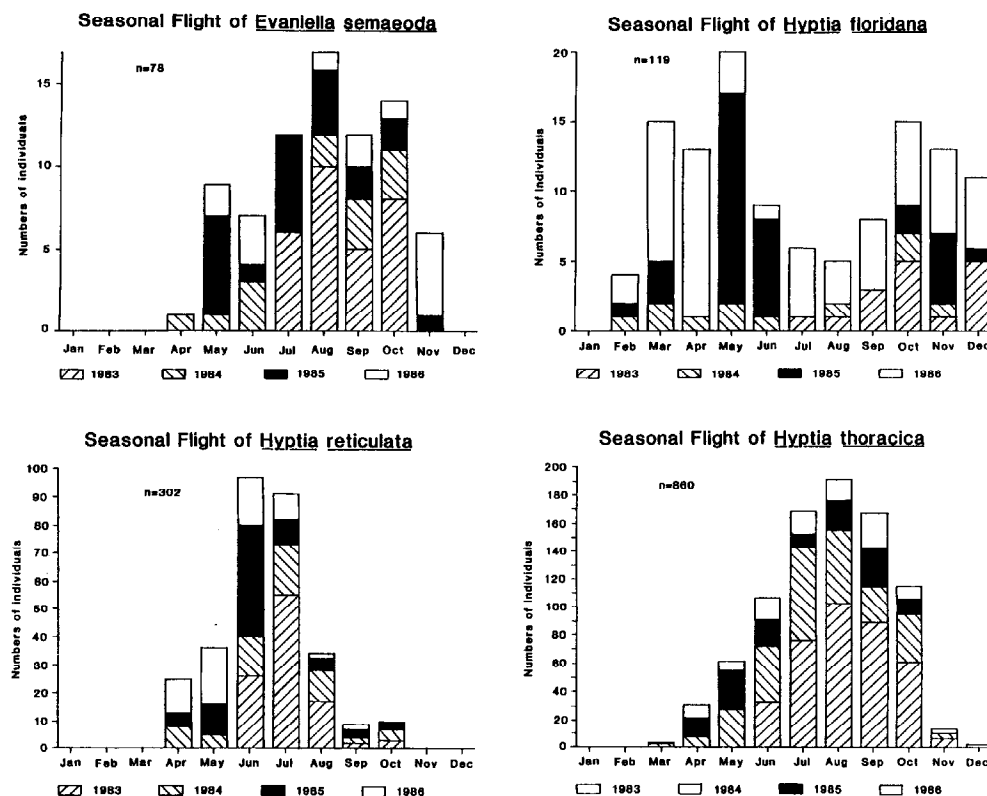


Fig. 1. Seasonal flight patterns of four species of evaniid wasps.

Archbold Biological Station seem confined to disturbed areas near buildings.

2. There is no evaniid big enough to be associated with *Eurycotis floridana* (Walker), unless there is a species that consumes only part of the eggs in an egg case.
3. Small cockroaches whose egg cases might be appropriate for *Hyptia floridana* are *Cariblatta lutea* (Saussure & Zehntner), *C. minima* Hebard, and possibly the small cockroaches *Compsodes cucullatus* (Saussure & Zehntner), *Euthlasto blatta gemma* Hebard, and *Chorisoneura texensis* (Saussure & Zehntner). Our impression is that individuals of *Cariblatta* spp. vastly outnumber all other possible hosts. It seems highly likely that *C. lutea* is the principle host of *H. floridana*.
4. For *Evaniella semaeoda*, *Hyptia reticulata*, and *H. thoracica*, plausible hosts are *Parcoblatta fulvescens* (Saussure & Zehntner), *Latiblatella rehni*, *Ischnoptera deropeltiformis* (Brunner), and just possibly *Arenivaga floridensis* Caudell; the latter is a burrowing species that probably buries its eggs deep in the sand. All three of these medium-sized evaniids occur far north of Florida, in areas where *Parcoblatta* and *Ischnoptera* species are the only possible hosts (Carlson 1979). *H. thoracica* and *H. reticulata* are known to parasitize *Parcoblatta pensylvanica* (DeGeer) (Roth & Willis 1960). *Parcoblatta fulvescens* is abundant at the study site. We reared a specimen of *E. semaeoda* from an ootheca of *I. deropeltiformis* found in deep pine litter in south Florida.
5. The diversity of cockroach genera, both native and exotic species, is greater in southern Florida than elsewhere in the Southeast (Atkinson et al. 1991).

TABLE 1. SPECIES OF COCKROACHES PRESENT AT STUDY SITE AND DIMENSIONS OF OOTHECA.

Family	Species	Length of Ootheca	Height of Ootheca	Sample Size (n)
Blattidae	<i>Eurycotis floridana</i>	16.9 ± .28	7.4 ± .09	25 ¹
	<i>Periplaneta americana</i>	9.0 ± .13	5.5 ± .05	25 ¹
	<i>P. australasiae</i> ¹	1.5	4.5	
Polyphagidae	<i>Arenivaga floridensis</i> ²	7.9 ± .14	3.8 ± .08	
	<i>Compsodes cucullatus</i>			
	<i>Mymecoblatta wheeleri</i> ³			
Blattellidae	<i>Euthlastoblatta gemma</i> ⁴	3.9	2.3	1
	<i>Blattella germanica</i> ⁵			
	<i>Caribblatta lutea</i>			
	<i>C. minima</i>	3.3 ± .04	2.0 ± .03	20 ¹
	<i>Chorisoneura texensis</i> ⁶	3.4	2.1	1
	<i>Ischnoptera deropeltiformis</i>	7.4 ± .19	4.0 ± .06	5 ¹
	<i>I. bilunata</i>	8.0 ± .38	3.2 ± .05	23 ¹
	<i>Latiblattella rehnii</i> ⁷	7.2 ± .09	3.0 ± .03	3
Blaberidae	<i>Parcoblatta fulvescens</i>	6.3 ± .09	3.4 ± .03	3 ¹
	<i>Panchlora nivea</i> ⁸			
	<i>Pycnoscelus surinamensis</i> ⁸			

¹Based on oothecae produced by adults collected in the field by T. H. Atkinson. May-June 1990, Gainesville, FL.

²Based on laboratory colony from Alachua & Levy counties.

³Found in ant nests.

⁴Based on single ootheca protruding from abdomen of female with following collection of data Georgia, 5 mi NE Leesburg, 7-XI-63, W. Glover (USNM).

⁵Ootheca carried by female.

⁶Based on single ootheca with following collection data: NC, Nag's Head, NII-55, K. V. Krombein (USNM).

⁷Florida, Archbold Biological Station, 13-14-V-80, Weems & Hohen (FCSA); Florida, Gainesville, 7-VI-61, H. V. Weems (FCSA).

⁸Ootheca carried internally until hatched.

In spite of this, there is not a greater number of species of evaniids in Florida, and no species is confined to Florida. On the other hand, there are at least six southeastern species of *Parcoblatta* that do not occur in south Florida (Atkinson et al. 1990) and only one additional evaniid, *Hyptia harpyoides* Bradley, within the range of these species. In other words, cockroach diversity in the Southeast is in no way correlated with evaniid diversity. The distribution of the six native evaniids could be explained by the distribution of the genera, *Parcoblatta*, *Ischnoptera* and *Caribblatta*.

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FIELD TEST OF MOSQUITO OVIPOSITIONAL CUES FROM VENEZUELAN PHYTOTELMATA

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ABSTRACT

Fluids held by four phytotelmata were compared for oviposition by mosquitoes in lowland rainforest in eastern Venezuela. Significantly more *Wyeomyia ulocoma* and *Culex pleuristriatus* were recovered in fluid from bracts of *Heliconia caribaea*, than in fluids collected from axils of *Aechmea* bromeliads, the aroid *Alocasia macrorrhiza*, or internodes of *Bambusa vulgaris*. *Wyeomyia ulocoma*, whose immature stages occur uniquely in *Heliconia* bracts, was more specific to *H. caribaea* fluid than was the phytotelm generalist *C. pleuristriatus*. No preferences for oviposition site color were detected.

Key Words: Diptera, fluids, *culex*, *Wyeomyia*, *Heliconia*.

RESUMEN

Fluidos retenidos por cuatro fitotelmatas fueron comparados en una selva lluviosa de tierra baja en el oriente de Venezuela con respecto a la frecuencia de oviposición por mosquitos. Significativamente más *Wyeomyia ulocoma* y *Culex pleuristriatus* fueron colectados en el fluido de las brácteas de *Heliconia caribaea* que en los fluidos de las axilas de bromelias del género *Aechmea*, de las axilas de *Alocasia macrorrhiza*, o de los internodios del bambú *Bambusa vulgaris*. La *W. ulocoma*, cuales estadios