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Notes on Members of the Vespidae Foraging on Honeydew Secretions from the European Fruit Lecanium, *Parthenolecanium corni* (Bouche)[1]

Amanda C. Hodges and Greg Hodges

Department of Entomology, University of Georgia, College of Agricultural and Environmental Sciences, Athens, GA 30602 USA

J. Entomol. Sci. 36(3): 312-314 (July 2001)

Key Words Honeydew, Vespidae

Honeydew is a sugar-rich solution produced by soft scales, mealybugs, aphids, and whiteflies as a by-product of feeding on plant tissue (James et al. 1997, J. Appl. Entomol. 121: 257-259). Extensive ecological experiments have focused on interactions between ants and honeydew-producing insects and have shown that ant foraging can inhibit natural enemies of soft scales (Hanks and Sadof 1990, Biotropica, 22: 210-213; Samways et al. 1982, Phytophylactica, 14: 155-157). Therefore, large outbreaks of soft scale populations can occur as a result of protection by ants (Bartlett 1961, Ann. Ent. Soc. Amer. 54: 543-551). Although *Apis mellifera* L. use honeydew secretions, they have not been shown to tend and guard honeydew-producing insects (Kunkel 1997, World crop pests Soft scale insects, their biology, natural enemies and control. Vol. 7A pp. 291-299).

The primitive eusocial wasp *Belonogaster juncea juncea* (F.) (Hymenoptera: Vespidae) has been observed foraging honeydew from Homoptera in the families Aphididae, Coccidae, Margarodidae, Stictococcidae, and Tettigometridae (Tindo and Dejean 1998, Sociobiology. 32: 101-107). Two introduced species of wasps in New Zealand, *Vespula germanica* L. and *V. vulgaris* L. have been shown to forage on beech scale insects (*Ultracoelostoma* spp. Homoptera: Margarodidae) (Harris et al. 1994, New Zealand Ins. Soc. 41: 379-395; Spurr 1996, New Zealand J. Zool. 23: 315-324). The following observations are the first in North America to report honeydew foraging of soft scales by *Polistes* spp. (Hymenoptera: Vespidae) wasps and the behavior of various foragers of the European fruit lecanium, *Parthenolecanium corni* (Bouche).

Two water oak trees, *Quercus nigra* L., heavily infested with European fruit lecanium and located in an urban setting in Clarke Co., GA, were observed. Behavioral observations were made on 12 August and 13 August 1999 on one *Q. nigra* tree (Tree one). Observations on a second *Q. nigra* tree (Tree two) were only made on 13

[1]Received on March 2000; accepted for publication 31 December 2000.

August 1999. Tree two was located approximately 10 m (south) of Tree one. One observer made all observations. Each observation period was 30 min. All observations occurred between the hours of 1300 and 1500. Only the lower three branches were observed for both trees; however, branches in the upper canopy also contained scales.

All of the members of the Vespidae observed feeding on (or collecting) scale honeydew for each observation period are listed in Table 1. Adult female life stages of the scale insect were collected and slide mounted for identification. Species identification of the scale insect was made through a key to the soft scale insects of Florida and its neighboring states (Hamon and Williams 1984, Arthropods of Florida and neighbors, Vol. 11, Florida Dept. of Agriculture and Consumer Services 11: 1-9). Identifications of the members of the Vespidae were made using a key constructed by Krispyn and Hermann (Krispyn and Hermann 1977, Agricultural Experiment Stations Research bulletin 207). The vespids most frequently present with more than one individual representing the species throughout the observation periods were *V. squamosa* (Drury), *P. carolinus* (L.), and *P. fuscatus* (F.). Other insects that visited the honeydew sites but were not the focus of these observations included *Apis mellifera, Cotinus nitidia* (L.), *Speciosus speciosus* (Drury), *Eumenes* spp., *Crematogaster* spp., a Muscidae, a Calliphoridae, an Otitidae and a Scoliidae.

Aggressive interactions such as chasing, biting, and grappling occurred between the vespids over possession of a honeydew site. The vespids used these aggressive interactions to forcefully take possession, or usurp, a honeydew site from another vespid. A vespid that was trying to usurp another vespid attacked it either by running up the branch and approaching the vespid or by flying towards the vespid and attacking it from the air. The vespid at the honeydew site was not always feeding when another vespid attempted to usurp it from its honeydew site. The vespids frequently guarded a honeydew site after or before they were seen feeding or collecting honeydew from that site. The vespids were sometimes seen guarding an entire branch on which a honeydew site was located. *Vespula squamosa, V. maculifrons* (Buysson), and *P. fuscatus* were observed grouping two individual together to usurp a honeydew site. *Polistes carolinus, P. metricus* (Say), and *V. squamosa* were seen guarding a scale and feeding on the honeydew deposits sporadically on Tree one/Observation two. Two *P. carolinus* cooperatively guarded an entire branch of scales at Tree

Table 1. Members of the Vespidae collecting or foraging on honeydew secretions from *Parthenolecanium corni* (Bouche)

Tree one/observation one	Tree one/observation two	Tree two
Polistinae	Polistinae	Polistinae
Polistes carolinus	*Polistes carolinus*	*Polistes carolinus*
Polistes fuscatus	*Polistes fuscatus*	*Polistes exclamans*
Polistes metricus		*Polistes fuscatus*
Vespinae	Vespinae	
Vespula maculifrons	*Vespula maculifrons*	
Vespula squamosa	*Vespula squamosa*	

one/Observation two. Also, two *P. fuscatus* cooperatively guarded an entire branch of scales at Tree one/Observation two.

Polistes carolinus was the most aggressive vespid species present at all the observations and attempted to usurp other vespid species more than any other species present. *Polistes carolinus* was seen grappling with *P. fuscatus* at Tree one/Observation one and at Tree two. *Polistes carolinus* also attempted to sting *P. fuscatus* at Tree one/Observation one. *Polistes carolinus* chased *P. fuscatus* even though an immediate honeydew source was not present at Tree one/Observation one. On Tree one/Observation two, two *P. carolinus* were seen antennating with one another and subsequently grappling. A *P. carolinus* fought an *V. squamosa* individual at Tree one/Observation one.

These behavioral observations provide information about competition between vespids for scale honeydew secretions. The potential importance of scale honeydew secretions to social wasps, especially *Polistes,* is generally unknown. The presence of the vespids obtaining honeydew from scales may allow the scales to proliferate by lowering their vulnerability to parasitoids and predators. Also, the vespids tending the scales may prevent the scales from having excess honeydew present. In addition to honeydew providing a good medium for various molds, excessive honeydew secretion can smother the scale insects. Within Vespidae, the Polistinae seemed more successful at guarding a scale and at usurping a feeding territory as compared with the Vespinae that were present. Of the *Polistes* species present, *P. metricus* and *P. carolinus* appeared to be the most successful. More observations are needed in order to determine if significant differences in interactions between species occur.