

# NEST DEFENSE BY THE SOCIAL WASPS, *POLISTES EXCLAMANS* AND *P. INSTABILIS* (HYMENOPTERA: VESPIDAE) AGAINST THE PARASITOID, *ELASMUS POLISTIS* (HYMENOPTERA: CHALCIDOIDEA: EULOPHIDAE)<sup>1</sup>

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**ABSTRACT:** *Polistes exclamans* and *P. instabilis* were observed to remove from their nests larvae of *Elasmus polistis*, and to snap at adult parasitoids. These are newly reported defenses against a parasitoid that is new to North American *Polistes*.

Social wasps are plagued by many nest parasitoids which attack and eat brood (Nelson, 1968; Rau, 1941; Jeanne, 1979; Strassmann, 1981). *Polistes* employ several different defenses against these parasitoids. When adult parasitoids are detected near the nest, *Polistes* engage in a "parasite dance" and search all over the nest and substrate for the parasitoids (West Eberhard, 1969; Strassmann, 1981). Litte (1981) found that *Mischocyttarus labiatus* cut their nests down to the pedicel when phorid flies were detected nearby. Jeanne (1979) discovered that *Polistes canadensis* formed multiple combs to protect new brood from tineid moths infesting older cells. Starr (1976) suggested that nests of *Polistes* are not used for more than one season because of the parasitoids that overwinter in them. This hypothesis was supported by the observation that a population of *P. annularis* that was nearly free of parasitoids reused 10% of its nests (Strassmann, 1979).

## METHODS

The observations reported here were part of a larger study of the behavior of *P. exclamans* and *P. instabilis*. A wild population of *P. exclamans* on the roof of the biology building at Rice University was observed in the summer of 1982. *P. instabilis* was observed in Puerto Oscondido, Oaxaca, Mexico in August 1983. Females were marked in both cases and nests were monitored daily.

## RESULTS

We found that *Polistes exclamans* and *P. instabilis* actively defended their brood against *Elasmus polistis*, a small chalcid parasite whose larvae

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are external parasitoids on prepupae and pupae in capped cells of *Polistes* (Reed and Vinson, 1979). They snapped at adult parasitoids with their mandibles, sometimes cutting them in two, and searched over the nest for females trying to lay eggs. Larvae of *E. polistis* were pulled out of cells and dropped or fed to wasp larvae.

We observed an older worker that had been marked on a regularly-censused nest of *P. exclamans* in Houston, Texas, pull several larvae of *E. polistis* out of a cell and drop them. Since the nest was in a plywood nest box, the expelled larvae fell only a few inches to the bottom of the nest box where about 15 parasitoid larvae had accumulated. The worker *P. exclamans* had reached the larvae of *E. polistis* by chewing through the partition separating them from the remains of the wasp larva. This partition is made of meconia of the larvae of *E. polistis* and is constructed just before pupation, after they have finished feeding on the host prepupa, or pupa (Reed and Vinson, 1979). The partition appears to simulate the texture and color of the meconium normally deposited in the bottom of the cell by larvae of *Polistes* and pupation.

*P. instabilis* was observed in a tree in Puerto Escondido, Oaxaca, Mexico. After briefly observing the nest one day we returned the following day to find that about half of the cells with pupal caps had been destroyed by the workers on the nest. While we watched, two more paper wasp pupae with larvae of *E. polistis* attached to them were aborted by the workers. The *E. polistis* were chewed up and fed to brood by workers.

## DISCUSSION

The short development times from egg to adult of *E. polistis* of 17 to 20 days allow several generations of *E. polistis* to infest the same nest over the season (Reed and Vinson, 1979; Strassmann, 1981). Strassmann (1981) found that males emerged before females, remain near the nest to mate with their sisters who reinfested the nest. Numbers of parasitized cells increased over the season to a maximum of 25 cells per nest parasitized by *E. polistis* (S.D. = 37, N = 41 nests) in an Austin Texas population of *P. exclamans* in 1978 (Strassmann, 1981). Since the potential for increased parasitism on the host nest exist, *Polistes* with a high incidence of parasitism by *E. polistis* may be expected to benefit from an active defense mechanism — even one that removes parasitoids after the wasp brood has been killed.

*E. polistis* is a parasitoid that is new to central Texas *Polistes*. Burks (1971) described it for the first time in 1971. *Polistes* have been so thoroughly collected and studied that it is unlikely that it was present and undetected previously (Reed and Vinson, 1979 and refs. therein). Rau, a most thorough collector, collected in Austin, Texas, and does not mention

*E. polistis* or anything similar though he does mention other parasitoid species (Rau, 1943). He stored his nests in bags from which *E. polistis* could not escape (Rau, 1941). It is possible that *E. polistis* has a defense behavior that can be defeated by wasps because *Polistes* are a new host for *E. polistis*.

Parasitoids adopt one of two general types of defense against destruction by *Polistes*: concealment and fortification. *E. polistis* have pupae concealed under a layer which mimics meconium of *Polistes*. *E. polistis* achieves this by migrating as larvae to one position, and all larvae depositing their meconia at one level resulting in a plate of meconium thicker at the edges than in the center (Reed and Vinson, 1979). The ability of adult *Polistes* to tear through this and remove parasitoids of *E. polistis* once they have defeated the mimicry involved contrasts with the situation of several other parasites. *Chalcoela iphitalis* (Lepidoptera: Pyralidae), another common parasitoid of *Polistes*, builds webbing so strong that workers seem to be incapable of chewing through it. However *C. iphitalis* do not reinfest the nest from which they emerge in the same season so it would only be worthwhile to remove them before they have damaged brood (Strassmann, 1981). *Polistes* may also remove brood of *C. ipitalis* to keep them from attacking nearby nests if those nests are likely to belong to relatives. *Pachysomoides stupides* and *Pachysomoides fulvus* (Hymenoptera: Ichneumonidae) also construct casings that *Polistes* can remove only by destroying that entire region of the nest. *Polistes* also tear great sections of the nest away to remove pupae of *Sarcophaga polistis* (Diptera: Sarcophagidae) which lie across several cells at the very bottom of the nest where they are concealed (Strassmann, unpubl.; Hughes, unpubl.). Apparently these pupae can only be removed by substantial nest destruction.

Of 16 nests which had extensive areas of the nest chewed away at a field site near Houston, seven contained brood of *P. stupidus* and 2 contained brood of *C. iphitalis*. Since some parasitization probably went unrecorded, for example that underneath pupal caps, this nest destruction is probably always a response to parasitoids. Fourteen of the 16 nests were *P. carolinus*, a species which nests very close to its natal nest site (Hughes, unpubl.; Rau, 1931), and would therefore aid relatives by removing parasite pupae from the immediate area.

Over 60% of all nests of *P. exclamans* lose brood to the parasitoids *E. polistis* or *C. iphitalis* or both each year in central Texas (Strassmann, 1981). Though worker wasps appear to make every attempt to keep adult parasitoids from laying eggs in the nest, and to remove parasitoid eggs and larvae when they do, many of these attempts are ineffective. The abundance of *E. polistis* in nests of *Polistis* suggests that workers often do not detect the parasitoids.

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