



## RESEARCH ARTICLE - WASPS

## Differential Nest Parasitism in Three Sympatric Social Wasps (Hymenoptera: Vespidae: *Polistes* spp.) in the West Indies

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**Abstract**

Jamaica's three species of social wasps were found nesting together in a suburban area. Their nests gave evidence of markedly different parasitoid loads in the sequence *Polistes crinitus* > *P. dorsalis* > *P. major*. Based on larval and pupal silk remains, the moth *Chalcoela pegasalis* appears to be the main nest parasitoid at this locality. Despite widely different parasitoid loads, the estimated per-nest production of adults was similar among the three species. This suggests a trade-off between investment in anti-parasitoid tactics and in other brood-care activities.

**Introduction**

Social wasps of the subfamily Polistinae (Hymenoptera: Vespidae) are host to nest parasitoids from at least 14 families of insects (Makino, 1985; Nelson, 1968). Social wasps with open-comb nests would seem especially vulnerable to parasitoid invasion. In most of the records compiled by Makino (1985), the host is a species of *Polistes* or *Mischocyttarus*, whose nests are of this type. However, this bias may partly be due to the ease with which such parasitism is noted and the overall greater study devoted to these genera.

Wasps have a number of tactics to limit penetration by nest parasitoids. The presence of a parasitoid near the nest is likely to elicit prolonged, agitated patrolling of the comb surface by the wasps (Lutz et al., 1984; pers. obs.), and Starr (1990) and Gadagkar (1991) suggest that constant vigilance and active repulsion by adult females are the most important guard against parasitism. If a parasitoid succeeds in laying eggs in the nest, most *Polistes* and *Mischocyttarus* make little apparent effort to remove parasitoid brood at any stage

(Gadagkar, 1991). One apparent recourse is to excavate cells with parasitoid larvae and/or pupae, although we have seen evidence of this tactic in few species.

Nest parasitoids are very often made conspicuous by the larval silk and pupal cases that they leave behind, which may remain visible long after the wasps have left the nest. Our observations over the years indicate that regions and localities can differ a great deal in the parasitoid load seen in nests, so that the wasps in some places are subject to heavy parasitoid pressure, while those in others are relatively parasitoid-free.

What has not been examined up to now is whether co-occurring, closely-related species may differ in this respect. Our purpose here is to compare nest-parasitoid load in three congeneric species at a single neotropical locality.

**Materials and Methods**

Jamaica is an oceanic island with just three species of social wasps, all in the genus *Polistes* (Richards, 1978). One of us (CKS) found all three species nesting abundantly



on buildings and other human-made structures in suburban Mona, near the city of Kingston. Nests are easily identifiable to species in the absence of wasps. Among other features, the petiole is excentric in *P. crinitus* (Felton) nests, centric is those of *P. dorsalis* (Fabr.) and *P. major* Beauvois, and the cells are notably larger in *P. major* than the other two species.

The three species all nested in much the same places at our site, often interspersed, with no evident nest-site separation among them. All old nests that could conveniently be reached were collected from buildings on the University of the West Indies campus, up to 100 nests per species. These were then examined in the laboratory with an ordinary dissecting microscope. Cocoons spun by the wasp larvae just before pupating are closely applied to the cell walls (resembling a coat of varnish) and close the cell with a smooth cap. Silk from parasitoids, in contrast, clutters the cell interior and renders it unserviceable for brood rearing. We counted a nest as parasitized if at least one cell was fouled by such foreign silk. Adult wasps sometimes cut away parts of cells walls in an apparent attempt to remove the very tough, resistant parasitoid silk. We counted a nest as showing excavation if there was removal of at least a significant part of any cell wall.

The number of larvae that have pupated (and presumably emerged as adults) in a given cell can be determined with confidence by dissecting the cell and counting the fecal pellets deposited in the cell base after the cocoon is spun. Pellets are of fairly uniform size, and where there are two or (rarely) more in a cell base they are separated by a silk layer and therefore distinct (Yamane & Yamane, 1975).

## Results and Discussion

Nests of all three species varied widely in size in our samples from fewer than 25 to at least 250 cells. Average nest size was significantly greater in *P. dorsalis* than *P. crinitus* and *P. major* (Kruskal-Wallis test,  $p<0.01$ ), while the latter two showed no average difference ( $p>0.05$ ) (Table 1).

**Table 1.** Mean size (number of cells) of old nests, frequency of nests with parasitoid silk, and frequency of nests with evidence of cell excavation in three Jamaican social wasps. Further explanation in text.

	<i>Polistes crinitus</i> n=100	<i>Polistes dorsalis</i> n=100	<i>Polistes major</i> n=74
Mean size $\pm$ SD	75.2 $\pm$ 52.2	95.5 $\pm$ 58.8	73.4 $\pm$ 77.4
With silk	75 (75%)	21 (21%)	3 (4%)
With excavation	24 (24%)	7 (7%)	7 (10%)

The species show significant differences ( $p<0.01$ ) in both the frequency of parasitized nests and frequency of nests with excavation (Table 1;  $X^2 = 108.4$  and 13.7, respectively), although there is no significant difference between *P. dorsalis* and *P. major* in the latter parameter. Consistent with this, at Villa Altagracia, San Cristóbal, Dominican Republic one of us

(CKS) found a high incidence of *P. crinitus* nests with evidence of nest parasitoids, while no *P. major* appeared affected.

Based on remains of larval and pupal silk, the predominant parasitoid appeared to be the widespread *Chalcoela pegasalis* (Walker) (Lepidoptera: Crambidae), previously recorded from *P. crinitus* (Nelson, 1968). In contrast, no nest showed the pupae characteristic of *Pachysomoides* (Hymenoptera: Ichneumonidae), although members of this genus are important parasitoids of several New World *Polistes* spp. (Nelson, 1968; Makino, 1985). As seen in Table 2, *P. crinitus* had the highest incidence of cells showing *C. pegasalis* infestation, *P. major* the lowest ( $X^2>100$ ,  $p<0.01$ ), consistent with the relative fractions of nests with parasitoids in Table 1.

Because the three species nest in much the same places at this one locality, it is reasonable to believe that they are equally exposed to searching nest parasitoids. Nonetheless, the data show that *P. crinitus* colonies suffer the greatest impact and *P. major* the least.

Most cells of all species had at most one fecal pellet, with a very small number having two or three. Mean per-cell production of adults differed significantly among species (Kruskal-Wallis test;  $p<0.01$ ). Combining nest size with per-cell production does not significantly alter this pattern.

Although species differ significantly in per-cell and per-nest production of adults, the differences were quite modest and showed no evident correlation with differences in parasitoid load. It is our interpretation that differences in losses of brood to parasitoids are offset by differences in another, unknown parameter to produce a trade-off. It is a plausible hypothesis that successful anti-parasitoid vigilance by adult females is so demanding that it markedly diminishes their attention to foraging and other aspects of brood-care.

**Table 2.** Frequency of cells with apparent *Chalcoela pegasalis* silk and per-cell production of adult wasps in old nests of three Jamaican social wasps. Total numbers of cells below each species are from the nests enumerated in Table 1. Per-cell production of adults is based on counts of fecal pellets in cells bases; e.g. the 7523 cells of the *P. crinitus* nests contained an estimated 5203 pellets, a mean of 0.69 per cell.

	<i>Polistes crinitus</i> n=7523	<i>Polistes dorsalis</i> n=10,204	<i>Polistes major</i> n=5428
Cells with <i>C. pegasalis</i> silk	2042 (27.1%)	571 (5.6%)	27 (0.5%)
Per-cell production of adult wasps	0.69	0.72	0.59

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