

# Notes on Niche Separation in the Neotropical Social Wasps *Polistes lanio* and *Polistes versicolor* (Hymenoptera: Vespidae)

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## ABSTRACT

Nesting and colony productivity of the social wasps *Polistes lanio* and *P. versicolor* are compared at three sites in northern Trinidad, West Indies. Only *P. versicolor* was found nesting at the most vegetated site, while only *P. lanio* was at the least vegetated site. The two species were both abundant at an intermediate site. Where the species co-occur, there is no evident difference in their use of available nest sites. Furthermore, where they co-occur there is no significant difference in colony productivity. However, each species is more productive at the opener, less heavily vegetated site where it is found. As a result, *P. lanio* is significantly more productive, overall, than *P. versicolor*. These data are consistent with the hypothesis that *P. lanio* excludes *P. versicolor* by competition from more productive sites. The basis of this supposed competition remains unknown.

**Key words:** *Polistes*, niche, social wasp.

## INTRODUCTION

*Polistes* is a worldwide genus of social wasps. The approximately 200 known species (Carpenter 1996a) are very similar in their overall physical makeup, nest structure and social organization (Reeve 1991). In addition, although *Polistes* have been recorded taking a variety of prey as brood-food, it is believed that caterpillars form the main provision of most or all species (Reeve 1991).

In Trinidad, West Indies, seven species of *Polistes* are recorded (Starr and Hook 2003, 2006), with more than one often found nesting in the same sites. Little is known about flight ranges of *Polistes* foragers, although there is reason to believe that they do not usually range far from the nest. Dew and Michener (1978) found mean foraging distances of 48 and 102 m, respectively, in two North American species, while Suzuki (1978) estimated the mean foraging area at only about 120 m<sup>2</sup> (radius about 6.2 m) in a Japanese species. These sparse data suggest that, as a rule, *Polistes* forage close to home.

The two commonest species in Trinidad, *P. lanio* (Linnaeus) and *P. versicolor* (Olivier), both nest abundantly on human-made structures, often together. The two are readily distinguishable by colour differences and size (forewing length of females usually 19-20 mm in *P. lanio*, 12.5-13.5 mm in *P. versicolor*), but are otherwise physically almost identical (Carpenter 1996b). Likewise, the nests are effectively identical except in size (mean side-to-side cell diameter 6.5 mm in *P. lanio*, 5.5 mm in *P. versicolor*). Each species has a very broad geographic range and has been studied extensively in Brazil (Giannotti 1995; Giannotti and Machado 1994a-c, 1997, 1999, Giannotti and Mansur 1993; Giannotti *et al.* 1995, Gobbi 1977, Gobbi and Zucchi 1980, 1985). These similarities raise the question of what ecological factors separate such similar species and allow them to co-exist.

Our purpose here is to examine habitat differences between these two species that may contribute to a niche separation.

## MATERIALS AND METHODS

All observation were made during October-November 2000. We utilized three study sites within the same area of Trinidad, each part of the University of the West Indies (UWI). All three sites are in relatively flat lowlands with no sizeable body of water. Although each site is extensive, our attention was restricted to colonies spread over a very few hectares.

1. The medical school at Mt. Hope comprises many large concrete-and-steel buildings and other human-made structures in a relatively featureless grassland with almost no large trees.
2. The University Field Station, about 1 km south of Mt Hope, comprising fewer buildings, many more scattered large trees, and fields for crops and livestock.
3. The University of the West Indies main campus at St. Augustine, about three kilometers east of Mt. Hope, with a great number of steel-and-concrete buildings. It is the most heavily vegetated site, with large trees forming a diffuse parkland forest.

At each site we walked about haphazardly, recording the species and location of nests, whether old or still active. Each nest site on a building was categorized as an eave (on the outside of the building, usually under a short overhang), porch (recessed at least one-half meter from the building's edge, but with broad open access to the outside) or room (inside the building, with narrow access to the outside). Nest substrates were recorded as wood, concrete or metal.

In order to determine whether mature-colony size dif-

**Table 1.** Relative prevalence and nest situations of *Polistes lanio* and *P. versicolor* at three localities in Trinidad, West Indies. MtH = Mt. Hope, UFS = University Field Station, StA = St. Augustine. Further explanation in text.

Species	Locality	No. of nests	--- Nest site ---	--- Nest substrate ---				
			Eave	Porch	Room	Wood	Concrete	Metal
<i>P. lanio</i>	MtH	60	60	0	0	0	60	0
<i>P. versicolor</i>	MtH	0	0	0	0	0	0	0
<i>P. lanio</i>	UFS	97	97	0	0	86	6	5
<i>P. versicolor</i>	UFS	28	28	0	0	23	2	3
<i>P. lanio</i>	StA	0	0	0	0	0	0	0
<i>P. versicolor</i>	StA	30	30	0	0	0	30	0

fers between species, we collected old (abandoned) and late-stage (with very few adults or with males present) nests of the two species and computed a) number of cells, and b) total production of adults. The second parameter is estimated by dissecting a sample of cells and counting the number of fecal pellets in the base. Each mature larva deposits a single fecal pellet at the time of pupation, so that the number of pellets in a cell indicates the number of adults produced.

We attempted no rigorous measure of foraging distance in either species. However, in order to gain a rough estimate, we opportunistically followed wasps as they left the nest, measuring the distance to the foraging area to the nearest meter by pacing where we were able to follow them.

## RESULTS

In Trinidad these two species nest almost exclusively on human-made structures when these are available. We have only occasionally found either of them nesting on vegetation, in no case during the present study.

We found only *P. lanio* nesting at Mt. Hope, only *P. versicolor* at St. Augustine, while both species were abundant at the University Field Station (Table 1), a statistically highly significant difference ( $X^2$  test,  $p < 0.01$ ).

All nests in our sample were attached to eaves, although outside of this study we have found these species nesting on porches and in rooms. As seen in Table 1, at the UFS each species nested on wooden, concrete and metal substrates, with no evident preference difference between species ( $X^2$  test,  $p > 0.05$ ).

Nest sizes and productivity (as measured by fecal pellets) show an odd pattern in our modest-sized data-set (Table 2). Where the two species nest together, at the UFS, they show no significant difference in either parameter ( $p > 0.05$ ). However, it is striking that *P. lanio* did so much better at MtH than at the UFS ( $p < 0.05$ ), while *P. versicolor* did much better at the UFS than StA ( $p < 0.05$ ; all three comparisons by Kruskal-Wallis one-way non-parametric analysis of variance).

Nine *P. lanio* foragers flew an average of 39.2 m (range 15-87 m) from the nest before alighting on vegetation.

**Table 2.** Nest sizes and productivity of *Polistes lanio* and *P. versicolor* in Trinidad, West Indies. MtH = Mt. Hope, UFS = University Field Station, StA = St. Augustine. Numbers of cells and fecal pellets are mean  $\pm$  SE. Further explanation in text.

Species	Locality	Cells	Fecal pellets
<i>P. lanio</i> (n=60)	MtH	103.5 $\pm$ 11.2	101.9 $\pm$ 14.2
<i>P. lanio</i> (n=97)	UFS	55.6 $\pm$ 7.0	29.9 $\pm$ 6.0
<i>P. versicolor</i> (n=28)	UFS	62.9 $\pm$ 10.8	38.0 $\pm$ 8.8
<i>P. versicolor</i> (n=30)	StA	28.2 $\pm$ 6.1	6.2 $\pm$ 2.6

## DISCUSSION

The data are consistent with the hypothesis that *P. lanio* tends to nest in areas with fewer trees than those utilized by *P. versicolor*. Given the presumed short average flight distance of foragers, the nesting habitat and foraging habitat are the same. Where the two nest together, nothing is known of any differences in prey preferences.

Exclusive nesting on concrete at MtH and StA, but mostly on wood at the UFS in our samples, is evidently simply a reflection of what was available, not a preference. This is further shown in the lack of any significant difference between species at the UFS.

The data on nest size and productivity (two indices of the same thing) are curious and would bear further study. The pattern in our data is consistent with the hypothesis that a) each species does better at sites with more herbaceous vegetation and fewer trees, hence with greater primary productivity, and b) *P. versicolor* is largely excluded from the better sites through competition from *P. lanio*. However, the basis of any such competitive advantage is unknown.

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