

SHORT COMMUNICATION

Swarming Behavior of Two Parasitic Wasps, *Leurus caeruliventris* (Hymenoptera: Ichneumonidae) and *Conura* sp. (Hymenoptera: Chalcididae), at the Same Site

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Swarming behavior, in which individuals of one sex form groups at sites lacking resources but where they are likely to encounter receptive individuals of the other sex, is common in some orders of insects such as Ephemeroptera and Diptera (Thornhill and Alcock, 1983; Sivinski and Petersson, 1997). For reasons that are unclear it is less common in others, such as Hymenoptera (except, again for apparently unknown reasons, in Formicidae). In the family Braconidae, males of several species of *Blacus* form swarms (van Achterberg, 1975, 1977). There are scattered reports of swarming in several other species of parasitoids (Godfray, 1994). Because nothing is known of the mating behavior of most species of Ichneumonidae and Chalcididae, especially in the tropics, it seems worthwhile recording brief observations of swarming in two species, *Leurus caeruliventris* (Cresson) (Ichneumonidae: Metopiinae), and *Conura* sp. (Chalcididae) in Costa Rica. *Leurus* are endoparasitic koinobionts of microlepidopterans; *L. caeruliventris* is a common, widespread species ranging from the United States to Argentina (I. D. Gauld, pers. comm.). *Conura* is a huge genus (estimated 250–300 species in Costa Rica, >1000 species in the Neotropics) that are parasitoids of the pupae of Lepidoptera, Chrysomelidae, and their primary parasitoids (Delvaré, 1995), and also of ichneumonid wasp pupae (Eberhard, 2000).

Materials and Methods

Wasps were observed near San Antonio de Escazú, San José Province, Costa Rica (approximately 10° 20' North, 84° 15' West). I attempted to estimate the approximate distribution of constantly milling and shifting population of wasps at the site at the border of a grassy yard illustrated in (Fig. 1) by making repeated counts at different hours of the day. At a given moment during a session in which I counted flying wasps, I concentrated on a given 1 m stretch of the border, and counted the wasps I could see in the air every 10 sec (approximately 5 sec were spent scanning the site, and the other 5 sec writing). I made 10 counts (thus obtaining an average for 100 sec), and then moved on and repeated these counts for the next 1 m. The counts were probably only approximate; other similar sized and colored insects may have been occasionally included accidentally, and the areas under leaves were searched less thoroughly than areas above leaves. Seldom was a flying wasp present in a given 1 m stretch for more than 10 sec, so sequential counts were probably relatively independent of each other.

Voucher specimens will be deposited in the Museo de Zoología of the Universidad de Costa Rica, and the British Museum.

Results

Both species were observed swarming during a period of 23 (chalcidid) or 29 (ichneumonid) days, beginning on 3 August 2005 (when both species were first noted) and ending on 26 August (chalcidid) or 1 September (ichneumonid). I checked for wasps on 15 of these days, and on the 5 days following the last day on which the ichneumonids were seen. Both species were abundant on 3 August, when they were first noted, so the swarming period is probably underestimated. Wasps flew on both sunny and cloudy mornings, even when there were scattered small drops of light rain. They were present as early as 7:40 A.M., but were absent earlier on three mornings when they later appeared. They remained common until about noon; the latest they were seen was 3:25 P.M., and they were absent later in the afternoon. The swarm thus reformed each morning. All individuals that I collected were males (11 of *L. caeruliventris*, 5



Fig. 1. The edge of a grassy yard where swarming was observed. The 2 m stretch between the arrows was where most *L. caeruliventris* were seen.

of *C. sp.*). Several *L. caeruliventris* were observed during brief observations at the same site on 25 September 2006.

Leurus caeruliventris

The maximum estimated number of wasps in flight at any given moment along 5–7 m at the edge of the yard was 10–15. Most of the time each wasp flew into the light wind, moving slowly and erratically toward the downwind edges of leaves 20–120 cm above the ground. When the wind changed direction, the wasps also changed orientation accordingly and approached the new downwind sides of the leaves. Probably the most common single flight pattern was to make a relatively short (<1 m), gradual approach toward an object (generally the downwind edge of a leaf), veer sharply away after approaching to 1–5 cm, and then move toward another object farther upwind. Nearly all flight seemed to be oriented toward an object, and the wasps did not appear to attempt to maintain stationary positions in the air. There was no consistency regarding the site on a given leaf that was approached by different wasps, nor the particular leaves that were approached (other than a tendency for leaves and portions of leaves that stuck farther out from the plant toward the yard to receive more approaches). By concentrating on a 1 m space between protruding leaves, I also noted longer, more rapid flights downwind. Thus, although I could not follow their flight for more than 1 m or so, the wasps probably circled, working their way upwind from leaf to leaf, then moving rapidly downwind to begin again.

Early in the morning wasps landed more frequently on leaves (21 landings in 18 min ending at 8:00, versus 0 landings in 10 min (with more wasps present) ending at 8:43 on the same morning). In all of these landings, the wasp walked immediately to the edge of the leaf, and in 10 cases proceeded over the edge onto the underside, rested immobile for 5–60 s, and then flew off. Flying wasps did not show any sign of interest in other wasps that were resting on leaves. It was not unusual to see a flying *L. caeruliventris* veer briefly, apparently toward another flying individual, but the wasps seldom if ever collided (possibly due to both turning away at the last moment: I could not resolve this detail). Occasionally a wasp landed on a leaf, rather than veering away after approaching another.

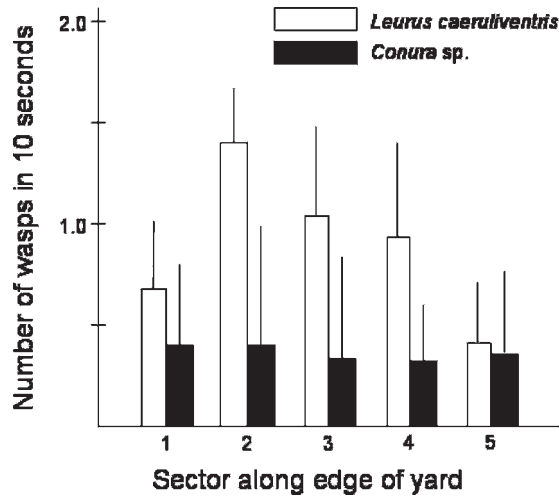


Fig. 2. Numbers of wasps seen at different 1 m stretches of the study site.

Conura sp.

These wasps were less common (Fig. 2). Their flight patterns were similar in that they made repeated approaches to the distal portions of different leaves, and an approach usually ended with the wasp veering away. They differed in that the wasps usually approached the undersides of leaves, and they flew less consistently upwind. I also had the impression that this species was less concentrated along the border of the yard, and more likely to approach leaves 1–2 m back into the mass of plants than the ichneumonids. The wasps sometimes landed on a leaf, usually (but not always) on its underside. Once a wasp landed, it was either immobile, or walked around apparently aimlessly, and then took flight again within a min or so.

I saw no cases in which one flying male apparently veered toward or away from another. Their densities were low, however, and males were only seldom as close as 0.3 m from each other.

Distribution

The abundance of *L. caeruliventris* was greater in the central portion of the 5 m stretch studied (Fig. 2). Fewer counts were made beyond the ends of this 5 m stretch, but the wasps seemed to be even less common there.

Cursory checks of other areas at the edge of this and another grassy yard showed that both species were also present at some other sites. In all cases where they occurred, both species were present, and they seemed to be concentrated near plants with protruding leaves along the border of the yard. But not all areas with protruding leaves had wasps, and I was unable to see why they were present at some sites but not others. They were seen approaching the leaves of at least four species of plants.

Discussion

The fact that apparently only males were present suggests that these were mating swarms. No interactions with females of either species were seen, however, and interactions with conspecific males were ephemeral and of low intensity at most. It is common, however, for mating to be relatively uncommonly observed in the mating swarms of some species (Downes, 1969; Sivinski and Petersson, 1997). The fidelity to the same short stretch of the border of the yard suggests that there was something attractive about the swarming site. The wasps showed no sign of attraction to particular leaves or particular sites on leaves, as might have been expected if they had been attracted to chemical marks. There were no obvious resources or landmarks at the swarming sites.

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