

**Notes on Male Territorial Behavior in the Galápagos
Carpenter Bee**

(Hymenoptera : Apidae)

E. GORTON LINSLEY

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Incidental to a study of the floral relationships of the Galápagos Carpenter Bee, *Xylocopa* (*Neoxylocopa*) *darwini* Cockerell (Linsley, Rick, and Stephens, 1965), brief opportunities were offered in which observations could be made on territorial behavior among the males. These observations, although fragmentary, are offered at this time, since there is relatively little in the literature regarding this phenomenon in *Neoxylocopa*, the largest subgenus of New World or American carpenter bees (Hurd and Moure, 1963).

The Galápagos Carpenter Bee, like other members of the New World subgenus *Neoxylocopa*, is markedly sexually dichromatic, the females being dark, the males ferruginous. This greatly eases the task of the observer in an area like the Galápagos where but a single species occurs. However, on the mainland where species may have overlapping ranges, the two sexes are almost impossible to associate except in nest-collected series (Hurd and Moure, 1963).

Females of the Galápagos Carpenter Bee nest in wood and their nesting habits have been briefly alluded to elsewhere (Williams, 1926; Hurd, 1958b; Linsley, 1965; Linsley, Rick, and Stephens, 1965). Since territorial behavior among males did not appear to be associated with female nest sites, this information will not be repeated here.

TERRITORIALITY AMONG MALES.—On 23 January 1964, in the mid-Transition Forest Zone of Santa Cruz Island, at 12:20 p.m. a male was observed "defending" a territory in an open area, about 10 feet by 15 feet, in the woodland area adjacent to the trail to the highlands above Academy Bay. The plant "defended" was a shrub of *Alternanthera echinocephala*, varying from about 20 to 36 inches in height. The defense consisted of a constant patrolling of the plant, interrupted by temporary pauses during which the male poised in the air, generally from 2 to 3 feet above the ground. Whether patrolling or poised, the "defender" darted after each male *Xylocopa* that tried to enter the defended zone, also at butterflies and finches (*Geospiza*), but made no attempt to investigate or molest female *Xylocopa* entering the area or working nearby flowers for pollen or nectar (females do not visit

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Alternanthera!). Some invading males persistently tried to chase away the "defending" male, and often these were pursued round and round the plant for several seconds before leaving and sometimes they were chased completely out of the area so that the "defender" was absent from the "defended" zone for 20–30 seconds. In one 10-minute period three males and one finch were pursued and four females collecting pollen from *Galactea jussiana* var. *volubilis* within the "defended" zone were ignored. Female *Xylocopa* have a hum different from that of the males, and perhaps they are identified in this manner. On two occasions, females were seen to fly within 15 inches of a male without producing a reaction. Near midday, male activity was not altered visibly when clouds covered the sun. Also, during hovering flight, the legs did not hang loose as they do in *Protoxaea* (Cazier and Linsley, 1963). At times, the "defending" male flew to the highest branch of *Alternanthera* (39 inches above the ground) as though to alight or pause for a moment, but did not actually do so during 45 minutes of observation. On this day a heavy tropical downpour began at 1:05 p.m. and the male disappeared. No further observations were possible on that occasion.

Two days later, at a somewhat higher elevation along the same trail, three males were encountered at 1:10 p.m. chasing one another in a broad circle in a similar open area of woodland. When one flew off the other two settled in hovering flight guarding a dead tree overgrown with the yellow pea-flower, *Rhyncosia minima*, but separated from each other by a large, arborescent tree cactus, *Opuntia echios*, approximately 7 inches in diameter at chest level where the bees were poised. Both males commonly pursued the same intruder, but afterwards returned to their respective territories.

Between 2:10 and 2:40 p.m. along a section of the trail about 1 km in length leading down to the lower edge of the Transition Zone, 17 separate male territories were noted. The bees were mostly poised between 30 and 40 inches above the ground, each facing an open area or patrolling the "defended" plants, several of which were *Alternanthera*. Between 2:40 and 3:10 p.m., eight established territories were observed along the trail in the Upper Arid Zone. Captured individuals all had intact wing tips and pubescence and appeared to be freshly emerged. In two cases, captured males were replaced in territory by another male within minutes, in one case within seconds. Ten undisturbed territories, seven in the Transition Zone and three in the Arid Zone, were tagged with the intent of marking the males and keeping them under observation for a period of consecutive days. However, unfavorable weather and other circumstances prevented further visits to these sites on sunny

days until 23 February, 30 days later. At this time only seven of the ten tags could be located, but of these, six territories were occupied precisely as before. However, the male bees occupying them were young adults with fresh wings and pubescence, suggesting that physical characteristics are an important feature of territory selection and that the same "territories" are attractive to a succession of male bees.

TERRITORIALITY AMONG CARPENTER BEES IN GENERAL.—Hurd (1958a) has summarized the available information on territoriality among carpenter bees in general, and Janzen (1964) and O'Brien and Hurd (1965) have supplemented the summary with new data on *Notoxylocopa*. Included in Hurd's summary are data on representatives of the subgenera *Koptorthosoma*, *Xylocopoides*, *Notoxylocopa*, *Alloxylocopa*, and *Neoxylocopa*. Hurd quotes Michener, as authority for the observation that males of *Xylocopa* (*Neoxylocopa*) *varipuncta* Patton, as well as similar species in Brazil, México, and Panamá, fly about within the branches of a selected tree or group of bushes for hours at a time, returning to the same place day after day. Michener is quoted also as speculating that the purpose of the flight may be related to mating in some way. On the other hand, Janzen (1964), associated male territoriality in *Notoxylocopa* with physical prominences, such as clumps of herbs, exceptionally tall plants, and hedges, rather than areas immediately above flowers frequented by females, a situation more similar to that observed in the Galápagos Carpenter Bee.

CONCLUSIONS

From the limited observations recorded above, the following conclusions, in part tentative, may be drawn:

- (1) Males of the Galápagos Carpenter Bee exhibit definite territorial behavior.
- (2) Individuals identified with this behavior pattern give every evidence of being freshly emerged or relatively young adults.
- (3) Territorial sites appear to exhibit physical characteristics that make them attractive to males whose flight is synchronic as well as to those whose flight is allochronic.
- (4) No clear evidence is available to relate this behavior to mating; perhaps its principal function is spacing, or, as suggested for *Protoxaea* by Cazier and Linsley (1963) and for *Notoxylocopa* by Janzen (1964), defense of the pollen and nectar sources of the female.

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LITERATURE CITED

- CAZIER, M. A., AND E. G. LINSLEY. 1963. Territorial behavior among males of *Protoxaea gloriosa* (Fox) (Hymenoptera: Andrenidae). Canadian Entomol., 95: 547-556, 2 figs.
- HURD, P. D., JR. 1958a. Observations on the nesting habits of some New World carpenter bees with remarks on their importance in the problem of species formation. Ann. Entomol. Soc. Amer., 51: 365-375, 5 figs.
- 1958b. The carpenter bees of the eastern Pacific Oceanic Islands. Jour. Kansas Entomol. Soc., 31: 249-255, 4 figs.
- HURD, P. D., JR., AND J. S. MOURE. 1963. A classification of the large carpenter bees (Xylocopini). Univ. Calif. Publ. Entomol. 29: 1-365, 244 figs.
- JANZEN, D. H. 1964. Notes on the behavior of four subspecies of the carpenter bee, *Xylocopa* (*Notoxylocopa*) *tabaniformis* in Mexico. Ann. Entomol. Soc. Amer., 57: 296-301, figs. 1, 2.
- LINSLEY, E. G. 1965. Pollinating insects of the Galápagos Islands. In Bowman, R. I. (Ed.), Proceedings of the Symposia of the Galápagos International Scientific Project. Univ. Calif. Press, Berkeley-Los Angeles (in press).
- LINSLEY, E. G., C. M. RICK, AND G. STEPHENS. 1965. Observations on the floral relationships of the Galápagos Carpenter Bee (Hymenoptera: Apidae) (in press).
- O'BRIEN, L. B. AND P. D. HURD, JR. 1965. Carpenter bees of the genus *Notoxylocopa* (Hymenoptera: Apoidea). Ann. Entomol. Soc. Amer., 58 (2): 175-196.
- WILLIAMS, F. X. 1926. The bees and aculeate wasps of the Galápagos Islands. Proc. Calif. Acad. Sci., (4) 2: 347-357.
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