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FIELD STUDIES OF CANTHARIDIN ORIENTATION BY *NEOPYROCHROA FLABELLATA* (COLEOPTERA: PYROCHROIDAE)

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ABSTRACT

During field studies conducted in south-central Michigan in 1977 and 1980, 109 specimens of *Neopyrochroa flabellata* were observed and collected at filter papers baited with cantharidin. Only the two highest concentrations used (39.2 mg, 392 μg) elicited responses, and the beetles did not prefer one over the other. In the 24-h studies, most specimens were observed at the cantharidin baits between dusk and 0100 hrs (61%; n = 14), and 0430-0630 hrs (26%; n = 6). Only two of the 109 specimens were female.

Neopyrochroa flabellata (Fabricius) is one of several insect species known to orient positively toward cantharidin, the sesquiterpenoid defensive compound of meloid and some oedemerid beetles. During four, 16-h field studies in June and July 1977, 85 males and one female were observed and collected at cantharidin baits between the hours of 0900-0100. Unfortunately, none of the studies covered the interval of time between 0100-0800; also, no attempt was made to ascertain what concentration of cantharidin was necessary in order to elicit a positive response.

Additional studies in 1980 addressed three questions: what range of cantharidin concentrations elicit positive field response?; what is the pattern of daily activity for *Neopyrochroa flabellata* with respect to cantharidin orientation?; and, what is the sex ratio of cantharidin-orienting specimens?

MATERIALS AND METHODS

Four cantharidin solutions (10^{-1}M, 10^{-3}M, 10^{-4}M, and 10^{-5}M) were prepared along with a solvent (acetone) control; 0.5 ml of a given solution was applied to a single filter paper disk (Balston #1, 7.0 cm), and four disks of a given cantharidin concentration comprised a single "bait." Thus, five cantharidin concentrations were available for the field study (39.2 mg, 392 μg, 39.2 μg, 3.92 μg, and the control).

The 1980 study site was located within a relatively undisturbed section of a mixed deciduous forest in the Dansville State Game Area (Ingham County, MI). A brief survey of the area early in the summer indicated a good population of *N. flabellata* larvae. A bait line was established through the center of the woods, along an old pathway which had been blocked off to traffic. Distance between baits was 70 m. Baits were arranged so that the two baits of lowest cantharidin concentration were interspersed between those of higher concentration.

For recording purposes, a "station" was defined as a cordoned off, 1-m^2 area with the bait (an open plastic dish with two filter papers in each half) located in the center; only those specimens within the station area were counted. Once recorded, specimens were immediately removed, placed in individualized petri dishes and stored in a cooler for further studies in the lab. Observations were taken for 5-min periods, with 5 min between successive stations. Utilizing two persons, this worked out to 30 min between successive observations at a given station. The duration of the study was 24 h. Once the bait line was

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set up at the onset of the experiment, an initial 15-min exposure period was provided prior to taking the first observations.

RESULTS AND DISCUSSION

In attempting to assess the daily cantharidin-orienting activity of *N. flabellata,* it was useful to divide the 24-h period into three portions which conformed rather nicely to physical events as well as to cantharidin orientation behavior. The first period, 0700-2100 corresponded roughly to "daylight." Obviously, the endpoints of this interval were not sharp, but they did conform to those points in the 24-h period when we could begin to make observations without the use of headlamps, or vice versa. The remaining 10-h period was arbitrarily divided into two equal halves, with 2100-0200 representing dusk to middle-of-the-night and 0200-0700, middle-night to dawn.

Only the two highest cantharidin concentrations (39.2 mg and 392 μg) elicited responses and the beetles showed no preference for one concentration over the other (11 [48%] at the 39.2 mg baits; 12 [52%] at the 392 μg baits).

In terms of daily activity, three specimens (13%) were observed at the stations during the period corresponding to daylight; 14 specimens (61%) were noted between dusk and middle-night; six specimens (26%) were recorded from middle-night to dawn.

Of the 23 specimens of *N. flabellata* observed in this study, only one was a female; it was observed at one of the 39.2 mg cantharidin baits at 0050 hrs on 19 July 1980.

Several of the specimens which were taken at cantharidin in the 1977 field studies were observed while still in flight. Their gross orienting behavior and antennal movements suggested that relatively close range (within 3 m of the chemical source) in-flight cantharidin orientation might be explained best in terms of anemotaxis (*sensu* Fraenkel and Gunn 1961). Unfortunately, additional observations in 1980 were not possible because no specimens were observed in flight. In fact, all but two specimens were already on the filter papers when the observation interval commenced.

The fact that no attractancy gradient could be demonstrated over a 100-fold difference in cantharidin concentration (i.e. 392 μg and 39.2 mg) and yet no orientation whatsoever was noted at the next lowest concentration (39.2 μg) suggests that the response threshold for cantharidin orientation on the part of *N. flabellata* in the field may be somewhere between 39.2 μg and 392 μg. Future field studies should perhaps be directed to this concentration range in order to more accurately define the field response threshold concentration and assess whether individual variation would yield a gradient of response within this range.

Previous collecting experience with *N. flabellata* at lights, at fermenting baits at night, and in conjunction with the 1977 cantharidin orientation studies suggested that a nocturnal pattern would best describe the 24-h activity of this species. However, the 3.5-h span of no activity in the 1980 studies (0100-0430) would seem to point to a crepuscular rather than a nocturnal activity pattern. The three males observed during the first period (0700-2100) appear to show no relationship to the majority of responses, but low total numbers make it impossible to speculate on the significance of these results. In any case the observations certainly cast doubt on the validity of a strictly nocturnal activity hypothesis as regards cantharidin orientation behavior.

Between the 1977 and 1980 field studies, 107 males and two females of *N. flabellata* were observed and collected at cantharidin bait. Since previous distributions of the sexes in this area show males and females to be equally abundant it remains to be seen whether females actually orient to cantharidin. The present data lead me to speculate that either females are physiologically capable of responding to cantharidin but normally do not (as a function of age, sexual maturity, etc.) or, their presence in the vicinity of the baits represents a response to the males present there, not to the cantharidin itself (secondary pheromone production by cantharidin-orienting males, etc.).

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LITERATURE CITED

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