flight and swarming by *C. clunalis* over the food source continued until 9:15 PM, then it ended as suddenly and abruptly as it began. Total duration of the flight was 25 min. During this same period my wife located many specimens on the ground just beneath and around the Apache pine tree by homing in on the loud rattling noise made by the beetles in attempting to fly while surrounded by low bushy vegetation. Close examination of these specimens revealed that many of them had fresh moist dirt clinging to the outer protibial teeth, probably indicating their emergence only minutes before from the soil in response to the nocturnal feeding instinct.

This mass flight of *C. clunalis* was natural and not induced by UV or white light, as we had not yet started our traps. Once this natural flight ended we turned on the light traps and some 34 *C. clunalis* were taken within the next 100 min, with many others noisily flying near by but not coming directly to the light. Trapping continued until 10:30 PM, with this dynastine species coming in until the very last.

On July 29 this site was again sampled and we observed the same type of swarming flight. The feeding activity again took place within a 20- to 30-min burst beginning just at dusk, at 16.5°C and 84% RH.

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Chemosensory Relationship Between *Epilachna vigintiocto-punctata*[1] and Its Host Plant, *Luffa aegyptiaca*[2,3]

S. S. KRISHNA AND A. K. SINHA

Department of Zoology, University of Gorakhpur, Gorakhpur (U.P.) India

As stated by Schoonhoven (1968), one of the conventional procedures adopted to investigate the chemosensory relationship between an insect and its food plant is the precise evaluation of the role of certain chemoreceptors in the feeding behavior of the insect, based on observations of the effects of amputation of particular sensilla. Such study has not been undertaken so far with respect to epilachnine beetles, many of which are serious pests of several economically important vegetable plants. This communication includes some observations on the role of antennae in food perception by *Epilachna vigintiocto-punctata* F., an important pest of *Luffa aegyptiaca*, a variety of gourd plant used as a valuable food by the people of Gorakhpur.

Adult insects of mixed age and sex, collected from *L. aegyptiaca*, were used in our investigation. These insects were divided into 4 groups, each consisting of 20 individuals, on the basis of their antennal condition; group A, both antennae intact; group B, the left antenna removed; group C, the right antenna removed; and group D, both antennae removed.

Antennae were extirpated completely from their bases with a pair of Dewecker's scissors. The cut ends of the antennal bases were immediately sealed with paraffin to prevent bleeding. Subsequent to this operation the insects were released into a cage containing flowers and leaves of *L. aegyptiaca* and were left there for 24 hr. This 24-hr interval between the antennal operation and the commencement of an experiment was considered, from previous experience, reasonably sufficient for the insects to recover from any postoperational shock that might otherwise interfere in the investigation. At the end of 24 hr, each antennectomized individual of groups B, C, and D was given access for 1 hr to calyx and corolla of *L. aegyptiaca*, arranged inside a feeding chamber in a manner similar to that described by us (Krishna and Sinha 1969). The choice of the 2 plant materials used in these experiments was based on our earlier findings, about the feeding preference of these insects for different components of *L. aegyptiaca*. The time taken by each operated individual to make its 1st bite on either of the 2 plant materials, during the 1-hr period, was determined and compared with similar data obtained from normal individuals (group A). Eventually, the individuals in each group that made the 1st bite on either of the plant parts, during the 1-hr period, were counted and arranged according to the temporal position of their 1st biting response in the time scale as indicated in the schematic diagram (Fig. 1). All experiments were conducted at room temperature ranging between 30 and 33°C.

It is evident from the schematic representation (Fig. 1), that in groups A, B, and C, 13 out of 20 individuals took their 1st bites in the 1st 15 min, while in group D only 4 beetles made their 1st bite during this period.

From these observations it is reasonable to conclude that the chemoreceptors situated on the antennae of *E. vigintiocto-punctata* serve as principal olfactory sensilla associated with the insect's food-plant finding. Their role in this setup appears to be mainly concerned with attraction of the insect toward its food plant as indicated by the considerably reduced number of individuals showing the 1st biting response, during the 1st 15 min, in the bilaterally antennectomized group. In this respect, the function of olfactory sensilla in *E. vigintiocto-punctata* differs from that of similar sensilla in larvae of the Colorado potato beetle, *Leptinotarsa decemlineata* (Say) (Coleoptera: Chrysomelidae), in which, according to the suggestion of Thorsteinson (1960) based on Chin's (1950) work, "olfaction may be more concerned with avoidance than attraction." The fact that bilaterally antennectomized individuals, with both maxillary and labial palpi intact, did not respond to the food plant with the same efficiency as the normal or unilaterally antennectomized individuals suggests that the olfactory receptors, if present in the maxillary and labial palpi of these beetles, played only a secondary role in the food-plant finding of the insects. Because attraction was not minimized in individuals subjected to unilateral antennectomy, we suggest that the

[1] Coleoptera: Coccinellidae.
[2] Cucurbitaceae.
[3] Accepted for publication Jan. 2, 1969.

number of olfactory receptors present in a single antenna of these insects is amply adequate to guide them to their food plant.

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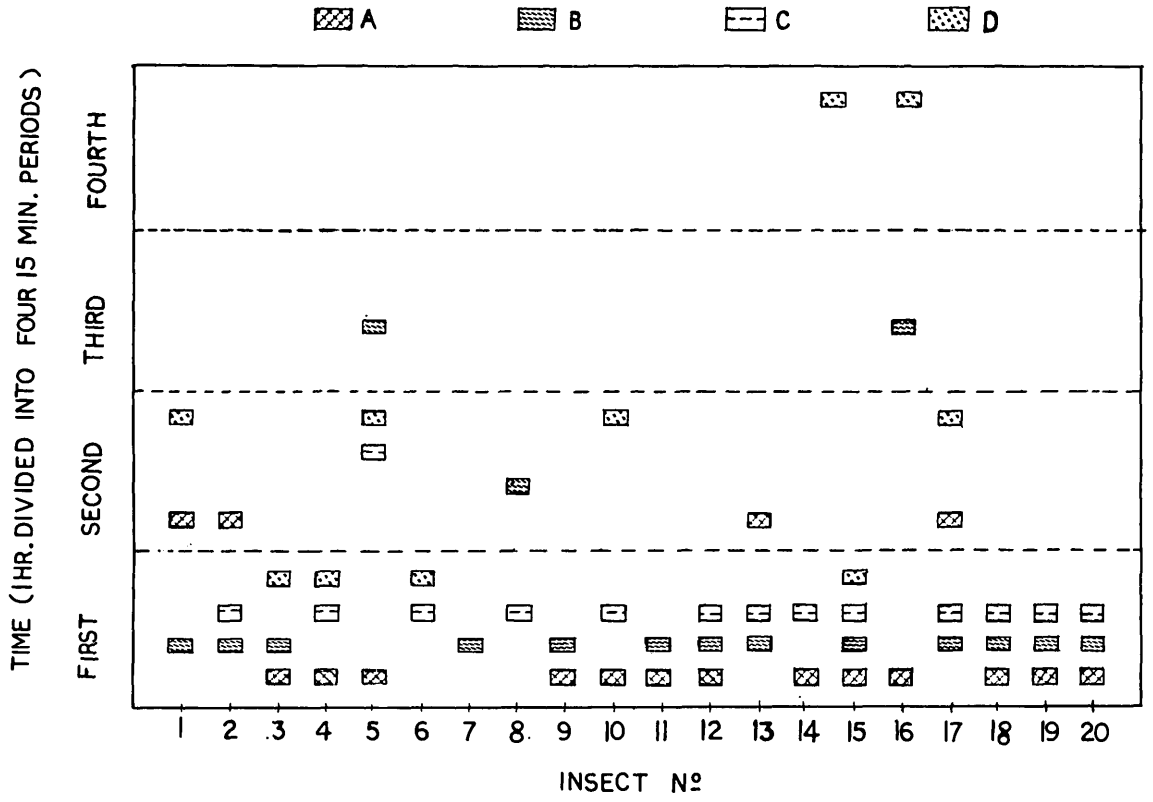

FIG. 1.—Schematic diagram showing the temporal position of the 1st biting response, of normal and antennectomized individuals of *E. vigintiocto-punctata,* on either calyx or corolla of *L. aegyptiaca.* Absence of any group symbol above an insect number indicates no feeding by that individual during the entire observation period.

Add Water—"Instant" *Culicoides*[1,2]

ROGER W. WILLIAMS

School of Public Health and Administrative Medicine, Columbia University, New York City 10032

In a previous publication I discussed the breeding habitats of *Culicoides* in Trinidad, W. I. (Williams 1964). Other biological observations were omitted from that paper. A certain aspect of the biology of *C. phlebotomus* (Williston) may be of interest to others working with this genus, and the subject discussed might prove to be a phenomenon common to other species of *Culicoides* and possibly other genera within the family Ceratopogonidae.

My 1st experience with this phenomenon was noted in connection with a tree hole containing only damp wood frass but no standing water (Williams 1955).

As indicated in my earlier paper on Trinidad *Culicoides, C. phlebotomus* was found in pure culture where the Curaguate River crosses the wide expanse of sand at Las Cuevas Beach. Here, where ocean tides mix with and back up the fresh water causing it to flood large sandy areas with each high tide, tremendous larval populations were found. More than 2500 larvae could be isolated from 1 ft³ of sand ½ in. deep. At low tides larvae were found to be abundant in sand 40 ft. from the margin of the river. However, most of this area would be inundated with water at most high tides. When the tide was out there was no standing water and the sand, although moist, would be hard and compact. Therefore, *C. phlebotomus* spent part of its immature existence in a habitat that was too dry for movement but moist enough for life. Sand

[1] Diptera: Ceratopogonidae.
[2] Accepted for publication Jan. 2, 1969.