Skototaxis in Three Species of Flat Bugs (Heteroptera: Aradidae)

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ABSTRACT Adults of three species of Aradidae, *Neuroctenus simplex* (Uhler), *Mezira granulata* (Say), and *Mezira sayi* Kormilev, were tested to determine if they orient towards dark objects. All three species showed a positive response to dark objects. No major differences between skototactic responses of males and females were detected. Skototaxis is probably important in aradid dispersal and habitat selection.

KEY WORDS Insecta, behavior, orientation, Aradidae

VERY LITTLE is known about how aradids orient themselves, and even less is known about how they find suitable habitats. Although orientation toward dark objects (skototaxis) is well known in various invertebrates (Fraenkel & Gunn 1961) and some forest insects (Couturier & Robert 1958, Jander 1971, Campan & Gautier 1975, Preiss & Kramer 1984), this behavior has only recently been reported in the Aradidae (Brammanis 1975, Heliovaara & Terho 1981). Heliovaara & Terho (1981) investigated orientation and locomotion of the pine bark bug, *Aradus cinnamomeus* Panzer. Using outdoor arenas, they found over 88% of the individuals oriented toward the nearest dark object, although in dense vegetation the skototactic response was reduced. *A. cinnamomeus* also oriented toward the sun, as Brammanis (1975) had also observed; but Heliovaara & Terho (1981) believe this occurs only in the absence of a dark object.

Here I present the results of a study of skototaxis in the adults of three flat bugs, *Neuroctenus simplex* (Uhler), *Mezira granulata* (Say), and *Mezira sayi* Kormilev.

Materials and Methods

Specimens were collected in Texas and Arkansas from February 1984 through April 1987 under bark of dead hardwoods (mostly *Quercus* spp.) in deciduous forests. The bugs were maintained in Petri plates lined with filter paper, with moist cotton as a water source. All experimental trials were carried out at 21–24°C. Because the food for these aradids has not been determined, the effects of starvation and hunger on behavior were minimized by testing the aradids no more than 24 h after capture. All specimens were given at least 1 h to acclimate to laboratory conditions.

Animals were tested in a white paper cylinder, 32 cm in circumference and 13 cm high. Eight small (1 mm) pencil marks around the bottom edge of the inside of the cylinder divided it into eight 45° segments, each making up 4 cm of the circumference. One segment was covered with a piece of black paper 4 cm long and 13 cm high. The cylinder was placed on white paper and a 40-watt soft white light bulb was suspended over the middle of the cylinder 34 cm above its floor. The light provided 27 foot-candles of illumination on the floor of the chamber. Observations were made in a dark room from almost directly above the light. Viewing the bugs from above the light should make it difficult for the insects to see the observer, thus eliminating this variable.

After being kept in darkness for one-half hour before being tested, the flat bugs were placed individually in the center of the chamber. When the bug reached the side of the chamber, the segment it first contacted was recorded. After each trial the cylinder was rotated at random so any chemosensory variables would not affect the results. Five males and five females of each species were used, and 10 trials were run with each individual.

A χ^2 goodness-of-fit test was used to determine if the data differed significantly from a random distribution. A χ^2 test of independence was used to determine if there was a significant difference between the males and females of each species.

Voucher specimens from this study are deposited in the author's collection and in the Texas A&M University Collection, College Station.

Results

N. simplex selected the black segment in 43% of the trials, *M. granulata* in 47% of the trials, and *M. sayi* in 50% of the trials (Fig. 1). When bugs did not choose the black segment, *N. simplex* and *M. granulata* did not demonstrate a significant

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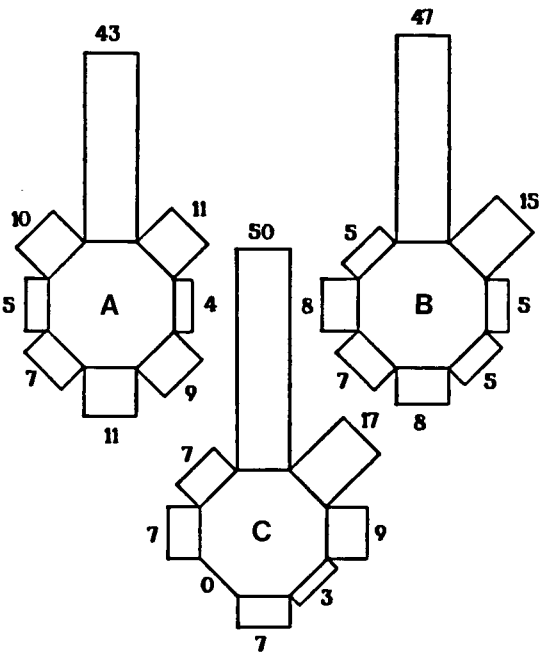

Fig. 1. Number of individual trials in which each direction was selected in the skototaxis experimental chamber. Uppermost bar represents the black segment in the chamber. (A) *Neuroctenus simplex.* (B) *Mezira granulata.* (C) *Mezira sayi.*

preference for any one of the white segments (*N. simplex:* df = 6, $\chi^2 = 5.99$, $P = 0.423$; *M. granulata:* df = 6, $\chi^2 = 10.00$, $P = 0.125$), whereas *M. sayi* tended to select the white segment immediately to the right of the black segment (df = 6, $\chi^2 = 23.64$, $P = 0.001$). This is especially true of the two species of *Mezira* (Fig. 1). The distribution of the direction selected is significantly different from a random distribution (*N. simplex:* df = 7, $\chi^2 = 88.51$, $P < 0.001$; *M. granulata:* df = 7, $\chi^2 = 114.88$, $P < 0.001$; *M. sayi:* df = 7, $\chi^2 = 142.00$, $P < 0.001$). Males of all three species selected the black segment in 42% of the trials, and females chose the black segment in 44–58% of the trials. There are no significant differences between the distributions of the males and females of each of the species (*N. simplex:* df = 7, $\chi^2 = 8.238$, $P = 0.312$; *M. granulata:* df = 7, $\chi^2 = 8.318$, $P = 0.305$; *M. sayi:* df = 6, $\chi^2 = 10.862$, $P = 0.093$). However, males and females of *M. sayi* were somewhat differently distributed around the experimental chamber; 52% of the females not choosing the black segment selected the white segment immediately to the right of the black one, whereas males which did not select the black segment were more evenly distributed around the chamber.

Discussion

These three species show a strong positive response to dark objects, with no major differences between males and females. Based on my results and the work of Heliovaara & Terho (1981), skototaxis is probably widespread in the Aradidae. Further studies (on skototaxis of aradids in flight) are needed. Needed, too, is a study comparing the skototactic response of leaf litter-inhabiting aradids with that of aradids found on dead trees; habitat differences within the Aradidae may affect the way different species respond to dark objects.

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