

PREDATION BY SPIDERS ON PERIODICAL CICADAS (HOMOPTERA, *MAGICICADA*)

Periodical cicadas (Homoptera, Cicadidae, *Magicicada* spp.) are noted for massive emergences of adults that occur on either 17-year or 13-year cycles in eastern United States (Simon 1979). Such emergences present veritable cornucopias to insectivorous predators and represent the classic example of predator swamping or satiation (Lloyd and Dybas 1966a, b). Periodical cicadas apparently contain no noxious compounds (Brown and Chippendale 1973) and a wide variety of vertebrate predators, particularly birds, have been reported feasting on periodical cicadas. Little attention has been given to arthropod predation on periodical cicadas. Since emergences occur in early summer, adults have died when arthropod predators (e.g., cicada killer wasps (Sphecidae)) that specialize on dog-day cicadas (*Tibicen* sp.) become active in late summer. However, we noted several arthropod predators, e.g., spiders, dragonflies, and juvenile reduviids, eating adult periodical cicadas during an emergence of 13-year periodical cicadas in May and June of 1985 in northwestern Arkansas. Spiders were the most commonly observed arthropod predators eating periodical cicadas. In this report, we document several instances of spiders eating periodical cicadas and discuss reasons why periodical cicadas may be vulnerable prey for certain kinds of spiders.

Latrodectus mactans (Fabricius).—At 0900 on 10 May 1985 at Durham, Washington Co., an immature black widow was observed preying on an adult periodical cicada. The spider had belayed the cicada and was hoisting it up into foliage about 12 cm off the ground, in a manner similar to that depicted in Gertsch (1979). Neither spider or cicada was collected; spider identification by J. Heiss was based on detailed field notes.

Agelenopsis naevia (Walckenaer).—Funnel web spiders, which were common at our study site at Durham, were observed eating periodical cicadas on several occasions. On 9 June 1985, six of 26 (23%) funnel webs with spiders present contained remains of at least one adult periodical cicada; six cicada exoskeletons were found in one web (C. Kellner pers. obs.). An immature female *A. naevia* collected in late May weighed 336 mg (fresh weight); the female *M. cassini* she was eating weighed 333 mg.

Xysticus spp.—On five occasions between 6-25 May at Durham, *Xysticus* crab spiders were found feeding on adult cicadas in plastic mesh emergence traps. The cone-shaped traps sampled 0.5 m² of ground surface (see Steward 1986). Crab spiders were found feeding on cicadas that had become tangled in the mesh at the top of the cone. Additionally, a crab spider was observed feeding on a periodical cicada on the ground at 0930 on 6 May; another was observed feeding on a cicada 0.3 m off the ground at 0900 on 10 May. Although several crab spiders were photographed in the act of feeding, positive species determinations could not be made from photographs (J. Heiss, pers. comm.). Two nearly-identical species, *X. elegans* Keyserling and *X. fraternus* Banks, commonly occur in northwestern Arkansas (Heiss 1977).

***Phidippus audax* (Hentz).**—At 1200 on 9 May at Durham, a 326 mg female *P. audax* was collected while dragging a 443 mg male periodical cicada (*M. cassini*) by the head through tall grass. C. Simon (pers. comm.) also has observed this jumping spider eating periodical cicadas.

***Phidippus whitmani* Peckham and Peckham.**—In late May at Durham, a 97 mg female *P. whitmani* was collected in tall grass while feeding on a 425 mg female cicada (*M. cassini*). The spider had grasped its prey just posterior to the head.

***Phidippus* sp.**—At 0930 on 15 June at Leatherwood Reservoir, Carroll Co., a salticid was collected in a woody shrub while feeding on a cicada. The spider was similar in size and exhibited a similar feeding behavior to *P. whitmani*, but probably was not that species (J. Heiss, pers. comm.). The specimen was lost in the mail before it could be positively identified.

Two other observations of unidentified salticids were made: a salticid was found feeding on a periodical cicada on the ground at Durham at 1100 on 9 June; another salticid was observed feeding on a cicada on the ground at 0800 on 25 June at Lake Wilson, Washington Co.

Several species of diurnally-active jumping spiders captured periodical cicadas, despite the larger size and mass of cicadas. Other researchers have also found that salticids commonly (Robinson and Valerio 1977) or occasionally (Jackson 1977) eat large prey. *Xysticus* also has been reported to capture large prey (Morse 1983). Although limited, our observations are consistent with those of Freed (1984), i.e., female jumping spiders tend to attack larger prey than do male jumping spiders. Also, jumping spiders tended to attack large prey along the suture between the head and prothorax.

Webless spiders usually do not capture large hard-bodied prey (see Enders 1975); however, events associated with cicada eclosion may make periodical cicadas particularly vulnerable to hunting spiders. After digging out of the ground, periodical cicada nymphs climb vegetation, undergo the last molt, and emerge as adults. Adults hang motionless for about two hours while the exoskeleton hardens. Most periodical cicadas emerge during night, but we commonly found freshly eclosed cicadas hanging in vegetation after dawn until mid-morning. Most of our observations of predation by hunting spiders were during morning hours, suggesting that spiders were capturing cicadas in the act of hardening.

Periodical cicadas probably dropped from the canopy into funnel webs of *Agelenopsis naevia*, which orient their webs parallel to the ground. Adult periodical cicadas spend much of their time in the forest canopy, where males form chorus centers that attract females. Females oviposit in the canopy after mating. Orb-weaving spiders that oriented webs perpendicular to the ground apparently did not capture cicadas: daily checks of webs of two common orb-weavers, *Neoscona arabesca* (Walckenaer) and *Micrathena gracilis* (Walckenaer), throughout the cicada emergence failed to produce any cicada prey.

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Kimberly G. Smith, Noma C. Wilkinson, Kathy S. Williams¹, Department of Zoology, and **V. Bruce Steward**, Department of Entomology, University of Arkansas, Fayetteville, Arkansas 72701.

¹Present address: Department of Biology, San Diego State University, San Diego, California 92182.

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