EFFECTS OF DIET ON DEVELOPMENT AND SURVIVORSHIP OF *NARNIA FEMORATA* NYMPHS (HEMIPTERA: COREIDAE)

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Little is known about the biology and natural history of *Narnia femorata*, a cactus-feeding bug (Fig. 1) (Stål 1862; Brailovsky 1975; Brailovsky et al. 1994). This coreid is native to the southwestern United States, Mexico, and parts of Central America, and has recently been introduced to central Florida (Baranowski & Slater 1986). *Narnia femorata* feeds mainly on the flowers and fruit of *Opuntia* species (prickly pears and cholla) (Baranowski & Slater 1986; Miller et al. 2006), especially *Opuntia imbricata*, a cholla cactus native to the southwest United States (Kinraide 1978; Benson 1982).

In nature, deer, gophers, coyotes, birds, and rodents frequently remove ripe and unripe *Opuntia* cactus fruits (Gonzalez-Espinosa & Quintana-Ascencio 1986; Janzen 1986; Hellgren 1994). Thus, these structures are not always accessible to *N. femorata* adults and nymphs. While adult *N. femorata* can readily fly to a new host plant with fruits if one is available, wingless nymphs have limited mobility and can be stranded without accessible fruit for part or all of their growth and development. In this study, we examined how fruit availability affects the development and survivorship of *N. femorata* nymphs.

In Alachua County, Florida, *Narnia femorata* feeds on *Opuntia humifusa* cactus, the only species of *Opuntia* native to the area. Both *N. femorata* and *O. humifusa* were collected at Ordway-Swisher Biological Station, University of Florida (82°W, 29°41'N) from Oct through Nov 2007. We collected 10 male and 10 female *N. femorata* from across 40 hectares. To maximize genetic diversity of our laboratory population, we did not collect any insects from the same cactus patch. Collected insects were paired and mated in a greenhouse with a photoperiod of 12:12 (L:D). We collected *N. femorata* eggs from adult containers and placed them into containers separate from adults.

After hatching, first instars were individually transferred to discrete containers with either *Opuntia* cladodes (cactus pads), or cladodes and fruit. These containers included single *O. humifusa* cladodes planted in approximately 6.4 cm of topsoil and potting soil mix. The lids of these containers were fitted with screening for ventilation. Containers were kept in a greenhouse with a temperature between 4 and 32°C. Cacti were watered weekly. *Narnia femorata* nymphs complete 5 instars before eclosing as adults, and we tracked survivorship and development (instar) of all nymphs weakly for 10 weeks.

We used a total of 150 insects in the experiment, with 75 juveniles placed in each treatment (cladodes with fruits or cladodes without fruit). We employed an ordinal regression analysis to compare developmental stage of insects at 10 weeks. Survivorship was compared with 2 different statistical tools; we conducted a logistical regression to analyze resulting survivorship after 10 weeks and a Kaplan-Meier Survival Analysis with Tarone-Ware test to estimate survival curves over the 10-week time period. All analyses were run with SPSS 16.0.

At 10 weeks post-hatching, juveniles reared with fruits were significantly further along in their development than those reared without fruits ($\chi^2 = 29.745$, $df = 1$, $P < 0.001$) (Fig. 2). In fact, 35 of the 37 surviving insects from the cla-

Fig. 1. *Narnia femorata* at the fifth instar. Photo credit: C. W. Miller.

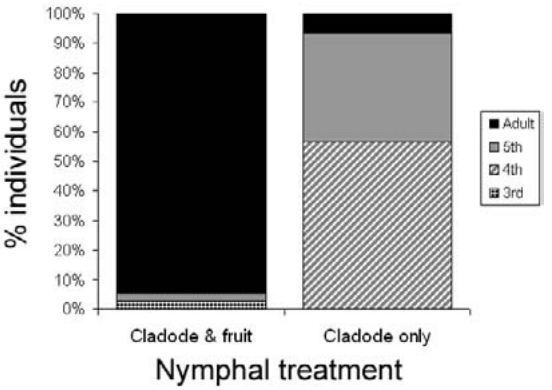

Fig. 2. Developmental stages of *N. femorata* at the tenth week post-hatching

dodes with fruits treatment had reached adulthood, compared to a mere 2 of the 30 surviving insects from the cladodes without fruit treatment (Fig. 2).

Resulting survivorship at 10 weeks for insects from both treatments was not significantly different (χ^2=1.161, df = 1, P = 0. 281), with 49% survival in cladodes with fruit and 41% survival in the cladodes without fruit. The survivorship curves of the 2 groups did not differ over the 10 weeks (χ^2= .020, df = 1, P > 0.50).

Our results demonstrate that *N. femorata* can achieve growth and development without cactus fruits, and thus may have adapted to some degree to ephemeral nature of this resource. However, we found that nymphs reared on cladodes without cactus fruits have slower development, which may have survival costs in natural situations. The presence of predators in nature such as spiders, assassin bugs, and lizards could result in a lower survivorship for animals with longer development time (Calef 1973; Pastorok 1981; Caswell 1983; Doughty & Roberts 2003). In a separate study we found that *N. femorata* individuals reared without fruits eclose as smaller adults with reduced mating success (Nageon de Lestang, unpublished data; Miller & Nageon de Lestang unpublished data). Thus, the developmental environment of nymphs likely has numerous consequences for survival and reproduction in this species and deserves further investigation.

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Summary

We examined the influence of 2 natural nutritional environments on the development and survivorship of *Narnia femorata* in a greenhouse setting. *Narnia femorata* raised on cactus with fruits developed faster than those raised on cactus without fruits, yet no significant difference in survivorship was found between the 2 treatments.

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