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NOTE

Caterpillars of *Eumaeus childrenae* (Lepidoptera: Lycaenidae) feeding on two species of cycads (Zamiaceae) in the Huasteca region, Mexico

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Abstract: There are few genera of butterflies that feed on cycads. Among them the genus *Eumaeus* (Lycaenidae) presents aposematic coloration in all its life stages. In this work we report for the first time the herbivory of young leaflets of *Ceratozamia mexicana* and *Zamia fischeri* (Zamiaceae) by caterpillars of *E. childrenae* in their natural habitat in the Huasteca region, Mexico.

Key words: *Ceratozamia mexicana*, cloud forest, *Eumaeus childrenae*, herbivory, Mexico, *Zamia fischeri*.

Insects and cycads are ecologically interrelated, mainly by pollination and herbivory. Beetles, especially weevils, have a special role in pollination (Norstog 1987, Vovides 1991). This ecological relationship is very strong, which is evidenced in cultivated plants that, far from their original area, may remain unfertile due to the absence of their natural pollinators (Schneider 1999). In relation to herbivory, some phytophagous insects of cycads have been reported in previous studies, such as beetles, moths, flies, and butterflies (Ehrlich and Raven 1964, Jones 1993). Few genera of butterflies feed on gymnosperms; among them *Eumaeus* (Lycaenidae) feed on Zamiaceae (Comstock 1948, Ehrlich and Raven 1964, De La Maza 1987), especially on some species of *Zamia* (*e.g.*, Rothschild *et al*. 1986, Clark *et al*. 1992, Jones 1993). All species of *Eumaeus* display striking coloration in the imago, eggs, larva, and pupa (Schneider 1999). In Mexican cycads, larvae of *Eumaeus childrenae* (Geyer, 1834) have been only reported feeding on *Dioon edule* Lindl. (Comstock 1948, Ehrlich and Raven 1964). Larvae of *E. childrenae* also feed on *Amaryllis* (Amaryllidaceae) and *E. atala* Poey on *Manihot* (Euphorbiaceae), both angiosperms (Comstock 1948, Ehrlich and Raven 1964). No information about toxic compounds used by *Eumaeus* larvae taken from flowering plants exists in the current literature.

Larval choice plays an important role in food plant relationships and chemical factors are decisive in two ways, nutrition and protection (Ehrlich and Raven 1964). In some species of the genus *Eumaeus*, toxins of *Zamia* leaves, such as cycasin and macrozamin, are utilized by the caterpillars for their protection and also for the latter developmental stages of pupae and adults (Rothschild *et al*. 1986, Jones 1993). Adult butterflies of *E. atala* store cycasin in their wings, and also a considerable amount in their eggs and spermatophores (Schneider 1999). Cycasin is a chemical compound exclusive of cycads (De Luca *et al*. 1980, Moretti *et al*. 1983) and their presence represent a synapomorphy for the group (Crane 1988).

This paper presents, for the first time, evidence that caterpillars of *E. childrenae* (Lepidoptera: Lycaenidae) feed on leaflets of *Ceratozamia mexicana* Brongn. and *Zamia fischeri*

Miq. (Zamiaceae), both in their natural habitats in the Huasteca region of Mexico.

During recent field work in the cloud forest of the Mexican states of Hidalgo and Querétaro from the Huasteca region, caterpillars of *E. childrenae* were found feeding on leaves of two cycad species. Larvae were collected from leaves of *Z. fischeri*, in an ecotonal zone of cloud forest and tropical evergreen forest in Pisaflores, Hidalgo, and from leaves of *C. mexicana* in the cloud forest of Landa de Matamoros, Querétaro; both sites are located in the Sierra Madre Oriental region, in northeastern Mexico.

One mature larva and two young larvae were collected and preserved in alcohol (70%) and were deposited in the collection of the Museo de Zoología, UNAM (MZFC). Botanical reference specimens of both cycad species with signs of herbivory were deposited in the Facultad de Ciencias herbarium, UNAM (FCME).

Newly hatched larvae and older caterpillars were observed, in some cases on the same leaf (Fig. 1), where only the leaflets and not the stem or cones show signs of herbivory, such as occurs in *Zamia skinneri* Warscz. ex A. Dietr. fed by *Eumaeus minyas* Hbn. (Clark *et al*. 1992). The gregarious habit and the aposematic coloration are characteristics of unpalatable insects, which suggest that *Eumaeus* species are unpalatable for predators (Bowers and Larin 1989).

In the Mexican state of Hidalgo, the population of *Z. fischeri* shows very strong signs of herbivory. Two species of the genus *Zamia*, *Z. fischeri* and *Z. loddigesii* Miq., grow together in the locality of El Coyol in Hidalgo, but we do not have evidence of feeding on the latter species. In the locality of La Florida in the state of Querétaro, a single juvenile plant of *C. mexicana* showed signs of herbivory by *Eumaeus* caterpillars. In this last species the presence of cycasin and macrozamin in seeds and ovules has been reported in previous studies (De Luca *et al*. 1980, Moretti *et al*. 1983).

Reference botanical specimens: **México. Hidalgo:** ca. 1.5 km al SE del Coyol,

Fig. 1. Larvae of *Eumaeus childrenae* in a leaflet of *Ceratozamia mexicana* from Landa de Matamoros, Querétaro, Mexico.

Municipio de Pisaflores, 850 m, 27-08-2000, *R. Contreras-Medina, O. Alcántara & J. Escutia # 14* (FCME). **Querétaro:** 2.13 km al NW de La Florida, Municipio de Landa de Matamoros, 1850 m, 28-09-2000, *C. Ruiz, A. Ponce & J. Escutia # 8* (FCME).

Insects use cycad toxins to protect the different stages of their life cycle from predators (Bowers and Larin 1989, Schneider 1999). The concentration of cycasin is more elevated in young leaves in the case of *Zamia integrifolia* L. (Rothschild *et al*. 1986). This is probably true in the Mexican species because larvae prefer young leaves.

Much remains to be discovered about the relationships of cycads and insects (Stevenson *et al*. 1998), especially studies in their natural habitat, of both pollination and herbivory. This study represents an example of animal and plant interaction where the cycad toxins are involved in a complex ecological relationship. Further chemical studies are required for analysis of sequestration and storage of cycad toxins in *E. childrenae*, and to corroborate the concentration of cycasin and macrozamin in leaves of both cycad species and different life stages of the butterfly.

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RESUMEN

Muy pocos géneros de mariposas se alimentan de cícadas. Entre ellos, el género *Fumaeus* (Lycaenidae) presenta coloración aposemática en todos sus estadíos de vida. En este trabajo informamos por primera vez la herbivoría de folíolos jóvenes de *Ceratozamia mexicana* y *Zamia fischeri* (Zamiacecae) por orugas de *E. childrenae* en su hábitat natural en la región Huasteca, México.

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