

insects to satiation (e.g., Murphy, Launer & Ehrlich, 1983, *Oecologia* 56:257-263). Using the method described here, one can precisely control the volume of nectar imbibed by individual insects by regulating the volume placed within the capillary tube or by simply removing them from the capillary tube once a predetermined volume has been consumed.

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OBSERVATIONS ON THE LIFE HISTORY OF *OCCIDRYAS ANICIA BERNADETTE* (NYMPHALIDAE) AT THE TYPE LOCALITY

Although Leussler's checkerspot, *Occidryas anicia bernadetta* (Leussler), was described over 60 years ago (Leussler, 1920, *Entomol. News* 31:102-103), little is known about its habits, and nothing has been published on the early stages or larval foodplant of this butterfly. Intensive collecting has been done at the type locality, Monroe Canyon (Sioux Co., NE); the latest report was from collections made from 1960-65 (Johnson & Nixon, 1967, *Amer. Mid. Nat.* 78(2):508-528). Even so, Leussler (1938, *Entomol. News* 49:3-9, 76-80, 213-218, 275-280) sums up all that had previously been known about *bernadetta*. He states that *bernadetta* is "very abundant along the canyon rims in Sioux Co. in late May and early June."

In an attempt to learn more about *bernadetta*'s life history, two years of observations were made at Monroe Canyon. This report identifies a larval foodplant, describes mature larval and pupal stages, and identifies three parasites associated with the butterfly.

Our experience with *bernadetta* began in 1982, when trips were made to Monroe Canyon on 22 and 29 May to search for larvae and/or adults. Several suspected foodplants were examined for damage, but no larvae were found. Only two adult males were seen and collected on 22 May. *Bernadetta* adults were common on 29 May, with highest densities observed nectaring on choke cherry, *Prunus virginiana* L. Adults were also seen resting on leaves of wolfberry, *Symphoricarpos occidentalis* (Hook.), which was in close proximity to the *P. virginiana*. After watching *bernadetta* females alight on the *S. occidentalis* leaves, examinations of the leaves were made for ova but none were found. However, a pair of *bernadetta* were observed in copula at 1250 h, less than 0.5 m from the nearest *S. occidentalis* plant. The pair was taken alive in an attempt to induce oviposition by the female, but the female died in transit.

We returned to the type locality again on 30 May 1983, with hopes of finding immature stages of the butterfly. Chances were better for finding larvae in 1983 since the season was slightly retarded due to a late spring snowfall. An afternoon of collecting resulted in many Lepidoptera, including a few male *bernadetta* caught on the canyon slopes, but no larvae were found until the sky became overcast about 1600 h. Several extremely fresh male *bernadetta* were flushed out of the grass near a stand of *S. occidentalis*. A search of the *S. occidentalis* yielded a dozen large larvae feeding on newly visible leaf tips of the plants. Damage was seen only upon very close examination; it seemed that larval feeding was restricted to newer leaves. A thorough search of the area also revealed pupae and desiccated larvae. Other stands of *S. occidentalis* were examined for larvae, but only several on the higher hillsides contained larvae. Altogether, 18 larvae and three pupae were found on 30 May.



FIG. 1. Larva of *Occidryas anicia bernadetta* on *Symphoricarpos occidentalis*.

The next morning (again under an overcast sky), 27 more larvae were found, which led us to believe that *bernadetta* larvae normally fed during crepuscular to nocturnal hours. This might explain why larvae had been previously overlooked in the field.

The overall color of the mature *bernadetta* larva is white. A thin mid-dorsal black stripe is interrupted by orange spots, centrally located on the dorsal area on each segment. A heavy, black, sub-dorsal stripe is present, and a thin, black stripe bisects the spiracular area. The basal color of the supraspiracular row of scoli is orange. The head and scoli are black, covered with black setae (Fig. 1).

The overall color of the pupa is white. Black and orange spots and/or markings are present, especially on the thorax and abdomen. Wings are streaked with black. Antennal segments alternate black and white (Fig. 2).

Of the 45 larvae collected, 19 (42%) were parasitized. The remaining pupated and eclosed as eight males and 18 females.

The parasitized larvae were categorized by two main symptoms: (1) they would either shrink lengthwise, swell, and desiccate, or (2) they would remain normal size, desiccating only after small parasitic larvae had crawled out of the *bernadetta* larva and made cocoons nearby. The parasites that emerged from the swollen *bernadetta* larvae were identified as ichneumonids, *Benjaminia* sp. (probably new). Only one *Benjaminia* adult emerged per parasitized *bernadetta*. The parasites that emerged from the normal size *bernadetta* larvae were identified as braconids, *Cotesia koebelei* (Riley). Up to 30 *C. koebelei* adults emerged from a single *bernadetta* larva. Another ichneumonid parasite, *Pterocormus* sp., emerged from the anterior region of a single *bernadetta* pupa. No parasites were observed in the field.

As other trips to the type locality are planned, observations on *bernadetta* will continue to be made. Other larval food plants are suspected; efforts will be made to identify them. The overwintering habits of *bernadetta* remain unknown and need to be researched.

We wish to thank the following people for making identifications: R. C. Lommasson,



FIG. 2. Pupae of *Occidryas anicia bernadetta*.

School of Life Sciences, University of Nebraska, Lincoln, NE 68588 (*S. occidentalis*); V. K. Gupta, Center for Parasitic Hymenoptera, Gainesville, FL 32602 (*Benjaminia* sp., *Pterocormus* sp.); S. R. Shaw and P. M. Marsh, Systematic Entomology Laboratory, USDA-ARS, Insect Identification and Beneficial Insect Introduction Institute, Beltsville, MD 20705 (*C. koebele*).

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NOTE ON CRUMB'S "LIBERAE ET CONFLUENTAE" COUPLET (NOCTUIDAE)^{1,2}

The first major systematic treatment of the larvae of North American Noctuidae was written by Crumb (1956, *Larvae of the Phalaenidae*, USDA Tech. Bull. 1135. 356 pp.). It is a monumental work, containing extensive diagnostic keys, larval descriptions, geo-

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² Michigan Agricultural Experiment Station Journal Article No. 11102.