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GENERAL NOTES

OBSERVATIONS ON THE DIURNAL GREGARIOUS ROOSTING OF *OCALARIA* SP. (NOCTUIDAE) IN COSTA RICA

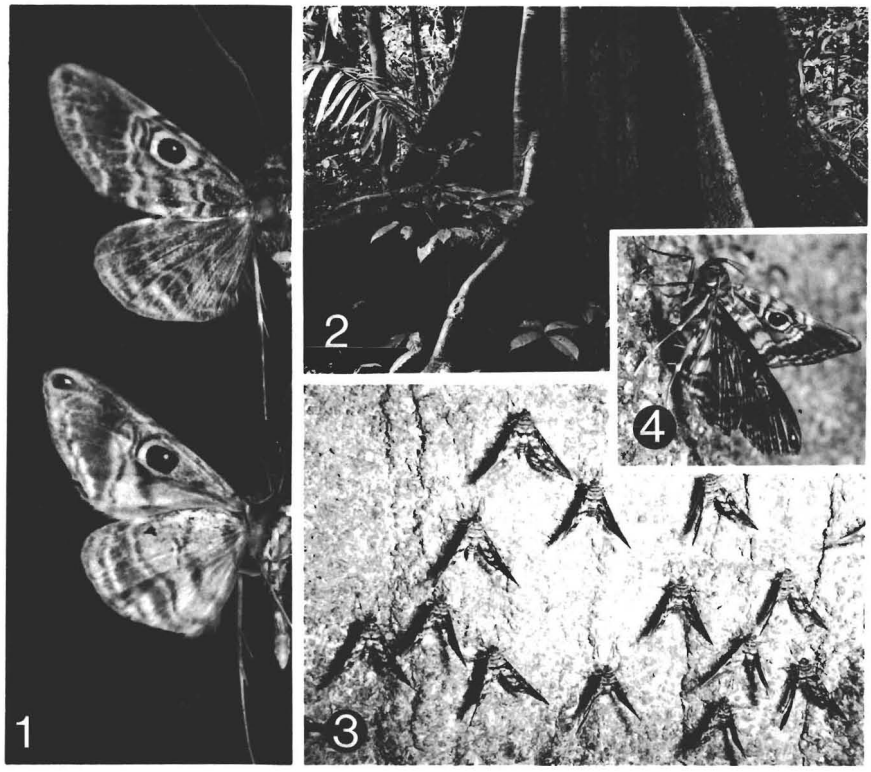
Gregarious roosting behavior (quiescent aggregations for sleeping or passing unfavorable periods) has been documented for various diurnally active Lepidoptera (DeVries et al., Zool. J. Linn. Soc., in press). Among nocturnally active Lepidoptera, however, little evidence of a consistent roosting habit has been found. An exception is the well-documented aestivation behavior of the Australian bogong moth, *Agrotis infusa* (Boisduval) (Noctuidae). During the summer when its larval host plants are not available, adults migrate to granite outcrops and there form dense aggregations (Common 1954, Aust. J. Zool. 2:223–263) reminiscent of those formed by the North American monarch butterfly, *Danaus plexippus* (Linnaeus) (Nymphalidae). Another type of diurnal roosting in a nocturnally active species is that of the skipper butterfly, *Celaenorrhinus fritzgaertneri* (Baily) (Hesperiidae). It forms roosts in caves and hollows during the dry season in Costa Rica, apparently as a mechanism for passing a time of year when conditions for larval development are unfavorable (DeVries et al., cited above). In contrast to the bogong moth, however, *C. fritzgaertneri* adults leave and return to the roost following a synchronous circadian rhythm.

The genus *Ocalaria* (Noctuidae) was established by Schaus (1906, Proc. U.S. Nat. Mus. 30:132) for a group of moths whose phylogenetic affinities are uncertain, but which is at present tentatively placed at the end of the subfamily Ophiderinae (Erebinae of authors) in the U.S. National Museum of Natural History (NMNH) (R. W. Poole, pers. comm.). The *Ocalaria* species treated here is a small, mottled gray-brown moth with an eyespot on both upper and lower surfaces of the forewing and a wingspan of about 1.5 cm (Fig. 1). Based on NMNH collections, this undescribed species has been collected most often in tree buttresses in lowland areas of Panama (R. W. Poole, pers. comm.). We describe here a roost of the species from Costa Rica, and provide notes on its roosting behavior.

In July and August 1983, a diurnal roost of *Ocalaria* sp. was observed on six separate occasions near the Sirena Station of Parque Nacional Corcovado in southwestern Costa Rica. A group of approximately 30 individuals occupied a sheltered hollow between two moss-covered buttress roots of an unidentified canopy tree along a ridgetop trail (Fig. 2). The roost was found again in the same location the following year (July and August 1984), when a preliminary investigation of moth behavior at the roost was undertaken. No other *Ocalaria* roosts were observed in either 1983 or 1984, but in 1985 several roosts were found in the immediate area (including the original site), as well as on other ridges.

The number of moths found at the roost in 1984 varied, but on average 18–21 individuals occupied the roost during the day, as estimated by visual censuses made during 10 observation periods. The moths typically congregated during the day in the hollow portion between the buttress roots in a loosely clustered group about 1 m above ground (Fig. 3). While roosting the moths were motionless, held their wings in a partially upright position, and were well camouflaged against the textured, mossy trunk in the shady hollow (Fig. 4). Most individuals would not move unless prodded. Once when attempting to capture a specimen, we disturbed two of the moths. They flew out of the hollow and landed on the same tree about 60° around the trunk. One individual was immediately seized and eaten by an *Anolis* sp. lizard (Anolidae), predation similar to that described for the diurnally roosting skipper, *Celaenorrhinus fritzgaertneri* (Hesperiidae) (DeVries et al., cited above).

To document moth activity at the roost, and times when the roost was occupied and not occupied, two evening and two morning censuses were undertaken. A synchronous pattern similar to that observed in the cave-roosting skipper *C. fritzgaertneri* characterized both departure and return to the roost. In July and August at Parque Nacional Corcovado the sun sets at approximately 1745 h, and by 1810 h it is completely dark. On August 12, observations were begun at 1730 h. Twenty-two moths were found in the roost at that time. As nightfall approached, the moths appeared restless; some changed



FIGS. 1–4. **1,** Dorsal surface (top) and ventral surface (bottom) of a male *Ocalaria* undescribed species from Costa Rica; **2,** Buttressed tree where *Ocalaria* roost was observed; **3,** A cluster of *Ocalaria* moths in the roost; **4,** Detail of roosting *Ocalaria* individual.

position in the roost. At 1750 h two moths left their perch and began to flutter inside the hollow. A few seconds later these moths flew out of the roost. Shortly thereafter (1755 h) most of the roosting moths followed suit, first hovering from 5 to 15 seconds in the hollow before flying out into the night. By 1800 h all had left the roost. At this time the light was too dim to read handwritten notes. The departing moths, which have a weak, fluttery flight, were not observed to land on the adjacent vegetation, and these moths were never found in collections made at lights in 1984. It is not known how far from the roost they fly or what they do during the night, but they did not return to the roost until daybreak. A second observation period on August 15 showed the same pattern.

On the mornings of August 14 and 18, the moths' return to the roost was observed. Observations began at 0430 h when it was still completely dark, and no moths were found on the roost on either occasion. The first light of dawn began at about 0500 h, and thereafter light intensity increased rapidly until about 0535 h when the sun rose above the horizon; however, light levels remained low in the forest understory where the roost was located until nearly 0600 h. On August 14 the first moth to approach the roost came at 0512 h and landed almost immediately. At this time light levels were barely high enough to distinguish handwriting on a page. Three more moths entered the hollow at 0515 h, and spent 10–30 seconds hovering in the hollow before landing on the trunk. As the sky became lighter (0525 h) a large pulse of moths arrived at the roost, with several fluttering

simultaneously in the hollow for 5–20 seconds before taking positions on the trunk. By 0545 h all activity ceased, and the 18 individuals in the roost remained stationary. No more moths were seen to arrive from that time until 0615 h when the observation period ended. A similar pattern of arrival was observed on the morning of August 18.

These observations suggest that the timing of roost departure and arrival in *Ocalaria* may be closely tied to light intensity, as found in cave-roosting skippers (DeVries et al., cited above). Our observations suggest that roosting sites are important for *Ocalaria* since moths were found at the same unremarkable roost site for two consecutive years, with a fairly stable roost membership over the four-week observation period during both years. This is corroborated by further observations in Costa Rica and Panama during 1985–86, where the same roosts were found occupied by populations of *Ocalaria* over long periods. Recovery of marked individuals from the roost where they were originally captured (mark-release-recapture experiments conducted in 1985) indicates that *Ocalaria,* like the cave-roosting skippers, are "faithful" to a particular roost (Greig & DeVries, in prep.).

Although there are parallels in the roosting behavior between this species and the skipper butterfly *Celaenorrhinus fritzgaertneri,* there is little evidence that *Ocalaria* moths are roosting as an aestivation response. The roosts were first observed during the early wet season when larval resources are presumably plentiful (however, there are no host plant data available for any species in the genus), and our subsequent observations in both Costa Rica and Panama suggest that *Ocalaria* roosts may persist throughout the year.

We thank the Servicio de Parques Nacionales de Costa Rica and the personnel of Parque Nacional Corcovado for hospitality during our stay in Costa Rica. J. Rawlins identified the moth to genus and R. Poole confirmed that it is an undescribed species. I. F. B. Common and an anonymous reviewer provided helpful comments on the manuscript.

NANCY GREIG, *Division of Biological Sciences,* AND P. J. DEVRIES, *Department of Zoology, University of Texas, Austin, Texas 78712.*

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Starting with *Journal* volume 41 (1987), up to five index or key words or phrases not already in titles will appear with articles and general notes. Such words should accompany manuscripts being submitted now. Terms should be selected that, together with the title, most fully describe a paper's scope and depth. Authors are best able to select supplemental index words, but reviewers and editors can help. A comprehensive index-word resource is R. H. Foote's 188-page *Thesaurus of Entomology,* published by the Entomological Society of America in 1977.

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