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REPORT OF DIURNAL ACTIVITY IN MIMALLONOIDEA WITH NOTES ON THE SEXUAL BEHAVIOR OF *LACOSOMA CHIRIDOTA* GROTE, 1864

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ABSTRACT. We report diurnal behavior in the mimallonid *Lacosoma chiridota* Grote, 1864. Female pheromone releasing behavior was recorded in the late afternoon in Gainesville, Florida. A single diurnal male was recorded responding to a “calling” female at 1745 h. We discuss the unique case of sexual dimorphism exhibited by *L. chiridota*, such that most Mimallonidae generally do not display pronounced sexual dimorphism, and suggest that this may be related to the likewise unique diurnal behavior of this species.

Additional keywords: Lepidoptera of Eastern North America, Sexual dimorphism

The superfamily Mimallonoidea containing the single family Mimallonidae, which is restricted to the New World, includes about 300 species (Becker 1996, St Laurent unpublished), with four species occurring north of Mexico (Franclemont 1973). One of the two North American *Lacosoma* Grote, 1864 species, *L. chiridota* Grote, 1864 (Figs 1, 2, 5–7), has a broad range in eastern North America and can be expected anywhere with oak (*Quercus* L., Fagaceae), the host plant, east of the Great Plains. Records exist from southern Ontario, southern New England, south to Florida, west to the Plains and south-central Texas (Franclemont 1973, Moth Photographers Group 2017). The natural history of *L. chiridota* was described by Dyar (1900), with a focus primarily on the immature stages. *Lacosoma chiridota* is often listed and reported in many Lepidoptera-related publications that cover eastern North America (Covell 2005, Wagner 2005, Handfield 2011). This species displays strong sexual dimorphism which is more pronounced than in most other Mimallonidae (compare Figs 1, 2 to 3, 4 for example). There was no study focused on the adult behavior of this species or any other Mimallonidae. No species of Mimallonidae were known to be diurnal, and data regarding the sexual behavior of this superfamily are not published.

The purpose of the research was to determine if *L. chiridota* exhibits diurnal behavior. Our hypothesis was that males of *L. chiridota* are infrequent at lights because they are diurnal. Females of *L. chiridota* are more often taken at light than the males (Franclemont

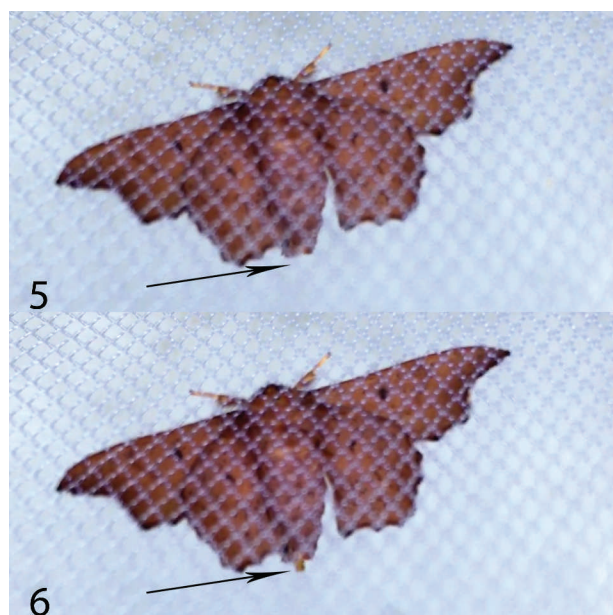
1973, Covell 2005, St Laurent pers. obs.). In all major entomological collections visited by the first author, the number of female *L. chiridota* far outnumber the males. The opposite has been observed for the majority of Mimallonidae species in collections.

MATERIALS AND METHODS

Utilizing captive reared females of *L. chiridota*, we investigated the period of pheromone release by the female, and a subsequent wild male response. All specimens utilized in this study resulted from eggs collected from a wild-caught female at UV light on 20.VII.2016, from USA: Florida: Alachua County: Gainesville, Austin Cary Forest, 29.732039°, -82.219913°. We reared the larvae on a potted *Quercus shumardii* Buckland through to the final two instars, at which time the larvae were transferred to cut *Q. shumardii* branches placed in water. Pupae were formed within the larval sacks, which are structures consisting of leaves, silk, and frass. The sacks containing the pupae were maintained outdoors until adults eclosed. Five males were killed and vouchered before their activity commenced. Females were moved to separate screened cages after emerging. On different days in October 2016, three captive reared females were monitored in order to register pheromone release periods and male response in Gainesville, Florida at the University of Florida, Natural Area Teaching Lab (NATL), 29.633191°, -82.368669° or in a residential area near NATL.



FIGS. 1–4. Adults of *Lacosoma*, a=recto, b=verso. **1.** *L. chiridota* male, USA, Texas, Anderson Co., Bethel, Engling Wild Life Management Area, 16.IV.1968, J.G. Franclemont leg. (Cornell University Insect Collection, Ithaca, NY, USA [CUIC]). **2.** *L. chiridota* female, USA, Virginia, Arlington Co., Arlington, 21.VI.1950, J.G. Franclemont leg. (CUIC). **3.** *L. arizonicum* male, USA, Arizona, Santa Cruz Co., Santa Rita Mts, Santa Rita Canyon, 4880 ft., 7.VII.1959, J.G. Franclemont leg. (Carnegie Museum of Natural History, Pittsburgh, PA, USA [CMNH]). **4.** *L. arizonicum* female, data as for Fig. 3 but 2.VII.1959 (CMNH). Scale bar= 1 cm.



FIGS. 5, 6. Adult female of *Lacosoma chiridota*, pheromone releasing behavior, arrow points to ovipositor. USA, Florida, Alachua Co., Gainesville, 14.X.2016, about 1815 h. **5.** Ovipositor retracted. **6.** Ovipositor extended.

Specimens from this experiment are deposited in the research collection of Ryan St Laurent, Gainesville, Florida, USA, the research collection of Richard Peigler, San Antonio, Texas, USA, and in the molecular collection of the McGuire Center for Lepidoptera & Biodiversity, Gainesville, Florida, USA.

RESULTS

Both males and females of *L. chiridota* eclosed from pupae generally between 1400 h and 1600 h EDT. Depending on the time when the females emerged, they would begin a brief flight within the cage starting between 1500 and 1650 h. Eventually the females would alight at the top of the cage and immediately commence pheromone releasing behavior (usually around 1700 h), consisting of a cyclic extension/retraction of the ovipositor from the tip of the abdomen (Figs 5, 6). A single cycle of extension to retraction to re-extension occurred roughly once every second. If unmated, the female would continue this behavior for several hours, until sunset. Throughout the night and morning hours this behavior was not detected, although we did not monitor the females between 2400 h and 0800 h.

On October 14th, 2016, we began to monitor the female at 1745 h, and this was when a single male was observed hovering around the caged female (Fig. 7) for several minutes. Daylight was still obvious during this

observation, which took place more than an hour before sunset (sunset on 14.X.2016 was 1859 h). We did not allow the male to enter the closed cage and eventually he flew away. Observation continued until 1808 h and no additional males were attracted.

On October 15th, 2016, the same female was set in the same location in Gainesville, FL, and she started releasing pheromones at 1658 h. Pheromone release did not start until after ongoing rains subsided. No males arrived despite continuous observation. Intensifying rain resulted in the female performing rapid flight within the cage, with pheromone release behavior not restarting until after rain weakened substantially.

DISCUSSION

Prior to this work, diurnal behavior in Mimmallonidae was not mentioned in the literature. However, we are aware of anecdotal reports from Carlos and Olaf Mielke of Brazil that males of *Cicinnus funebris* (Schaus, 1896) are also diurnal, where numerous individuals were witnessed in response to a virgin, calling female during the daytime (C. Mielke pers. comm.). We report here the diurnal pheromone releasing behavior of female *L. chiridota* as well as the diurnal male response to a



FIG. 7. Adult male of *Lacosoma chiridota* responding to "calling," caged female, USA, Florida, Alachua Co., Gainesville, University of Florida, Natural Area Teaching Lab, 14.X.2016, 1749 h.

“calling” female. This behavior confirms our hypothesis and suggests a possible explanation for this unique case of sexual dimorphism in Mimallonidae. In most other species of Mimallonidae, such as those of the genera *Menevia* Schaus, 1928 and other *Lacosoma*, females are larger than males, with broader wings and larger bodies. However, maculation usually does not differ substantially between the sexes as it does so dramatically in *L. chiridota* (St Laurent pers. obs.). For comparative purposes, we here illustrate *L. arizonicum* Dyar, 1898 (Figs 3, 4), a species that exhibits the degree of sexual dimorphism more commonly encountered in Mimallonidae. It is interesting to note that sexual dimorphism and very dark (nearly black) coloration of males is also apparent in the only other mimallonid known to be diurnal, *C. funebris*.

Research suggests that sexual dimorphism may be a result of male-limited mimicry and/or divergent selection pressures on males and females due to the sexes experiencing different ecological interactions (e.g. flying during the day versus the night) (Allen et al. 2011). Similarly, dark, diurnal males and lighter colored, nocturnal conspecific females are known in other families of moths, such as in the Saturniidae genus *Callosamia* Packard, 1864 (Tuskes et al. 1996). We therefore consider the possibility that sexual dimorphism, specifically the dark color of the male, and diurnal behavior in *L. chiridota* may be related.

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