Research Article

Larval Feeding Habits of the Cuban Endemic Firefly *Alecton discoidalis* Laporte (Coleoptera: Lampyridae)

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Alecton Laporte, 1833, with four known species is the only firefly genus endemic to Cuba. *Alecton discoidalis* Laporte, 1833, is its most common species, distributed in the western half of the country. Unfortunately, much of its life history remains unknown, as with the rest of Cuban representatives of the family Lampyridae. Larvae are associated with adults of *A. discoidalis* through rearing, and observations on larval feeding habits of this species are presented. Thirteen species belonging to seven gastropod families are reported for the first time as prey of *A. discoidalis* larvae. Our data suggest that these are generalist predators of terrestrial snails. A remarkably close association exists between this lampyrid and operculate species of snails. The later represents the most abundant and diverse group of molluscs in limestone landscapes, where the beetles are commonly found.

1. Introduction

The Lampyridae is one of the coleopteran families with many gaps regarding the knowledge of its taxonomy and ecology in the Caribbean region. Currently, 37 species in 8 genera of fireflies are reported in Cuba [1].

Alecton Laporte, 1833, with four known species is the only genus of the family endemic to Cuba. *Alecton discoidalis* Laporte, 1833, is its most common species, distributed in the western half of the country. All what is known about the genus natural history is that larvae prey on terrestrial snails of the family Helicinidae [2, 3]. Ecological and ethological data are lacking for any Cuban Lampyridae, both for adults and larvae. As for the latter, there are some important contributions for lampyrids of other regions [4–7]. The entire literature on Cuban fireflies is represented by taxonomic works [8–11] or species lists [1, 12]. Data on *A. discoidalis* natural history, specifically the feeding habits of its larvae, are herein provided.

2. Materials and Methods

Specimens were collected throughout two nights in August 2009, at Pan de Matanzas ($n = 14$), one night in February 2010, at Bacunayagua ($n = 3$) and during the day of the same month at Escaleras de Jaruco, La Jaula ($n = 3$). All these areas are located in western Cuba (Figure 1(a)). Localities where immature stages were collected are characterized by outcrops of limestone and some degree of disturbance (Figures 1(b), 1(c), and 1(d)). Most larvae were captured while emitting light signals (from 20:00 to 22:00 hours approximately). Individuals of different instars were collected, most of them in the leaf litter and some under or even on rocks. Temperature and humidity of those nights were in the range of 26–32°C and 64–86%, respectively, and for Escaleras de Jaruco, during the day, were between 22–25°C and 80–93% respectively, recorded with a digital Control Company thermohygrometer (error = 1°C and 1% RH).

FIGURE 1: (a): Collection localities of *Alecton discoidalis* larvae in western Cuba: 1- Pan de Matanzas, 2- Bacunayagua, 3- Escaleras de Jaruco, La Jaula. (b): Habitat at Pan de Matanzas, Matanzas. (c): Habitat at Bacunayagua, Matanzas. (d): Habitat at Escaleras de Jaruco, La Habana.

Several species of terrestrial snails were also collected to feed lampyrid larvae in captivity. The snails were abundant on the ground, near the firefly larvae, on neighboring limestone walls, and on vegetation, less than 1m above ground. All possible representatives of the snails that could be potential prey items were collected. Also, snail species from Sierra del Rosario, where this firefly genus is present, were offered to the larvae. Preys offered were always snails, except for one earthworm.

Individuals were reared in Petri dishes of 9 cm diameter, with fragments of soil litter and mosses that were sprayed regularly with water to preserve humidity, the most critical

requirement for other lampyrid species [13]. In most cases they were individualized, but the smallest instars were kept together. Room temperature and humidity were daily monitored, and kept in the range of 22–33°C and 47–98%, respectively. The broad variation range of room humidity should not have any effect on larvae since the insides of the dishes were always damp.

3. Results and Discussion

The larva of *A. discoidalis* is associated with conspecific adults for the first time through rearing, the most reliable

FIGURE 2: Larval feeding habits of *Alecton discoidalis*. (a): Larva feeding on *Torrella immersa* in nature. (b): Two larvae of early stages feeding on *Torrella immersa* in captivity. (c): Predation on *Ustronia sloanei*, keeping the operculum at side in captivity. (d): Predation on *Chondropoma pictum*, with the operculum out, in captivity. (e): Predation on the carnivorous snail *Oleacina* sp. in captivity. (f): Foaming behaviour of *Helicina aspersa* while attacked.

association, sometimes very difficult to obtain in this group [14]. Two earlier publications [2, 3], both on gastropods, identified the larvae only as *Alecton* sp. A complete description of the larva is being prepared. Clench and Jacobson [2] mentioned predation of *Alecton* larvae on *Viana regina*, and González [3] on *Trochelviana* sp. Both snail genera are operculate (Subclass: Prosobranchia), as well as the

majority of prey items accepted in this study (Table 1). Helicinidae and Potamiidae species represented 71% and 92%, respectively, of those accepted by the larvae. These groups constitute the most abundant and diverse families in Cuban limestone landscapes. Particularly, the density of Potamiidae is very high in these areas, sometimes over 10 ind/m².

TABLE 1: List of snail species offered to *Alecton discoidalis* larvae. The most common substrate of each species is indicated, G: ground dwelling, R: rock dwelling, T: tree dwelling.

Family and species	Number of snail offered	Number of snail accepted
Helicinidae (Subclass Prosobranchia)		
<i>Helicina aspersa</i> (T)	15	12
<i>Ustronia sloanei</i> (R)	11	7
<i>Alcadia hispida</i> (G)	4	4
<i>Emoda sagraina</i> (G)	4	1
Potamiidae (Subclass Prosobranchia)		
<i>Chondropoma pictum</i> (G, R, T)	16	15
<i>C. auberianum</i> (T)	1	1
<i>C. irradians</i> (G, R)	5	5
<i>Eutudora jimeno</i> (R)	8	7
<i>Torrella immersa</i> (R)	1	1
<i>Rhytidopoma coronatum</i> (R)	3	3
Megalostomidae (Subclass Prosobranchia)		
<i>Farcimen tortum</i> (G)	5	2
Bulimulidae (Subclass Pulmonata)		
<i>Liguus fasciatus</i> (T)	1	0
Urocoptidae (Subclass Pulmonata)		
<i>Pycnoptychia</i> sp. (G)	1	0
Oleacinidae (Subclass Pulmonata)		
<i>Oleacina</i> sp. (G)	1	1
Polygyridae (Subclass Pulmonata)		
<i>Praticolella griseola</i> (T)	3	3

The snails most vulnerable to *A. discoidalis* larvae's attack seem to be ground and rock dwellers, followed by tree dwellers. The latter can fall to the ground with the leaf where they are resting or hibernating; it is even possible that lampyrid larvae climb up to the trees, as they do with rocks. Species of Urocoptidae (*Pycnoptychia* sp.) and Bulimulidae (*Liguus fasciatus*) were not eaten by *A. discoidalis* larvae. The former is a very spirally and elongated species, preventing access of the larva to the snail's body. It is therefore quite likely that this group of gastropods does not constitute prey of *A. discoidalis* larvae. The earthworm offered was not eaten either.

Larvae of *A. discoidalis* were also observed in nature feeding on three snail species: *Torrella immersa* (at Pan de Matanzas), *Chondropoma pictum* (Bacunayagua), and *Rhytidopoma coronatum* (Escaleras de Jaruco). The first two observations were made at night while the third one was made during daylight (0900–1200 h) on three different occasions. Although McLean et al. [13] in photurid larvae, said that feeding is promoted by temperatures of 20–25°C and by darkness, *A. discoidalis* larvae could be so nocturnal as diurnal, since the attacks observed in captivity not always occurred at night. Nevertheless, according to our observations, the larvae may spend around 24 hours inside a single prey until finishing with it. Lampyrid larvae were seen

feeding only on both living and fresh terrestrial snails, either in nature or in captivity (Figure 2). On some occasions, that is, the early stages, several larvae (up to three) were seen consuming together a single snail (Figure 2(b)).

Clench and Jacobson [2] suggested that lampyrid larvae may wait for the *Viana* to relax the operculum and then attack. In this paper, we observed that they attack mostly active or recently active snails. When snails spend many days inactive with the opercula closed, they are seldom attacked. On some occasions, the snails (especially *H. aspersa* and *C. pictum*) begin to foam when lampyrid larvae attack them (Figure 2(f)). Performing such a specific behavior, they evaded the attack. Another behavior was observed in the field when *C. pictum* swung the shell forward when disturbed by us. Wang et al. [5] described this behaviour in other snails and interpreted it as a defense mechanism in order to avoid attacks by other larvae.

More detailed papers are needed for a better understanding of the natural history of this endemic firefly. Label data from collections of *A. discoidalis* are mostly from limestone landscapes. This may suggest an association with operculate gastropods, abundant in such places. Therefore, a food preference study and a biogeographical analysis of these two invertebrate taxa could show how closely related they are or even they may have had a coevolving relationship defined by their predator-prey connection.

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