tively). After moving, the larvae typically became inactive again, only feeding 27.8% in the laboratory and 25.5% in the field. However, in the field, encountering food is not guaranteed, and these percentages do not take into account distance traveled. Once a larva in the field had fed, it would either remain inactive or move with equal probability. However, larvae in the laboratory would remain inactive after feeding 81.3% of the time.

Larvae would eat the violet leaves rapidly during feeding bouts and, when not feeding, larvae would hide in clumps of grass or walk. McCorkle and Hammond (1988) observed similar feeding behavior for *S. zerene hippolyta*. The fifth instar larva that was released back to the prairie walked in a curved path (25.40 m over a 24 hour period) and fed only on violet plants that were in its path (although it walked past violet plants as close as a centimeter away and apparently did not perceive them). Wind direction did not seem to matter as the larvae walked equally close to violets up and down wind without noticing them. As the sun set, the larva walked and fed progressively less, until it became inactive at the base of a grass clump and remained there until the following morning. The larvae studied in the laboratory and greenhouse displayed a sinnilar diurnal feeding pattern. The inactivity associated with nightfall may be due to a reduction in temperature, however temperature does not drop substantially as soon as the sun sets in eastern Kansas, leading us to believe that light is a more important cue for activity than temperature.

This study of a small sample of *S. idalia* larvae in Kansas tallgrass prairie indicates that they do not forage entirely at night. More study is needed covering a larger geographic region in order to determine how widespread this behavior is within *S. idalia* and the genus *Speyeria*.

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# BIOLOGY OF *ADELPHA MYTHRA* FEEDING ON ASTERACEAE, A NOVEL PLANT FAMILY FOR THE NEOTROPICAL LIMENITIDINAE (NYMPHALIDAE), AND NEW DATA ON *ADELPHA* "SPECIES-GROUP VII"

**Additional key words:** *Adelpha syma*, *Adelpha cocala*, life history, Rosaceae, Rubiaceae.

The Neotropical genus *Adelpha* Hübner (Nymphalidae) includes about 85 species (Keith Willmott pers. comm.) spread from western USA to Uruguay, and occurring in a wide variety of habitats and vegetation types (Aiello 1984). Species determination is very difficult in some *Adelpha* groups, and the natural divisions of the genus are not yet fully resolved, although a number of species relationships have been proposed on the basis of the immatures (Aiello 1984). Unfortunately, immatures are known for only 32 species of *Adelpha*, solely 21 of which have some portion of the early stages illustrated. Thus, although a cladistic analysis of the genus is needed, it would be impossible at this time. Because information on additional species is essential to a better understanding of the genus (DeVries 1987; Aiello 1991), it is important that any new data about *Adelpha* immatures be reported (Otero & Aiello 1996).

This paper describes the immature stages of *Adelpha mythra* (Godart 1824) and *A. syma* (Godart 1824), reports their larval host plants, and discusses the position of both species within *Adelpha*, based on their immatures.

**Study sites and methods.** *Adelpha mythra*, a montane species in southeast Brazil, is one of 16 species of *Adelpha* known in the Santa Genebra Forest Reserve (22°44′S, 47°06′W, altitude 600–630 m), a 250 ha fragment of semideciduous forest in Campinas, São Paulo State, SE Brazil (see additional information on the area in Morellato and Leitão-Filho 1995). In January 1999, a female *A. mythra* was observed there ovipositing on the scandent vine, *Mutisia coccinea* St. Hil. (Asteraceae). The egg did not hatch, so this very unusual "record" was thought to be an oviposition mistake of this female. However, from February to April 1999, *A. mythra* was reared from first to fourth instars collected on the same plant species and also on *Bathysa meridionalis* (Rubiaceae) in several parts of the Serra do Japi (23°11′S, 46°52′W), a mountain range (700–1300 m altitude) covered by semideciduous forest, in Jundiai, São Paulo State, SE Brazil (Brown 1992). Immatures of *Adelpha syma* were also found on *Rubus* (Rosaceae) in the Serra do Japi, and immatures of *A. cocala* were discovered feeding on a Rubiaceae in the Parque Ecológico do Voturuá (46°22′W, 23°57′S, altitude 20–100 m), a 200 ha fragment of lowland subtropical rainforest in the city of São Vicente, coastal São Paulo State, SE Brazil.

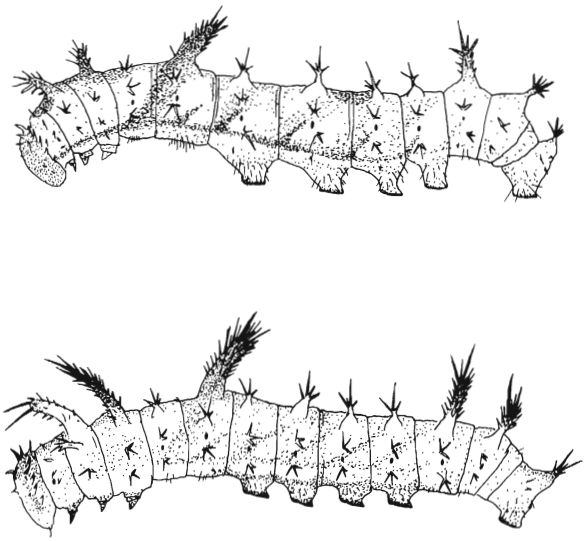

FIG. 1. Fifth instar larvae of *Adelpha syma* (above) and *A. mythra* (below)

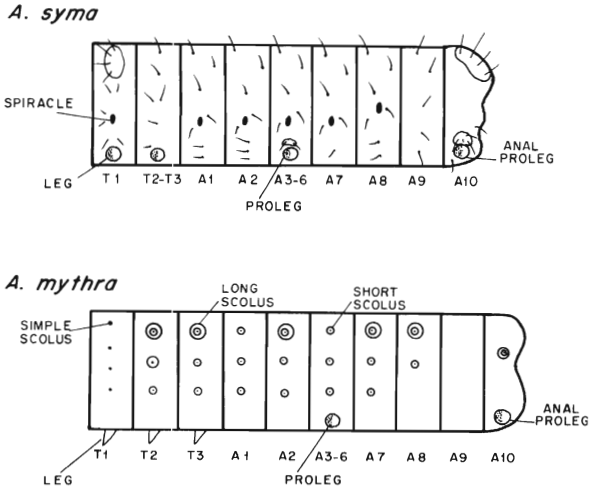


FIG. 2. Above, Chaetotaxy of first instar larva of *Adelpha syma*. Below, Distribution of scoli in a fifth instar larva of *A. mythra*.

Larvae were reared in plastic cages cleaned daily, following Freitas (1991). Adults, head capsules and pupal skins are in the collection of the first author. Larval food plant vouchers, identified by Dr. Jorge Tamashiro, have been deposited in the herbarium of the Universidade Estadual de Campinas.

**Descriptions of immatures and host plants of *Adelpha mythra*.** The only egg observed was greenish brown, sculptured with hexagonal pits, with spines arising from the pit junctions, consistent with eggs described for other species of *Adelpha*. The egg was placed on the upper surface of the leaf, near the apex. It was laid rapidly by a startled female, and did not hatch.

First and second instars were not described in detail. The third instar had conspicuous head scoli and a faintly visible variegated pattern that, with few changes, was maintained and intensified through the remaining larval stadia. The fifth instar (Fig. 1) was variegated green, with a pattern of oblique lateral stripes. The green areas changed to light orange as the larvae neared pupation. In the final larval stadium, the body scoli were short and thick, with a dense covering of spines; the scoli on A2 were arched posteriorly. The distribution of the scoli (Fig. 2) was the same as for most *Adelpha* species. The mature larva was about 25 mm long.

The first through fourth instars initiated feeding at the apex of a leaflet, leaving the midvein intact and extending it with fecula and silk to form "frass chains" (Aiello 1984). They rested upon these structures when not feeding. In addition, they attached dead leaf fragments and clumps of fecula to the base of the chains. When feeding on *Bathysa meridionalis*, larvae built "frass chains" on other parts of the same large leaf.

The pupa (Fig. 3A) showed an elongated general profile (about 17 mm long), with segment A2 produced and curved anteriorly, and segment T2 pointed and directed posteriorly. The head horns were pointed and shaped like tiny asymmetrical leaves, curving out from the sides of the head. The general color was brown, with dark lines on the wing pads and no reflective areas.

*Mutisia coccinea* (Asteraceae), a scandent shrub common in wet second growth habitats, was observed as the larval food plant of *Adelpha mythra* both in Santa Genebra and in the Serra do Japi. In the latter site, *A. mythra* was also reared on *Bathysa meridionalis* L. B. Smith & Downs (Rubiaceae), a plant with enormous leaves (up to 1m in length and width), of montane habitats, where it occurs most often near watercourses. *Bathysa meridionalis* is used by many other *Adelpha* species in that site (Brown 1992 and AVLF pers. obs.).

**Immatures and host plants of *Adelpha syma*.** The egg was greenish brown, with sculpturing and ornamentation as described for other species of *Adelpha*, placed on the upper surface of the leaf, near the apex. The height and diameter were about 0.8 mm; the duration was not determined.

The first instar was entirely brown, with pale body setae about 0.06 mm long, arranged as in Fig. 2. The head capsule was pale brown without ornamentation. The final body length was 4 mm. The second instar was entirely brown, with a spiny brown head. The body bore short stubby scoli. The final body length was 6 mm. The third and fourth instars showed a clearly visible variegated pattern, with head spines longer. The final lengths were 9 mm in the third and 15 mm in the fourth larval stadia. The fourth and fifth instars had the same general pattern. The fifth instar (Fig. 1) was variegated with green, cream and brown, showing a general pattern of oblique lateral stripes. The green areas change to light orange before pupation. The body scoli were short and thick, with dense spines, and the scoli of A2 arching posteriorly. The distribution of the scoli was the same as in *A. mythra*. The fully grown larva was 25 mm long. Data on head capsule widths for all instars are in Table 1. The first through fourth instars constructed frass chains and had a behavior similar to that described for *A. mythra*.

The pupa (Fig. 3B) showed an elongated general profile (about 18 mm long), with segment A2 projecting and curved anteriorly, and segment T2 pointed and directed posteriorly. The head horns were very small and pointed, curved out from the sides of the head. The general color was brown, with dark lines on the wing pads and no reflective areas.

The host plant in the Serra do Japi was *Rubus brasiliensis* Mart. (Rosaceae), a common blackberry of sunny second growth habitats, especially in montane sites. *Rubus rosifolius* Sm., an introduced species, is also used as larval food in other montane sites in SE Brazil.

**Positions within *Adelpha*.** The scolus shape and the general pattern of the larvae, and the general form of the pupae, suggest

TABLE 1. Head capsule widths of *Adelpha syma*

| Larval instar | Range (mm) | Mean | SD | n |
|---|---|---|---|---|
| 1° | 0.56–0.58 | 0.57 | 0.011 | 7 |
| 2° | 0.78–0.82 | 0.80 | 0.014 | 5 |
| 3° | 1.18–1.22 | 1.18 | 0.042 | 6 |
| 4° | 1.64–2.03 | 1.81 | 0.151 | 13 |
| 5° | 2.73–3.12 | 2.89 | 0.133 | 11 |

that both *Adelpha mythra* and *A. syma* belong to the Species-Group VII of Aiello (1984). The immatures of both species are very similar to those of *A. cocala*, the main difference being that the A2 process of the pupa is much longer in *A. mythra* and more arched in *A. syma* than in *A. cocala* (Fig. 3C). In *A. mythra*, the length of the A2 projection approaches the condition observed in *A. phylaca* (as described by Müller 1886) (Fig. 3D), a species belonging to Group II of Aiello (1984). However, the T2 projections of *A. mythra* and *A. syma* are sloped posteriorly, and not curved upward as in Group II pupae, giving pupae in the two groups distinctive general appearances. The pupal head horns of *A. mythra* (Fig. 3A) are similar in shape to those of *A. cocala* (Fig. 3C), but are farther apart at their bases and are more tapered. The head horns of *A. syma* (Fig. 3B) are similar to those of *A. phylaca* (Fig. 3D), but are more curved.

Additional species of *Adelpha* need to be reared in order to clarify the scenario based on the morphology of the immatures and to make a cladistic analysis possible. Some species groups are based on only one, two or three species, and the immatures of many common species remain to be discovered, or their descriptions are not sufficiently detailed to permit assignment to a species-group. Additional descriptions of *Adelpha* immatures with figures are important, especially when they show apparent deviations from the eight known species groups (Aiello 1984, Otero & Aiello 1996).

**Host plant use.** Among the Nymphalidae, the association with Asteraceae as larval food plants is found in only a few groups (especially Melitaeinae and Acraeinae) (Ackery 1988, Freitas 1991). The record of Asteraceae as a larval host of the Limenitidinae represents a new plant family for neotropical *Adelpha*. Larvae of *Adelpha* species have been recorded as feeding on Aquifoliaceae, Asteraceae, Bombacaceae, Caprifoliaceae, Combretaceae, Ericaceae, Fagaceae, Flacourtiaceae, Icacinaceae, Malpighiaceae, Melastomataceae, Moraceae, Ochnaceae, Piperaceae, Rosaceae, Rubiaceae, Tiliaceae, Ulmaceae, Urticaceae, Verbenaceae and Vochysiaceae (Jones & Moore 1883, Müller 1886, Moss 1933, Biezanko et al. 1966, Aiello 1984, 1991, DeVries 1987, Ackery 1988, Brown 1992, Otero & Aiello 1996, Diniz & Moraes 1997, Constantino 1998, and this work). Some themes may be recognized in the different species-groups (Aiello 1984). Basically the species of *Adelpha* can be sorted into rubiaceous feeders and non-rubiaceous feeders. Four examples of species feeding on both Rubiaceae and other families have been reported (*A. serpa*, *A. boreas tizona*, *A. syma* and *A. cocala*), and *A. mythra* is the fifth recorded case. Although interesting, this pattern must be considered with caution, because some plant identifications need to be confirmed by additional field observations.

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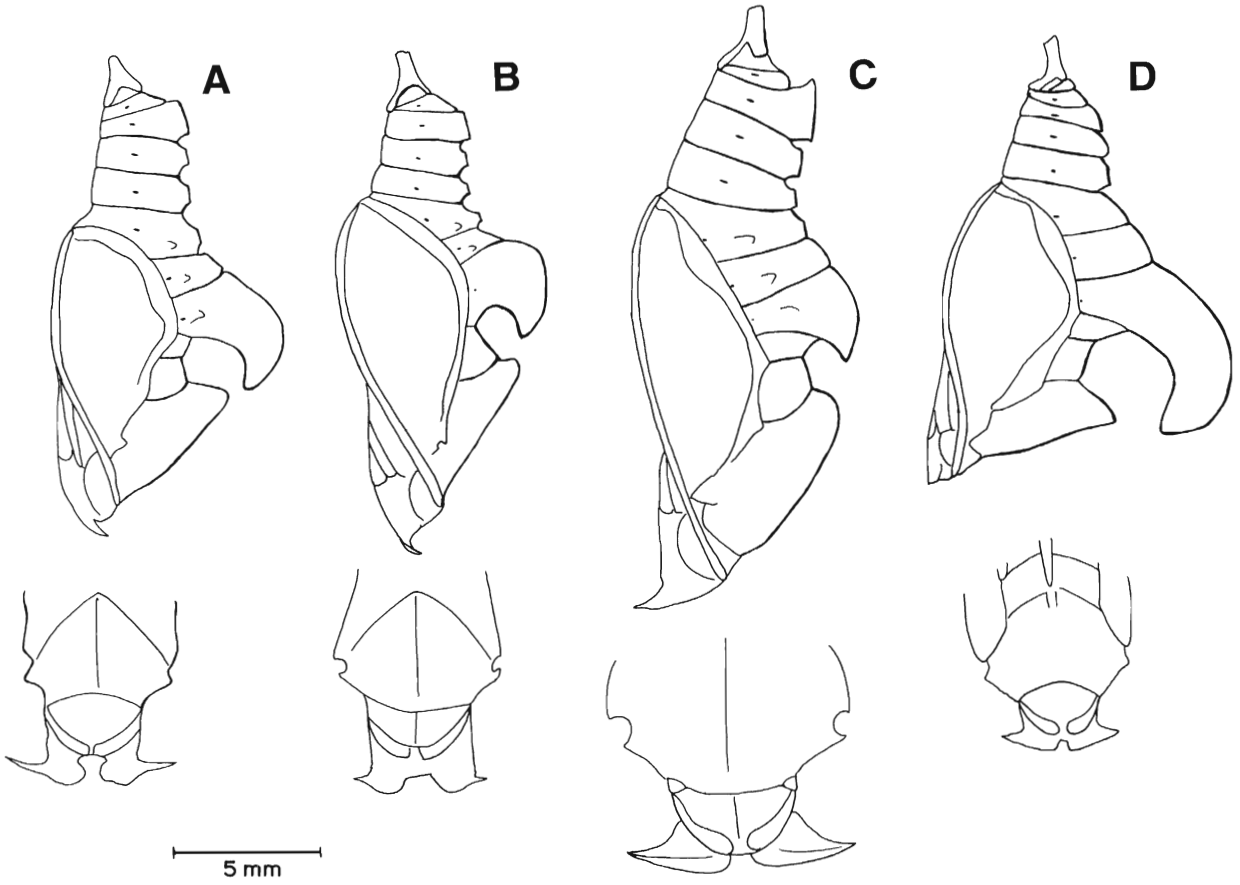


FIG. 3. Pupae of *Adelpha mythra* (A), *A. syma* (B), *A. cocala* (C) and *A. phylaca* (D) (*A. phylaca* redrawn from Aiello, 1984, in a different scale; the bar means 7.3 mm).

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