

LIRIMIRIS MERIDIONALIS (SCHAUS), A NOTODONTID MOTH  
ASSOCIATED WITH COCOA (*THEOBROMA CACAO* L.) IN BELIZE

Knowledge of the biology of the large Neotropical notodontid moth, *Lirimiris meridionalis* (Schaus), is limited to the early descriptions of adults of this species and allied ones from Costa Rica (Schaus, 1901, Trans. Entomol. Soc. London 1901:257-343; 1904, Trans. Amer. Entomol. Soc. 30:135-178; 1911, Ann. Mag. Nat. Hist. 7:262-285; 1912, Ann. Mag. Nat. Hist. 8:34-57). But, one early report from Argentina mentions that the caterpillar of the related species, *L. lignitecta* Walker, feeds on *Chorisia insignis* Kth. (Bombacaceae) and pupates in the soil (Schreiter, 1943, Acta Zool. Lilloana 1:7-44). Seitz (1907, Macrolepidoptera of the World, American Rhopalocera, Notodontidae 6: 901-1452, A. Kernan, Stuttgart) was, therefore, correct in stating that, although the Notodontidae of the Neotropical Region were diverse, very little is known about the life cycles and larval food plant associations of most genera and species. This note reports the discovery of *L. meridionalis* feeding on cocoa, *Theobroma cacao* L. (Sterculiaceae), in Belize. It constitutes not only the first published record of a larval food plant for this species but also the first description of the larval and pupal stages, including notes on behavior.

During August 1981 I discovered three caterpillars of *L. meridionalis* feeding on the mature leaves of *T. cacao* in Field Block 18 of the Hummingbird Hershey Cocoa Farm (88°38'W, 17°8'N) located about 18 road miles southeast of Belmopan. A good general description of this cocoa farm is available (Harler, Agribus. Worldwide, April/May 1981: 22-31). The discovery of the caterpillars was made during the rainy season. They were found on a cocoa tree with a well developed leafy canopy. The caterpillars were collected and confined with fresh cuttings of cocoa leaves to a large, clear plastic bag for further rearing. At the time of collection, a ceratopogonid midge (Diptera) was found attached to the cuticle of one caterpillar. The midge, together with the caterpillar, was gently placed in a separate rearing bag for further observation, as the midge appeared to be feeding on the caterpillar.

When collected the caterpillars were about 30 mm long, but they attained nearly 100 mm in length (and 15-17 mm in width) by the time of pupation (3 September 1981 for the first one), following about three weeks in captivity. Each caterpillar molted once in captivity, suggesting that they were in the fourth instar at the time of discovery (assuming five instars prior to pupation).

A macro-description of the caterpillar follows: Head capsule glossy butterscotch-yellow with two dorsal pairs of black dots, a central dot on each side, and three latero-ventral pairs. Background body color white with large black splotches. "Collar" connecting head capsule with rest of body, yellow. First thoracic segment with dorsal black patch with white in center, lateral black mottling and a row of long, lateral white hairs. Second thoracic segment entirely white with one pair of dorsolateral white hairs, shorter than those of first segment. Third thoracic segment white with pairs of black spots, one central and two larger ones dorsolateral. Dorsolateral hairs also present. Segments 4 through 6 similar to 3, but segments 6 and 7 without hairs. Segment 6 entirely white dorsally with a lateral black wedge-shaped streak continuous with intricate dorsal black pattern on 7. Segments 8 and 9 entirely white with small lateral black spot on 9. Conspicuous black wedge-shaped pattern on segments 10 through 12. Thin, irregular black line delineates lateral from ventral sections lengthwise; all legs and ventral cuticle butterscotch-yellow speckled with many small black dots. Last three segments enlarged, almost bulbous and thicker than the head capsule. These segments yellow with black speckling. Segments 9 through 11 with lateral long white hairs. Dorsolateral protuberances on last three segments with long white hairs, and a latero-ventral set on last segment as well. Anal plate shiny black. Together with anal plate, last three segments resemble a false head. When feeding, the caterpillar emits a loud

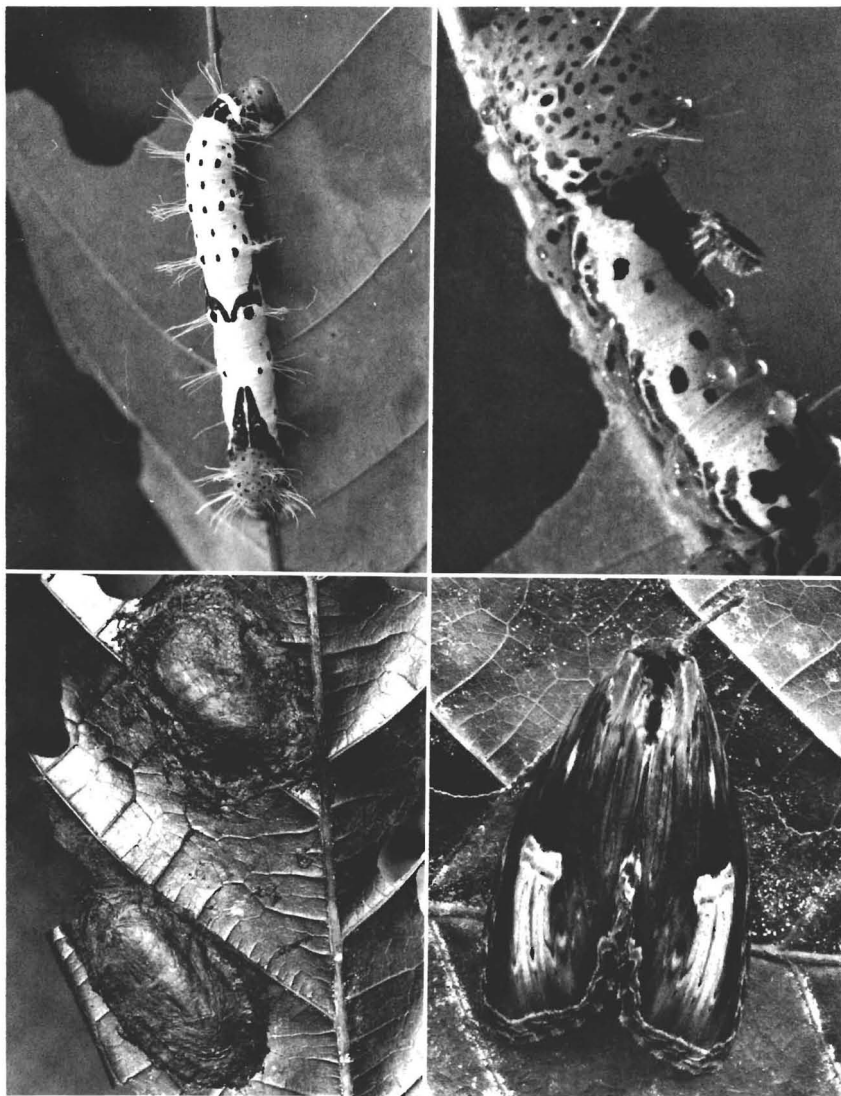


FIG. 1. Life cycle of the notodontid moth *Lirimiris meridionalis* (Schaus). **Counter-clockwise, top to bottom:** biting midge *Forcipomyia* (*Microhelea*) *fuliginosa* (Meigen) (Diptera: Ceratopogonidae) feeding on the caterpillar of *L. meridionalis* at Hummingbird Hershey Cocoa Farm in Belize; fourth instar feeding on mature cocoa leaf; two cocoons with top cocoa leaf peeled away to show the flattened, compact structure; newly-eclosed adult moth.

clicking sound, clearly audible from several feet away. During the rearing period, the appearance of the caterpillar did not change. But, it becomes an active prepupa, turning completely yellow-orange and the body contracts greatly in size. In captivity, the caterpillar makes a thin, dark-brown papery cocoon wedged between dead cocoa leaves;

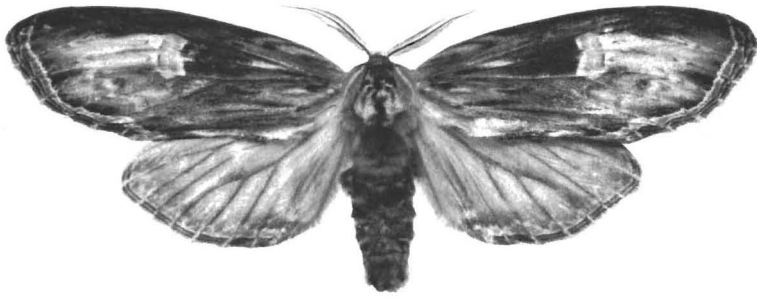


FIG. 2. **Below:** pupal case, cast-off exuvium, and cocoon of *L. meridionalis*. **Above:** mounted specimen reared from the Belize sample of caterpillars and deposited in the permanent collections of the Milwaukee Public Museum.

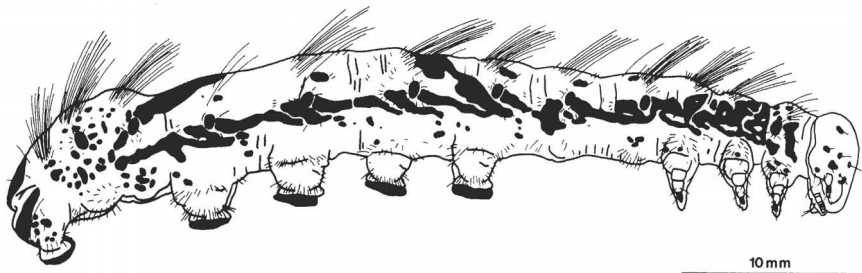


FIG. 3. Schematic line drawing of the fifth instar caterpillar of *L. meridionalis*.

it is conspicuously flattened dorsoventrally. The life stages studied are shown in Figs. 1 and 2, and an approximate schematic representation of the caterpillar's appearance is given in Fig. 3. The cocoon is loosely made of coarse strands of silk holding leaves together to comprise a flat envelope. The pupal stage lasts 18 days under the rearing conditions employed.

While either feeding or resting, the caterpillar assumes a tight "J" position, with the head curled around and partly concealed with the bulbous hind region. It was determined that a biting midge, *Forcipomyia (Microhelea) fuliginosa* (Meigen) (Diptera: Ceratopogonidae) was sucking haemolymph from one caterpillar (Fig. 1). The discovery was made at 0900 h, and the midge remained in the position even when the caterpillar was transferred to a plastic bag from the tree. At 1700 h the same day, the midge was still attached at the same spot on the cuticle. By this time the caterpillar appeared traumatized, with the cuticle darkening. By 0700 h the following day the midge was no longer feeding and the caterpillar appeared healthy once again. This caterpillar survived to pupate and produce an adult.

Although three caterpillars were found on the same cocoa tree, it is unlikely that *L. meridionalis* oviposits in clusters, as noted for some Temperate Zone notodontids (e.g., Farris & Appleby, 1980, *J. Lepid. Soc.* 34:368–371; Holland, 1916, *The Moth Book*, Doubleday, Page & Co., New York and Garden City, 479 pp.). *Lirimiris meridionalis* was originally described from adults collected in British Guiana (Schaus, 1904, op. cit.), and because the caterpillars, as for most notodontids with known life cycles, are tree-feeders, little else was discovered about this species. It is very doubtful that this species has been studied (R. W. Poole, pers. comm.). In the Temperate Zone notodontids have diversified considerably at the generic level in terms of larval food plant selection (e.g., McFarland, 1975, *J. Lepid. Soc.* 29:112–125; 1979, *J. Lepid. Soc.* 22(Suppl. 3):72 pp.), but sometimes a single species exhibits considerable polyphagy (Dirks, 1937, *Maine Agric. Expt. Sta.*, Orono, Bull. 389, 162 pp.). In some tropical and subtropical regions, there is considerable diversification of larval food plant patterns among genera (e.g., Pinhey, 1975, *Moths of Southern Africa*, Tafelberg Publ., Cape Town, 273 pp.). Also noted to vary greatly among genera and species is the type of cocoon construction or pupation habit (Kendall, 1974, *J. Lepid. Soc.* 28:243–245; Farris & Appleby, op. cit.).

There are no published records of *L. meridionalis* being associated with cocoa as a larval food plant (Costa Lima, 1936, *Terceiro Catalogo Nos Insectos Que Vivem Nas Plantas Do Brasil*, Minist. Agricult., Rio de Janeiro, 460 pp.; Entwistle, 1972, *Pests of Cocoa*, Longmans, London, 779 pp.). The association may be of economic interest since there are some records of other notodontids in the tropics being serious defoliators of fruit trees (e.g., Fujii & Yoshida, 1981, *Proc. Hawaiian Entomol. Soc.* 23:345–350), although some studies reveal very low densities of a single herbivorous insect species in large stands of a single food plant species (e.g., Solomon, 1981, *Ecology* 62:1205–1214). Although some Lepidoptera associated with cocoa in Brazil have tachinid (Dip-

tera) parasites associated with them (Silva, 1980, Rev. Theobroma 10:257-259), the impact of biting midges such as *F. (M.) fuliginosa* on caterpillars is probably slight. Neotropical biting midges of the genus *Forcipomyia* and the subgenus *Microhelea* are ecto-parasites on a variety of plant-associated insects (Wirth, 1971, Entomol. News 82: 229-245; 1972, Ann. Entomol. Soc. Amer. 65:564-577), and particularly the soft-bodied caterpillars of Lepidoptera (Wirth, 1972, J. Lepid. Soc. 26:65).

The general lack of information on the association of *L. meridionalis* with cocoa anywhere in the Neotropical Region tentatively suggests that the interaction is very patchy regionally, even though this notodontid and related species are known from various localities in Central and South America. But, given the close evolutionary affinity between the Sterculiaceae and the Bombacaceae (Cronquist, 1981, An Integrated System of Classification of Flowering Plants, Columbia, New York, 1262 pp.), it is not surprising to find closely related species of *Lirimiris* associated with both tropical plant families (this report and Schreiter, op. cit.). Because of intense commercial interest in cocoa, there exists an unusually long list of herbivorous insects associated with this fruit tree (e.g., Entwistle, op. cit.); but there is still a dearth of biological data on *L. meridionalis*. A fourth-instar caterpillar of *L. meridionalis* was discovered on *T. cacao* at Finca la Tigra, near La Virgen (10°23'N, 84°07'W), Heredia Province, Costa Rica, on 2 March 1983. The association of this moth with other Sterculiaceae warrants investigation.

I thank Dr. R. W. Poole for confirming the determination of the moth, and Mss. Joan Jass and Susan Borkin with literature searches. Dr. Willis W. Wirth identified the biting midge. Christine Deniger prepared the line drawing in Fig. 3. Special thanks to Gordon R. Patterson of Hershey Foods Corporation for arranging my stay at Hummingbird Hershey, and to Norris Wade and his staff there for assistance and fine hospitality. This report is a by-product of research on cocoa funded by the American Cocoa Research Institute.

ALLEN M. YOUNG, *Invertebrate Zoology Section, Milwaukee Public Museum, Milwaukee, Wisconsin 53233.*