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NOTES ON THE LARVA AND BIOLOGY OF *MOODNA BISINUELLA* HAMPSON (PYRALIDAE: PHYCITINAE)[1]

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ABSTRACT. The last stage larva of *Moodna bisinuella* Hampson is described, and the biology of this phycitine with reference to gama grass (*Tripsacum*) in North Carolina is briefly outlined.

Recently, gama grass (*Tripsacum* sp.) was brought to Raleigh, North Carolina from Mexico and planted on a research farm as part of a plant breeding program. Inadvertently, phycitine larvae were introduced with the plants. Injury to the plants eventually prompted the collection of larvae and rearing of adults. Adults were identified as *Moodna bisinuella* Hampson, a species of economic importance in Central America. Although the phycitines were eradicated from the grass in North Carolina after the insects were identified, notes taken and larval specimens obtained during the rearing procedures provided worthwhile information relative to this pest. Little has been published regarding the appearance of the immature stages and biology of *M. bisinuella*. Previous authors have only mentioned a few morphological features of the larva (Capps, 1963) and merely stated that the species feeds as a larva in the ears of soft or "green" corn (*Zea mays* L.) (Capps, 1963; Heinrich, 1956). In this paper, I describe the last stage larva in detail and briefly discuss the biology of *M. bisinuella* in association with its previously unreported host, gama grass.

Description of Last Stage Larva

General. Length 10.2–16.0 mm, avg. 13.5 mm.

Color. Head yellowish brown (at times with green undertones in living larva); tonofibrillary platelets pale brown, indistinct; usually, a pale brown to brown patch within arc of stemmata and pale brown to brown streaks near notch of postgenal region (these 2 pigmented areas sometimes coalescing); hypostoma with brown to black markings; mandibles yellowish brown between articulations becoming dark brown along lateral margins and distally.

Prothoracic shield pale yellow to pale brown with lateral and posterior margins darker (green undertones in living larva). Prespiracular plate yellowish brown to dark brown. Remainder of prothorax white to yellowish white overlaid with brown to gray integu-

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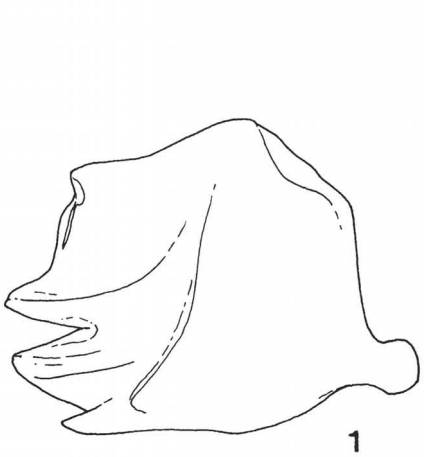
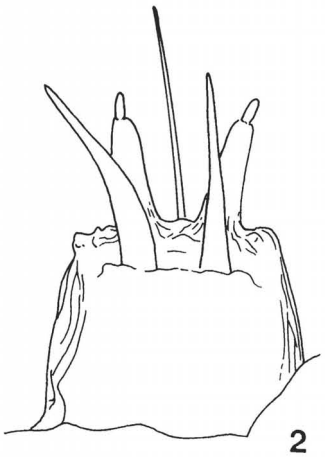




FIGS. 1, 2. *Moodna bisinuella* Hampson. **1,** mesal aspect of right mandible of last stage larva. **2,** dorsal aspect of part of right maxilla of last stage larva.

mental granules (living larva with remainder of prothorax pale red to red with brown to gray granules and scattered blue undertones; red pigmentation usually more intense on mesothorax and metathorax, and blue more pronounced laterally and ventrally); mesothoracic pinaculum ring pale brown to dark brown, white within ring; thoracic legs mostly pale brown to brown.

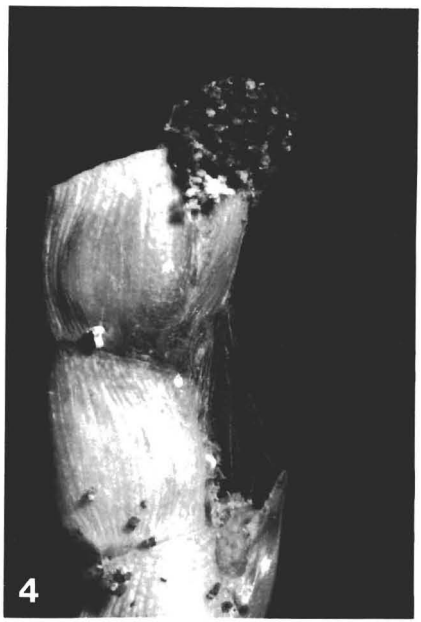
Abdomen similar to mesothorax and metathorax; eighth abdominal segment pinaculum ring pale brown to brown; anal shield pale yellow to yellowish brown with slightly darker margins.

Morphological features: Head. Width 0.83–0.93 mm, avg. 0.90 mm; surface slightly uneven; adfrontals reach ca. ⅚ distance to epicranial notch; AF2 setae usually slightly ventrad of level at which epicranial suture forks; AF2 setae slightly above imaginary line between P1 setae; P1 setae further apart than P2 setae; labrum shallowly notched; mandibles simple, distal teeth distinct (Fig. 1); sensilla trichodea of maxillae simple (Fig. 2). Spinneret moderately long.

Prothorax. On shield, distance between D1 setae less than distance between XD1 setae; on each side of shield, distance between SD1 and SD2 greater than distance between SD1 and XD2, distance between D1 and D2 greater than distance between D1 and XD1, and XD2, SD1 and SD2 form an acute angle; L setae of each side in a nearly vertical configuration.

Mesothorax and metathorax. SD1 pinaculum rings of mesothorax well developed; SD1 setae of mesothorax ca. 2 times as long as SD1 setae of metathorax; SD1 and SD2 pinacula of metathorax fused; D1 and D2 pinacula of metathorax fused.

Abdomen. D2 setae of anterior segments ca. 0.4 mm long; D1 setae of anterior segments ca. as long as D2 setae; distance between D2 setae on segments 1–7 slightly greater than distance between D1 setae; distance between D1 and D2 on each side of segments 3–6 about same as distance between D1 and SD1; SD1 setae of segments 1–7 without pinaculum rings; crochets in a biordinal ellipse, avg. number on prolegs of segments 3, 4, 5, 6, and anal segment, 50, 56, 57, 58, and 49, respectively; vertical diam. of spiracles on segment 8 ca. ⅓ larger than same diam. of spiracles on segment 7; horizontal diameter of spiracle of each side of segment 8 slightly less than distance between L1 and L2; SD1 pinaculum rings of segment 8 relatively broad but appearing incomplete; SD1 setae of segment 8 ca. 1.9 times longer than SD1 setae of segment 7; 2 SV setae on each side of segment 8; distance between D1 and D2 on each side of segment 9 ca. 3 times distance between D1 and SD1; 2 SV setae on each side of segment 9.



FIGS. 3, 4. Seeds of gama grass infested with last stage larvae of *Moodna bisinuella* Hampson.

Material Examined

North Carolina: Raleigh; 5 larvae, *Tripsacum* sp. seed, 19-IX-80, Coll. H. H. Neunzig; 11 larvae, *Tripsacum* sp. seed, 30-IX-80, Coll. H. H. Neunzig. These specimens have been deposited in the NCSU Insect Collection.

BIOLOGY AND DISCUSSION

In North Carolina, *M. bisinuella* overwintered as diapausing larvae within silk enclosures constructed at the inner base of gama grass. Pupation occurred in the spring, and adults emerged in April and May. Oviposition and larval feeding sites for the spring generation could not be determined. Larvae of the summer generation (July–September) were all found associated with the seeds of gama grass. These larvae fed on the well-developed, but more or less soft, seeds. Usually this occurred while the seeds were still attached to the plant, but seeds that had fallen from the plant were also eaten. The seeds were bored into and frass and silk extruded from the entrance hole (Figs. 3 & 4). Several seeds were eaten by each larva as it developed. Ergot (*Claviceps* sp.), which was at times associated with gama grass seed, was also sometimes ingested by the larvae.

The fact that *M. bisinuella* feeds on gama grass as well as corn supports the botanical view that the two plant genera (*Tripsacum* and *Zea*) are closely related (they are considered by most botanists to be the only members of the New World tribe Maydeae). In Central America, where the two plants sometimes grow in close proximity, wild communities of gama grass are in all likelihood providing a reservoir of *M. bisinuella* that periodically infest fields of corn.

ACKNOWLEDGMENTS

D. L. Stephan of the Plant Disease and Insect Clinic of North Carolina State University made available to the author the initial series of larvae of *M. bisinuella* collected in North Carolina.

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Covell, Jr. (1984. A field guide to the moths of eastern North America. Houghton Mifflin Co., Boston. 496 pp.) places this tiger moth in genus *Grammia*. Dr. Norman Johnson, Department of Entomology, Ohio State University, presently is revising the taxonomy of Scelionid wasps. He recently informed me (pers. comm.) that most of the early type specimens of *Telenomus* are females but that the male genitalia possess important diagnostic features for determining species status. This wasp species in his opinion may be undescribed and no specific designation can be given at this time.

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NOTES ON THE HABITAT AND FOODPLANT OF *INCISALIA HENRICI* (LYCAENIDAE) AND *PYGRUS CENTAUREAE* (HESPERIIDAE) IN MICHIGAN

The foodplant of *Incisalia henrici* (Grote and Robinson) in Michigan was unknown until 1981, when it was confirmed that maple-leaf viburnum, *Viburnum acerifolium* L. (Caprifoliaceae) is an acceptable foodplant. According to Tietz (1972, An index to the described life histories, early stages, and hosts of the Macrolepidoptera of the Continental United States and Canada, Allyn Mus. Entomol., Sarasota, FL) and Pyle (1981, The Audubon Society field guide to North American butterflies, A. Knopf, Inc., NY), viburnum is not listed as a known foodplant for *I. henrici*.

I first became acquainted with Henry's Elfin in 1953, when a series was collected in the Langston State Game Area, Montcalm County, on 15 and 23 May. Since that time, *I. henrici* has been collected and observed in the same area in close proximity to second growth aspen (*Populus grandidentata* Michx. and *tremuloides* Michx.), white oak (*Quercus alba* L.) and red maple (*Acer rubrum* L.), with scattered white pine (*Pinus strobus* L.) on sandy soil. Most of the adults have been taken (before full leaf development along sandy trails and narrow wooded sunny openings) while perched on small shrubs, on dried leaves and twigs or on bare sand. At this site, adults could easily be overlooked because of their small size and dark color. Only once was an adult observed nectaring on choke cherry, *Prunus virginiana* L., along the trail. During this period, the elfin gave no clues to the preferred larval foodplant despite the presence in the Game Area of *Prunus* sp. and *Vaccinium* sp., two previously recorded foodplants for *I. henrici*.

It wasn't until 3 June 1979, that Harry King and I discovered several Lycaenidae larvae feeding on the flower cymes of *V. acerifolium* in a similar aspen-oak woods, located one and one-half miles north of the original site. The greenish slug-shaped larvae, with pale lateral stripes, appeared to resemble *I. henrici*, based on the brief description in Klots (1951, Field guide to the butterflies, Houghton Mifflin Co., MA). The larvae were removed and kept in captivity until the following spring when (to my disappointment) *Celastrina ladon* (Cramer) emerged. Then during 1980–1982, I examined flower cymes of *V. acerifolium* at both Game Area locations and found numerous larvae of various instars representing *C. ladon* and what was believed to be *I. henrici*. Subsequent emergence of *I. henrici* in 1981 and 1983 from over-wintering pupae finally confirmed the use of *Viburnum acerifolium* as the preferred foodplant in this location.

In 1974, Larry West, noted nature photographer, observed a female *Pygrus centaureae wyandot* (Edwards) oviposit an egg on the underside of a wild strawberry leaf, *Fragaria virginiana* Duchesne, on 22 May in Otsego County, Michigan. Since 1958, the grizzled skipper has been collected from 15 May to 3 June on a pine barren in an area of short

grasses and sedges (including *Danthonia spicata* (L.) Beauv. and *Carex pennsylvanica* Lam.) on sandy soil. This skipper is not easily seen on the wing but can be collected with some frequency while nectaring on wild strawberry scattered in large patches throughout the open areas. Butterfly species that occur in the same area during the approximate flight period of *P. centaureae* include *Euchloe olympia* (Edwards), *Oeneis chryxus strigulosa* McDunnough and *Hesperia metea* Scudder.

With wild strawberry as the possible foodplant for *P. centaureae,* I searched strawberry patches during the summer from 1975 to 1979 for signs of larvae. Several mid-instar larvae were finally found in leaf nests on wild strawberry; the nests varied from a single folded leaf to three leaves held together with silk. The larval nests were constructed so the larvae rested on the upper leaf surface. Frequently, the heat of the day would curl many leaves, or a spider would curl a leaf for its egg mass, making it frustrating and difficult to find *P. centaureae* larval nests. The larvae were removed to captivity and finished feeding by late summer and over-wintered in the pupa stage. In reviewing the literature, this is the first record of wild strawberry as the foodplant for *P. centaureae wyandot*; other authors (Pyle, ibid.; and Ferris & Brown, 1981, Butterflies of the Rocky Mountain states, Univ. Oklahoma Press, OK) have cited *Rubus* and *Potentilla* (Rosaceae) as foodplants for *P. centaureae* in other parts of its range.

Perhaps both species will prove to be more widespread in the Great Lakes region when collectors are aware of their habitat and foodplant requirements. I wish to express my deep appreciation to Harry King and Larry West for sharing their field observations with me.

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