

BIOLOGY OF *MORRISONIA CONFUSA* (NOCTUIDAE)

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ABSTRACT. Studies on *Morrisonia confusa* were conducted in 1984 and 1985 in the laboratory and at Cooper's Rock State Forest in northern West Virginia. Adult flight period was from 2 May to 8 June, and larvae were collected from 6 June to 20 September. Nineteen host plants and 15 species of parasites are recorded for *M. confusa* larvae. The egg and seven larval instars are described. Larval duration averaged 71.4 days at 24°C.

Additional key words: immature stages, hardwood defoliator, West Virginia, parasites, Hadeninae.

Morrisonia confusa (Hübner) (Noctuidae: Hadeninae) is common throughout eastern North America with adults flying in April and May (Forbes 1954). Within this wide geographical area the larvae are defoliators of broad-leaved trees and shrubs and may be found from late June to mid-August in Canada (Prentice 1962).

The earliest larval description for *M. confusa* was given by Dyar (1891) who described coloration of the head and body. Brief descriptions of larvae were given by Crumb (1956) and Forbes (1954). A more detailed larval description was given by Godfrey (1972) who also figured the head, hypopharyngeal complex, and mandible. Crumb (1956) described *M. confusa* as a leaf folder, and Prentice (1962) indicated it to be a solitary webmaker.

During 1984 and 1985 as a part of a larger study, we studied *M. confusa* at Cooper's Rock State Forest in northern West Virginia, just west of the gypsy moth, *Lymantria dispar* (L.) (Lymantriidae), infestation as it was moving into the state. The objective of our larger study was to obtain baseline data for native macrolepidopterous defoliators and their parasites before the build-up of gypsy moth to enable evaluation of later native defoliator populations in face of projected gypsy moth population increases. During the part of the study reported here *Morrisonia confusa* was taken frequently in samples, but appeared to be producing insignificant defoliation. Since little information is available on the biology of *M. confusa*, we recorded its duration of larval development, larval food, and parasites. Voucher specimens are in the West Virginia University Arthropod Collection.

MATERIALS AND METHODS

The West Virginia University Forest at Cooper's Rock State Forest is located in Preston and Monongalia counties about 32 km east of Morgantown, West Virginia. The area consists of 50- to 60-year old even-aged mixed mesophytic forests and has a mean elevation of 561 m (Carvell 1983). The most abundant tree species in the study area are red maple (*Acer rubrum* L., Aceraceae), white and red oak (*Quercus alba* L., *Q. rubra* L., Fagaceae), black cherry (*Prunus serotina* Ehrh., Rosaceae) and black birch (*Betula lenta* L., Betulaceae).

The flight period of *M. confusa* was determined by blacklight trapping once each week from 7 March to 28 October 1984 and from 28 March to 6 November 1985. In 1985, 21 adult *M. confusa* were live-trapped at a blacklight trap and caged in the laboratory with foliage of red maple, black cherry, black birch, and red oak on which to oviposit; moths were provided with water and black cherry blossoms as a nectar source.

Larvae were reared in 150 × 25 ml plastic petri dishes; they were transferred onto fresh foliage in clean petri dishes every other day. Larvae were fed red maple since larval numbers taken from foliage in 1984 indicated a slight preference for red maple. Larvae were observed daily, and at each instar some were killed in KAAD (Peterson 1962) and preserved in 80% ethanol for head measurements. Pupation was in a 5 cm deep layer of moist vermiculite in quart canning jars provided with filter paper lids. All rearing was conducted at 24°C and 12L:12D photoperiod.

Larval descriptions were based on laboratory reared specimens only. The terminology used is that of Godfrey (1972) and Hinton (1946). Egg and larval head capsule measurements were made with an ocular micrometer.

To evaluate general biology, field sampling of *M. confusa* larvae was conducted by pole pruning foliage samples once each week from 16 May to 11 October 1984 and from 2 May to 30 October 1985. Foliage sampled was primarily *Acer rubrum*, *A. saccharum* Marsh., *A. saccharinum* L., *A. nigrum* Michx., *Prunus serotina*, *Betula lenta*, *Quercus alba*, *Q. rubra*, *Q. prinus* L., and *Q. velutina* Lam. Three 25-branch-tip samples per species group (mixed oaks, mixed maples, black birch, black cherry) were taken for a total of 300 branch tips per week. A branch tip represented about one square foot of foliage. Some additional host plants were observed during field sampling. All field collected larvae were laboratory reared on the appropriate host plant for isolation of parasites.

A cage of field-collected *M. confusa* larvae was set up in the labo-

ratory for observation of feeding habits and webmaking activity. The cage contained six small red maple seedlings in six-inch pots embedded in moist vermiculite covered with leaf litter.

RESULTS

Phenology, Life History, and Food Plants

Flight period of *M. confusa* during 1984 was from 12 May to 8 June; 79 specimens were trapped. In 1985, 119 specimens were collected between 2 May–16 May. Peak trap numbers were on 25 May 1984 (27 specimens) and 10 May 1985 (101 specimens).

In 1984, 228 larvae were collected on foliage in the field from 21 June to 20 September, and in 1985, 31 larvae were collected from 6 June to 8 August. During 1984, the percentage of larvae taken from each of the four regularly sampled tree species was as follows: 21% on black birch; 28% on mixed maples, 27% on black cherry, and 24% on mixed oaks.

During this study, larvae of *M. confusa* were found on the following plants: *Acer nigrum*, *A. rubrum*, *A. saccharinum*, *A. saccharum* (Aceraceae); *Betula lenta* (Betulaceae); *Castanea mollissima* Blume, *Quercus alba*, *Q. prinus*, *Q. rubra*, *Q. velutina* (Fagaceae); *Prunus serotina*, *Malus sylvestris* Mill., *Rosa* spp. (Rosaceae); *Cornus florida* L. (Cornaceae); and *Carya* spp. (Juglandaceae). Additional food plants given by other authors include: *Salix* spp. (Salicaceae) (Dyar 1891); *Vaccinium* spp. (Ericaceae) (Forbes 1954); *Tilia americana* L. (Tiliaceae), *Betula papyrifera* Marsh. (Betulaceae), *Populus balsamifera* L. (Salicaceae), *Carpinus caroliniana* Walt. (Corylaceae), *Aesculus hippocastanum* L. (Hippocastanaceae), *Ulmus americana* L. (Ulmaceae) (Prentice 1962), and *Pinus* spp. (Pinaceae) (Covell 1984). We suspect that *Pinus* is not an acceptable food plant for *M. confusa* but has appeared in the literature because of an error in page arrangements in Tietz (1972).

Larval instar durations for the seven instars of *M. confusa* as determined from laboratory rearing from eggs are summarized in Table 1. During the 1984–85 study all laboratory reared larvae died during the 7th instar. The data given for that instar in Table 1 are from larvae field collected as instars 3–6 in 1989 during a similar study at Fernow Experimental Forest, Parsons, West Virginia. The rearing times noted here for *M. confusa* larvae are considerably longer than would be expected. We suspect that the prolonged development time resulted from the frequent disturbance of this web-constructing species as fresh foliage was added. No larva pupated at instar six. We believe that within the *M. confusa* population with which we worked, seven instars are normal.

TABLE 1. Larval period of *Morissonia confusa* reared on leaves of red maple (*Acer rubrum*) at 24°C.¹

Instar	N	Mean time ± SD (days)
1	20	6.4 ± 1.8
2	19	4.2 ± 1.3
3	18	5.2 ± 1.2
4	17	7.9 ± 2.6
5	18	14.4 ± 3.0
6	13	19.3 ± 2.9
7	7	14.0 ± 0.6
Total		71.4

¹ Data for the 7th instar are from larvae field collected and reared in 1989. All 7th instar larvae in the 1984–85 laboratory study died prior to pupation.

Parasites reared from field collected *M. confusa* larvae during the 1984–85 study were as follows: *Hyphantrophaga virilis* (Aldrich and Webber) (Diptera: Tachinidae); *Euplectrus maculiventris* Westwood, *E. bicolor* (Swederus), and *Pediobius crassicornis* (Thomson) (Hymenoptera: Eulophidae); *Perilampus* sp. (Hymenoptera: Perilampidae); *Cotesia* sp., *Microplitis hyphantriae* Ashmead, *Micropolitis* spp. (2 other species) (Hymenoptera: Braconidae), *Hyposoter annulipes* (Cr.), *Dusona wyomingensis* (Vier.), *Enicospilus merdarius* (Grav.), *Itoplectis conquisitor* (Say), *Isodromas lycaenae* How., and *Mesochorus vittator* Zett. (Hymenoptera: Ichneumonidae). *Euplectrus bicolor* was the most frequently reared parasite followed by *Hyposoter annulipes* and *Microplitis* spp.

Description of Eggs and Larvae

Eggs. In the laboratory, a total of 7 egg clusters was oviposited in single-layered masses ranging in size from 48 to 316 eggs (mean = 182). No ovipositional preference was noted as egg clusters were laid on walls of the cage as well as on all four plant species. The eggs were spherical in shape, 0.62 mm in diameter (n = 50). One egg observed by scanning electron microscopy was sculptured with 37 longitudinal ridges and paralleled by transverse striae forming rectangles on the egg surface. Nine rosette cells were observed in the micropylar area. Salkeld (1984) in a detailed study of noctuid eggs noted that *M. confusa* eggs had a width of 0.60 mm, 34–35 longitudinal ridges, and 11–13 rosette cells.

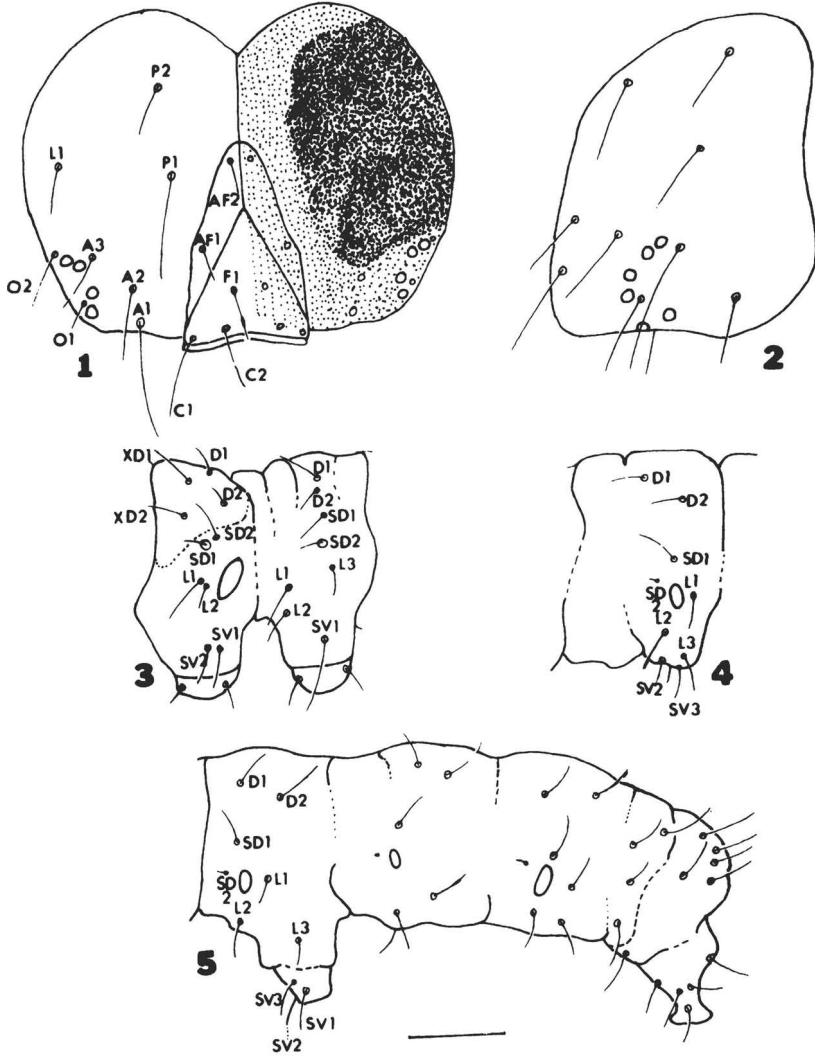
Larvae. **Instar 1** (n = 20): Head capsule \bar{x} = 0.33 mm (range 0.32–0.36), orange brown. Pinacula dark brown; cervical shield tan; thoracic legs medium brown. Body transparent with green gut contents visible; proleg sclerites dark brown.

Instar 2 (n = 19): Head capsule \bar{x} = 0.56 mm (range 0.50–0.60), orange brown. Pinacula maroon; large maroon spot surrounds SD1 setae on abdominal segments 1–8 and is expanded to include SD2 on thorax; body uniformly pale green with white D, SD, and L lines.

Instar 3 (n = 20): Head capsule \bar{x} = 0.94 mm (range 0.90–1.05). Coloration similar to that of instar 2.

Instar 4 (n = 20): Head capsule \bar{x} = 1.51 mm (range 1.43–1.57), orange brown. Pinacula dark maroon; maroon patch remains around all SD1 setae and thoracic SD2 setae, but smaller than in previous instars; D, SD, and L lines white, prominent.

Instar 5 (n = 15): Head capsule \bar{x} = 2.0 mm (range 1.86–2.15). Coloration similar to that of instar 4.



FIGS. 1-5. *Morrisionia confusa* larva, instar 7: 1, head capsule, frontal view; 2, head capsule, lateral view; 3, prothorax and mesothorax, lateral view; 4, abdominal segment 2, lateral view; 5, abdominal segments 6-10, lateral view. Setal designations follow Hinton (1946). Scale bar = 1 mm.

Instar 6 (n = 10): Head capsule \bar{x} = 3.06 mm (range 2.72-3.43), orange brown with faint darker brown reticulations. The maroon patches around SD2 setae begin fading away with those on abdominal segments 4, 5, and 6 disappearing first; white D and SD lines faint. Body becomes a mottled whitish-green as the D, SD, and L lines fade and scattered white dots appear.

Instar 7 (n = 8): Head capsule \bar{x} = 3.84 mm (range 3.54-4.16), dark brown with the exception of the tan frons, adfrons and clypeus, giving the appearance of large ocular

spots. Cervical shield and remainder of body an off-white to pale green; no maroon color remains; D and SD lines indistinct. Head capsule measurements given here for instar seven are within the range of those that we collected as mature larvae from the field and for that range given by Godfrey (1972). Body 22–33 mm long and 4 mm wide; prolegs present on abdominal segments 3–6, size increasing caudad; crochets uniordinal, 21–24 per third abdominal proleg, 23–28 per fourth, 26–29 per fifth, 28–30 per sixth. All setae simple. Chaetotaxy illustrated in Fig. 1–5.

Behavior: Larvae caged in the laboratory and observed in the field constructed a nest by webbing a single leaf or two adjacent leaves. When disturbed, larvae curl the body with the anal prolegs near the head.

Diagnosis: The only other *Morrisonia* species common within the Cooper's Rock study area is *M. evicta* (Grote). Godfrey's (1972) description of *M. evicta* states that it possesses a yellow-brown head with indistinct to dark brown reticulation and coronal stripes. At no larval instar does the *M. confusa* head have this appearance; it is orange brown and virtually unmarked until instar 7 when it is all dark brown except for the tan adfrons, frons, and clypeus. The grayish body color given for *M. evicta* differs from that of *M. confusa*. Also, *M. evicta* is described as having a shiny dark brown cervical shield, which *M. confusa* lacks in all instars. *Morrisonia mucens* (Hbn.) has not been collected at Cooper's Rock. The most diagnostic feature of *M. confusa* larvae from instars 2–6 is the presence of the large maroon spot around SD1 on all segments. This feature easily separates larvae of this species from all others in the study area.

During this two-year baseline study, *M. confusa* was one of the most frequently collected noctuids, along with *Polia latex* (Wood & Butler 1989). The Cooper's Rock study area shows a diverse community of Macrolepidoptera as indicated by blacklight trapping of 400 species of adults and the recording of 101 species of larvae from the four groups of sampled foliage (Butler, unpubl. data).

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