

# Descriptions of the Immature Stages of *Bruchomorpha oculata*<sup>1</sup> with Notes on Laboratory Rearing<sup>2</sup>

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## ABSTRACT

Ann. Entomol. Soc. Am. 74: 341-344 (1981)

The immature stages of *Bruchomorpha oculata* Newman are described. This species was reared on grass clippings under a 16L:8D photoperiod and constant temperature of 23°C. The incubation period averaged 18.8 days. Durations of the five nymphal stadia were 11.1, 8.8, 7.9, 8.8, and 12.5 days, respectively.

*Bruchomorpha oculata* Newman ranges from Maine south to Mississippi, and west to Minnesota and Kansas (Doering 1940).

Little information is available on the biology of this insect. It has been recorded from blue grass (*Poa pratensis* L.) (Wirtner 1904), soybean (*Glycine max* L.) (Balduf 1923), and sedge (Metcalf 1924). It is attacked by the dryinid (Hymenoptera) parasitoid *Bocchus mirabilis* (Perkins) (Krombein et al. 1979). A late instar was illustrated by Osborn (1922).

This paper includes descriptions of the immature stages and data on laboratory rearing.

## Materials and Methods

### Collecting Sites

Specimens to be described or used in laboratory rearing were collected from May through October in 1977 and 1978 by sweeping grassy vegetation at the following southern Illinois locations: La Rue-Pine Hills Ecological Area, Union County; Indian Creek walnut plantation, Jackson County; and Tree Improvement Center walnut plantation, Jackson County. The Indian Creek and Tree Improvement Center plantations were planted in 1965.

### Descriptions of Immature Stages

Specimens were preserved in 95% ethyl alcohol. The description of each stage is based on 10 specimens unless otherwise stated. The 1st instar is described in detail, but only major changes from previous instars are described for subsequent instars. Comparative statements refer to previous instars (e.g., "darker"). Dimensions of eggs and nymphs are expressed in millimeters as mean  $\pm$  SE. For nymphs, length was measured from tip of vertex to tip of abdomen; width was measured across the widest part of the body. Thoracic length was measured along the midline from the anterior margin of the pronotum to the posterior margin of the metanotum; this measurement was included because total length measurements are affected by differences in head shape between specimens, and because the abdomen occasionally becomes bloated when preserved in ethyl alcohol due to relatively broad intersegmental membranous areas. Drawings of eggs and nymphs were made with the aid of a camera lucida.

### Laboratory Study

Field-collected adults were kept in oviposition cages and maintained on the grass *Festuca pratensis* Hudson. Each oviposition cage consisted of a lantern globe (ca. 16.8 cm high) set on a clay flower pot (ca. 4 cm diameter at top) filled with potting soil, in which the grass was grown, and placed in a dish containing water. The soil was covered with ca. 1.5 cm of white sand so that the black adults could be easily observed. The globe was covered with a piece of cheesecloth secured by an elastic band.

Eggs were laid on the grass blades. The blades were examined daily, and eggs removed with a fine paint brush. The eggs were placed on cheesecloth on a disc of moistened filter paper that lined the bottom of a petri dish. Each dish (9 cm diameter, 2 cm depth) was covered with plastic secured by an elastic band, and covered with the lid. The plastic prevented recently hatched nymphs from escaping between the dish and lid. Upon hatching, each nymph was transferred to a separate petri dish, also with a disc of filter paper on the bottom, and reared on blade clippings of *F. pratensis*; clippings were replaced every 3 to 4 days. The grass was grown in a flat in the laboratory.

Eggs, nymphs, and adults were kept in incubators under a 16L:8D photoperiod at  $23 \pm 1.1^\circ\text{C}$ . Filter paper was changed approximately once per week and moistened every 1 to 2 days.

Data on incubation and rearing were collected daily and included the number of eggs laid, number hatched, and the number and instar of nymphal molts.

Field-collected adults were examined daily for the emergence of parasitoids. Parasitoids emerged as larvae and were left in their hosts' oviposition cages until they reached adult or died; they were then preserved in 95% ethyl alcohol.

## Results and Discussion

### Descriptions of Immature Stages

The following descriptions of eggs, 1st, 2nd, and 3rd instars are based on laboratory specimens, and those of 4th and 5th instars on laboratory and field specimens. Description of the 5th instar is based on the brachypterous form; only two macropterous field specimens were found among the five field and seven laboratory 5th instars.

**Egg** (Fig. 1A). Length  $0.96 \pm 0.007$ ; width  $0.40 \pm 0.015$ ; five specimens examined. Eggs laid singly; each

<sup>1</sup> Homoptera: Fulgoroidea: Issidae.

<sup>2</sup> Part of a dissertation submitted to Southern Illinois University at Carbondale by S.W. Wilson in partial fulfillment of the requirements of a Ph.D. in Zoology. Received for publication 31 July 1980.

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elongate, oval; white when laid, turning reddish orange ca. 7 days before hatching; chorion translucent, smooth; cephalic end with a short cylindrical process.

**1st Instar** (Fig. 1B). Length  $0.67 \pm 0.032$ ; thoracic length  $0.32 \pm 0.009$ ; width  $0.46 \pm 0.005$ ; seven specimens examined.

Form elongate, oval, subcylindrical, widest across metathorax. Body dark brown with legs, membranous areas, and pits light reddish brown.

Vertex approximately five times wider than long, carinate anteriorly and laterally. Frons subrectangular, longer than wide, broadest just beneath eyes, lateral margins convex; with a median carina; each lateral margin carinate (outer carina) and paralleled by a second carina (inner carina) approximately midway between midline and outer carina; with two longitudinal rows of pits between each inner and outer carina, inner row with six to seven pits, outer row with three to four pits. Clypeus narrowing distally, consisting of a subconical,

basal postclypeus and a beaklike, cylindrical, distal anteclypeus; postclypeus with a short basal median carina. Beak three-segmented, white, base of second segment brown, extending beyond metacoxae; segment 1 covered by anteclypeus; segments 2 and 3 subequal. Eyes red. Antennae three-segmented, brownish gray; segment 1 short, cylindrical; segment 2 subcylindrical; segment 3 bulbous basally, with an elongate bristle-like extension apically.

Thoracic nota divided by a longitudinal mid-dorsal line into three pairs of plates. Pronotum longest medially, extending to ventral level of antennae; each plate subtriangular, narrowing laterally with anterior margin arcuate and weakly carinate and posterior margin slightly sinuate, with a dorsal row of two to four pits which parallels anterior margin and with one pit ventral to eye. Mesonotum longest medially, median length 1.5 to 2 times that of pronotum; each plate subrectangular, posterior margin sinuate, with a longitudinal carina approx-

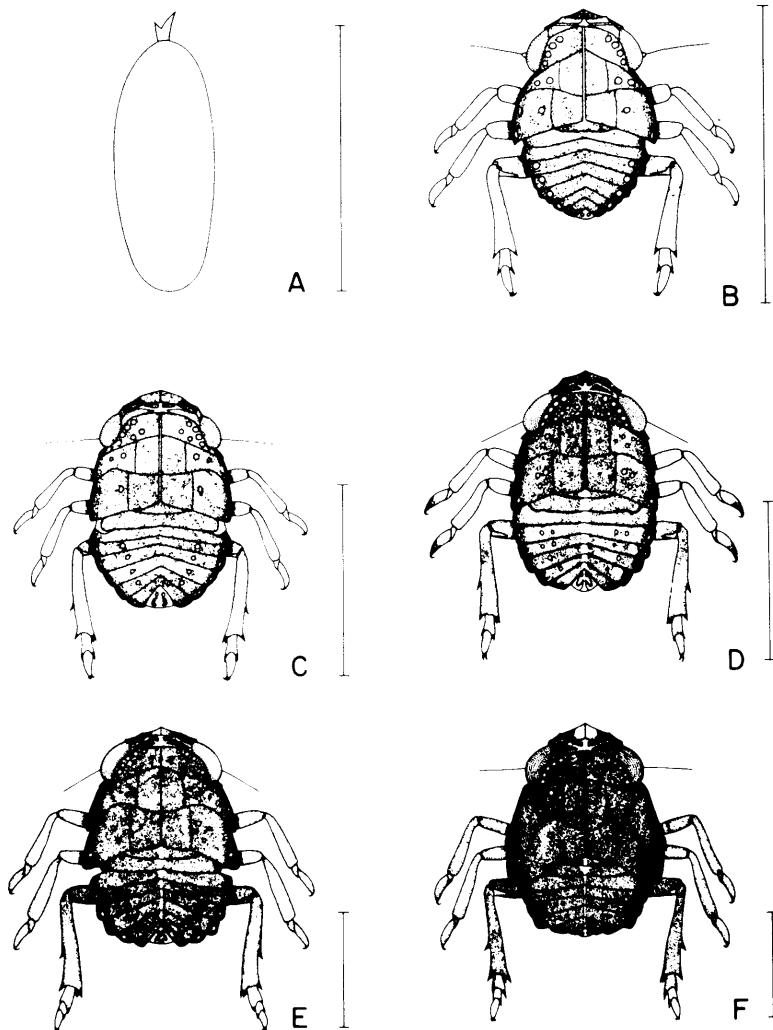


FIG. 1.—Immature stages of *B. oculata*. (A) Egg; (B) 1st instar; (C) 2nd instar; (D) 3rd instar; (E) 4th instar; (F) 5th instar. Vertical bar = 1.0 mm.

imately midway between midline of mesonotum and lateral margin of mesonotum, two pits between carina and lateral margin of mesonotum and one pit (not visible in dorsal view) in posterolateral corner of mesonotum. Metanotum longest medially, median length from two-thirds to equal that of mesonotum; each plate subrectangular, posterior margin slightly curved, with a longitudinal carina approximately midway between midline of metanotum and lateral margin of metanotum, one pit near carina lying between it and lateral margin of metanotum, and one pit in posterolateral corner of metanotum. Coxae reddish; pro- and mesocoxae elongate subcylindrical, posteromedially directed; metacoxae subrectangular transverse; remaining segments of legs with very fine setae (not illustrated). Femora and bases of tibiae yellowish brown, apices of tibiae and tarsi white. Metatibiae bearing an apical row of four black-tipped spines ventrally. Tarsi two-segmented; pro- and mesotarsi with segment 1 wedge-shaped, metatarsi with segment 1 cylindrical and bearing two apical black-tipped spines ventrally; all tarsi with segment 2 subconical and slightly curved, with a pair of black claws and a white pulvillus apically.

Abdomen nine-segmented, subcylindrical, widest across segment 3; with a well-developed dorsolongitudinal median carina; segment 9 elongate vertically, surrounding anus, with a small ventral finger-like process on either side of midline. Segments 3 through 9 with tergites curving around lateral margin to ventral side; tergites dark brown, sternites reddish. Each segment with the following number of pits on either side of midline (lateralmost, ventral and caudal pits often not visible in dorsal view): segments 4 through 7 each with two lateral pits on tergite, segment 8 with one ventral pit; segment 9 with two caudal pits.

**2nd Instar** (Fig. 1C). Length  $1.06 \pm 0.071$ ; thoracic length  $0.45 \pm 0.015$ ; width  $0.63 \pm 0.027$ ; five specimens examined.

Frons with two longitudinal rows of pits between each inner and outer carina, inner row with eight pits, outer row with four pits. Frontal process present and formed from slight anteroventral production of frons and clypeus.

Each plate of pronotum with two dorsal rows of pits which parallel anterior margin, anterior row with four pits and posterior row with two pits, and with two pits ventral to eye. Metatibiae bearing one black-tipped spine on lateral margin and an apical row of five black-tipped spines ventrally.

Abdomen with median carina weaker or absent. Segments 4 and 9 with the same number of tergal and caudal pits, respectively, as previous instar, other segments with pits generally more numerous; segments 4 through 6 each with two to three small pits on a small brown lateral sclerotized area of sternite on either side of midline.

Otherwise, similar to 1st instar.

**3rd Instar** (Fig. 1D). Length  $1.30 \pm 0.089$ ; thoracic length  $0.59 \pm 0.013$ ; width  $0.83 \pm 0.020$ ; four specimens examined.

Frons with each inner carina slightly sinuate. Postclypeus with sides subparallel, narrowing at base and apex. Frontal process slightly more produced. Beak with seg-

ment 3 approximately two-thirds the length of segment 2. Antennae with segment 2 bearing two to three pits.

Each plate of pronotum with three irregular dorsal rows totaling 9 to 11 pits which parallel anterior margin and with three pits ventral to eye. Mesonotum with median length ca. 1.5 times that of pronotum; each plate with a group of five pits between carina and lateral margin of mesonotum. Metanotum with median length approximately two-thirds that of mesonotum; each plate with two to four pits near carina lying between it and lateral margin of metanotum. Metathoracic legs brown, darker than yellowish brown pro- and mesothoracic legs.

Abdomen with a pale longitudinal mid-dorsal line. Segments 8 and 9 with the same number of pits as previous instar, other segments with pits generally more numerous.

Otherwise, similar to 2nd instar.

**4th Instar** (Fig. 1E). Length  $1.59 \pm 0.058$ ; thoracic length  $0.85 \pm 0.013$ ; width  $1.19 \pm 0.036$ ; three specimens examined.

Body almost black.

Frontal process slightly more produced. Beak with segment 3 approximately half the length of segment 2. Antennae with segment 2 bearing four pits.

Each plate of pronotum with 11 to 14 dorsal pits (rows very irregular) and with 3 to 4 pits ventral to eye. Each plate of mesonotum with a group of seven to eight pits between carina and lateral margin of mesonotum. Pro- and mesotarsi two-segmented; metatarsi three-segmented, segments 1 and 2 each terminating in two black-tipped spines ventrally, segment 3 similar to segment 2 of previous instars.

Abdomen with pale, longitudinal, mid-dorsal line narrower. Segments 8 through 9 with the same number of pits as previous instar, other segments with pits more numerous.

Otherwise, similar to 3rd instar.

**5th Instar** (Fig. 1F). Length  $1.95 \pm 0.043$ ; thoracic length  $1.00 \pm 0.017$ ; width  $1.51 \pm 0.026$ .

Frons with a longitudinal, median, pale yellow stripe. Frontal process slightly more produced. Antennae with segment 2 bearing eight pits.

Each plate of pronotum with 15 to 18 dorsal pits. Each plate of mesonotum with a group of 10 to 12 pits between carina and lateral margin of mesonotum, with a weak sinuate carina between this group of pits and lateral margin of mesonotum, and without a pit in posterolateral corner; each wingpad broadly rounded posterolaterally and covering one-half to two-thirds of each metanotal plate laterally; in macropterous form (not illustrated), wingpads narrow, almost extending to apex of metanotal wingpads. Metanotum with wingpads broadly rounded laterally, extending to third abdominal tergite; in macropterous form, to fifth abdominal tergite.

Abdomen with longitudinal stripe slightly narrower. Segments 8 and 9 with the same number of pits as previous instar, other segments with pits generally more numerous.

Otherwise, similar to 4th instar.

#### Laboratory Study

Females laid 44 eggs from 3 to 21 July, 61.4% of which hatched; the eggs were attached to the bases of

grass blades. The incubation period averaged 18.8 days (Table 1). The 1st, 2nd, 3rd, 4th, and 5th stadia averaged 11.1, 8.8, 7.9, 8.8, and 12.5 days, respectively (Table 1); total nymphal development averaged 49.1 days. Development from egg to adult averaged 67.9 days.

Two parasitoids were found during this study. A larval dryinid (Hymenoptera) emerged from a *B. oculata* adult and pupated on the wall of its host's oviposition cage; however, the adult wasp never emerged, and this parasitoid could not be identified below family level. A pipunculid (Diptera), *Cephalosphaera biscaynei* Cresson, larva emerged from a *B. oculata* adult, pupated, and emerged after 25 days.

#### Acknowledgment

We thank the following faculty members of Southern Illinois University at Carbondale (SIUC) for their critical

**Table 1.**—Duration (in days) of each immature stage of *B. oculata*.

Stage	No. completing stadium	Days	
		Range	Mean $\pm$ SE
Egg	27 <sup>a</sup>	15–25	18.8 $\pm$ 0.64
Nymph			
1st instar	21	7–14	11.1 $\pm$ 0.44
2nd instar	16	6–19	8.8 $\pm$ 0.87
3rd instar	11	5–15	7.9 $\pm$ 0.81
4th instar	8	6–14	8.8 $\pm$ 0.94
5th instar	4	10–18	12.5 $\pm$ 1.89

<sup>a</sup> A total of 44 eggs were laid.

reviews of the manuscript: R. A. Brandon, B. M. Burr, W. G. Dyer, Department of Zoology and R. H. Mohlenbrock, Department of Botany.

We also thank the following individuals for their help on this research: B. C. Weber, Forestry Sciences Laboratory, North Central Forest Experiment Station, USDA, Carbondale, for encouragement and aid and J. A. Richardson, Scientific Photography, Department of Botany, SIUC, for valuable advice in preparing the illustrations.

We thank F. C. Thompson, Insect Identification and Beneficial Insect Introduction Institute, USDA, Beltsville, Md., for confirming the identification of the fly parasitoid.

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ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA