

Field Identification and Sex Determination of *Aphidecta obliterata*,¹ an Introduced Predator of *Adelges piceae*^{2,3}

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ABSTRACT

A brief description of each stage of *A. obliterata* (L.) (Coleoptera: Coccinellidae) is given. Size differences and some ecological differences were observed between this species and *Mulsantina hudsonica* (Casey) and *M. picta* (Randall), which are predators also but native to North Carolina. Size was of limited value in differentiating *Aphidecta* from *Mulsantina* spp. in the field, but helpful

in identification of early instars. Color was an accurate and rapid means of distinguishing most stages of these lady beetles. Sex was identified correctly in 93% of *A. obliterata* adults by observing differences in head markings. Sex was identified correctly in 100% of adults by observing both head markings and length.

The balsam woolly aphid, *Adelges piceae* (Ratzeburg), was probably introduced into North America ca. 1900 on nursery stock imported from Europe (Balch 1952). Since then the aphid has caused considerable damage and mortality to true firs, *Abies* spp., in North America (Balch 1952, Johnson and Wright 1957, Amman and Speers 1965). It was discovered in North Carolina in 1957 (Speers 1958), and a research program was started in 1959 to test the ability of foreign predators to control the aphid (Amman 1961).

The European predator *Aphidecta obliterata* (L.) was released near Mt. Mitchell, N. C., in 1960 and 1963. It now appears to be permanently established (Amman 1966). Papers on the life history and descriptions of the various stages have been published by Weise (1892), Portevin (1931), Wilson (1938), Van Emden (1949), Van Dinther (1951), Delucchi (1953), Wylie (1958), and Brown and Clark (1959). The descriptions and photographs presented in this paper will aid in identifying *A. obliterata* in the field and permit differentiating this species from *Mulsantina hudsonica* (Casey) and *M. picta* (Randall), the 2 commonest native coccinellid predators of the balsam woolly aphid in North Carolina.

METHODS

Both length and width of the various stages were measured with a binocular microscope fitted with a reticle. Larvae and adults were measured for length from the anterior margin of the head to the posterior end of the abdomen and elytra, respectively. The pronotum was measured for width. Average measurements were based on 10–46 observations for each stage.

Secondary sex characteristics of 100 adults were

studied under a microscope. The adults were classified male or female according to length and head markings. Each adult was then dissected to verify sex.

RESULTS AND DISCUSSION

Egg.—The eggs of *A. obliterata* are smaller than those of *M. hudsonica*, but there is an overlap in the ranges of measurements (Table 1). *Aphidecta* eggs averaged 1.05 mm long and 0.48 mm wide (Fig. 1). Eggs were a shiny yellow when first laid, became yellowish-orange as embryogenesis proceeded, and turned gray just before hatching. Eggs of *M. hudsonica* averaged 1.23 mm long and 0.58 mm wide. Egg clusters of *A. obliterata* were found on the bottom sides and at the tips of needles in the top third of the tree. Most of the egg clusters were found within 60 cm of the bole. Eggs of the *Mulsantina* spp. were found in similar places, and also at greater distances from the bole, including needles near the tips of branches.

First-Stage Larva.—Average length of *Aphidecta* was 2.23 mm; average width was 0.59 mm. Larvae were dark brown with slightly darker spots on the abdominal segments. First-stage larvae of *Mulsantina* spp. were of similar size but black (Table 1).

Second-Stage Larva.—Average length of *Aphidecta* was 3.17 mm; average width was 0.80 mm. The head of this species was shiny and brownish-yellow, the thorax grayish-white, and the abdomen gray with 6 white spots on each segment. Second-stage larvae of *Mulsantina* spp. were similar in size but black.

Third-Stage Larva.—Average length of *Aphidecta* was 4.21 mm; average width was 1.06 mm. One characteristic yellow spot appeared on the lateral edge of the 1st abdominal tergum within 24 hr after molting into the 3rd instar. Larvae were gray with a yellow margin and a yellow median dorsal line. Third-stage larvae of *Mulsantina* spp. were similar in size, but were black with a white margin and a white median dorsal line.

Fourth-Stage Larva.—Average length of *Aphidecta* was 6.14 mm; average width was 1.56 mm. Larvae were gray with a yellow margin and a yellow median

¹ Coleoptera: Coccinellidae.

² Homoptera: Phylloxeridae.

³ Based partly on a Master's thesis submitted by the senior author to Virginia Polytechnic Institute, Blacksburg, 1967, and a Ph.D. thesis submitted by the junior author to the University of Michigan, Ann Arbor, 1966. Accepted for publication Sept. 26, 1968.

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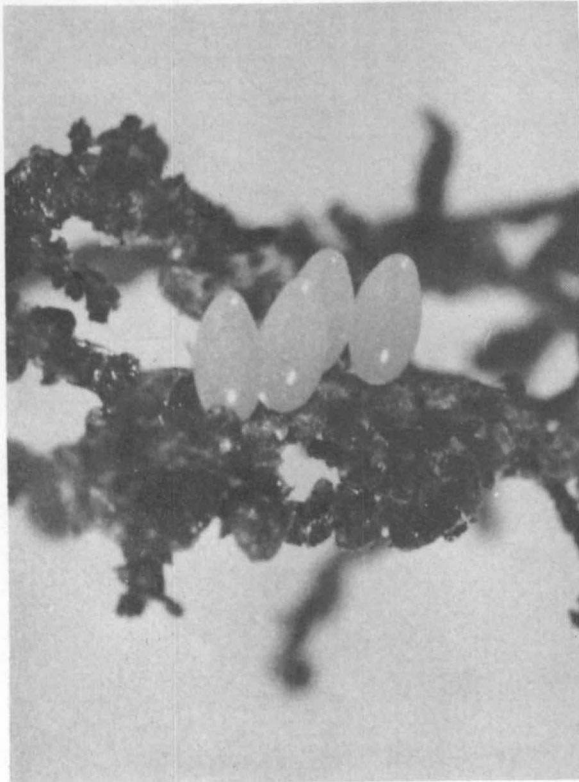


FIG. 1.—Eggs of *A. obliterata*.

dorsal line. Fourth-stage larvae of *Mulsantina* spp. were similar in size, but were black with a white margin and a white median dorsal line. Larvae of *A. obliterata* were more spinose (Fig. 2) than those of *Mulsantina* spp.

Almost all *A. obliterata* larvae were encountered resting and feeding on balsam woolly aphids on the upper bole and branches of Fraser fir. This feeding seems to be consistent with its habit of preying on twig-infesting *Adelges* in its native home in Europe

Table 1.—Measurements (in mm) of *A. obliterata* and *M. hudsonica*.

Stage	Avg length	Range	Avg width	Range	n
<i>A. obliterata</i>					
Egg	1.05	0.90-1.15	0.48	0.41-0.57	25
1st instar	2.23	1.64-2.79	.59	.45-.74	14
2nd "	3.17	2.17-4.02	.80	.66-.94	22
3rd "	4.21	2.40-6.00	1.06	.64-1.44	24
4th "	6.14	4.40-7.60	1.56	1.12-2.08	24
Pupa	3.45	3.08-3.90	2.07	1.52-2.48	12
Adult	3.88	3.04-4.21	2.24	1.60-2.48	12
<i>M. hudsonica</i>					
Egg	1.23	0.94-1.44	0.58	0.49-0.66	46
1st instar	2.49	2.13-2.56	.69	.65-.72	20
2nd "	3.14	2.40-3.76	.76	.64-.88	12
3rd "	4.54	3.62-5.00	1.11	.88-1.32	10
4th "	6.10	5.25-7.43	1.54	1.32-1.97	20
Pupa	3.55	3.28-3.84	2.38	2.13-2.64	10
Adult	4.56	4.00-5.04	2.12	1.92-2.24	12

(Wylie 1958). Larvae of *Mulsantina* spp. were found in similar habitats but their preferred prey was the balsam twig aphid, *Mindarus abietinus* Koch, which occurs primarily on new growth near the tips of twigs.

Pupa.—Average length of *Aphidecta* pupae was 3.45 mm; average width was 2.07 mm. Pupae were yellowish-brown with white spots and dark orange markings (Fig. 3). Pupae of *Mulsantina* spp. were similar in size, but white and pinkish-tan, with black spots on the dorsum. Pupae of *A. obliterata* were found on needles, twigs, under bark scales, and in bark depressions of Fraser fir; pupae of *Mulsantina* spp. were found primarily on needles and twigs.

Adult.—Average length of *Aphidecta* adults was 3.88 mm; average width was 2.24 mm. Elytra were light to dark brown, and most specimens had a black longitudinal mark near the posterior end of each elytron (Fig. 4). Adults of *M. hudsonica* were longer (average 4.56 mm) than *A. obliterata*, but the average width of the pronotum was similar (2.24 mm). *M. hudsonica* has bright orange elytra with a black longitudinal line in the middle of each. There was also 1 black mark anterior to the line about midway longitudinally, and another black longitudinal mark below the line and posterior of the middle. *M. picta* adults have yellow or orange elytra, with large coalescing black markings through the center and along the median and posterior edges of each.

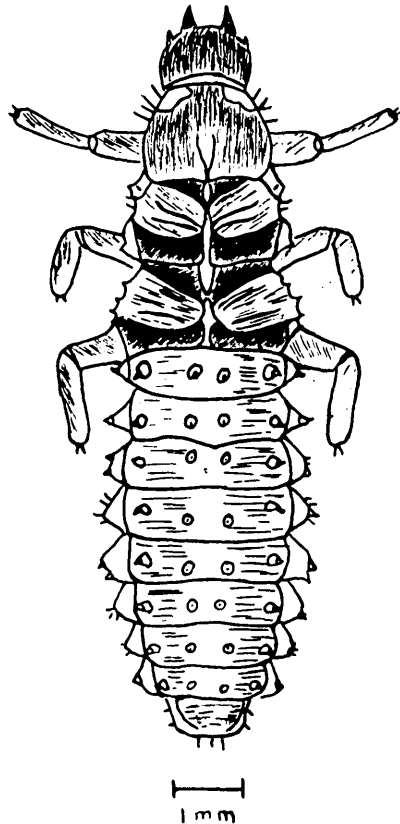


FIG. 2.—Drawing of 4th-stage larva of *A. obliterata*.

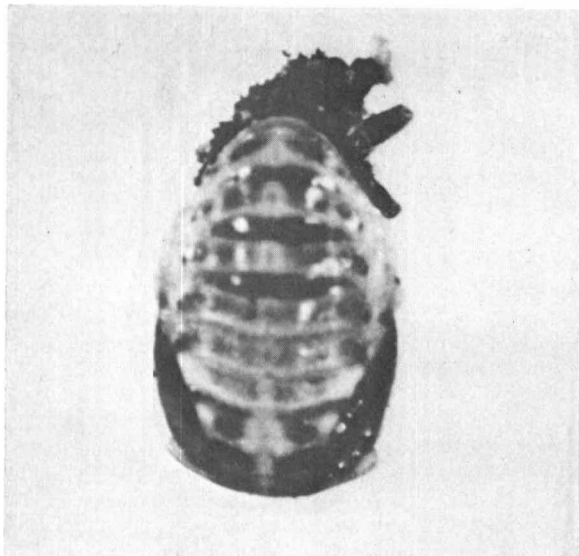


FIG. 3.—Pupa of *A. obliterated*.

Adults of *A. obliterated* were observed feeding and resting mainly on the upper portions of the bole, branches, and needles of trees. On June 3, 1966, for example, 28 *A. obliterated* adults were found on the upper portion of 1 tree, while only 4 were found on the lower part of the bole. The adults were observed on Fraser fir from mid-April to mid-August. Activities of the adult after mid-August are not known either in Europe (Wylie 1958) or in North Carolina.

Color differences would be most useful in identifying various species in the field. Measurements of the various stages of *A. obliterated* and *M. hudsonica* indicate considerable overlap; therefore, size would not be especially useful in field identification. However, measurements would be of considerable value in identifying early larval instars of individual species when the colors are similar.

Sex Identification.—By observing only differences in head markings, 93% of the adults of *A. obliterated* were sexed correctly. The typical male had broken markings down the center of the dorsal surface of the head and the markings were light brownish-black (Fig. 5). Markings of the male were not always broken, but were always lighter in hue than markings of the female. The typical female usually had a solid mark down the center of the dorsal surface of the head. The markings on the female were dark brownish-black to black, but not always solid.

Aphidecta males averaged 3.98 mm long, (range 3.84–4.12 mm). Females averaged 4.25 mm long, (range 4.13–4.37 mm). Males averaged 2.52 mm wide (range 2.35–2.69 mm). Females averaged 2.65 mm wide (range 2.51–2.79 mm). These measurements show a slight difference in widths of males and females but not enough to be used in identifying sexes.

Although the length of the adult appears fairly distinct for each sex, the use of both length and head markings assures correct identification in the area

where measurements of the 2 sexes approach each other. Sex was identified correctly in 100% of the adults by observing both the head markings and length.

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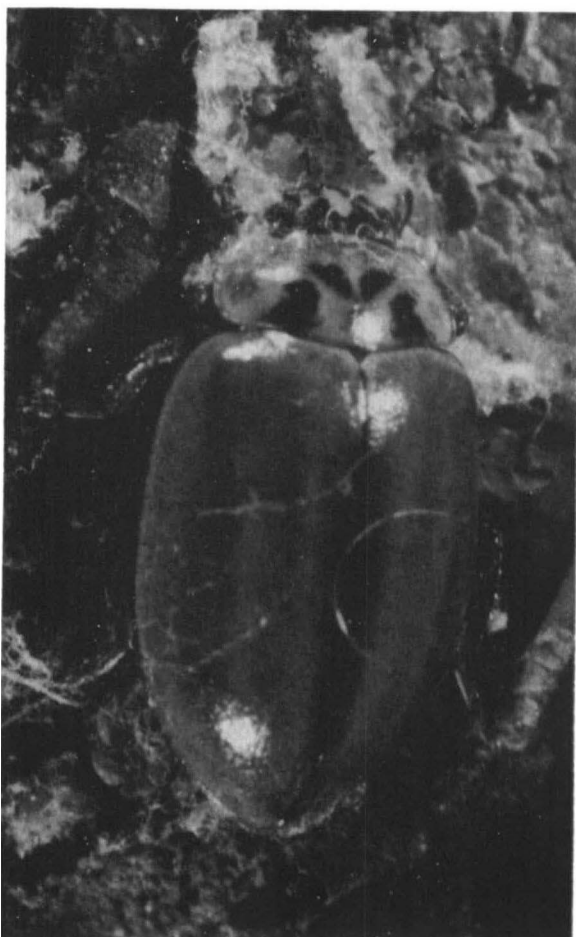


FIG. 4.—Adult of *A. obliterated*.

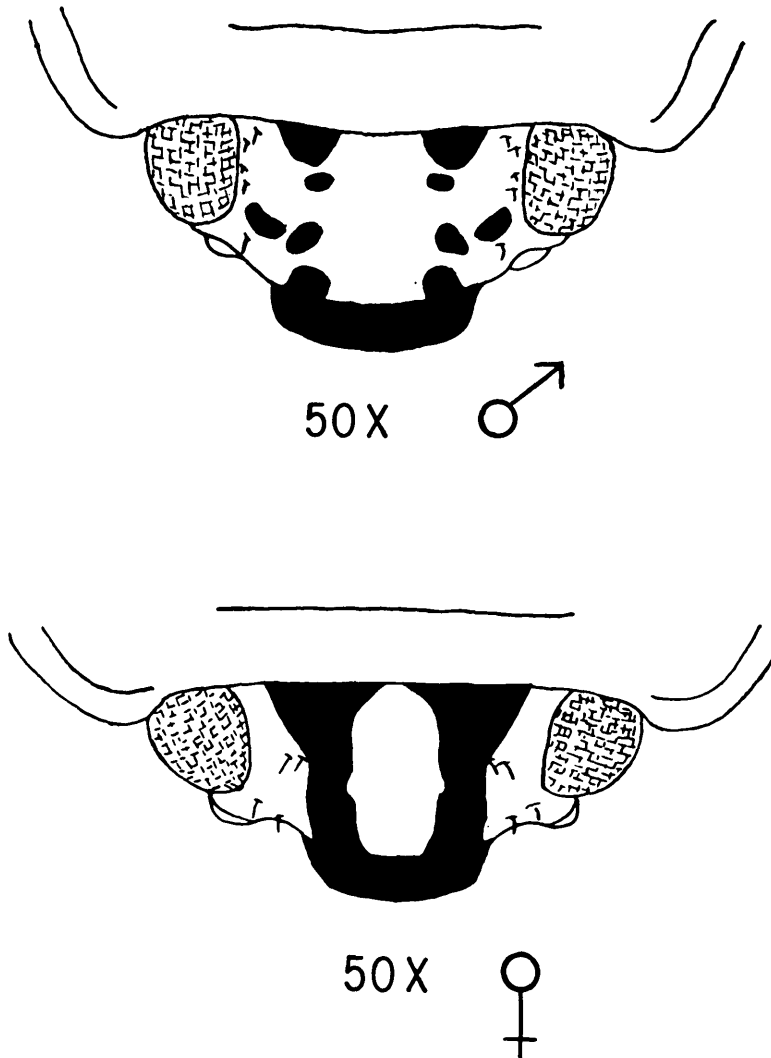


FIG. 5.—Markings on the heads of both sexes of adult *A. obliterata*.

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