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LOCATION AND CONDITION OF WHITEMARKED TUSSOCK MOTH (LEPIDOPTERA: LYMANTRIIDAE) COCOONS IN A MICHIGAN BLACK WALNUT PLANTATION

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ABSTRACT

Whitemarked tussock moth, *Orgyia leucostigma*, cocoons were monitored in a black walnut, *Juglans nigra*, plantation in Michigan from 1978 to 1981. Larvae spun cocoons on the exposed bark of the bole (29.6%), in crevices on the bole formed by pruning wounds (17.5%), beneath limbs (24.2%), and in branch crotches (28.7%). Parasites and predators destroyed 88% of the pupae in their cocoons. The tussock moth population, although moderate to high in the egg stage, decreased sufficiently in the larval stages each year to cause no more than 5% defoliation to individual trees.

The whitemarked tussock moth, *Orgyia leucostigma* (J.E. Smith), is a native defoliator that feeds on many species of trees, including black walnut, *Juglans nigra* (Nixon and McPherson 1977). In mixed-tree hardwood forests this insect is seldom abundant, but it can cause severe defoliation in monoculture hardwood forests, cities, and parks (Martineau 1984). When conditions are favorable, outbreaks develop rapidly, and then subside in one or two additional seasons, apparently as a result of natural enemies (Browne 1968, Howard 1897, Johnson and Lyon 1988). However, a single heavy defoliation by this tussock moth can reduce tree growth and subject trees to attack by secondary insects and diseases. From 1975 to 1978, this insect was particularly abundant in portions of the eastern United States and Canada where it denuded tree crowns over large acreages (Martineau 1984).

In 1978, during an investigation of a black walnut plantation near Keeler, Van Buren County, Michigan, light defoliation by the whitemarked tussock moth was observed. The level of defoliation increased in 1979. In the vicinity of Keeler, tussock moth adults appear from mid- to late July, and a few are present as late as September. The wingless females oviposit on or near their empty cocoons. After the eggs overwinter, most larvae hatch from April through June. They mature in 5 to 6 weeks and then spin silken cocoons on the bark of the host. The pupal stage lasts 2 to 3 weeks.

The objectives of the study reported here were (1) determine the location and condition of tussock moth cocoons, (2) assess tussock moth population levels, and (3) predict if these populations would be injurious to the walnut trees.

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MATERIALS AND METHODS

This study was made in a black walnut plantation near Keeler, Michigan, from 1978 to 1981. The trees were planted 3.4 to 3.7m apart from 1971 to 1973 using 1–0 and 2–0 seedlings. Thereafter, the 12-acre stand was cultivated and fertilized (NPK 18–18–18) annually. Over several years the trees received both corrective and lateral pruning. Eight 0.08 ha circular plots (diam. 32.5m) were established in 1978 to measure tree growth and to monitor insect infestations. Tree density ranged from 55 to 66 per plot for a total of 498 trees.

Tussock moth cocoons were noted in each plot in fall 1978 when the trees were 3.7 to 5.4 m tall. In 1979, we noted that many larvae were present during the summer, and on 15–17 October, we recorded the locations of all cocoons on all plot trees. Then, all cocoons, except those with egg masses on them, were removed in plots 1 and 3 and their condition noted. Cocoons with egg masses were tallied as emerged adult females. Ten egg masses were removed from the plots and reared in the laboratory. The stand was examined again in mid-August 1980, with defoliation assessed in 5% increments; each tree was inspected by two people, with the average value recorded. On 1 October 1980, cocoons were counted on 10 randomly selected trees in each plot. The study was terminated in late summer 1981, after the trees were examined for tussock moth defoliation.

RESULTS AND DISCUSSION

This insect is occasionally multivoltine in the northern United States (Johnson and Lyon 1988), but there was only one generation each year of this study. Larval densities were relatively low in the summer of 1978, and the scarce cocoons were concentrated in the southeastern corner of the plantation. Larvae were more abundant during 1979, but no trees suffered more than 5% defoliation. In addition, there were 847 cocoons observed in 1979 on the plots – an average of 1.7 cocoons per tree (range 0 to 12). Cocoons once again were most abundant in the southeastern plots 1 and 3, and relatively sparse in the northwestern plots 5 and 7. Plot 8, which was isolated from the other plots by about 200m, had the fewest cocoons.

The whitemarked tussock moth probably first entered the black walnut plantation during 1976 or 1977. Apple orchards that surround the plantation may have been the source of the infestation. Apparently the moth entered the stand in the southeast corner and then spread throughout the rest of the plantation. The southeast corner, however, maintained the highest population throughout this study.

Approximately 47% of the cocoons observed in 1979 were on the boles of the trees – 29.6% on the bark surface and 17.5% in crevices formed by pruning wounds (Table 1, Fig. 1). The remaining cocoons were either beneath limbs (24.2%) (Fig. 2) or in branch crotches (28.7%) (Table 1).

Of the 341 cocoons removed from plots 1 and 3 (including those attached to egg masses left on the trees), 12% yielded cast pupal cases and 88% contained dead pupae. Parasitic Hymenoptera and parasitic Diptera emerged from 43% and 3% of the pupae, respectively. Examination of cadavers indicated that predators attacked 7% of the pupae, and pathogens killed 33%. The cause of the remaining 2% mortality could not be determined.

Howard (1897) identified 21 species of parasites and 11 species of predators attacking various stages of the tussock moth. Also, he noted that birds readily fed on the colorful larvae. Raizenne (1952) listed 12 species of parasites that apparently were responsible for keeping outbreaks under control in Canada. In our study, natural enemies may have reduced the population sufficiently to keep defoliation below 5%.

In summer 1980, larvae were again present on several trees, but fall defoliation was no greater than that done by the 1979 population. The cocoon count for the

Figure 1. Whitemarked tussock moth cocoon in a pruning wound.

Table 1. — Locations of whitemarked tussock moth cocoons (N = 847) on 498 black walnut trees in a Michigan plantation in 1979.

	Cocoons		
Location	Mean (range)/tree	Number	Percent
Beneath limb	0.42 (0–6)	205	24.2
Limb-crotch	0.48 (0–6)	243	28.7
Bole	0.51 (0–6)	251	29.6
Bole-wound	0.29 (0–4)	148	17.5

eight plots, however, was estimated at 2,356 cocoons. This was 4.7 cocoons per tree, or nearly three times more abundant than in 1979. Nevertheless, the population collapsed in 1981 due to unknown causes. Raizenne (1952) noted that viruses often depleted tussock moth populations in Canada.

The 75 egg masses recorded in the plots in 1979 averaged 362 eggs per mass (range 333 to 478). Egg masses were not counted in 1980, but they probably were more abundant than in 1979, because the cocoon population increased from 847 in 1979 to 2,356 in 1980.

Not all the eggs reared in the laboratory hatched, and larvae that emerged lived only a few hours. This suggests that they may require food shortly after eclosion.

Figure 2. Whitemarked tussock moth cocoon in a limb-crotch. Note egg mass on the cocoon.

Howard (1897) showed that many eggs of *O. leucostigma* did not hatch during natural outbreaks, and many larvae starved to death because they were too far from foliage at eclosion. All egg masses found in the present study were on the boles and branches, and many were a meter or more from foliage.

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