Douglas-Fir Tussock Moth

Orgyia pseudotsugata (McDunnough)
Lepidoptera: Lymantriidae

Mason, R. R. 1970. Development of sampling methods for the Douglas-fir tussock moth, *Hemerocampa pseudotsugata* (Lepidoptera: Lymantriidae). *Canadian Entomologist* 102: 836-845.

Objective: To develop and compare methods of sampling *O. pseudotsugata* populations.

Abstract: The Douglas-fir tussock moth is a major defoliator of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, and true firs, *Abies* spp., in western North America. Outbreaks occur quite unexpectedly so that a large number of trees are often defoliated before direct control measures can be applied. Growth loss, top-kill and tree mortality are common during outbreaks. Procedures that estimate the density of eggs and larvae of *O. pseudotsugata* were developed and compared with respect to their standard error relative to the mean.

Population density was estimated in terms of the number of eggs or larvae per 0.645 m^2 of branch area. A significant proportion of the variation in the density of eggs and larvae was attributed to crown level and outbreak status. In an outbreak, egg masses are concentrated on inside branches near the bottom of the crown. However, in light infestations they are often on outside branches in the upper crown. The mean density of larvae in the mid-crown was representative of the whole tree. Egg density was estimated from whole branch samples collected from three crown levels. Larval density was estimated from 43-cm twig samples collected from the mid-crown. Since eggs are clumped in masses and larvae are dispersed over the foliage, larval density was estimated with less effort. Tables are provided that list required sample sizes to estimate egg and larval populations with known precision.

Sampling Procedure:

Eggs: Sample one branch from the upper crown, two from the mid-crown, and one from the lower crown. The number of eggs in each sample unit is expressed as a function of the foliated area of each branch. Estimate the foliated area per branch by dividing the product of length and width by two ((W*L)/2). All insect counts are adjusted to a 0.645 m^2 of branch area. The number of eggs in the sample is simply calculated by multiplying the average number of eggs per mass by the number of egg masses. Table 1 lists the number of sample trees required for four levels of precision.

Larvae: Cut one 43-cm foliated twig sample from the outer mid-crown, and two samples from the inner mid-crown. Special care should be taken when

using pole pruners so that larvae are not dislodged from the samples. The number of larvae on each sample unit is expressed as a function of the foliated area of each twig. Calculate twig area as in the egg sample. Table 2 lists the number of sample trees required for four levels of precision.

The authors suggest that a standard error within 20% of the mean is adequate for estimating population densities of *O. pseudotsugata*. This level of error can be attained by sampling 11 trees for larval populations in heavy infestations. In light larval or egg populations more samples would be required.

Notes: In practice, surveys of light populations are better handled through different sampling techniques involving sequential analysis. The authors suggest that this data should not be extrapolated to include trees greater than 12 m in height. Because larvae are better dispersed through the foliage than eggs, the variance is significantly smaller for larvae than for eggs. Sampling the larval population will yield more accurate results, with much less sampling effort, than sampling eggs.

Tables:

Table 1. Number of sample trees required at different levels of error for estimating egg populations at a sample point.

Mean no. of eggs per 0.645 m^2 (1,000 in^2)	Standard error as per cent of mean			
	5	10	20	40
2	1,141	285	71	18
5	1,064	266	66	16
10	981	245	61	15
20	961	240	60	15
30	955	239	60	15
40	951	238	60	15
50	949	237	59	15
60+	948	237	59	15

Table 2. Number of sample trees required at different levels of error for estimating larval populations at a sample point.

Mean no. of larvae per 0.645 m^2 (1,000 in^2)	Standard error as per cent of mean			
	5	10	20	40
2	370	92	23	6
5	260	65	16	4
10	210	52	13	3
20	190	48	12	3
30	183	46	12	3
40	180	45	11	3
50	178	44	11	3
60+	176	44	11	3

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