Western Pine Beetle

Dendroctonus brevicomis LeConte
Coleoptera: Scolytidae

Dudley, C.O. 1971. A sampling design for the egg and first instar larval populations of the western pine beetle, *Dendroctonus brevicomis* (Coleoptera: Scolytidae). *Canadian Entomologist* 103: 1291-1313.

Objective: To develop a sampling method for the egg and larval stages of *D. brevicomis*.

Abstract: The western pine beetle, *Dendroctonus brevicomis* LeConte, is primarily a pest of ponderosa pine, *Pinus ponderosa* Dougl. ex Laws., in the western USA. Outbreaks are associated with factors that contribute to a lack of tree vigor such as crowding, mechanical damage, pathogens, or drought. The insect is capable of killing sections, strips, or patches of the cambium without causing tree death. Severe infestations cause growth loss and extensive tree mortality.

This study was conducted in the central Sierra foothills of California in a mixed conifer cover type with a predominance of ponderosa pine. The distributions of attack, gallery lengths, eggs, and first instar larvae of an endemic population of *D. brevicomis* were described. Mean gallery length (GL) and mean larval densities (L) of mature populations are correlated significantly with mean attack density (A), and can be described by the simple linear regressions GL = 20.76 + 24.50A and L = 20.52 + 33.34A, respectively. The ratios of E/GL and L/GL are stable over a wide range of gallery length densities, and consequently egg-gallery length (E = - 2.63 + 1.64 GL) and larval-gallery length (L = - 5.59 + 1.32 GL) correlations are highly significant.

An 88-cm^2 sampling unit was satisfactory for estimating egg or first instar populations. Taking four paired samples, evenly spaced along the infested bole of each of four trees per *D. brevicomis* generation, provided a sampling precision of 85%. Increasing the number of paired samples to 10 and the number of trees sampled per generation to 9 improved the precision to 90%. If trees are sampled before oviposition is complete, then the number of trees sampled per generation should be increased by one for each level of precision (i.e., 1%).

SAMPLING PROCEDURE: Cut two circular 88-cm^2 sample bark cores at 1.5 m intervals along the infested bole. Extract samples by cutting through the bark with a portable circular saw. Carefully remove the cores, label and place them in a refrigerator prior to examination.

To sample eggs, remove cores with a 2 cm thick sapwood backing attached to prevent desiccation. For most trees, collect 2 sets of egg samples 1 week apart. To sample larval gallery mines, cores are taken 6-8 weeks after the initial attack when all viable eggs have hatched. These samples are taken adjacent to the earlier egg samples. Remove the sapwood backing and frass, and record the number of attacks, parent gallery length, and eggs and larval mines. Dissect all samples under 10 power magnification.

Egg sampling requires more effort than larval sampling to estimate density with similar precision (Table VIII). A practical sampling method should provide population estimates with the highest precision pertinent to the objective of the investigation. For example, at least 10 samples (20 cores) would be required to estimate egg populations at a precision level of 90% (Table VIII). If time and cost considerations are important, and a lower precision is acceptable (i.e., 85%), a minimum of 4-5 samples (8-10 cores) can be taken from just the lower half of the bole. Only nine samples (18 cores) would be required to estimate larval densities with a precision level of 90% (Table VIII).

Table:

Table VIII. The number of sample trees needed to estimate mean density of *D. brevicomis* eggs, larvae, and gallery length per dm^2 at selected sampling intensities (N_s) and precision levels. Blodgett Research Forest, Georgetown, California 1967 (Modified from Dudley, 1971).

		N_s		
Variable	Precision (%)	4	8	20
Eggs	95	52	44	40
	90	13	11	10
	85	6	5	4-5
Larvae	95	42	38	36
	90	10-11	9-10	9
	85	5	4	4
Gallery length	95	41	37	35
	90	10	9	9
	85	4-5	4	4

Table VIII reprinted with permission from the Canadian Entomologist, January 15, 2001.