

## Western Spruce Budworm

*Choristoneura occidentalis* Freeman

Lepidoptera: Tortricidae

Carolin, V. M.; Coulter, W. K. 1972. Sampling populations of western spruce budworm and predicting defoliation on Douglas-fir in eastern Oregon. Res. Pap. PNW-149. Portland: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station; 38 p.

**Objectives:** To develop a method of predicting defoliation of current growth Douglas-fir; and applying this method in area-wide surveys.

**Abstract:** The western spruce budworm, *Choristoneura occidentalis* Freeman, is an important pest of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco, true firs, *Abies* spp., Englemann spruce, *Picea englemannii* Parry ex. Englem., and larch, *Larix occidentalis* Nutt., in the western USA and Canada. Infestations in mature stands cause growth loss, top kill, and occasional tree mortality. Douglas-fir that is defoliated severely or top-killed is often subsequently attacked by the Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins.

A compilation of studies on sampling *C. occidentalis* in Oregon is presented for developing forecasting methods to predict defoliation levels of current growth Douglas-fir. Budworm density in non-feeding stages was tested for predicting the density of larvae in buds and the subsequent defoliation level. In addition, egg mass density was evaluated as an index of defoliation. Sampling cost and efficiency was emphasized in selecting appropriate sample units, sizes, and allocation of samples.

A cluster design appeared to be the best solution for sampling non-feeding stages. For low, medium, and high populations, number and size of clusters per stand, and number of stands, were determined with a sampling error of 20% of the mean, and also for other precision levels. Sampling sizes were particularly large for low egg and medium larval densities. Tables were developed using regression equations to show egg mass density, corresponding larval density, and expected degree of defoliation.

**Sampling Procedure:** The sampling procedures described in this paper are detailed and lengthy. We recommend you refer to the original publication for specific information on how to use these techniques in the field. In general, sample dominant and codominant Douglas-fir in second-growth stands. For egg sampling, collect one whole branch from the mid-crown by climbing. For larval sampling, collect four 38-cm twigs with a 10.7 m pole-pruner for each designated crown level. Locate and record the number of eggs and larvae. Multistage analysis, involving variance and costs, is used to determine optimum size and allocation of samples for these life stages.

**Notes:** The predictive relationships are based on initial estimates of egg mass density and are specific to Douglas-fir in the Blue Mountains of Oregon. The relationship between egg mass and larval density is likely to vary among regions as evidenced by the fact that egg mass size varies accordingly (Carolin and Honing 1972).

**Reference:**

Carolin, V. M. Jr.; Honing, F. W. 1972. Western spruce budworm. Pest Leaflet 53. Washington, DC: U.S. *Department of Agriculture, Forest Service*; 8 p.