Western Spruce Budworm

Choristoneura occidentalis Freeman
Lepidoptera: Tortricidae

Srivastava, N.; Campbell, R. W.; Torgersen, T. R.; Beckwith, R. C. 1984. Sampling the western spruce budworm: fourth instars, pupae, and egg masses. *Forest Science* 30: 883-892.

Objectives: To predict average densities of each life stage of *C. occidentalis* per square meter of foliage; and to develop a sampling program based on a predictive equation linking branch tip estimates to whole-tree and whole-plot densities.

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 Engelm., and larch, *Larix occidentalis* Nutt., in the western USA and Canada. Infestations in mature stands cause growth loss, top kill, and occasional tree mortality.

Foliage samples were collected from the lower, mid-, and upper crowns of Douglas-fir and grand fir, *A. grandis* (Dougl.) Lindl., in Washington, Oregon, Idaho, and Montana. Populations of *C. occidentalis* larvae were sampled during the fourth instar larval stage and also during the egg and pupal stages. A sampling scheme based on a predictive equation that links whole-tree density of *C. occidentalis* to densities found on 45-cm branch tips was presented for each life stage.

No significant differences were found between distributions of eggs, larvae or pupae between Douglas-fir and grand fir. Mid-crown samples of fourth instars and egg masses were good predictors of density in the whole stand. Whole-stand density (WS_L , WS_E) per square meter of foliage was related positively to average density on terminal tips (X_M) taken from the mid-crown (WS_L = 0.238 (X_M), R^2 = 0.98; WS_E = 0.82 (X_M), R^2 = 0.88). Lower crown, terminal tip samples for pupae (X_L) were also related positively to density of the whole stand (WS_P) per square meter of foliage (WS_P = 0.629 (X_L), R^2 = 0.89).

Sampling Procedure: Select a minimum of 15 trees, 7-14 m in height, randomly within a 5-ha plot. Remove two sample branches with pole pruners from the mid-crown if sampling fourth instars and egg masses, and lower crown if sampling pupae. Branch length should be measured from the base of the foliage to the tip. Branch width is measured perpendicular from the midrib to the outermost edge. Estimate foliated area per branch by dividing the product of length and width by two ((W * L)/2). After measuring each branch, remove a 45-cm terminal tip from the branch. Count and record the number of each life stage present.

In dense populations (i.e., 100 fourth instars, 10 egg masses per tip, or 40 pupae per square meter of foliage), a precision of ± 20% can be obtained by sampling one tip from each of 15 trees (fourth instars), 48 trees (egg masses), and 9 trees (pupae).