Western Spruce Budworm
Choristoneura occidentalis Freeman
Lepidoptera: Tortricidae

Objective: To validate a method of stratified sampling for *C. occidentalis* pupae on branch tips.

Abstract: Western spruce budworm, *Choristoneura occidentalis* Freeman, is an important pest of Douglas-fir [*Psuedotsugae menziesii* (Mirb.) Franco], true firs (*Abies* spp.), Englemann spruce (*Picea englemannii* Parry ex. Englem.), and larch (*Larix occidentalis* Nutt.) in the western US and Canada. Infestations in mature stands result in growth loss, top kill, and occasional tree mortality.

Methods of sampling spruce budworm, *Choristoneura fumiferana* (Clemens), were validated for use with *C. occidentalis* pupae in north-central Washington. Mean pupal densities from 45-cm branch tips accurately estimated the whole-tree pupal density. Pupal densities varied among the upper, middle, and lower crown levels, thus stratified sampling from all three levels is recommended. Pupal densities did not differ among terminal tips, lateral tips, and whole branches. The recommend sampling unit consists of two 45-cm terminal or lateral branch tips from each crown level of a tree. In this study, the mean number of pupae per 100 buds ranged 0.6–11.3 (± 0.18–3.50 SEM). At this range of densities, the authors suggest sampling 10 clusters of three trees each to estimate pupal densities with a 15% level of precision.

Sampling Procedure: Conduct sampling in early to mid-July when most *C. occidentalis* larvae have pupated. Randomly select 10 sampling points within 5-ha plots. At each point, randomly select three host trees for sampling. Divide the live crown of each tree into thirds. Cut at least two 45-cm terminal or lateral branch tips from the upper, middle, and lower crown levels of each tree. Count the number of pupae and the number of buds present on each branch tip. Express pupal densities as counts per m^2 foliage or per 100 buds.

Check the precision level after sampling 10 clusters of three trees each. In this study, the mean number of pupae per 100 buds ranged 0.6–11.3 (± 0.18–3.50 SEM). At this range of densities, the authors suggest sampling 10 clusters of three trees each to estimate pupal densities with a 15% level of precision. Continue sampling if the desired precision level has not been met yet.

Note: The authors found that variation among trees had a greater effect on pupal density than variation among clusters, therefore they suggest sampling additional trees in each cluster rather than including additional clusters of three trees each.