

Spruce Budworm

Choristoneura fumiferana (Clemens)

Lepidoptera: Tortricidae

Wilson, L. F. 1959. Branch "tip" sampling for determining abundance of spruce budworm egg masses. *Journal of Economic Entomology* 52: 618-621.

Objective: To develop an efficient and accurate sampling technique, based on area stratification, for estimating *C. fumiferana* egg mass densities on balsam fir.

Abstract: The spruce budworm is the most destructive defoliator of balsam fir, *Abies balsamea* (L.) Mill, and white spruce, *Picea glauca* (Moench) Voss, in eastern North America. The last three larval instars (i.e., fourth, fifth and sixth) cause most of the defoliation. Periodic outbreaks occur every 30 years and epidemics can last 5-10 years. A study was carried out in Superior National Forest, Minnesota to determine if reliable estimates of egg mass density could be obtained by conducting partial samples based on area stratification. This sample plan is a modification of methods developed previously whereby sample sizes are decreased without reducing greatly the accuracy.

The majority of egg masses were found within the first 8 cm of new growth. Thus, the technique called for separating the tips of the shoots from the rest of the branch. The number of egg masses per tip (Y) was related positively to the number of egg masses per branch (X) ($Y = 1.167X - 0.055$) ($R = 0.99$, $P = 0.05$, $n = 145$). To adjust the density of budworm egg masses on branch tips to reflect the density of egg masses per branch, add 16% to the total number of egg masses per tip. Depending upon the size of the branch, the time saved by this technique ranges from 25-40% over previous techniques. Branches of all sizes from all crown levels can be examined using this technique. However, this sample method is not feasible on branches with severe or complete defoliation because females ovipositing on these branches tend to place their eggs adjacent to the main stem.

Sampling Procedure: Cut either a 38-cm long branch tip or a whole branch from the live crown of balsam fir. Refer to the description below and Fig. 1 for a graphical representation of the stratification procedure (letters A-F correspond with those in Fig. 1).

- A. Remove a balsam fir branch.
- B. Cut nodal branchlets from the main stem and put aside for further treatment.
- C. Remove the terminal shoot 10 cm below the main bud if foliated, and 10 cm below the defoliated area if defoliation has occurred. Put aside for counting of egg masses.

- D. Cut short internodal branchlets (2.5 - 12.5 cm) at their center and put aside for counting. Cut long internodal branchlets in same way as nodal branchlets and put aside for further treatment. Discard remaining foliage.
- E. Assemble nodal and long internodal branches (see Fig. 1).
- F. Cut apical twigs from nodal and internodal branches; cut lateral twigs less than 7.5 cm in length at their base and lateral twigs greater than 7.5 cm at their center. Put aside for counting of egg masses. Discard remaining foliage.

Count and record the number of egg masses for each sample. Sample an appropriate number of trees per stand to give an average representation of the whole stand.

Note: This sampling plan is based merely on 145 samples taken from all parts of the live crown and from different sized branches. Therefore, use this plan with caution.

Figure:

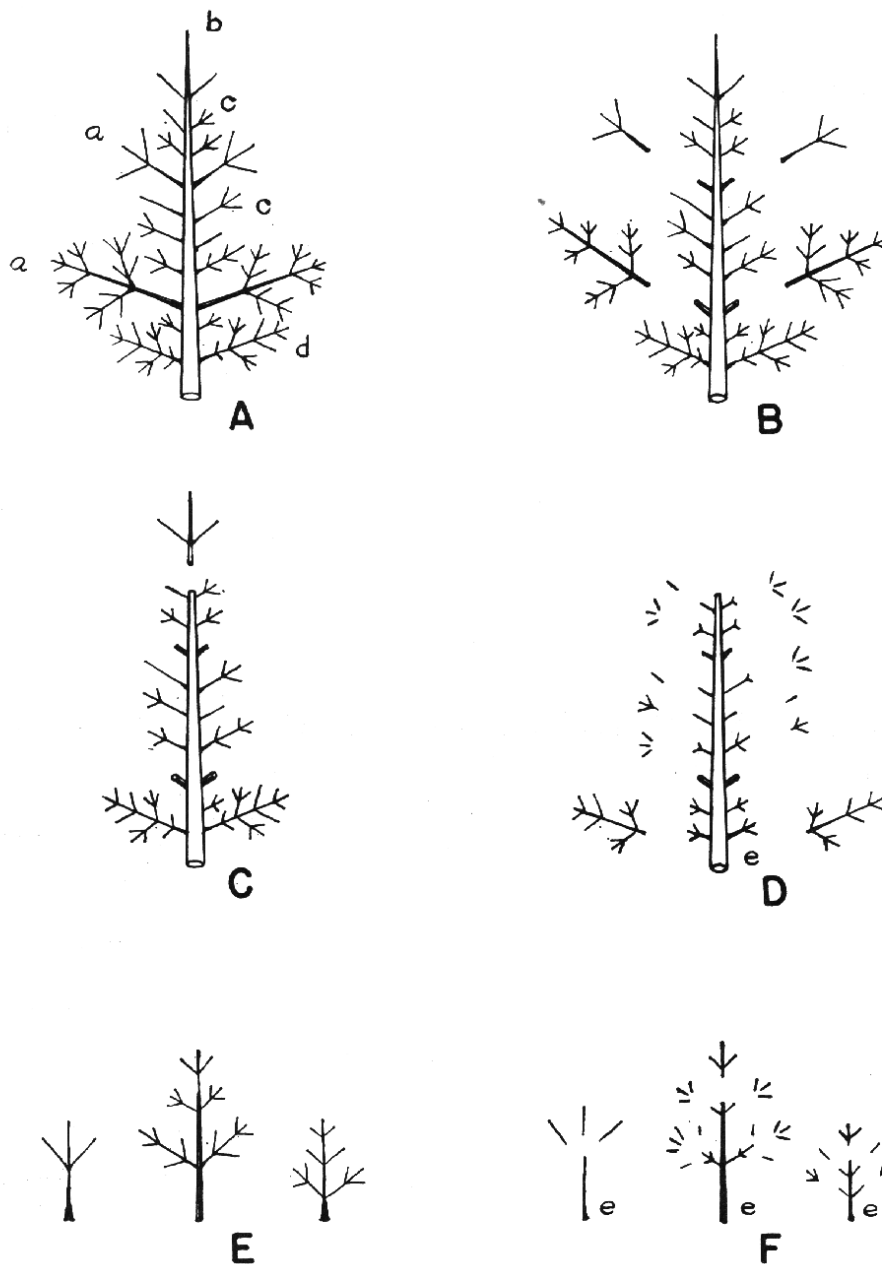


FIG. 1.—Branch “tip” sampling technique showing the proper sequence of sampling. Small letters in drawings A, D, and F denote the following: a, nodal branchlet; b, apical branch tip; c, short internodal branchlets; d, long internodal branchlets; e, discard material.

- A. Cut balsam fir branch.
- B. Cut nodal branchlets from main stem and put aside for further treatment.
- C. If terminal shoot of main stem is not defoliated, cut it 4 inches behind bud; if defoliated, cut 4 inches behind defoliated area. Put aside for counting egg masses.
- D. Cut short internodal branchlets (1 to 5 inches long) at their center and put aside for counting. Cut long internodal branchlets in same way as nodal branchlets and put aside for further treatment. Discard remaining (e) foliage.
- E. Assemble nodal and long internodal branchlets.
- F. Cut apical twigs from nodal and internodal branchlets; cut lateral twigs (less than 3 inches) at their base; cut lateral twigs (more than 3 inches) at their center. Put aside for counting egg masses. Discard remaining (e) foliage.

Figure 1 reprinted with permission from the Journal of Economic Entomology, January 15, 2001.