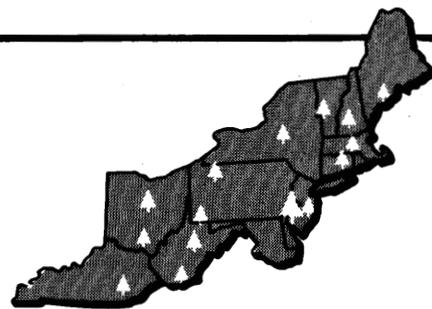


1978

Northeastern Forest Experiment Station



FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA. 19082

A SAMPLING DEVICE FOR COUNTING INSECT EGG CLUSTERS AND MEASURING VERTICAL DISTRIBUTION OF VEGETATION

SOUTHERN FOREST EXPERIMENT STATION
LIBRARY

MAR 2 1978

—ROBERT L. TALERICO
Research Entomologist,

—ROBERT W. WILSON, JR.
Research Forester
Northeastern Forest Experiment Station,
Hamden, Connecticut

Abstract. The use of a vertical sampling pole that delineates known volumes and position is illustrated and demonstrated for counting egg clusters of *N. sertifer*. The pole can also be used to estimate vertical and horizontal coverage, distribution or damage of vegetation or foliage.

INTRODUCTION

Field entomologists often have to estimate numbers of insects by examining branches, buds, or twigs. Insect eggs are especially difficult to find and count for population studies or surveys. Several years ago, we investigated ways to estimate numbers of sawfly eggs or egg clusters in a pine plantation. We built a sampling pole that delineates known volumes for sampling to estimate population parameters of interest. For instance, it can be used for estimates of vegetation coverage, vertical and horizontal distribution of vegetation or foliage, and estimates of damage to vegetation caused by defoliation or deer browse.

We will illustrate the use of the sample pole on an insect problem, but the same procedure can be used for vegetation or damage assess-

ment. Larvae of the European pine sawfly (*Neodiprion sertifer* (Geoffroy)) are spring colonial defoliators of Scotch, red, jack, mountain, and mugho pines. The economic impact of defoliation is particularly severe in plantations of Christmas trees approaching marketable size.

Several techniques are available for counting *N. sertifer* eggs, larvae and cocoons. Lyons (1964) utilized quadrats of various sizes for sampling cocoons and found that the optimal size of the quadrat is related to cocoon density and degree of aggregation, soil type, and method of cocoon extraction. To estimate densities of egg clusters and larval colonies, he used the quadrats and whole trees as sampling units. He concluded that using whole trees generally gave more precise results. Wilson and Gerrard (1971) have proposed a method of estimating the mean number of egg clusters or larval colonies per

tree from an estimate of the proportion of trees that are infested.

Working with 6- to 8-foot tall trees, we found it difficult to count egg clusters accurately. Sawfly eggs are laid in the fall in loose clusters on the current year's needles. Foliage must be examined thoroughly and systematically to make sure none of the clusters is missed or counted more than once. Examination of whole trees is expensive unless the trees are quite small. The sampling pole was used to overcome these problems by delineating a volume of known size and position.



The sampling device

In field situations it is very difficult to locate the boundaries of vertical sampling units. To overcome this problem, a hardwood pole, 1 inch in diameter and 6 feet long, was fitted with 3/8-inch hardwood dowels at 1-foot intervals from the base to the top (Fig. 1). Each dowel is at a right angle to the one below. Near each end of each dowel, a 3/16-inch vertical hole was drilled; the two holes being 8.478 inches apart. A 1/8-inch sighting wire can be inserted vertically through the holes. The dowels and sighting wires delineate a 0.25 cubic foot (0.5 x 0.5 x 1.0 ft) space (Fig. 2). For trees taller than 6 feet, two poles can be joined with an aluminum sleeve to provide a stack of 11 cubes. Larger or smaller volumes can be sampled by using different distances between the dowels and sighting wires. Each cube is a vertical sampling unit. Numbers of egg clusters and the presence or absence of vegetation can be recorded for each vertical unit.

During the preliminary field trials, it became apparent that the convenient size of sample unit depends on stand conditions. In open stands, cubes as large as 2 feet on a side are convenient. Smaller cubes are easier to use when the foliage is dense. In our judgement a 0.25 cubic foot unit is satisfactory in such conditions. The sampling pole should be as long as the tallest tree expected to be encountered.

Field test

To gain experience with the sampling pole, we sampled a 20-acre Scotch pine plantation at Pine Plains, Dutchess County, New York, that was infested with the European pine sawfly. The plantation was established in 1958. Data were collected during the winters of 1969 and 1970.

Four 208- by 208-ft blocks were selected at random in the plantation. A map of each block was divided into quarters five times in succession, producing 1024 squares 6.5 by 6.5 feet.

Figure 1.—General view of the sampling pole being used to delineate vertical sampling units.

Figure 2.—Detailed view of the sampling pole in use. Sighting wires are being used to locate position for clipping a branch with a hand pruning tool.



Each square was partitioned into 169 smaller squares measuring 0.5 by 0.5 foot, the outer dimensions of the sampling pole.

We used cluster sampling to select the sampling units. In cluster sampling terminology, the blocks are called primary units and the 0.5-by 0.5-ft squares are the elementary sampling units.

We selected at random two secondary units in each block, two tertiary units within each selected secondary unit, and so on. Altogether we selected 128 sampling units per block.

In the plantation, the sampling pole was placed as close as possible to the sampling location indicated on the map. The current year's foliage within each vertical sampling unit was collected and logged for later examination. The number of eggs and egg clusters and the presence or absence of foliage was recorded for each vertical unit.

RESULTS AND DISCUSSION

In our sample, we found 28 egg clusters ranging in size from 60 to 170 eggs, with a mean size of 59.3 ± 6.28 eggs per cluster. The average size of the egg clusters did not differ significantly, nor is there any evidence that size of egg cluster varied with density of egg clusters (Table 1).

However, there is evidence that egg clusters higher in the tree were larger (Table 2). The mid-crown mean differs little from the overall mean. Lyons (1964) noted that the largest egg clusters of *N. sertifer* are most often found in the upper crowns of red pines.

The number of egg clusters also varied with height in the crown (Table 2). In this plantation, the tree crowns extended to the ground, but crown closure was nearly complete. The egg

Table 1.—Characteristics of the Scotch pine plantation and *N. sertifer* egg populations in the four blocks sampled.

Item	Block				All
	A	B	C	D	
Mean tree dbh (inches)	0.9	1.6	2.4	1.4	
Mean height of dominants (feet)	5.8	8.6	7.9	8.0	
Trees per acre	644.5	1,482.4	999.0	1,192.4	
Eggs per tree	638	867	1,504	1,203	
Eggs per square foot	9	29	34	34	
Eggs per acre	411,000	1,285,000	1,521,000	1,435,000	
Mean number of eggs per cluster	50.3(3) ^a	71.8(6)	55.2(10)	58.6(9)	59.3(28)
Standard error	12.6	21.3	7.4	10.3	6.3

^a Sample size in parenthesis.

Table 2.—Number and relative density of *N. sertifer* egg clusters according to vertical position in the tree crown canopy.

Item	Height Above Ground (ft)			
	6-9	3-6	0-3	All
Mean number of eggs per cluster	72.6(5) ^a	59.0(16)	50.6(7)	59.3(28)
Standard error	26.5	61.2	11.4	6.3
Proportion of egg clusters in the sample	.18	.57	.25	1.00
Current foliage space in the sample - ft ³	7	34	59	100
Egg clusters per cubic foot of foliage space (no.)	.71	.47	.12	.28

^a Sample size in parenthesis.

clusters were distributed in the upper, middle, and lower thirds of the tree height in the ratio of 1:2:1. When the number of clusters is compared with the amount of space occupied by current foliage (where the eggs are deposited) in each height level, it is apparent that the density of clusters increases from 0.12 per cubic foot of foliage space in the lower crown to 0.71 per cubic foot in the upper crown. This substantiates the conclusion of Lyons (1964), that the sawfly preferred to oviposit on the exposed portions of the crown.

These examples show the wide range of data that can be obtained with our vertical sampling pole. We feel that it is widely applicable to the investigation of other problems.

ACKNOWLEDGMENTS

The field assistance of David L. Hubbard, forestry technician, and Alan A. Squires, biological technician, is greatly appreciated.

LITERATURE CITED

- Lyons, L. A.
1964. The spatial distribution of two pine sawflies and methods of sampling for the study of population dynamics. *Can. Entomol.* 96:1373-1407.
- Wilson, L. F. and D. J. Gerrard.
1971. A new procedure for rapidly estimating European pine sawfly (*Hymenoptera:Diprionidae*) population levels in young pine plantations. *Can. Entomol.* 103:1315-1322.