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A Photographic Technique for Estimating Egg Density of the White Pine Weevil, Pissodes strobi (Peck)

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ABSTRACT

Compares a photographic technique with visual and dissection techniques for estimating egg density of the white pine weevil, *Pissodes strobi* (Peck). The relatively high correlations (.67 and .79) between counts from photographs and those obtained by dissection indicate that the non-destructive photographic technique could be a useful tool for determining egg density.

INTRODUCTION

The white pine weevil, *Pissodes strobi* (Peck) is a major pest of coniferous trees in the northeastern United States, causing losses of several million dollars annually. Its major hosts are eastern white pine, (*Pinus strobus* L.), pitch pine, (*Pinus rigida* Mill.), Jack pine (*Pinus banksiana* Lamb.), and red spruce, (*Picea rubra* Link.)

Life-table data on this insect are being collected to improve our understanding of its population dynamics and facilitate its control. Several methods of gathering these data have been used (Waters and McIntyre 1953; Marty and Mott 1964; Ford, Talerico, and Mott 1965). These methods were based either on counts of adult weevils or on the number of weeviled leaders in a stand. Adult populations can also be predicted from egg-stage measurements, but determining egg density is time-consuming, expensive, and destructive. It requires removing the leader from a tree and examining it under a dissecting microscope to count the egg holes, or dissecting it to determine the actual number of eggs present. This study was designed to evaluate a rapid, nondestructive photographic technique for determining egg density.

METHODS

Field Procedures

The study was conducted during the spring and summer of 1971 in a mixed white pine and larch plantation in Cheshire, Conn. Forty white pines 2 to 7 feet in height, and showing signs of either oviposition or extensive feeding, were selected for study.

All needles were removed from the leaders of 20 trees; the other 20 trees were left unaltered. The leaders were marked with white enamel on the east, north, west and south sides. Each week five trees with deneedled leaders (fig. 1) and five trees with unaltered leaders (fig. 2) were selected for study. Leaders were photographed in the field, then cut and taken to the laboratory for study and dissection.

Figure 1.—Signs of fresh feeding on a leader with needles removed.

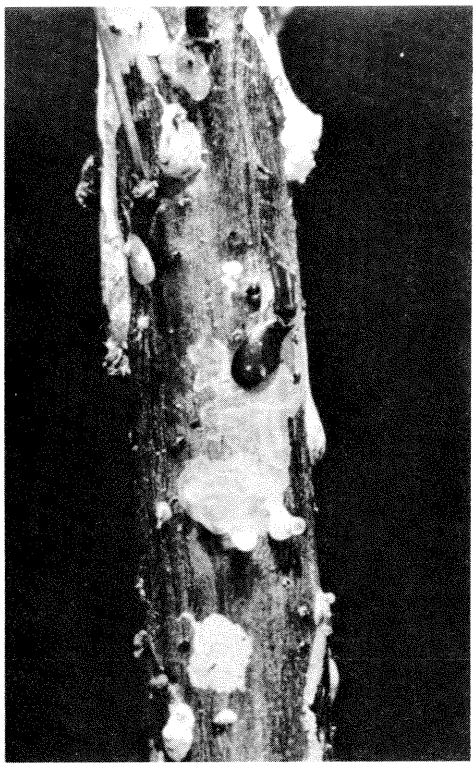


Figure 2.—Unaltered leader.

Photographic Technique

The photographic equipment and techniques used to obtain the photographs are outlined in an unpublished office report on file at the Forest Insect and Disease Laboratory at Hamden, Connecticut.

Laboratory Procedures

Egg holes were first counted from the 35mm transparencies and recorded by section and compass quadrant. Then 50mm sections, beginning just below the new growth, were marked on the leaders, using landmarks such as needle fascicles that appeared in the transparencies. Under a dissecting microscope, egg holes visible in each section and quadrant were counted. Then the leaders were dissected to obtain an exact count of eggs present.

RESULTS AND DISCUSSION

A comparison of these egg counts is shown in table 1. The number of egg holes counted on the photographs for the deneedled leaders was 1202 as compared to 1037 counted visually. The actual number of eggs found was 1126. On the unaltered leaders the hole count from photographs was 305, the visual hole count was 463 and the actual number of eggs found on dissection was 513.

Linear regression analysis was used to compare these egg-counting techniques: the results are shown in table 2. The total number of eggs found on all the deneedled leaders did not differ significantly from the hole counts made from photographs or visually, but individual counts were highly variable. The correlation between the photo counts and dissection counts in both the deneedled and unaltered leaders ranged from .7 to .8, but the standard deviation ranged from 20 to 25. Although this amount of variation may be unacceptable for some applications, the data indicate that the photo technique would be useful where nondestructive sampling is required.

The highest correlations were between egg hole counts made under the dissecting microscope and actual numbers of eggs found by dissection (.96 to .82).

Table 1.—Holes and eggs counted on white pine leaders from photographs, visually, and by dissection

Deneedled leaders				Unaltered leaders			
Leader number	Photo (holes)	Visual (holes)	Dissect (eggs)	Leader number	Photo (holes)	Visual (holes)	Dissect (eggs)
1	64	44	31	18	15	43	57
2	41	34	49	19	9	20	22
3	70	77	67	20	25	23	28
4	46	24	30	21	9	8	7
5	30	27	44	22	40	71	79
6	45	28	28	23	35	44	49
7	16	13	19	24	25	39	49
8	28	16	23	25	20	17	21
9	65	66	80	26	53	100	106
10	53	51	71	27	25	52	51
11	69	56	57	28	49	46	44
12	62	58	84	—	—	—	—
13	65	55	47	—	—	—	—
14	75	66	53	—	—	—	—
15	205	127	129	—	—	—	—
16	83	153	154	—	—	—	—
17	185	142	160	—	—	—	—
Total	1,202	1,037	1,126	Total	305	463	513

Twelve leaders were not examined because growth of saprophytic fungi made landmarks and egg and feeding holes unrecognizable.

Table 2.—Regression analysis of hole and egg counts by different methods

Statistic	Unaltered leaders		Deneedled leaders	
	Photo-dissection	Visual-dissection	Photo-dissection	Visual-dissection
Intercept	14.9303	.9134	17.3401	5.8597
Slope	1.1824	.9786	.6915	.9897
r	.6765	.8245	.7958	.9621
Standard deviation	19.7349	16.2603	25.6456	11.5555

The highest correlation between egg hole counts made from transparencies and actual egg numbers was in the leaders with needles removed (.79). Although the surface of the leader was not obscured by needles, any scars, feeding punctures or imperfections increased the counting error and, as a result, the standard deviation was high.

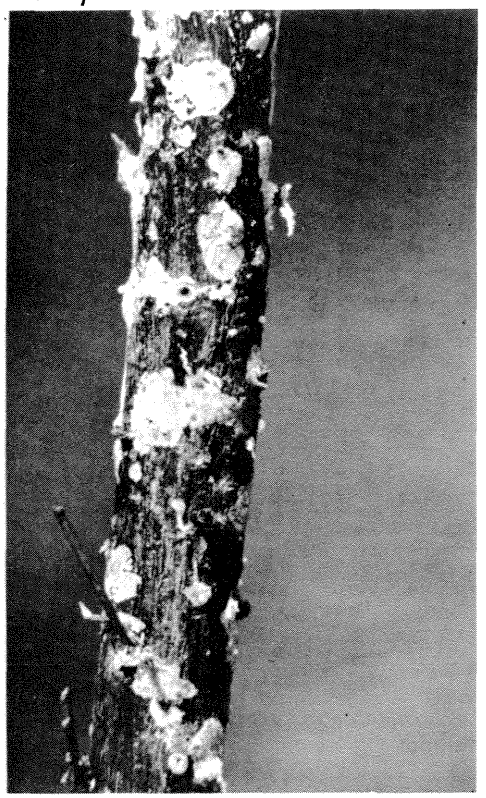
The lowest correlation between egg hole counts and egg numbers was in the unaltered leaders (.67). Needles obscured egg holes on these leaders and the resulting counts were low.

The highest variability in photo and visual counts was at the top 50mm of the leaders. Feeding is begun at the top of the leader near the new growth and the highest concentrations of eggs are found in this area.

Several seasonal changes interfered with the interpretation of the photographs. Large numbers of feeding punctures and large quantities of pitch on the top 50mm of the leader caused confusion in counting (fig. 1) as did developing larvae migrating down the leader. Additionally, landmarks changed as needle fascicles dropped off (fig. 3). Furthermore, the leaders had to be dissected within 2 weeks after cutting or saprophytic fungi obscured landmarks and egg holes.

Other factors that caused problems were

Figure 3.—Leader with needles removed (late in season).



wind, damage to leaders, and inadequate marking. Identifying marks should be made from the top of the leader to the first whorl at predetermined positions (N.E.S.W.). Marks at 50mm intervals should be made around the leader. Also, a support to stabilize the camera at a predetermined spot would enable the operator to shoot exactly corresponding pictures in successive weeks. These changes would improve the system, but the greatest success would still be achieved with leaders with a low needle density.

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