

***Pissodes* Terminal Weevils**

White Pine Weevil, *Pissodes strobi* (Peck)

Lodgepole Terminal Weevil, *Pissodes terminalis* Hopkins

Coleoptera: Curculionidae

Fletcher, V. E. 1986. Development of sampling guidelines for estimating the proportion of weeviled trees on a plantation (plus errata). Forest Service Internal Rpt. PM-PB-18. Victoria, B.C.: British Columbia Ministry of Forests; 19 p.

Objective: To estimate the density of leaders damaged by *P. strobi* and *P. terminalis* at the 80 and 95% confidence levels in coastal plantations of Sitka spruce trees in British Columbia.

Abstract: White pine weevil, *Pissodes strobi* (Peck), is an important pest of a number of spruces, *Picea* spp., and pines, *Pinus* spp., in North America. Larvae tunnel down through the terminal leader of host trees, destroying the apical dominance of the shoot and destroying two years' growth. The resulting tree deformation reduces the commercial value of sawlogs and landscape trees. Stands of even-aged spruce trees, such as plantations or natural regeneration following a fire, are susceptible to attack when juvenile and are most susceptible between 10 and 30 years old. Attack by *P. strobi* typically does not kill older trees, but does reduce their growth rate. The related lodgepole terminal weevil, *Pissodes terminalis* Hopkins, produces similar damage in current-year growth.

Systematic sampling of trees in plantation rows provides an estimation of the percentage of trees attacked by *P. strobi* and *P. terminalis*. Systematic sampling offers the benefits of uniformly covering the plantation while detecting random and aggregated attacks. Sampling guidelines were developed for *Pissodes* spp. in Sitka spruce based on visual observation of terminal damage along set transects across a plantation. Managers can use this sampling scheme to determine the extent of an infestation before applying a residual insecticide in the spring when adults are feeding but before oviposition occurs, or to evaluate the efficacy of chemical application.

Sampling Procedure: Use Table 6 to determine the sample size (number of transects) needed given a required bound on the error of estimation and a set confidence interval of 80 or 95%. Twenty transects per plantation is a general recommended guideline. Determine a "transect interval" by dividing the total number of rows at the plantation by the number of transects required. If the plantation has 150 rows and 20 transects are desired, then the resulting transect interval is 8 after rounding up. Randomly choose a number between 1 and 8 as a starting row, such as 5. Set the first transect at row 5, the next at row 13, then rows 21, 29, etc.

Walk along transects and record the number of healthy trees and trees with *Pissodes* spp. damage on rows to either side. Ignore dead trees or damage from previous years. If little brush is present across the plantation, the observer can survey two rows on either side while walking down each transect. Transects may represent 1, 2,

or 4 rows of trees, but a similar number of trees should be surveyed on each transect. Calculate the total number of trees with leader damage and the total number of trees observed from all transects. Estimate the average percentage of infested trees by dividing the cumulative number of trees observed with damage by the cumulative number of observed trees and multiplying by 100.

Notes: This is a *preliminary* sampling plan that should be used with the understanding that it could be improved with additional data. Furthermore, the plan was developed for spruce trees and may not be applicable for pines attacked by *P. strobi* or *P. terminalis*.

Table

Table 6. Sample size calculations for estimating proportion of infested trees. Between transect variation ($S_c^2 = 200$) estimated from previous field data.

Bound on Error of Estimation	No. of Transects in Population	Average Transect Size (no. of trees)	No. of Transects Required (sample size)
80% Confidence Limits			
0.10	100	100	3
0.10	150	100	3
0.10	200	100	3
0.05	100	100	12
0.05	150	100	12
0.05	200	100	12
95% Confidence Limits			
0.10	100	100	7
0.10	150	100	8
0.10	200	100	8
0.05	100	100	24
0.05	150	100	26
0.05	200	100	28

Table 6 was modified to reflect the changes made in the Errata for this publication. The table is reproduced with the permission of the Forest Establishment Officer, Ministry of Forests and Range, Victoria, BC, granted May 6, 2008.