Pine Root Collar Weevil

Hylobius radicis Buchanan
Coleoptera: Curculionidae

Wilson, L. F.; Millers, I. 1983. Pine root collar weevil--its ecology and management. Tech. Bull. No. 1675. Washington, DC: *U.S. Department of Agriculture, Forest Service*; 34 p.

Objectives: To provide a comprehensive review of the survey methods used to detect the presence and population density of *H. radicis* as well as assess techniques used to determine damage caused by this forest pest.

Abstract: The pine root collar weevil, *Hylobius radicis* Buchanan, is an important pest of pine, *Pinus* spp., plantations in the northeastern USA. Larvae cause most of the damage as they feed below ground and bore into the inner bark. As they grow larger, *H. radicis* larvae also damage xylem tissues. Signs of infestation include pitch-soaked soil adjacent to the root collar of attacked trees, reduced shoot vigor, chlorosis and windthrow. Several types of surveys can be conducted by forest landowners to detect, evaluate, and predict weevil populations or damage.

Three direct surveys that look for the presence of *H. radicis* and two indirect surveys that assess damage caused by its feeding were presented. A hazard-rating system was also presented to guide in the establishment of new pine plantations.

Sampling Procedure: The first three surveys deal with estimation of *H. radicis* presence and population levels whereas the last two surveys deal with estimation of damage.

Detection survey: First, look for obvious symptoms of weevil damage including yellowing or red foliage, or windthrown trees typical of heavy infestations. Second, examine the root collars of damaged trees for girdling by pulling the soil away with a shovel to look for blackened, pitch-soaked soil sticking to the bark. If this sign is present, remove more soil out to 15 cm from the root collar and look for larvae or pupae in the outer bark tissues. Stop sampling once *H. radicis* is found or continue with an appraisal survey.

Immature weevil appraisal survey: This survey determines the proportion of trees with immature weevils and should be conducted in stands with trees 5-13 cm diameter at ground level or trees 1-5 m in height. Sampling for immature weevils should be carried out between mid-June and mid-July when the greatest number of large, immature weevils are present. Identify these specimens to confirm they are *H. radicis*.

Determine the parts of the stand that will be sampled and conduct the survey systematically. Only live, standing trees should be sampled. Use the following chart to determine the sampling intensity:

Table 1. Recommended sampling intensity based on stand area.

Stand size		Sample trees	
Acres	Hectares	Number per acre (0.4 ha)	Total
1	0.4	20	20
3	1.2	7	21
5	2.0	4	20
10	4.0	3	30
>20	>8.0	2	40

Sampling: Cut off one or more lower branches to expose the base of the tree. Remove the needle litter from the trunk out to about 30 cm. Dig a small trench around the tree 15 cm away from the trunk and 15 cm into the soil. Section the soil and examine each section by removing the soil and crumbling it to search for pitch and damage to the root collar. If there is no pitch present after digging around the tree, then record the tree as uninfested and move to the next tree. If pitch is present, then begin searching the soil for *H. radicis* larvae, pupae and callow adults (light- to reddish-brown weevils in pupal cells). Record the tree as either infested or uninfested based on the presence or absence of weevils, respectively, and move to the next tree. After sampling the minimum number of trees for the acreage in question, determine the proportion of infested trees. If the proportion of infested trees is >75%, then the infestation is severe enough to cause high mortality and control is warranted.

Adult appraisal survey: This survey determines the proportion of trees with adult *H. radicis* and should be conducted in stands with trees 5-13 cm in diameter at ground level or 1-5 m in height. The best time to conduct this survey is from mid-May through to the end of June when most adult weevils are close to the root collar for mating and oviposition. Be certain that any adult weevils found are *H. radicis* because several other weevil species may be found.

Determine the parts of the stand that will be sampled and conduct the survey systematically. Only live, standing trees should be sampled. See Table 1 for recommended sampling intensity.

Sampling: Cut off one or more lower branches to expose the base of the tree. Carefully search the interface between the organic layer and soil layer for adults, as well as the root collar out to about 46 cm. Be sure to examine bark crevices for hiding weevils. If one live *H. radicis* is found, then record the tree as infested and move to the next tree. If no weevils are found, then continue searching the soil around the root collar by digging down to a depth of 10 cm. If no weevils are found at this point, then record the tree as uninfested. After sampling the minimum number of trees for the acreage in question, determine the proportion of infested trees. If the proportion of infested trees is >40%, then the infestation is severe enough to cause tree mortality.

Damage appraisal survey: If tree mortality and windthrow have already occurred in the stand, then a nondestructive damage appraisal survey should be carried out. The number of freshly attacked trees is an accurate estimate of tree losses to occur the following year, assuming a rising or stable infestation.

Sampling: Sample a cluster of trees every 20 m along transect lines throughout the stand. In each cluster, record the number of living and dead trees. Calculate the percentage of dead trees but make sure the dead trees were attacked and killed by *H. radicis* (see Detection Survey). If 3-5% of trees were recently killed, then approximately 95% of apparently healthy trees are likely infested.

Stand damage index: This survey is a destructive but detailed assessment of *H. radicis* damage that is used primarily for research purposes. This technique is also useful in practical field application when a precise estimate of damage is needed. Randomly select trees 1-3 m in height to be surveyed.

Sampling: Sample 20 to 30 trees systematically throughout the plantation or portion of the plantation to be surveyed. Dig around the root collar to root depth looking for larval injury. If no injury is found, then record the tree as uninfested. If injury is found, then cut the tree and remove the stump portion. Saw each stump in cross section across the area that appears to have the worst external damage. On one face of the cross section, calculate the degree of damage "d" by the formula:

$$d = \frac{G_{o_1} + G_{o_2} + \ldots + G_{on} + G_{i_1} + G_{i_2} + G_{in}}{C_{o_1} + C_{o_2} + \ldots + C_{on} + C_{i_1} + C_{i_2} + C_{in}},$$

where G_o, G_i are measurements of girdled outer and inner bark (cm or inches) for each root collar; C_o, C_i are circumferences (cm or inches) for the outer and inner bark, and "n" represents the sample size. The damage index (DI) is calculated by multiplying the total damage (d), by the proportion of trees

infested (p) and a constant (k) (i.e., DI = dpk, where k = 1,000). Three damage classes were developed:

1. Light – DI <100: Contains pines with <40% of the root collars scarred by larval feeding and no abnormal growth or off-color symptoms.

2. Moderate – 100<DI<300: Contains pines with 30-85% of the root collars scarred by larval feeding and >10% with shortened terminal growth.

3. Heavy – DI>301: Contains pines with 80-100% of the root collars scarred by larval feeding and from a few to many trees leaning, off-color, or dead.