Jeffrey Pine Needle Miner

Coleotechnites sp.
Lepidoptera: Gelechiidae

Unruh, T. R.; Luck, R. F. 1982. Comparison of two sampling methods for the Jeffrey pine needle miner, *Coleotechnites* sp. (Lepidoptera: Gelechiidae) in southern California. Canadian Entomologist 114: 605-615.

Objective: To propose a sampling plan for *Coleotechnites* sp.

Abstract: Jeffrey pine needle miner, *Coleotechnites* sp., is an aesthetic pest and stressor of Jeffrey pine, *Pinus jeffreyi* Grev. and Balf., in California. The caterpillars feed inside all needles older than the current year. Sporadic outbreaks may occur with severe defoliation and growth reduction. Often very little mortality is caused by this pest but secondary pests, such as the Jeffrey pine beetle, *Dendroctonus jeffreyi* Hopkins, and the California flatheaded borer, *Melanophia californica* Van Dyke, can attack and kill trees stressed by Jeffrey pine needle miner.

No information was previously available on intra- and inter-tree distribution of Jeffrey pine needle miner, therefore two sampling plans were developed for this pest. One plan was developed from the component of variance technique (Cochran 1963; Southwood 1978) and the other from the mean crowding relationship (Kuno 1976). The mean crowding technique was recommended over the component of variance technique because it requires no assumptions about the population distribution of the insect and because it also is easily adapted to sequential sampling techniques. Sampling 90 tips (1 tip per tree) or 30 tips (6 tips per tree) was found to give good estimates of population density at a site at the 10% level of precision. For integrated pest management of *Coleotechnites* sp., additional research is needed to relate population estimates to resulting levels of defoliation by this pest.

Sampling Procedure: The upper crown of *P. jeffreyi* contained more currently mined needles than either the middle or lower crown. The majority of current mines were found in fully-grown needles ≤4 years old. Refer to Table III to determine the number of trees to sample based on the number of tips sampled per tree. Randomly select 15- to 40-cm branch tips from the upper third of the live crown of *P. jeffreyi*. Trees should be between 6–10 m tall. Count the number of needles with current mines containing live *Coleotechnites* sp. larvae, pupae, or parasitoids. Average counts among trees if sampling 1 tip per tree. Average counts among tips if sampling >1 tip per tree and then average the estimates among trees.

Notes: The 10% level of precision is usually intended for detailed studies where large sample sizes are required. The 25% level of precision is more appropriate for management purposes, and can be calculated by the following equation:

$$N = \left[\frac{1}{n} \left[\frac{\alpha + 1}{m} + \frac{\beta_1(\beta_2 - 1)}{\beta_2} \right] + \frac{\beta_1 - \beta_2}{\beta_2} \right] \Big/ D_0^2$$

where N = the number of trees required for a given value of precision, n = sample size of tips per tree, m = mean, α = intercept, β_1 = the slope of the regression of mean on mean crowding for the composite population, β_2 = the slope of the mean on mean crowding for trees, and D^2_o = (Var m)/m^2 (Kuno 1976). Change the value of the variable D_o from 0.1 to 0.25, or any other desired level of precision. The other variables in this equation can be taken from Table III. See the original publication for additional information.

To be applicable over a larger geographic area and with larger and/or smaller trees, sampling additional stands/trees is necessary. Consequently, please use this plan with caution.

References:

Cochran, W. G. 1963. Sampling techniques, 2nd ed. New York: John Wiley and Sons, 413 p.

Kuno, E. 1976. Multistage sampling for population estimation. Researches on Population Ecology 18: 39-56.

Southwood, T. R. E. 1978. Ecological methods with particular reference to the study of insect populations, 2nd ed. London: Chapman and Hall; 524 p.

Table

Table III. Sample sizes necessary (number of trees at a rate of *n* tips per tree) to estimate the mean density of needles infested with the Jeffrey pine needle miner with 10% precision along with the parameters required for the mean crowding technique. Parameters for the mean crowding technique are derived from each plot (A), and from the plots pooled (B).

	Plot	Mean (m)	Mean crowding (m*)	Intercept (α)	β_1	β_2	r^2	*n* = 1	2	3	6	15	30
					A								
Raw	Snow Valley	32.8	53.2	5.28	1.45	1.13	0.957	65	47	41	35	31	30
	Erwin Lake	29.4	57.4	-0.18	1.96	1.62	0.846	99	60	47	34	27	24
	Big Bear City	50.9	84.8	8.60	1.50	1.18	0.940	69	48	41	34	30	28
					B								
Raw	Snow Valley	32.8	—	6.26	1.512	1.2302	0.86	74	49	41	32	27	25
	Erwin Lake	29.4	—	6.26	1.512	1.2302	0.86	77	50	41	33	26	24
	Big Bear City	50.9	—	6.26	1.512	1.2302	0.86	67	45	38	31	27	25

Table III modified and reproduced with permission from the authors, granted April 2, 2009.