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A COMPARISON OF SPRUCE BUDWORM POPULATION ESTIMATES BETWEEN SOUTHERN IDAHO AND EASTERN OREGON

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ABSTRACT

Two relationships--prediction of immature budworm larval populations based on the pupal case population of the previous year and estimates of final defoliation severity based on the immature larval populations of the same year--are developed for southern Idaho by regression analysis and compared to the same relationships developed in eastern Oregon.

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KEYWORDS: population, defoliation damage (estimates), budworm.

A recently initiated cooperative program on western spruce budworm populations has brought about an awareness of a need for more information on population measurements. Consequently, it would seem appropriate and timely that results from a study I made during 1958-1960 should be documented as background information to a recent publication by Carolin and Coulter.¹ My study primarily was concerned with the measuring of budworm population levels and subsequent extent and severity of defoliation.

Ten trees from each of three plots were sampled for 3 years. Four 15-inch twigs per tree--one terminal and three laterals--were used to sample larvae, pupae, and foliage. The early larvae were sampled after approximately 50 percent had emerged from hibernation and had mined buds or needles. Pupae were sampled when approximately 50 percent of the larvae had emerged.

Seasonal defoliation was based on the number of damaged buds (new growth tips) found on the twigs, which were classed according to percent of the needles destroyed per bud as follows: (1) 90 percent or more; (2) 75-90 percent; (3) 50-75 percent; (4) 25-50 percent; (5) less than 25 percent; and (6) residual undamaged buds.

¹V. M. Carolin and W. K. Coulter. Sampling populations of western spruce budworm and predictive defoliation on Douglas-fir in eastern Oregon. USDA For. Serv. Res. Pap. PNW-149, 38 p. 1972.

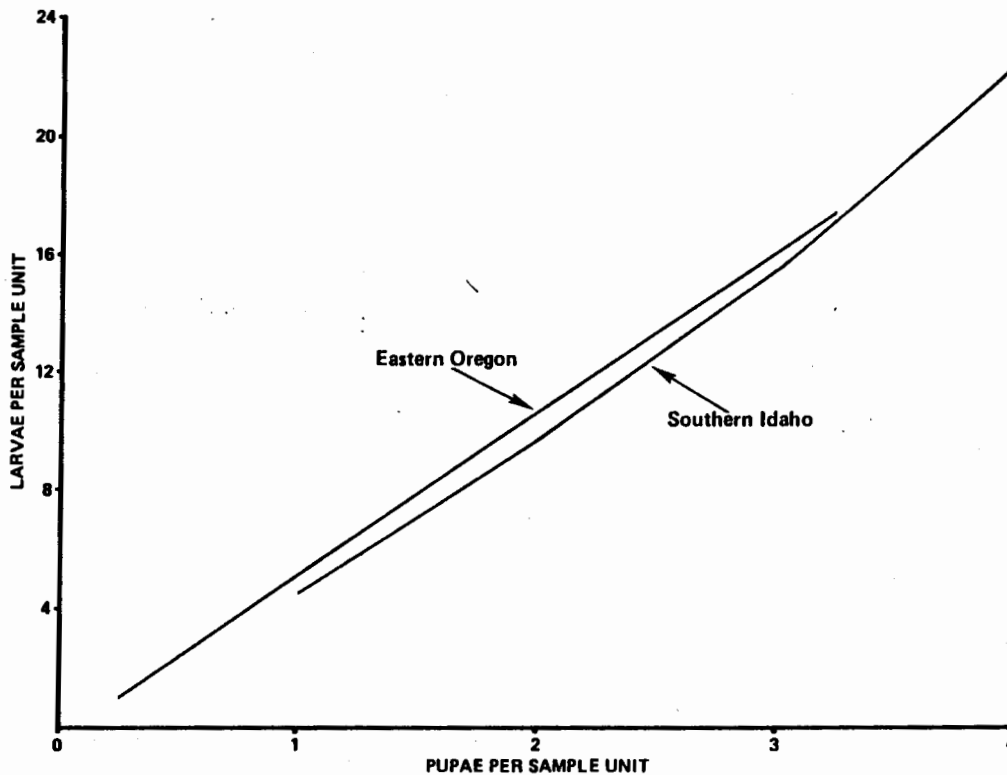


Figure 1.--Linear regression of larval density on pupal density (southern Idaho based on larvae per 15-inch twig; eastern Oregon based on larvae per 100 15-inch twigs).

During the 3 years of my study there was no significant difference between years in the early larval populations per twig, in the late larval populations per twig, and in reduction of larval numbers between early and late populations.² In other words, the populations approximated each other among plots each year and within each plot during the study period. Consequently, the data were pooled over the 3-year period.

The regression of immature larval populations on pupal case populations was determined to be

$$\text{Log } (y + 1) = 0.27 + 1.57 [\text{Log } (x + 1)] \quad (r = 0.75)$$

where

y = expected number of immature larvae per 15-inch twig

x = number of emerged pupal cases per 15-inch twig.

Figure 1 shows the comparison of my regression to Carolin and Coulter's regression which was

$$y = -62.6 + 5.608x \quad (r = 0.81).$$

However, Carolin and Coulter's regression was based on nontransformed data; furthermore, their sample unit was 100 15-inch twigs.

²Based on a 90 percent confidence level. (Data were transformed using $y = \log_{10}(x + 1)$ because budworm larval populations follow the negative binomial distribution.)

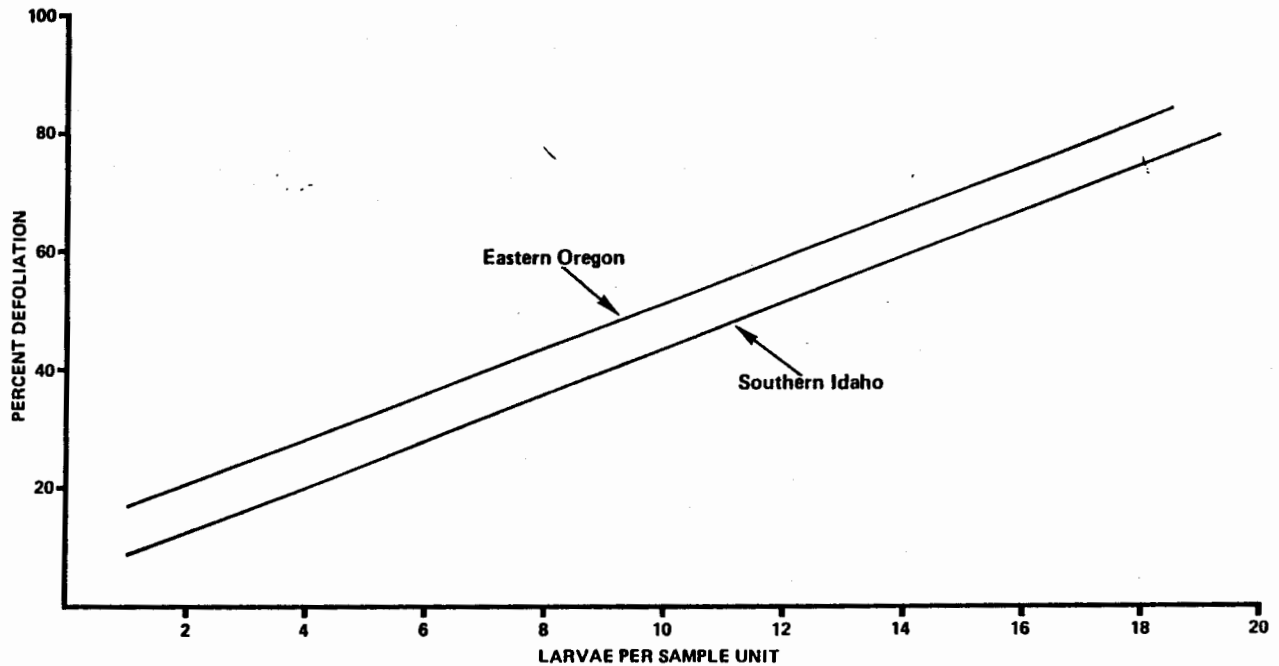


Figure 2.--Linear regression of defoliation of current growth on larval density (southern Idaho based on larvae per 15-inch twig; eastern Oregon based on larvae per 100 15-inch twigs).

My regression of ultimate defoliation on immature larval populations per 15-inch twig was

$$y = 5.17 + 3.8x \quad (r = 0.69).$$

Again, their regression was based on a 100 15-inch twig sample. Figure 2 shows a comparison of my regression with Carolin and Coulter's regression:

$$y = 12.84 + 0.038x \quad (r = 0.88)$$

Caution should be used in basing a prediction on pupal cases, particularly within a highly fluctuating population or when the time to sample is based on 50 percent emergence. Carolin and Coulter used 75 to 90 percent emergence; this possibly explains the difference between their regression estimates and mine. Also, differences between their regression estimates and mine for defoliation could be attributed to differences in sampling techniques. However, these differences are only evident in degree; our slopes of regression are parallel. Therefore, a reasonable estimate of desired populations can be made using a 4-twig sample; precision of such an estimate can be improved using a 100-twig sample.