EGG DISPERSION IN THE LARCH CASEBEARER, *COLEOPHORA LARICELLA* (LEPIDOPTERA: COLEOPHORIDAE), IN NORTHERN IDAHO[1]

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ABSTRACT

During 1976, a total of 3122 eggs of the larch casebearer, *Coleophora laricella*, was found on 2937 needles. Of these needles, 94% had 1 egg, 5.8% had 2 eggs, and 0.2% had more than 2. The dispersion pattern fitted a negative binomial distribution (k = 0.498). There were significantly more eggs (α=0.01) on insolated than on shaded branches. The dispersion pattern is due primarily to the heterogeneity of environmental factors affecting oviposition.

INTRODUCTION

Egg dispersion has not been examined in previous biological and ecological investigations of the larch casebearer, *Coleophora laricella* (Hubner), the primary insect pest of western larch, *Larix occidentalis* Nutt. To sample a species adequately, it is necessary to know its initial dispersion. Our investigation was combined with a project to measure the pre-overwintering mortality of *C. laricella* (Brown 1976).

METHODS

Two larch casebearer populations were investigated in mixed coniferous stands having moderate to heavy infestations, in northern Idaho. Stand 1, 7 km northwest of Troy, Latah County, was in a *Thuja plicata/Pachistima myrsinites* habitat type (Daubenmire and Daubenmire 1968), with 18% (stems per ha) larch and at an elevation of 850-975 m. Stand 2, 35 km southwest of Lewiston, NezPerce County, was in an *Abies grandis/P. myrsinites* habitat type, with 45% (stems per ha) larch, and at an elevation of 1340-1365 m. Four circular 0.02 ha plots were located within each stand. One branch within 0.5 - 2.0 m of the ground was selected on each of six trees per plot. On each plot, three of the branches were shaded, three were exposed. Branches were selected prior to oviposition to minimize sampling bias. Each sample branch consisted of 100 spur shoots, counted from the terminal end including secondary branches, or 100 casebearer eggs, whichever came first. Eggs were sampled four times beginning 1 July 1976 to ascertain the pattern of dispersion. The first two samples were made biweekly, and at four week intervals thereafter.

A two-tailed paired t-test was used to compare egg population density between the exposed and shaded branches. For this comparison, we averaged the population data for the three branches with similar exposure on the same plot. Dispersion of the eggs was analyzed by methods outlined by Southwood (1966), including a Chi-square test for a Poisson (random) distribution, the coefficient of dispersion, and Morisita's Index. The individual spur shoot was used as the unit on which the calculations were based. As the dispersion of many forest insects is aggregated and can be described by a negative binomial model (Waters 1955), the parameter k was calculated for the eggs. The statistic U was used to see how well the larch casebearer egg dispersion fitted the negative binomial as opposed to other models for aggregated distributions. The degree of contagion was measured using the mean crowding value (λ) based on the population mean and k.

RESULTS AND DISCUSSION

A total of 3122 eggs was recorded on 2937 needles. Of these, 2760 needles (93.97%) had one egg, 170 (5.79% had two eggs, 6 (0.21%) had three eggs and 1 (0.03%) had four eggs. The number of needles with more than 1 egg is lower than the value of 21% given by Denton (1964) but higher than that of Jagsch (1973). This implies a density-dependent relationship, since Denton worked with a larger population and Jagsch with a smaller population than we did. Similar to Miller and Finlayson (1977), we also found a significant difference (α= 0.01) in egg densities between the exposed and shaded branches. The exposed branches averaged 105.92 eggs per 100 spur shoots, but the shaded branches only 44.62 eggs.

The dispersion of *C. laricella* eggs fits the negative binomial distribution and is highly aggregated. The calculated Chi-square value of 10,810.72 (significant χ^2df4547 = 4771.01, α = 0.01) shows that dispersion does not follow a Poisson distribution and therefore is not truly random. The coefficient of dispersion (2.38), Morisita's Index (3.01) and k (0.498) all indi-

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cate a high degree of aggregation. Using the k value and mean number of eggs per spur shoot (0.686), the statistic U demonstrates that the dispersion pattern fits the negative binomial distribution. (If U ± S.E. encompasses 0, the negative binomial fits the data, the calculated $U = 2.8 \times 10^{-5}$, S.E. = 0.33.)

A λ value significantly less than 2 (Southwood 1966, Fig. 11, page 36), suggests that aggregation was due primarily to environmental rather than behavioral factors. Environmental factors that may contribute to aggregation of larch casebearer eggs include illumination (Schwenke 1958, Sloan 1965), ambient temperature (Quednau 1967), lushness of foliage (Sloan and Coppel 1965), or a combination of these factors. Gravid females are attracted to the well illuminated parts of the tree (Schwenke 1958, Sloan 1965). These are also more likely to maintain ambient temperatures in the optimum oviposition range of 21^0 to 27^0 C (Quednau 1967) for longer periods than are shaded branches. We also observed that exposed branches produced lusher foliage, which attracted gravid females (Sloan and Coppel 1965).

The aggregation of *C. laricella* eggs most probably involves the attraction of gravid females to lush, illuminated foliage. The clumping of eggs on both shaded and exposed foliage indicates that once a female finds the proper conditions for oviposition, she continues to oviposit in the same area, this resulting in the observed high degree of aggregation.

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