

GROWTH AND SURVIVAL OF THE HEMLOCK WOOLLY ADELGID (*ADELGES TSUGAE*)

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ABSTRACT

In order to characterize fluctuations in adelgid population size and their potential causes, we studied eight understory, 2- to 3-m hemlock trees at Mt. Tom Reservation in Holyoke, MA. Initial adelgid density (sistens generation) was measured on 10 randomly selected, 0.3-m branches per tree in November 2006. Overwintering mortality and sistens density were recorded each spring. In summer we recorded progrediens density, the proportion of branchlets producing new growth, and newly settled sistens density on new growth. Subsamples of new growth were marked and revisited in November to estimate of the amount of mortality occurring during aestivation. The population rate of increase, or λ , was calculated as N_{t+1}/N_t .

During the first 2 years of the study, we observed an increase and subsequent decline in adelgid densities similar to McClure (1991). The average initial density was 68.6 sistens per branch. Density peaked in mid-summer 2007 with 138.5 progrediens per branch, followed by a steady decline in adelgid density. In mid-summer 2008, the average number of adelgid per branch was only 4.7. As we continue to collect data, it will be interesting to see if we find another increase in adelgid on marked branches.

Although cold winter temperature is the most studied cause of adelgid mortality, the proportion of the population dying during aestivation and the progrediens

life stage was significantly greater than the proportion dying in the winters of 2007 and 2008. Possible reasons include exposure to harmful terpenoids when adelgid break aestivation in fall (Lagalante et. al. 2006) and poor branch quality during the progrediens stage, which settle on old growth already occupied by the sistens.

Another factor influencing adelgid survival and rate of increase (λ) was the amount of new growth produced in spring. Both survival and λ were significantly higher on branches that produced more new growth in the spring of 2007. In turn, the amount of new growth produced during the following spring of 2008 was negatively correlated with sistens 2007 overwintering density.

In addition to these factors we are also exploring the role of density dependence in population size fluctuation. We have preliminary evidence that survival of sistens and progrediens may partially depend on densities of adelgid at various times of the year.

Literature Cited

- Lagalante, A.F.; Lewis, N.; Montgomery, M.E.; Shields, K.S. 2006. **Temporal and spatial variation in terpenoids in eastern hemlock (*Tsuga canadensis*) in relation to feeding by *Adelges tsugae*** Journal of Chemical Ecology. 32: 2389-2403.
- McClure. 1991. **Density-dependent feedback and population cycles in *Adelges tsugae* (Homoptera: Adelgidae) on *Tsuga canadensis*** Environmental Entomology. 20: 258-264.