LEADING EDGE GYPSY MOTH POPULATION DYNAMICS

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ABSTRACT

Leading edge gypsy moth populations have been the focus of several intervention programs (MDIPM, AIPM). Knowledge of gypsy moth population dynamics in leading edge area is crucial for effective management. Populations in these areas tend to reach outbreak levels (noticeable defoliation) within three to four years after egg masses are first detected. Pheromone traps have proven effective for detection and estimating population density in building populations. However, after populations have reached outbreak levels the utility of pheromone traps is decreased, primarily due to trap saturation. The emphasis of our research has been to investigate several aspects of gypsy moth biology with the objective of identifying characteristics that would be useful to monitor populations. We have focused on quantifying the impact of defoliation on several life history attributes.

Seventeen sites were studied during 1988 and 1989. These sites had a range of population densities and varying ecological characteristics (i.e., elevation, host species composition). Larval phenology was compared using a stochastic phenology model developed from estimates of instar occurrence and temperature data (in degree day form using a lower threshold of 7.65° C). Inspection of model parameters indicate there are no observable trends in larval development (faster or slower) due to density. However, parameters are not sufficiently consistent to suggest site conditions do not influence development. Pupae from sites with significant defoliation (90 - 100%) generally developed in fewer julian days. The most distinctive difference in phenology attributable to defoliation was a greatly shortened period over which pupation occurred (i.e., decreased variability).

Mortality was not explicitly measured, but field observations suggest mortality from NPV and starvation were the most significant sources of mortality. Regardless of the causes of mortality, high mortality is correlated with defoliation. Defoliation was found to have a significant effect on fecundity, but only if the level of defoliation exceeded 40%. High mortality and low fecundity, both defoliation related, were responsible for decreases in population density. Using larval density and estimates of total leaf weight per ha we were able to fairly accurately estimate if defoliation would exceed the 40% threshold. Sites with small egg masses (less than 300 eggs per mass), regardless of egg mass density, were lightly defoliated.

The spatial dynamics of gypsy moths in Virginia were also studied using defoliation coverages of the Northern District of the Shenandoah National Park and of the State of Virginia. Most areas tended not to be defoliated two consecutive years. Areas that were defoliated two consecutive years tend to be small patches the first year and part of large patches the second.