

THE EFFECTS OF TREE SPECIES AND SITE CONDITIONS ON GYPSY MOTH SURVIVAL AND GROWTH IN MICHIGAN

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ABSTRACT

In 1987, we began a study to determine the relationships between gypsy moth growth and survival and forest site factors. The major objectives of this study were to determine the (1) relationships between gypsy moth survival and growth and different ecosystem conditions, (2) relationships among egg hatch, host phenology, and distribution of small larvae in the understory, (3) impact of leaf development age on gypsy moth growth and survival, and (4) role of host switching on gypsy moth growth and survival.

The research conducted in summer 1987 was to determine the variation in growth and survival of gypsy moth larvae on common understory plant species. Fourteen different understory tree and shrub species were studied at four different sites. Newly hatched larvae were caged on intact foliage in the field and survival and growth were determined by weighing larvae, recording mortality, and determining instar at 10 to 14 day intervals. Survival of small larvae and pupae varied greatly by tree species. Early larval survival was highest on witchhazel, paper birch, northern pin oak, and trembling aspen. Pupal weights varied considerably by sex and tree species, with female pupal weights 1.5 to 2 times larger on aspen than oaks. Relative growth rates varied by tree species; red oak decreased while white oak increased as the season progressed.

The effect of site on phenology of host tree and growth of gypsy moth larvae was emphasized in 1988. We studied the most common and most preferred host species: four oak species (red, white, northern pin, black) and two aspen species (trembling, bigtooth). In Michigan, there is up to a six week variation in date of leaf flush among aspen clones. Therefore, during 1988, detailed leaf phenology was obtained on eight sites for the four species of oaks and two species of aspen. During 1989, we continued gathering host phenology information for three species of oak and two species of aspen on six sites. The major experiments in 1989 were conducted on one site and emphasized: (1) the effect of host switching on gypsy moth growth and survival and (2) the impact of aspen leaf flushing dates (clonal variation) on survival and growth of gypsy moth.

The major results to date are: (1) survival and growth of gypsy moth larvae varied by tree species, year, and location, (2) the heaviest pupae were always produced on both aspen species, (3) drought has a major effect on overall pupal weights; pupal weights during the drought of 1988 were smaller for all species tested except red oak, which expressed no difference between the two years, (4) variability in insect growth and survival may be linked to the phenological development of individual trees, (5) phenological development of host plant varies by tree species and site, (6) red oak and trembling aspen had significantly faster leaf development than either northern pin oak, white oak, or bigtooth aspen, (7) host quality during the first two weeks of larval feeding has a major influence on overall size of mature larvae and pupae, (8) insects that fed on aspen during the first two weeks produced the heaviest larvae and pupae, no matter which host they were moved to, (9) all experiments involving gypsy moth growth and survival studies should use neonate larvae and natural hosts, because survival and growth during the first two weeks is extremely critical to understanding the interactions between gypsy moth survival and performance and host tree species, and (10) all experiments involving gypsy moth/host/tree interactions should consider host phenology, because host phenology has a major effect on gypsy moth growth and survival.