CENTRAL HARDWOOD NOTES

Gypsy Moth

The gypsy moth is the most important hardwood defoliating insect in North America. Since its inadvertent introduction into Massachusetts in 1869, it has spread naturally south and west at approximately 5 miles per year. Long distance spread has occurred from human activities such as moving household belongings, camping equipment, motor homes, or other articles harboring life stages. In North America, gypsy moth tends to erupt every 8 to 11 years and defoliate forest and urban trees and shrubs. Gypsy moth larvae can feed on over 500 plant species, but they prefer oaks. Other species readily attacked include bigtooth and quaking aspen, willows, paper birch, American basswood, maple, eastern hemlock, eastern white pine, and larch. Yellow-poplar, ash, and dogwood are avoided. Forests composed of less than 50 percent oak have less than half the likelihood of being defoliated than those with higher percentages of oak.

Gypsy Moth Bioecology

Gypsy moth may be confused with other hardwood defoliators so it is critical to accurately identify life stages and understand the gypsy moth development and behavior. The buff brown egg masses are the life stage most often observed since they persist even after larvae have emerged (fig. 1). Viable egg masses are hard to the touch; hatched masses are spongy. Masses vary from 1/2-inch long, containing 75 to 100 eggs or less (dense, declining populations) to 1 -1/2 inches long, containing 700 to 1,000 eggs (increasing populations). Although egg masses may be found anywhere from the leaf litter to the tops of trees, most are laid in protected locations on the tree such as bark flaps, crevices and holes, or on the ground on rocks, fallen branches, and other debris.

Egg hatch begins in late April-early May and continues for 2-3 weeks. First instar larvae (caterpillars between their first and second moults) climb to the tops of trees and are wind dispersed on silken threads. Dispersal distance is usually only several hundred yards, but a small fraction of the hatch may be caught in thermal updrafts and carried a few miles. Inadvertent dispersal by man-rather than wind-is responsible for establishing gypsy moth in new areas.

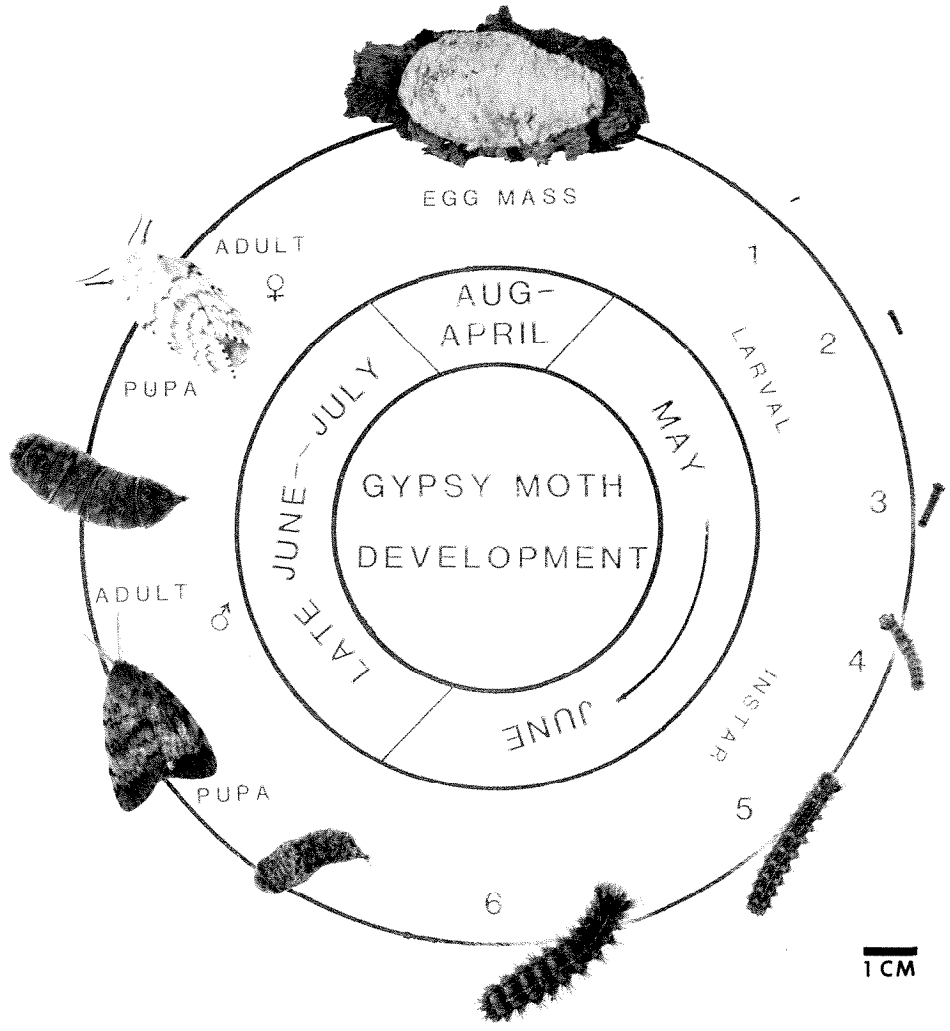

Figure 1 .-A generalized life cycle for gypsy moth in a northern climate depicting the time of year for each stage of the insect.

During the first three instars larvae remain in the tops of the trees. The fourth, fifth, and sixth instar larvae feed only at night, and descend the tree at dawn and rest under bark flaps, dead limbs, or other structures on the tree. Lacking such hiding places, they descend to the ground and rest beneath leaf litter, dead wood, or rocks. The brightly marked fifth and sixth instar larvae have 5 rows of blue dots and 6 rows of red dots along their backs. The last instar (fifth for males, sixth for females) causes 85 percent of total leaf consumption. Larval development is completed about 50 days after egg hatch, generally by late June to early July. Pupae are found in the same larval resting locations, adults emerge from pupae in 10 to 14 days. Both sexes are winged, but only males fly and are attracted to the flightless female by a sex pheromone (attractant). Eggs are laid immediately after mating.

Defoliation can lead to tree mortality but this depends on tree vigor, number and severity of prior defoliations, and the presence of organisms that attack stressed trees. Generally, if defoliation is severe enough to cause the trees to leaf out again the same year they are attacked; two or more consecutive defoliations significantly increases mortality. While trees may be killed directly by defoliation, most succumb to opportunistic organisms such as the shoestring rot fungus and two-lined chestnut borer. Mortality is the most visible result of defoliation but growth loss of surviving trees is also important. Highly susceptible stands have lost up to 17 percent of their timber value. So, potential mortality and growth loss must be weighed against protection costs when valuable stands are threatened with gypsy moth attack (see Note 6.14 *Using silviculture to Minimize Gypsy Moth Impact).*

Monitoring

Repeated surveys of egg masses, larvae, and adults are used by regional and state specialists to assess population trends and recommend action programs. Trapping male adults is an economical means to detect and delimit isolated infestation in newly invaded areas. Traditionally, egg mass surveys using the prism point sampling method or small plots or transects have been utilized to predict density and control measures. Many pest managers consider 250 large egg masses per acre a threshold for starting controls to keep defoliation less than 50 percent. Even though you are presently outside the gypsy moth area it is important to be able to recognize the life stages of this very serious pest. This is especially true if infestations are nearby and state and local monitoring programs are started.

Indirect Controls

An array of natural enemies attacks gypsy moth, including parasites, predators, and pathogens. Certain fly parasites, small mammal, bird and invertebrate predators help keep gypsy moth densities low. However, once populations expand beyond natural control, an outbreak occurs which terminates in 1 or 2 years by starvation or a virus epidemic.

Except for reducing the proportion of oaks in the stand, it is not clear what silvical procedures can be used to modify gypsy moth populations. Try to maintain and improve forest habitats important to predators. For example, you should avoid frequent disturbances, particularly those which destroy understory vegetation important to small mammals. Also maintain dead tree snags for cavity nesting birds. Try to reduce the number of nesting locations for larvae by: removing excessive numbers of broken tops or branches after a storm; removing “hard” litter such as old cans or trash metal; avoiding use of board-backed signs nailed to trees (larvae rest in the angles created).

Direct Control

If your forest is large you should: (a) assess stand values and vulnerability to gypsy moth; (b) maintain a system for monitoring densities of gypsy moth; and (c) be able to preemptively intervene at the correct time with an effective control. To date, larvae have been controlled through aerial spraying of biological and chemical insecticides and by insect growth regulators. Each gives predictable results when properly applied. Together they provide several options for various environmental, economic, and gypsy moth population considerations.

New approaches to gypsy moth management are under extensive study and development. You should consult federal and state agencies as well as universities, experiment stations, and cooperative extension service personnel to get the most up-to-date recommendations for control.

William Wallner
Northeastern Forest Experiment Station
USDA Forest Service
Hamden, Conneticut