# One mistaken notion

## that introduction of the Gypsy Moth into the U.S. could be of economic importance has resulted in unleasing one of the most serious insect pests this continent has ever experienced.

THE GYPSY moth was introduced into this country a hundred years ago under the assumption that it could be crossbred with the silkworm. Since that time, it has become a major pest in the Northeast and is threatening new areas every year.

A member of the order Lepidoptera, the gypsy moth lays millions upon millions of eggs every summer. The egg masses hatch out as caterpillars the following spring and begin feeding in April or May. They devour the leaves of shade trees — oak, hemlock, birch, willow but will defoliate fruit trees and even evergreens if nothing else is available.

Enormously destructive, a single two-inch caterpillar can devour a square foot of leaf surface in 24 hours. Since each egg mass is capable of hatching out up to 500 caterpillars, and since there may be as many as 10,000 egg masses in one heavily infested acre, the gypsy moth is capable of defoliating millions of acres of forest, parkland and wooded residential areas annually.

It is estimated that nearly two million acres of forest land suffered significant damage from gypsy moth infestation in 1974. The areas treated each year in State/Federal gypsy moth control programs are a tiny fraction of the total defoliated acreage and are limited to high-value areas. For example, in 1974 only 277,000 acres were sprayed under co-op programs. For 1975, the State/Federal co-op programs did not exceed 119,000 acres in the following states:

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| New Jersey | 29,000 acres |
| New York | 20,000 acres |
| Pennsylvania | 55,000 acres |
| Rhode Island | 15,000 acres |

The gypsy moth is a moving target. It doesn't fly very far, but it's well-named nevertheless, since it has hitch-hiked for thousands of miles. Campers, trailers and trucks hauling forest products are among its favorite means of transportation, serving as ideal hiding places for the moth's egg masses, which may hatch, long distances away from where they were laid. Thus, in addition to heavy infestations in the

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**The gypsy moth, with its voracious appetite, can devour a square foot of leaf surface in 24 hours. The U.S. Forest Service estimates that nearly two million acres of forest land suffered significant moth damage in 1974.**

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Northeast, there have been breakouts in Michigan, West Virginia, Maryland, Florida, and even in California, according to the U. S. Forest Service.

Most of the newly invaded areas have not suffered significant damage as yet, but in Michigan the infestation was heavy enough to warrant spraying with insecticides over several thousand acres, and a spray program was launched in two counties in Maryland last year. Some authorities are afraid that heavy damage may occur in the next few years to the hardwood forests south of the present infestation belt unless preventive measures are taken.

What about the future? To quote the current U. S. Forest Service Report: "One can speculate that, as the gypsy moth is introduced into new areas to the south and west, it will be successful because of an abundance of favored food and a relatively low control exerted by native parasites and predators. Apparently no climatic or geographic barrier exists to inhibit the spread of the species. . . . The gypsy moth might eventually extend its range in this country to include over 100 million acres." Oak and other trees favored by the gypsy moth caterpillars, the report points out, prevail in the southern Appalachians, Tennessee, the Ozarks and hugh areas of the Midwest, offering conditions highly favorable to the gypsy moth.

Attempts to control the persistent pest by a variety of methods date back to 1891. There were times when the control programs were so successful that authoriites felt the gypsy moth had been eradicated, but new infestations occurred nevertheless and the areas affected increased, ultimately including every state in the northeast.

Cooperative State/Federal programs directed against the gypsy moth began in 1932. DDT, introduced in 1944, was highly effective, but was phased out in 1968 because of its long-lasting residue, which had adverse effects on the total environment.

In the search for alternatives, experimentation with biological or microbial insecticides was launched in the 1960's. Unlike most chemicals, microbial insecticides are specific in their action. That is to say, they will kill the target pest when used properly without harming beneficial insects, birds, fish and wildlife.

**Each gypsy moth egg mass is capable of hatching up to 500 caterpillars. The newly hatched larvae seldom feed, thus application should be made during the second or third instar stage.**

A very effective biological agent, Bacillus thuringiensis, (B.t.) was discovered in the course of the search for new solutions to the defoliation problem. B.t. is a bacterium which is cultered to produce spores and crystals. It is this crystalline body that has a toxic effect on the gypsy moth caterpillar.

B.t.'s mode of action is unique;

after ingestion, enzymes in the insect's gut hydrolize the protein crystals and immediately affect the caterpillar's metabolism. B.t. is relatively specific for Lepidoptera, like gypsy moth, cankerworm, fall webworm and tent caterpillar, due to the alkaline nature of their digestive systems.

Within 30 minutes after ingestion of B.t., the insect's gut wall is badly disorganized, but even before that happens it loses its desire to feed. The fragmented protein perforates the gut wall, and at the same time, the pH in the gut falls to a level at which the B.t. spores can germinate. There ensues a rapid multiplication of the bacteria and the insect dies of septicemia.

The important thing is that feeding stops almost immediately after ingestion of B.t. although the insect may continue to live for hours or days afterwards. In other words, defoliation ceases.

B.t., sold commercially under the trade name THURICIDE, is produced by Sandoz, Inc., Crop Protection, Homestead, Florida.

Through continued research and development, Sandoz has brought to the market thuricide 16B, designed specifically as a low-volume aerial spray against the gypsy moth and other forest caterpillars. This formulation has consistently given 75 to 90 percent foliage protection from gypsy moth caterpillars when properly applied. Application costs can be reduced, since this easy-to-use liquid can be loaded aboard an aircraft, undiluted, or premixed 1:1 with water at the spray site without expensive mixing equipment or addition of adjuvants.

In the spring, application should begin when leaf expansion has reached a minimum of 20 to 30 percent of normal growth, to ensure sufficient leaf surface upon which to deposit the bacteria. A gypsy moth egg hatch often may occur over a period of several weeks, usually in mid-April to early-May. During this period, young, newly hatched gypsy moth caterpillars seldom feed until the second instar stage. Thus, application is most effective when timed to coincide with second and third instar larval development and maximum leaf or foliage expansion. Spray applications applied too early will likely make a second application necessary, while late applications result in excessive leaf injury.

Thuricide 16B should be applied at the rate of 1-2 quarts per acre, either undiluted, or diluted in water at a 1:1 ratio, depending upon the capabilities of the aerial application equipment. Either rotary or fan type nozzles arranged on a spray boom, consistent with the aircraft capabilities and calibration desires, have been proven effective. Spray droplets, ranging in size from 80 to 300 microns are satisfactory, but average mean diameter should be kept in the range of 80 to 120 microns (for optimum deposit.) Spray adjuvants or additives are not required in any case.

If egg hatch occurs over a long period of time, two applications may be required as with most other commonly used insecticides. □