This commitment of members to collaboration in a full range of tree improvement activities is what distinguished METRIA from related organizations. We recognize some overlap of interests with such groups as the Arboricultural Research and Education Academy of the International Society of Arboriculture, the Urban Forestry Working Group of the Society of American Foresters, and the Northeastern Forest Tree Improvement Conference. It is our intent to cooperate rather than compete with these organizations, while pursuing our interests in better metropolitan trees through the diverse affiliations of our members.

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GYPSY MOTH BIOLOGICAL CONTROL PROGRAM

by William W. Metterhouse

The New Jersey Department of Agriculture has strongly advocated the use of biological control organisms within an integrated control concept as a functional part of pest management programs. Since 1923 the Department has maintained a mass rearing biological laboratory in the propagation of control organisms for the suppression of Japanese beetle, Oriental fruit moth, European corn borer, European pine sawfly, cabbage looper, alfalfa weevil, gypsy moth, and more recently Mexican bean beetle and musk thistle.

Pest management as a control strategy is being emphasized by the United States Department of Agriculture and other state institutions throughout the nation. The advantages of the pest management concept are: the reduction of insect resistance, long-term benefits resulting from the self-perpetuating nature of biological control organisms, reduced production costs, energy conservation, and reduced environmental risks. Biological control therefore, becomes a necessary tool in preserving our natural resources and quality of life.

Of all the biological control programs gypsy moth has demanded greater time and work efforts. In 1963 the Department initiated the rearing, releasing and evaluation of gypsy moth parasites. This program is based on the philosophy that parasites are significant factors contributing to gypsy moth population collapse and stabilization. The objectives to be achieved in the parasite program are: 1) to colonize in newly infested areas, known, imported, and established parasites. These are parasites established in the New England states resulting from releases by the U.S. Department of Agriculture in the years 1902 through 1933. 2) To colonize new or exotic species of parasites in an effort to increase the biological resistance against the gypsy moth. It is, thus, the purpose to reduce the periodic destructive outbreaks.

We in New Jersey, as in other states, have accepted a pest management approach employing both chemical and biological control methods in

controlling the gypsy moth. Our biological and philosophical approach has been derived from field experiences and can be classified as traditional. Over the years multiple-species introduction concept has been accepted. It has been our philosophy that such releases establishing a complex of parasites produce a greater total host mortality. Secondly, because of the environmental variations, favored parasite species will select the varied ecological niches, therefore, inhabiting the total geographic range of the host. Thirdly, that polyphagous parasites support the difficulties of monogophagous parasites. For example, *Compsilura concinnata,* a polyphagous parasite, has expressed its ability to provide significant impact at low gypsy moth population densities.

From our experiences in the monitoring of study plots over the past eight years and comparing the results with European data, it appears that we do have established the major high and moderate host density parasites. There appears to be few low density parasites established in New Jersey other than *Compsilura* and *Phobocampe disparis.* Therefore, it is most significant to introduce low host density parasites as multiple introductions to fill the various ecological niches. Most of the past importation efforts in Europe and Asia have been made in high or moderate density gypsy moth populations. There is little or confusing information as to what parasite species are important at low host density levels, both in Europe and Asia.

The Department's efforts have been coordinated with the Beneficial Insect Laboratories, Agricultural Research Service, and the Animal and Plant Health Inspection Service, both branches of the U.S. Department of Agriculture, and the U.S. Forest Service. The Department has maintained, for the past four years, a cooperative agreement with APHIS under Project 4 for the purpose of mass rearing and distribution of parasites to other states.

The program as it exists in New Jersey consists of two areas of work: insect rearing and field evaluation. The rearing program occupies two laboratories of approximately 12,000 square feet employing a total of 30 persons. At the present time, a total of 15 species is being maintained of which 13 species are being mass reared and field distributed. This past year, a total of 461,373 parasites representing 10 species of parasites was shipped to 12 states. It has been the objective of the release program to distribute parasites in a wide geographical range. It is hoped that such distribution will provide some ecological niche necessary for parasite establishment. If, after three years of adequate release, surveys fail to indicate establishment, parasite species are dropped from the program.

The success of the program depends upon the search for and importation of new parasite species. This past year, 14 species of parasites were received from the Beneficial Insect Laboratories. Although many parasite species were synonymous with previous importations, they were carefully screened and observed for behavioral differences. It is most important that the importation efforts be accelerated, particularly from Asian areas of the world. However, no geographic area should be prejudged as being unsatisfactory for biological control recovery efforts. Bio-organisms considered of little significance in an indigenous environment could possibly achieve success in a foreign land.

Field evaluation in New Jersey is conducted from two field stations located in the northern and southern areas of the state. Each station employs three persons who are responsible for release of parasites, determine parasite establishment, and collect efficacy data. The sampling of gypsy moth populations for determination of parasite establishment is conducted from 148 sites scattered throughout the state. This effort consists of the placement of 10 burlap bands on preferred host trees at sampling sites for the collection of gypsy moth larvae and pupae. Collections begin when third instar larvae are observed. A total of 100 larvae is collected each week through pupation. The collected larvae are placed in 16-ounce paper cups, 5-10 larvae per cup, depending on instar, and maintained on oak leaves.

Native insect pests are also collected through the summer for the purpose of ascertaining whether exotic parasite species are establishing

on alternate hosts. This past summer, a total of 15 species of native hosts was collected and reared for parasite recovery. Although new parasite species are recovered during the release season, there is no evidence to date of establishment.

Since 1970, an additional 20 permanent woodland study sites were established throughout the state for the purpose of developing an understanding of gypsy moth population dynamics as related to biological agents and the forest environment. These permanent sites were selected on the basis of being different as to gypsy moth population levels and forest types. Within each site are recorded the stand composition, tree mortality, site environmental factors, egg mass number, and biological control agents. In these study systems, a total of 500 larvae was collected each week through pupation.

Years of survey results indicate the establishment of seven species of parasites and one predaceous beetle. These species are the same as the imported species that were released and established in the New England states during the years 1905 through 1933. In addition, three native pupal parasites, five larval parasites, and four predaceous beetles have been found to attack the gypsy moth in varying degrees.

As a result of survey efforts, which have closely monitored the gypsy moth as it moves through New Jersey, the trends in parasitism as related to the different gypsy moth population levels have been recorded. In the pre-outbreak stage, the Tachinid larval parasite, *Compsilura concinnata,* was the first parasite observed. This parasite was established in New Jersey prior to the introduction of the gypsy moth, having been recovered on alfalfa caterpillar, imported cabbage worm, and other native hosts. In the outbreak or culmination years, the Tachinid larval parasite, *Blepharipa pratensis,* the Braconid larval parasite, *Apanteles melanoscelus,* and the pupal parasite, *Brachymeria intermedia,* attain the highest rate of parasitism. In the post-culmination years, the Tachinid larval parasites, *Parasetigena sylvestris* and *Compsilura concinnata* exhibit the highest percentage of parasitism and, thus, appear to be contributing importantly in the dampening or stabilizing of the gypsy moth population.

Other parasites acting less significantly in the stabilized areas are the Tachinid parasite, *Blepharipa pratensis,* and the Braconid larval parasite, *Apanteles melanoscelus.* The Ichneumonid larval parasite, *Phobocampe disparis,* and the predaceous beetle, *Caolsoma sycophanta,* are not widely established. The egg parasite, *Ooencyrtus kuwanae,* expresses maximum benefit during the year of gypsy moth collapse and years of stability.

Only continued years of monitoring will provide more complete answers, but present results indicate, in stable areas, that parasitoids are host density dependent and appear to be factors contributing to stability following the viral collapse of the gypsy moth population.

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ABSTRACT

Blaser, R.E. 1976. **Plants and de-icing salts.** American Nurseryman 144(12): 8-9, 50, 52-53.

De-icing salts are used in increasing amounts in the snow belt states because highway and park agencies encounter public pressure to remove snow and ice from roadways, walkways, and cycling paths. Along with mechanical snow removal, the use of salts is the most economical and reliable method for preventing accumulation and for removing ice and snow. There are opposing factions concerning the use of de-icing salts. One faction demands that the roadways and walkways be kept free of snow and ice. The other is strongly opposed to de-icing salt practices. The detrimental effects of de-icing salt are soil and water pollution that is harmful to plants and humans as well as water contamination, which makes water useless for certain industrial practices.