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GYPSE MOTH (LEPIDOPTERA: LYMANTRIIDAE): HISTORY OF ERADICATION EFFORTS IN MICHIGAN, 1954-1981

Murray Hanna¹

ABSTRACT

Gypsy moth, *Lymantria dispar*, was first discovered in Michigan in 1954. Aerial spraying operations were conducted to eradicate gypsy moth infestations with synthetic insecticides (DDT, carbaryl, and diflubenzuron).

Riley (1870) documented the first occurrence of gypsy moth (*Lymantria dispar* L.), in North America. Perhaps *L. dispar* has been introduced into North America on more than one occasion, and there may be genetic differences among populations. In New England, where this insect has been established for more than a century, periodic widespread outbreaks result in substantial aesthetic, economic, and material losses. Gerardi and Grimm (1979) extensively reviewed the history, biology, damage, and control of gypsy moth in the United States from introduction until about 1976. Doane and McManus (1981) compiled almost all important recent research toward integrated management of gypsy moth.

The Michigan Department of Agriculture, Plant Industry Division (MDA-PID) is responsible for preventing the establishment and spread of gypsy moth in Michigan. The United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA-APHIS-PP&Q) endeavors to prevent or retard artificial spread of gypsy moth in the United States and Canada and to eradicate isolated infestations when feasible. A Federal Bee Indemnification Program administered by the USDA, Agricultural Stabilization and Conservation Service (ASCS), which provided for reimbursement to bee owners who sustained bee losses due to Federal-State treatment programs, was terminated about four months after gypsy moth aerial spraying had been completed in 1979. The USDA-APHIS-PP&Q and MDA-PID, under state authority, act together in quarantine and eradication efforts in Michigan.

INTRODUCTION INTO MICHIGAN

How long gypsy moth has occurred in Michigan is not known. Certainly it has been here for 30 years, probably for 40 years, and possibly for 50 years or more. It most likely has been introduced many times. During the summer of 1952, an unidentified individual left an unlabeled jar of larvae at the office of Walter F. Morofsky at Michigan State University in East Lansing. The sample went unnoticed until after the larvae had pupated and adult moths had emerged. Morofsky knew the specimens were gypsy moths, but he was unable to determine where the larvae had been collected. The insect was not reported in Michigan in 1953. Confirmation of a breeding colony of gypsy moths in Ingham County, Michigan, was obtained in 1954 when a resident on Jolly Road in Lansing informed the City Forester on 19 May that unfamiliar caterpillars were crawling on his house, garage, shrubs, and neighboring elm trees. Specimens of the larvae were identified as *L. dispar*.

Regulatory personnel and city employees conducted hurried visual surveys to determine the extent of the infestation while conditions were yet favorable to attempt eradication. Scouting for defoliation and other signs of infestation was done from vehicles along roads in

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East Lansing and Lansing in Ingham County, and in rural sections of eastern Eaton County. When survey was terminated on 5 June, it was estimated that the gypsy moth infestation extended over an area of 108 square miles encompassing the northwest corner of Ingham County and the adjacent portions of Clinton and Eaton counties.

EARLY ERADICATION EFFORTS

In 1954 Michigan was the westernmost state in which breeding colonies of gypsy moth had been found. A proposal to eradicate gypsy moth by applying synthetic insecticide from the air was promptly funded by the State Legislature and supported by interested residents of the community. Eradication then meant permanent elimination of gypsy moths from the state (it now means the reduction of existing gypsy moth populations in an area of operations to below detectable survey levels for an unspecified time into the future). A multi-engined aircraft was selected for safe operation at low altitude over densely populated areas. Single-engined aircraft, which could be maneuvered to avoid direct application of insecticide to cultivated fields and open water, were used in lightly populated rural areas. Aerial spraying was started on 6 June and completed on 10 June. About 84% of the 69,400 acre eradication plot consisted of favorable gypsy moth habitat. A total of 58,000 pounds of DDT was applied in these three Michigan counties to eradicate gypsy moth in 1954. O'Dell (1955) presented a detailed account of the activity.

In the years 1954–1959, DDT was used with complete confidence. Environmental concerns about misapplication of DDT eventually began to surface, and it should be noted that the insecticide was applied sparingly along the shoreline of Duck Lake in Calhoun County in 1960. By 1962 concern about adverse effects of persistent insecticide on human health and the environment abounded. The 1962 eradication plot in Onondaga Township of Ingham County encompassed a dairy farm. In an effort to avoid accidental contamination of milk, for which no legal tolerance of DDT had been established, carbaryl was used near pastures and forage crops; DDT was used in the usual way elsewhere. Notwithstanding this extra precaution, the farmer in the treatment area obtained a legal judgment against the USDA for loss sustained when milk was condemned due to the DDT contamination. DDT was never used again to eradicate gypsy moth in Michigan.

Gypsy moth pheromone trap survey results for the years 1962–1965 were negative (Hanna 1981). In the spring of 1966, the MDA enthusiastically prepared a publicity folder titled, "Oh Where Oh Where did the Gypsy Moth Go?", to report to the Michigan taxpayer on the successful eradication of an insect pest at a combined State-Federal cost of \$946,248. In the summer of 1966, before the folder became widely distributed, a property owner at Duck Lake in Calhoun County reported that gypsy moth caterpillars were feeding on oak and willow trees. The infestation occurred in an eradication plot that had been treated with DDT in 1960. By the time the infestation was reported, it was too late in the season to attempt eradication, but carbaryl was used in spring 1967. This time the risk of not applying enough insecticide was avoided.

RECENT PROGRAMS

More details have been summarized here about the years 1954–1972 because comparable information is far more readily available from state agencies beginning with 1973. The MDA gives notice of plans to eradicate gypsy moth to residents and property owners by personal service, mail, or newspaper publication. Such notice identifies the date of application, insecticide to be applied, and the area to be treated. The MDA and USDA hold public meetings, usually with help from the Michigan Cooperative Extension Service, to explain eradication operations to those directly concerned. Since 1973, the Michigan Environmental Review Board (MERB) has been provided written details of proposed action, probable environmental impact, probable adverse environmental effects, evaluation of alternatives which would avoid adverse environmental effects, and modifications to minimize environmental effects.

State of Michigan Environmental Impact Statements for Gypsy Moth, Gypsy Moth Management Policy Statements, and Gypsy Moth Management Program Reports for any year are public documents which are accessible through the MERB, MDA, or State of Michigan Record Center for a period of perhaps 10 years, after which they may be traced in the State Archives. Management strategies, which may have kept gypsy moth populations from dangerously exceeding economic thresholds thus far in Michigan, may be of interest to people in other places where it will inevitably become established.

Gypsy moth defoliation in all of Michigan has never exceeded 25 acres in any one year. Regulatory interventions with synthetic insecticide in 1954–1981 were correlated with gypsy moth survey results. No eradication operations were conducted in Michigan in 1958, 1961, 1963–1966 or 1968–1972 because no gypsy moth infestations were detected in the years immediately preceding.

Gypsy moth was collected in seven counties of Michigan in 1977, and plans were made for the aerial application of synthetic insecticide in 1978. On 3 May 1978, the MDA and USDA held a public meeting to discuss plans for applying diflubenzuron to 103,200 acres of infested gypsy moth habitat in portions of Clare, Gratiot, Isabella, Mecosta, Montcalm, and Saginaw counties. A majority of citizens in attendance objected strenuously to the proposed use of synthetic insecticide. Representatives of the Organic Growers of Michigan organization met later that same night at a private home near Lake, Michigan, to organize a protest group named Citizens Against Chemical Contamination. These two organizations later became plaintiffs against the MDA and the Director of MDA in the Circuit Court of the County of Ingham, and were successful in obtaining a Temporary Restraining Order on 25 May 1978 which resulted in cancellation of gypsy moth eradication plans in 1978.

Among regulatory interventions attempted over the years in Michigan as possible alternatives to aerial application of synthetic insecticide were (1) state quarantine enforcement (2) departmental regulation enforcement (3) mass trapping (4) disparlure mating disruption (5)

Table 1. Insecticide treatments to eradicate gypsy moth in Michigan, 1954–1981.

County	No. years treated	Acres treated			Total
		DDT	Carbaryl	Diflubenzuron	
Berrien	1	—	—	2,200	2,200
Calhoun	3	9,214	13,001	—	22,225
Clare	1	—	—	160	160
Clinton	5	37,537	—	—	37,537
Eaton	6	88,477	—	—	88,477
Gratiot	2	—	1,390	—	1,390
Ingham	5	121,947	—	—	121,947
Ionia	1	2,560	—	—	2,560
Isabella	6	—	36,468	28,739	65,207
Kalamazoo	1	—	643	—	643
Macomb	1	—	500	—	500
Mecosta	4	—	4,856	2,714	7,570
Midland	1	—	5,140	—	5,140
Montcalm	6	—	11,042	37,194	48,236
Newaygo	1	—	1,370	—	1,370
Oakland	1	—	704	—	704
Osceola	1	—	—	640	640
Saginaw	1	—	—	3,020	3,020
Shiawassee	2	5,280	—	—	5,280
Van Buren	1	—	493	—	493
Washtenaw	1	—	—	3,600	3,600
Wayne	1	—	405	—	405

gypsy moth nucleopolyhedrosis virus application (6) *Bacillus thuringiensis* bacterial application (7) exotic parasite release and (8) laboratory-reared sterile-male gypsy moth release. The only state quarantine enforced became effective 15 January 1973 and was rescinded effective 1 March 1976.

The dispersal of gypsy moth in Michigan, either by natural means (Mason 1975) or as a result of human activity (Spears 1974), went largely undetected until advanced pheromone trapping techniques became available. *L. dispar* males were captured in pheromone traps in three new counties in 1972. A small number of egg masses were found on firewood in a yard near where male moths had been caught in Isabella County. By tracing the source of the firewood, a well established infestation of gypsy moth was discovered in a 30-acre woodlot in Section 20 of Fremont Township in Isabella County. Either because gypsy moth populations had increased, or as a result of improved trapping technique, gypsy moth males were captured in 17 more new counties in 1973. Wallner (1974) reported that the pheromone trap survey in 1973 indicated at least 600,000 acres in Michigan were probably lightly infested with gypsy moth.

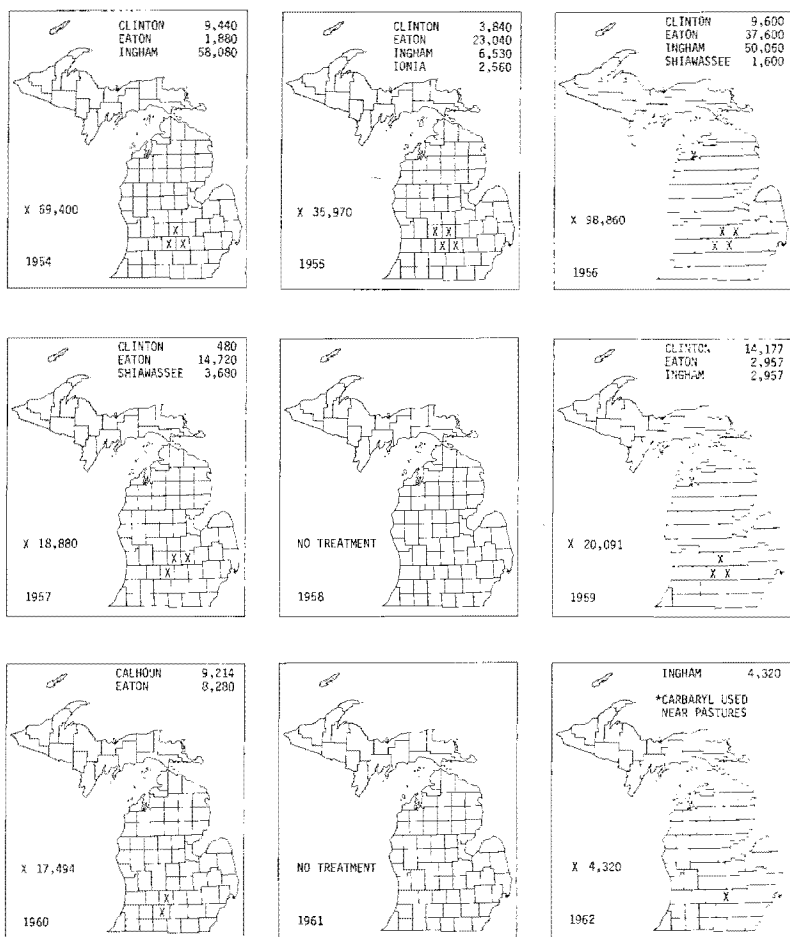


Fig. 1. Gypsy moth eradication operations, 1954-1962, employing DDT.

Table 1 lists the counties of Michigan in which synthetic insecticide was applied to eradicate gypsy moth, number of years treated, insecticides used, and acres treated. Figures 1 and 2 show by county, aerial spraying operations conducted to eradicate gypsy moth in the years 1954–1981, with insecticide used and acres treated. Eradication was a major component of gypsy moth management in Michigan in the years 1954–1981. Perhaps widespread aerial spraying of forests, woodlots, and wooded residential areas by regulatory agencies to eradicate gypsy moth, with relatively few valid claims of bee losses reimbursed by ASCS and with only the one reported dairy judgment regarding potential harm to human health or the environment, has provided both short-term and long-term benefits to the people of Michigan which well justify the investment.

For 28 years the management of gypsy moth in Michigan has been nearly the exclusive concern of federal and state government. Ecological factors may have been most important and may continue to keep gypsy moth populations from exceeding economic thresholds in certain places in Michigan. But gypsy moth will never completely go away by itself. And

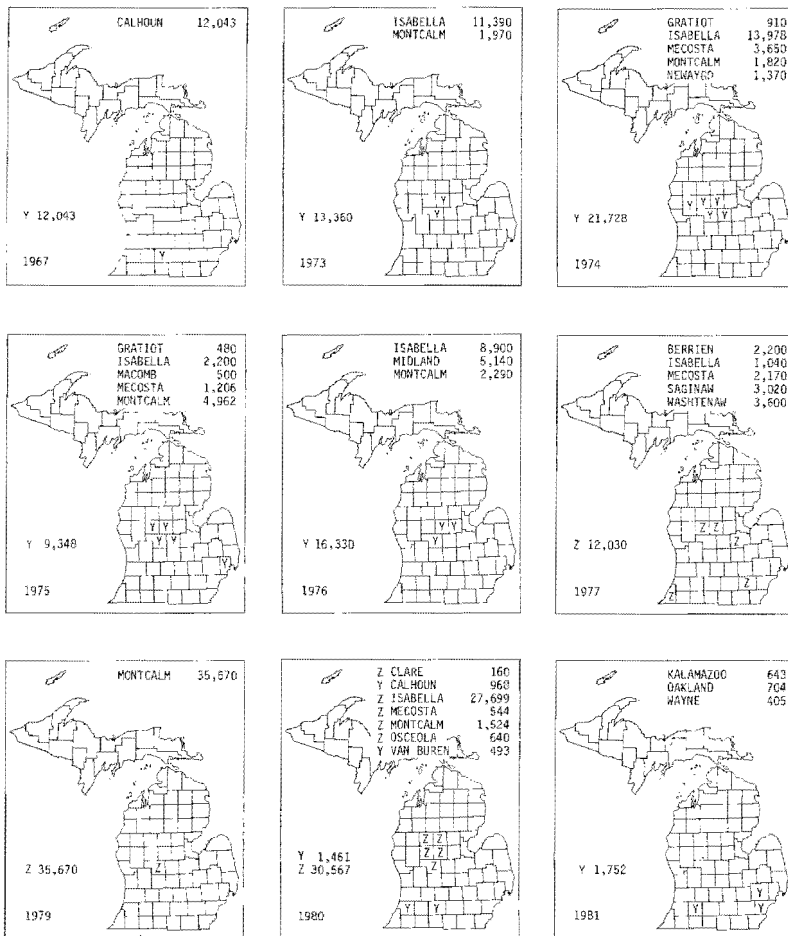


Fig. 2. Gypsy moth eradication operations 1967–1981. Symbol Y indicates application of carbaryl, while Z shows treatment with diflubenzuron.

right or wrong, whenever or wherever gypsy moth infestations interfere with business or comfort, citizens will demand relief. The time is coming when communities may want to decide for themselves whether or not to manage gypsy moth at the local level with local resources. Morse and Simmons (1978) used results of computer-simulated control strategies to devise alternatives to the gypsy moth eradication program in Michigan. Thomas E. Moore (pers. comm.) has proposed a system to create computer-generated models of gypsy moth population dynamics based on shared biological, ecological, environmental, and meteorological data accumulated in Michigan over a period of some 25–30 years.

Hanna (1981) summarized data from over 300,000 gypsy moth pheromone traps spanning 27 years, and identified the 47 counties of Michigan where gypsy moth had been collected in the years 1954–1980. Hillsdale, Jackson, Lapeer, Lenawee, Oscoda and Presque Isle counties were new 1981 records for gypsy moth based on male moths captured in pheromone traps. Combined records of the MDA, USDA, Michigan Department of Natural Resources, and National Campers and Hikers Association showed that gypsy moth was collected again in 1981 in Berrien, Clare, Clinton, Eaton, Gratiot, Ingham, Ionia, Isabella, Kalamazoo, Macomb, Mescota, Midland, Montcalm, Newaygo, Oakland, Saginaw, Shiawassee, Van Buren, Washtenaw and Wayne counties, all of which were counties where eradication operations had previously been conducted.

Regulatory interventions with synthetic insecticide in 22 counties had temporarily modified the environment of some 400,000 acres of Michigan woodlands inhabited by gypsy moth since 1954. MDA and USDA staff members engaged in regulatory activity occasionally have recorded observations on occurrence, development, quality, and persistence of gypsy moth populations in diverse habitats. Good weather data are available for Michigan. No other state has a comparable historical perspective against which to test predictive models of weather impact, the one agent which simultaneously and unpredictably affects host plants, target organisms and their competitors, predators and diseases, and intervention efforts. It is unfortunate that at least two people who were most familiar with gypsy moth eradication operations are already dead. My recollection on the property where gypsy moth was first discovered and of the localities where eradication operations have been conducted is surely fading. If existing historical gypsy moth population data for Michigan are to be combined with comprehensive Michigan weather data for the same period to provide a basis for predicting impact on forest environments, it had best be done soon, before more useful information becomes irretrievably lost.

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