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## AN ASSESSMENT OF GYPSY MOTH ERADICATION ATTEMPTS IN MICHIGAN (LEPIDOPTERA: LYMANTRIIDAE)

Steve H. Dreistadt<sup>1</sup>

### ABSTRACT

Michigan's infestation of gypsy moth, *Lymantria dispar*, extends over 600,000 acres. First discovered in Michigan in the 1950s, gypsy moth was reportedly eradicated through the use of DDT then reintroduced in the 1970s. Substantial circumstantial biological evidence, however, points to the probability that gypsy moth has resided continuously in Michigan for over 30 years. Environmental factors may be largely responsible for containing Michigan's gypsy moth populations.

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It is often argued that the failure of early attempts to eradicate the gypsy moth, *Lymantria dispar* L. (Lepidoptera: Lymantriidae), from the eastern United States was due largely to the lack of adequate pesticides (USDA 1981). The refinement of aerial application techniques and the commercial availability of chlorinated hydrocarbon pesticides in the 1950s led some persons to contend that the gypsy moth could still be eradicated from North America even though it was by then widely established (Dunlap 1980). An assessment of the attempted eradication of the gypsy moth in Michigan is therefore of great interest. Gypsy moth was first discovered in Michigan, distant from the generally infested eastern United States, after the availability of aerial DDT applications. Gypsy moth's reportedly successful eradication in Michigan in the 1960s and 1970s has been cited as a precedent by eradication proponents from North Carolina to Oregon (North Carolina Department of Agriculture 1974, Oregon Department of Agriculture 1982).

### ERADICATION HISTORY, 1950s AND 1960s

In the summer of 1952, an unidentified individual left an unlabeled jar of caterpillars at Michigan State University in East Lansing. These were later identified as gypsy moth. Where they had been collected could not be determined and no gypsy moths were reported in Michigan the following year (Hanna 1982).

In May 1954, a Lansing, Michigan, homeowner reported that unfamiliar caterpillars were crawling on his property. These were identified as *Lymantria dispar*. A visual roadside survey, primarily from slow-moving vehicles, was made by the United States Department of Agriculture (USDA) and Michigan Department of Agriculture (MDA) to delimit the apparent infestation. Ten persons in 10 days surveyed approximately 230 miles<sup>2</sup> (O'Dell 1955). The cities of Lansing and East Lansing and surrounding portions of Ingham, Eaton and Clinton counties in south central Michigan were determined to require immediate eradication treatment with DDT (Hanna 1982).

In early June 1954, approximately 58,000 pounds of DDT were aerially applied to over 100 miles<sup>2</sup>. More gypsy moths were found and from 1954 through 1962 approximately 265,000 acres were aerially sprayed with DDT (see Fig. 1). In 1962, a farmer in the treatment area was awarded damages as a result of loss sustained when his milk was condemned due to DDT contamination. No more gypsy moths were found the following year and 1962 turned out to be the last year during which DDT was sprayed against the gypsy moth in Michigan.

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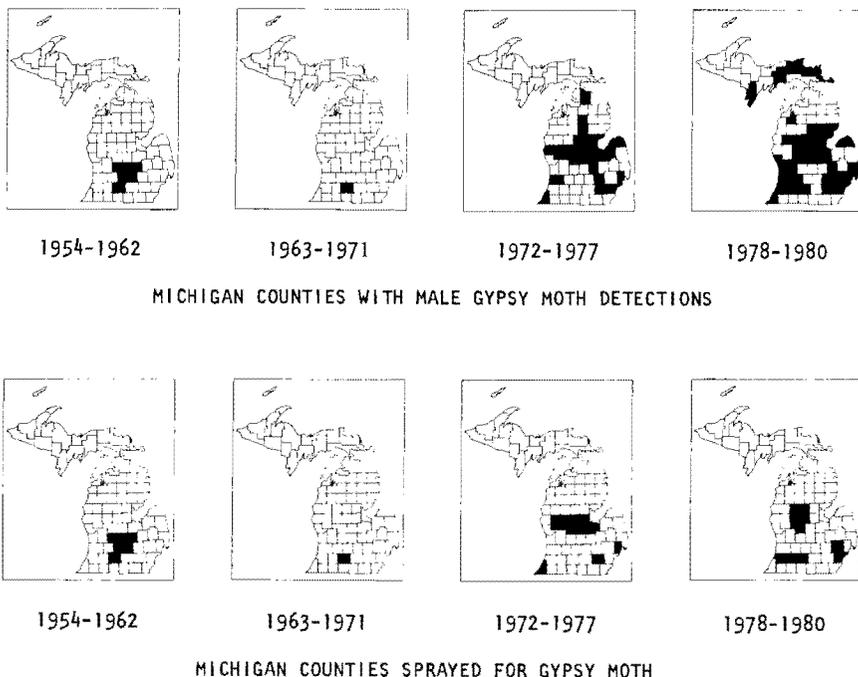


Fig. 1. Michigan counties with male gypsy moth detections and counties sprayed for gypsy moth, 1954-1980 (adapted from Hanna [1981, 1982]).

During the DDT spray period the MDA employed an average of 5000 traps a year. Each trap was baited with the natural sex attractant extracted from adult female gypsy moths. Treatment areas were determined largely on the basis of moth captures the previous spring and follow-up visual roadside surveys.

The discontinuance of DDT spraying in 1962 was followed in 1963 by a switch from the use of the natural pheromone, extracted from female moths, to the use of detection traps baited with Gyplure, a synthetic attractant. Gyplure was used in Michigan detection traps from 1963 through 1971. No gypsy moths were detected during the Gyplure trapping period with the exception of 1966.

In the spring of 1966, the MDA prepared and began distributing a publicity folder titled, "Oh Where Oh Where Did the Gypsy Moth Go?" which reported to the taxpayer on the supposedly successful million-dollar eradication of the gypsy moth (Hanna 1982). Early that summer, however, a Duck Lake property owner reported finding gypsy moth caterpillars in Calhoun County which had been previously treated with DDT. Trapping in this location did subsequently capture a few moths. In response, over 12,000 acres were aerially sprayed with carbaryl (Sevin) in the spring of 1967.

#### ERADICATION HISTORY, 1970s AND 1980s

In 1972, Disparlure, a new synthetic attractant, replaced Gyplure. Moths were captured in three counties, the first detections since 1966. In 1973, improved lure dispensing, including the use of a troctanoin keeper to extend the pheromone's useful life, was

employed in conjunction with redesigned traps. That summer 1828 moths were trapped in 21 counties (Hanna 1981).

Spring applications of carbaryl and diflubenzuron (Dimilin) were initiated beginning in 1973 in response to these and subsequent gypsy moth finds. According to the MDA, the objective of the 1970s treatment program was that of "reducing gypsy moth populations in Michigan to nondetectable levels." By 1976, MDA reported that "considerable progress has been made relative to the eradication of the gypsy moth from Michigan" (MDA 1976a). It was projected that "by 1980 the gypsy moth infestation in Michigan will be confined to Gratiot, Isabella, Midland and Montcalm counties" (MDA 1976b.)



In 1978, Michigan began a switch from the mixture of optical isomers of Disparlure in detection traps to the use of the more attractive (+) enantiomer. In 1980, the first year when most Michigan detection traps employed this improved lure, gypsy moth was detected in 37 counties. Much of the State of Michigan is now considered to be generally infested with the gypsy moth.

#### ASSESSMENT OF ERADICATION HISTORY

According to the MDA, the gypsy moth population first identified in 1954 was eradicated by 1962 through the use of DDT. With the exception of the 1966 infestation first discovered by a property owner, and reportedly eradicated through the use of carbaryl, the MDA stated that no gypsy moth populations were present in the state from 1962–1971 (Dreves 1982). The 1970's infestation reportedly was a reintroduction, in about 1972, traced to an egg mass contaminated trailer (Simmons 1982; Dreves, pers. comm.). The USDA also reported that gypsy moth was successfully eradicated from Michigan in 1967, and from Macomb and Washtenaw counties, Michigan, in 1976 and 1977 respectively (USDA 1982).

Substantial circumstantial biological evidence, however, points to the probability that gypsy moth has resided continuously in Michigan for over 30 years. The original infestation was never well-defined by the USDA and MDA. Although records as to the specific location of the detection traps in the 1950s and 1960s are apparently unavailable, 5000 natural pheromone-baited traps per year in a state of over 30 million acres was certainly inadequate to truly delimit the 1950s infestation. Roadside visual surveys are grossly inadequate for delimiting low-level insect populations. For example, 12,000 man-hours from 1979–1982, and the use of trained "sniffer" dogs, were required to find four egg masses known to exist within 10 miles<sup>2</sup> in Santa Barbara, California (California Department of Food and Agriculture 1982). This survey effort can be compared to less than 1000 man-hours spent in Michigan to delimit an infestation covering at least 100 miles<sup>2</sup>.

Inadequate efforts to delimit the initial infestation during the 1954–1962 DDT spray period were coincidentally followed by a switch in trap lure. Gyplure, which was used in Michigan detection traps from 1963–1971, was later found to be inactive against the gypsy moth (Jacobsen et al. 1970, Cameron 1973). With the exception of the 1966 moth captures in an area trapped in response to visual reports of caterpillars, no gypsy moths were captured in Michigan during the Gyplure trapping period (1963–1971). The 1966 capture may be attributed to the occasional blundering of a few moths into the traps. In 1973, with an improved lure and redesigned trap, almost 2000 moths were found to be distributed throughout 21 counties. The extreme importance of trap efficacy is further demonstrated by the dramatic increase in number and locations of moth finds which occurred by 1980 when the more attractive (+) enantiomer lure was substituted for the mixture of optical isomers which had previously been employed (Table 1).

The MDA reported that, except for the 1966 infestation, no gypsy moths existed in Michigan from 1963–1971. It is however, biologically implausible for the insect to have spread to 21 counties by 1973 if it had actually been eradicated and then reintroduced in 1972 as reported. A more likely explanation for the 1973 widespread discovery of gypsy moth is that low level populations existed prior to the switch to Disparlure but were not detected by Gyplure-baited traps. The increased moth captures may also have resulted from "carry-in" of gypsy moth from eastern states. The relative importance of gypsy moth carry-in vs. the probability that Michigan harbored undetected populations throughout the 1960s apparently cannot be evaluated. While inadequate detection tools and insufficient data-gathering and record-keeping preclude definitive conclusions, it appears that gypsy moth has been well-established in Michigan since before 1954.

The MDA is no longer attempting state-wide gypsy moth eradication. According to the MDA, "In 1981 (their) objective became the containment of gypsy moth populations within the generally infested area in the central lower peninsula and the eradication of small isolated infestations remote from the generally infested area" (MDA 1983). The

Table 1. Michigan male gypsy moth detection history.

Years	Trap Attractant	Average number of traps/year	Average number moths/year	Total number of counties with detections
1954-1962	Natural pheromone	5,000	16	6
1963-1971	Gyplure	1,700	NONE <sup>a</sup>	1
1972-1977	Disparlure (+/- enantiomers)	19,700 <sup>b</sup>	580	24
1978-1980	Disparlure (+ enantiomer)	36,000	9,600	37

<sup>a</sup>Excludes the 15 moths detected in Calhoun County in 1966 which were found after a property owner reported the presence of numerous larvae.

<sup>b</sup>Excludes the 35,000 traps employed in a mass trapping program in Isabella County in 1975 and 1976.

MDA's 1983 gypsy moth treatment program called for two aerial applications of carbaryl (Sevin-4-Oil) in nine locations harboring innocuous insect populations (MDA 1983). Several proposed treatments were cancelled in apparent response to local opposition. Five isolated infestations were treated in Kalamazoo, Livingston, Muskegon, Oakland, and Van Buren counties (Dreves, pers. comm.).

### CONCLUSIONS

Given the history of attempted gypsy moth eradications, it is questionable whether Michigan should be expending a major portion of its gypsy moth program budget on attempts to eradicate apparently isolated populations. Analysis at Michigan State University indicates that it is less costly and less environmentally disruptive in the long run to initiate treatments only where gypsy moth populations threaten to outbreak (Morse and Simmons 1979).

Gypsy moth today inhabits an estimated 600,000 acres in Michigan (Morse and Simmons 1979). An accurate determination of gypsy moth's current range cannot be made in part due to Michigan's lack of consistent state-wide trapping. In 1982 for example, three of the six original counties treated with DDT during the 1950s and 1960s contained no traps. Areas known to be infested in the other three DDT-sprayed counties contained localized "Delimiting" traps, but no county-wide detection grid survey (MDA 1982).

Though gypsy moth has probably been in Michigan continuously for over 30 years, a total of only 1 mile<sup>2</sup> has been noticeably defoliated (Dreves, pers. comm.). This lack of defoliation is probably due in part to efforts to reduce the rate of gypsy moth introduction into Michigan and to periodic pesticide applications. Most of Michigan, however, has never been sprayed for the gypsy moth.

The ability of gypsy moth to maintain naturally stable, innocuous populations has been documented in several studies in North America (Campbell et al. 1975a, 1975b; Campbell 1976; Campbell and Sloan 1976). No defoliation has ever been reported in some portions of the insect's world-wide range. Gypsy moth is rare and may have become extinct in the British Isles (Giese and Schneider 1979). Environmental factors may be largely responsible for containing Michigan's gypsy moth populations.

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