PRELIMINARY STUDIES OF THE OCCURRENCE OF COTTONY MAPLE SCALE IN FIVE MICHIGAN COUNTIES

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INTRODUCTION

Mosquito control operations were initiated in the two Michigan counties of Bay and Saginaw during the summer of 1977 and have been in continuous operation for the past 23 years. Ultradecheous low volume (ULV) application of insecticides from ground equipment has been an important part of the integrated mosquito management program established to control mosquitoes in these counties. Although scale outbreaks are well documented in agricultural settings (Michelbacher et al., 1946; Lord, 1947; DeBach, 1955; Ripper, 1956; Bartlett and Lagace, 1960), insecticide induced scale outbreaks in urban settings have been infrequently reported. Since the inception of mosquito control in these two counties they have experienced periodic outbreaks of Cottony Maple Scale (*Pulvinaria innumerabilis*). Outbreaks were reported in local newspapers during the summers of 1980 and 1995. The authors recall dealing with outbreaks in other years, although it wasn’t reported by the local media. Localized outbreaks also occurred in various counties in northwest Iowa during 1994 and 1995 (Lewis 1994 & 1995).

Low-volume aerial applications of pyrethroid insecticides have resulted in severe outbreaks of scale insects in southern pine seed orchards (Negron and Clarke, 1995). Studies of Malathion applied as a thermal fog in South Lake Tahoe, California suggested that the scale outbreak was associated with weekly applications to control nuisance mosquitoes (Roberts, 1971). Additionally, lecanium scale outbreaks on street trees have been observed in other Michigan cities (Midland and Plainwell) as a result of insecticide fogging for mosquito control (Kennedy and Merritt, 1980). During the late 1970s, Mackinaw Island, one of Michigan’s reknown tourist attraction experienced a severe lecanium scale (*Lecanium corni* complex) outbreak as the result of weekly applications of dimethoate along city streets to control house flies (*Musca domestica*) and biting stable flies (*Stomoxys calcitrans*) (Merritt et al., 1983).

Predators of scale insects can play an important role in the regulation of population densities (DeBach et al., 1971). Large changes in population densities often reflect the absence of natural predators or are the result of conditions that renders the predators ineffective (DeBach and Bartlett 1951: DeBach et al., 1971). High populations of scale insects have been associated with individual trees in dusty environments (Keen, 1952), small exotic ornamental plantings (Herrick, 1931), or overmature or stressed trees (Buttrick, 1912). However, the most frequent explanation for scale outbreaks is the result of lowered predator densities due to insecticide applications (DeBach et al., 1971; Croft and Brown, 1975; Frankie and Ehler, 1978).

The Saginaw County Mosquito Abatement Commission is a publicly funded mosquito control agency in Michigan. Part of the program includes ULV application of malathion (formulated as Fyfanon™) and permethrin (formulated as Biomist 4+4™) or sumithrin (formulated as Anvil 2+2™). During the 1995 outbreak of Cottony Maple Scale (CMS) this agency received numerous complaints from citizens claiming that the honeydew secreted from CMS was a result of our ULV applications. Additionally, Saginaw Counties Michigan Cooperative Extension Agent received numerous calls in regards to the CMS problem. Since this was a re-occurring problem we decided to study the occurrence of CMS in Saginaw County and four adjacent counties that do not have mosquito control operations.
MATERIALS AND METHODS

The study was conducted during the past five years (1995-1999) in ten villages of which five were in Saginaw County and five were in out-county locations. Each Saginaw County village was paired with the closest out-county village similar in size. Distances between the paired villages ranged from 9-18 km (5.6 - 11 miles). The paired villages were as follows: Birch Run (Saginaw Co.)/Clio (Genesee Co.), Merrill (Saginaw Co.)/Breckenridge (Gratiot Co.), Chesaning (Saginaw Co.)/Montrose (Genesee Co.), Frankenmuth (Saginaw Co.)/Vassar (Tuscola Co.), and Oakley (Saginaw Co.)/Elsie (Clinton Co.).

For sampling purposes, each village was divided into four quadrants with three Silver Maple (Acer saccharinum) trees selected in each quadrant totaling twelve trees sampled per village. The same trees were sampled throughout this study. Each tree was sampled by selecting 10 branch terminals and then counting all the white egg sacks on the last two feet of each branch terminal. Trees were sampled when egg sacks were most visible resulting in sampling dates ranging from May 28 - July 25.

RESULTS

Counts of CMS were significantly higher in all years of the study in Saginaw County locations compared to the out-county locations (fig.1). However, there was extreme variance from year to year in all locations (table 1). It is interesting to note that 1995, which had the highest mean CMS densities also was the year with the fewest ULV acres sprayed. In 1996 CMS densities dropped 21% even though ULV acres sprayed were the highest of the five year study and were 2.4 times greater than 1995. This study indicates that CMS densities are naturally very cyclical due to local climatic conditions and predator densities. Although it is possible that ULV spraying may have some effect on CMS densities, it also is apparent that ULV spraying is not the main factor effecting CMS densities since their seems to be little correlation between CMS densities and total number of acres sprayed. Another possible explanation is that ULV spraying is lowering predator densities thus causing out-breaks of CMS; however data in figure 2 doesn't support this hypothesis. In 1995 which had the largest densities of CMS also was the year with the fewest ULV acres treated. One may speculate that ULV spraying during a given year will have more effect on CMS or predator densities the following year. Again, figure 2 doesn't show this kind of relationship; for example in 1996 which had the greatest number of ULV acres treated it was followed in 1997 by the lowest CMS population densities.
Fig. 1. Mean number of cottony maple scale per branch from Saginaw villages and Out-County villages.

<table>
<thead>
<tr>
<th>Village of: Saginaw Co.</th>
<th>Low (year)</th>
<th>High (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birch Run</td>
<td>1.05 (97)</td>
<td>22.2 (99)</td>
</tr>
<tr>
<td>Merrill</td>
<td>0.67 (98)</td>
<td>8.97 (96)</td>
</tr>
<tr>
<td>Chesaning</td>
<td>0.13 (97)</td>
<td>13.26 (95)</td>
</tr>
<tr>
<td>Oakley</td>
<td>0.03 (99)</td>
<td>8.29 (95)</td>
</tr>
<tr>
<td>Frankenmuth</td>
<td>0.05 (97)</td>
<td>15.76 (95)</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Village of: Out-County</th>
</tr>
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<tbody>
<tr>
<td>Clio</td>
</tr>
<tr>
<td>Breckenridge</td>
</tr>
<tr>
<td>Montrose</td>
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<tr>
<td>Elsie</td>
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<td>Vassar</td>
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Table 1. High and low mean number of cottony maple scale per branch from Saginaw Co. villages and Out-County villages during five year study.
Fig. 2. Mean number of cottony maple scale per branch for Saginaw and Out-County villages compared to total yearly ULV acres treated.


