

Solving The Mystery of "Maple Malady"

BLAME THE PEAR THRIPS!

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INTRODUCTION

The adult pear thrips, *Taeniothrips inconsequens*, is unusual-looking and about the size of a comma (0.04 to 0.06 inch), with two pairs of feather-like wings (Fig. 1). This introduced or "exotic" insect was first observed in the United States in 1904 on pear blossoms in California. By 1907 pear thrips had been reported in New York on apple and pear trees. In both its native Europe and in North America it attacks a variety of orchard and forest trees. Primary hosts in the northeast include maple, basswood, beech, walnut, oak, white ash, dogwood, lilac, grape, pear, apple, cherry, peach, plum, apricot, and quince.

As early as 1978, sugarmakers in Pennsylvania reported late spring leaf damage on sugar maples, which was thought to be caused by early spring frost. However, the culprit that was actually responsible for this injury, called "maple malady," was not determined until the early 1980s when pear thrips was identified as the cause. Following an explosion of pear thrips populations in the late '80s, it temporarily gained stature as an economically significant pest in the northeastern United States. The outbreak of 1988 left over a million and a half acres of sugar maples leafless or with brown and distorted foliage. Consequently, considerable public and political concern focused for the first time on the negative impact of pear thrips on sugar maple and maple products.

LIFE CYCLE AND DAMAGE

Despite the fact that pear thrips has only one generation each year and spends most of its life in the soil, it has spread successfully across the Northeast. One factor contributing to the dispersal and build-up of this pest lies in the nature of its sex life. All pear thrips in this country are females which reproduce asexually (without males). Males have been observed only in the indigenous European populations. Females do not need to spend time searching for a mate, therefore, they can begin to feed and lay eggs as soon as they emerge from the soil at the end of March or early in April, just when sugar

maple buds are starting to swell. At this time, they feed on foliage within expanding buds. Later, using a saber-like egg-laying device (ovipositor), each female deposits 100-200 eggs in the base and veins of young, developing leaves. Eggs hatch after 6-14 days, depending on the temperature, but usually by the first part of May. The wingless larvae are pale to translucent white with red eyes, although sometimes appearing green due to the maple leaf background. Larvae habitually congregate on the undersides of the leaves. Both larvae and adults feed upon the foliage for 2-3 weeks. Larvae drop from the leaves during mid-May to mid-June and burrow 6 to 26 inches into the soil where they transform into overwintering adults by late October. Adults remain in the soil within protective chambers until warm soil temperatures (above 43°F) the following spring beckon them to emerge.

Bud development of sugar maple and emergence of new generations of pear thrips from the soil occur almost simultaneously. Herein lies the greatest threat to the welfare of the host. If pear thrips are able to enter sugar maple buds just as buds begin to swell, but before leaves expand, they have found a safe, dry environment within which to feed. In this refuge, the insect can wreak havoc on newly developing foliage, especially if buds develop slowly. The thrips pierces leaf tissue with a straw-like, piercing-sucking mouthpart, then siphons out the plant's juices, which creates a shriveled, discolored and wilted leaf (Fig. 2). Heavy feeding, followed by oviposition damage, can seriously deform sugar maple leaves. A heavily infested tree may drop these damaged leaves and attempt to produce a new complement of foliage. Such attempts at refoliation draw upon carbohydrate reserves in the roots, which further stresses the tree. Under these conditions, prudent sugar makers should use fewer taps per tree or cease tapping previously infested trees altogether the year following thrips damage to prevent additional stress.

In addition to leaf damage, scientists suspect that pear thrips can transmit a fungal disease, maple anthracnose. Maple anthracnose infections on sugar maple frequently coincide with pear thrips infestations. This disease decreases the photosynthetic ability of leaves and, in severe cases,



Fig. 1. Adult pear thrips resting on a sugar maple bud.

it can be fatal. The recent increase in maple anthracnose, possibly spread by pear thrips, poses yet another potential threat to the overall health of sugar maple forests.

A SURVEY OF PEAR THRIPS POPULATIONS IN NEW YORK'S SUGARBUSHES

Pear thrips can be monitored using several different techniques: soil sampling, emergence traps, bud counts, and visual traps. Visual traps in commercial sugarbushes were used in our New York survey to monitor population levels in 1990 and 1991. Traps were placed at 13 sites in 12 counties during 1990, and at 17 sites in 15 counties during 1991. In the spring of 1992, trapping has continued at 12 sites in 12 counties. Our survey is part of a larger effort in conjunction with 17 other states, and its goal is to monitor the damage caused by pear thrips as well as the insect's distribution and abundance. Support for the survey is provided by the National Cooperative Agricultural Pest Survey (CAPS), a program of USDA - Animal and Plant Health Inspection Service (APHIS).

Pear thrips was present in all of the counties surveyed in New York State during 1990 and 1991. The first trap catch of adult pear thrips in 1990 occurred between

(Cont'd)

16 occurred much later - between April 3rd and 10th. Peak trap capture, however, was at approximately the same time both years - between April 21st and 28th in 1990 and between April 24th and May 1st in 1991. The highest average trap counts in 1990 exceeded 100 thrips per day. In contrast, 7 was the highest average count per day in 1991. The difference between the average number captured per day during the peak emergence week *decreased fourteen fold* from 1990 to 1991!

Defoliation and leaf quality ratings were also estimated in mid-June each year of the survey in order to determine the extent of pear thrips damage. At most sites, defoliation caused by pear thrips was low (< 30%) or absent in 1990. Only slight leaf discoloration and distortion occurred in sites with low defoliation. Extent of damage appeared to be associated with the close timing of peak thrips emergence with the occurrence of the most susceptible stage of sugar maple bud development (early bud stage - "bud break"). Thus, given the relatively late emergence dates cited above for 1991, it is not surprising that defoliation was almost totally absent that year.

SUGAR MAPLE REGENERATION

In a study of sugar maple regeneration in Tompkins County, New York, pear thrips was the most numerous and damaging insect that fed on tree seedlings. At sites where pear thrips was abundant, most of the newly emerging seedlings died after being fed upon by thrips larvae. This happened even in years when thrips damage to overstory trees was low to moderate. In mid- to late-May, pear thrips larvae that feed in the tree canopy dropped to the forest floor, or were washed off overstory leaves by a heavy rain. Many of these larvae crawled onto understory plants to feed before going underground. If the thrips fed on newly germinated sugar maple seedlings in large numbers (10-100 larvae per seedling), the cotyledons and leaves soon shriveled and died. At this early stage the seedlings were not able to re-leaf, and within a week many died. If one is not consciously searching the woods for seedlings during the first few weeks in May, it is easy to overlook this impact on sugar maple by pear thrips, because by mid-June the dead seedlings have disappeared.



Fig. 2A Sugar maple leaf damaged by pear thrips.

Nevertheless, sugar maple seedlings remain abundant in most northern hardwood forests. Even at sites where thrips were numerous there were occasional years when the crop of new sugar maple seeds was especially large, such as 1985 and 1990, and some of the seedlings survived the thrips damage.

FUTURE IMPACT OF PEAR THRIPS ON SUGAR MAPLES

It is clear that pear thrips will be a permanent resident in northeastern hardwood forests and will continue to be associated with sugar maples. Although pear thrips has been recognized as one of the major insect pests contributing to the recent "maple dieback," the current trend of decreasing pear thrips populations is encouraging. We may never know exactly why a pear thrips outbreak of such magnitude occurred in the northeastern United States in 1988. Research is presently focused on finding biological control agents to manage pear thrips populations, such as naturally occurring soil fungi. Current studies also examine ecological factors that affect pear thrips populations and their ability to cause extensive damage. For example, the number of thrips present in soil from the previous fall, thrips winter survival rates, and the impact of local weather conditions

on thrips emergence and damage levels. As mentioned above, the most important variable appears to be the phenological synchrony between bud development and thrips emergence, so 1988 may very well have been a "fluke!" Nevertheless, with improved awareness the sugar maple industry will be better prepared to deal with this tiny pest in the years to come!

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