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Extension Based Tree and Small Fruit Insect Pest Management Strategies

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INTRODUCTION

In 1978, a System for the Computer Management of Pests (SCAMP) was developed at the New York State Agricultural Experiment Station as an extension communications and information delivery system. In response to requests by fruit agents for timely, in-depth strategies for fruit insect and mite pests, based on the same information available to the farm advisors in the New York Tree Fruit Pest Management Program, a STRATEGY file on SCAMP was developed in 1979. In 1980, a new computer program, LIBRARY, was developed for easier storage, retrieval, and editing of the strategies. In addition to the strategies transferred from STRATEGY, 10 new tree fruit and three small fruit strategies were placed in LIBRARY.

SCAMP users wishing to use LIBRARY may login and will be asked:

WHAT WOULD YOU LIKE TO DO NEXT?

They may answer:

LIBRARY

They will then be asked:

ENTER: COMMODITY, HELP, OR END

They may answer:

TFRUIT

They will then be asked:

ENTER: FILE NAME, HELP OR END

They may answer:

APPLE MAGGOT or AM

They will then be asked:

ENTER: WARNING, LIFE HISTORY, MONITORING, CONTROL, HELP, OR END

They may then enter and receive whatever information they wish.

The purposes of this publication are to update the strategies made available through New York's Food and Life Sciences Bulletin No. 85, January 1 980, to provide the new strategies, and to demonstrate and document the service provided New York extension agents and their constituents through LIBRARY. Portions or all of the strategies within this publication may be duplicated and disseminated if credit is given to the author and the Entomology Department, New York State Agricultural Experiment Station.

I wish to thank my colleagues within the department for advice in writing the strategies. Particular thanks go to James P. Tette, IPM Coordinator, and Douglas Bruno and David Way, Tree Fruit Pest Management Farm Advisors, for their help in developing the tree fruit monitoring and action thresholds; and to George Schaefers, small fruit enlumologist, for his aid in preparing the small fruit strategies.

I also wish to thank Janet Walton, Linda Smith, and Tammy Caplan for entering and editing the strategies in the computer.

APPLE GRAIN APHID (AGA)

Rhopalosiphum fitchii (Sanderson)

Life History

The AGA spends most of the growing season on grains and grasses, and although high populations can be found on apple in the early spring, it is not considered a serious pest of apple. The AGA overwinters as a black egg on the bark of the previous year's growth and can not be differentiated from rosy apple aphid and green apple aphid eggs. The AGA is the first of the three species to hatch in the spring as the trees begin to break dormancy; by bloom, heavy infestations may occur on the new growth and become a concern to growers. By petal fall, the AGA has begun to migrate to its alternate hosts and shortly thereafter it cannot be found on the trees.

Monitoring

Since the AGA is not an economic pest and leaves the trees shortly after petal fall, no specific monitoring is required.

Control

Since the AGA is not an economic pest and leaves the trees shortly after petal fall, insecticides directed specifically against this pest are not recommended. The pink and petal fall sprays applied to control the rosy apple aphid will also control the AGA.

APPLE MAGGOT (AM)

Rhagoletis pomonella (Walsh)

Warning

AM emergence is predicted to occur at about 1137 degree-day units, with a base of 43F. This normally occurs in mid-June in downstate New York and late June or early July in upstate New York. AM sticky boards should be ordered from the pest management program. See MONITORING for trap use.

Life History

The AM is a native American species that has become a pest of the introduced apple. Typically, there is a single generation a year with aduit flies emerging from about mid-June through apple harvest.

Normally, AM is not resident within commercial apple orchards, but annually migrates in from unsprayed sites and must be killed before oviposition occurs. Although migration can occur whenever flies are out, it is normally not a serious problem until late July or August. Growers should, therefore, become more concerned and tighten up their AM control programs as the season progresses.

AM emergence is related to heat units, soil type, host, and rainfall.

1. Heat units, more specifically, degree-days, must be above 1137 with a base of 43F for maggot to emerge. After the appropriate degree-days have been ac cumulated from March 1, other factors become impor tant.
2. Soil type. AM tend to emerge eariier in sandy soil than in heavy clay soil.
3. Host. AM tend to emerge earlier when they have been reared on early maturing varieties rather than late maturing varieties. AM females also prefer to oviposit on fruit as it begins to ripen, and, therefore, are often found first around these trees. Early oviposition stings on late maturing varieties frequently do not result in wormy fruit. The eggs or newly hatched larvae are believed to be crushed by the rapidly growing fruit.
4. Rainfall. There is a sharp increase in AM emergence following a soaking rainfall. It is believed that rain loosens the soil, especially heavier soils, and makes it easier for the adult to push its way to the surface.

Once the AM has emerged, a maturation or pre-oviposition period of 7 to 10 days is required before a female begins laying eggs. Growers have timed their first AM spray at least 7 to 10 days after first emergence in order to take advantage of this fact.

Monitoring

The method of determining when to spray for AM is important and is based on whether monitoring of adult emergence and migration into an orchard is being conducted.

The most commonly used monitoring tool for AM emergence and migration is the yellow sticky board. A few growers may be using red sticky spheres which are used the same way as the boards.

First emergence can best be determined for an area by placing sticky boards in an unsprayed site where early apple varieties are grown on sandy soil and AM is known to exist. Besides checking the traps on a regular schedule o,

no longer than 3 days, traps should be checked after the first warm day following a rain.

Once emergence has been determined for an area, the boards should be placed along the edge of the block closest to the area from which the greatest AM migration is believed to come. The traps should be inspected for AM adults at least every 3 days, and an insecticide should be applied as soon as possible after the first catch. The boards should continue to be monitored for AM, but another insecticide application should not be made until the first fly is caught after residues from the last spray are no longer present in amounts large enough to protect the crop. The length of this period will vary with conditions; for most materials, residues remain at effective levels for about 10 to 14 days. Rainfall is probably the most common factor that can reduce field residues.

Growers wishing to monitor orchards to determine spray timing should follow the directions provided in "Using Sticky Traps To Monitor Fruit Flies In Apple And Cherry Orchards." Copies of this publication are available through the pest management program or your county agent.

If boards are not being used to monitor migration into an orchard, growers have historically applied their first AM spray 7 to 10 days after first AM emergence in their area If there was not an AM problem within the orchard the previous season, or the block is not an early variety with an adjacent unsprayed site that could be a source of early infestation, a grower can normally extend the period before the first spray to 14 to 21 days after first AM emergence. Additional sprays should be applied on a 10 to 14 day schedule.

Control

The AM adult is an active insect and excellent control can be achieved with insecticide coverage that would not be acceptable for controlling many other insect pests. The fly will sooner or later come into contact with enough material to kill it. Growers using alternate middle row spraying, as well as those applying the insecticide high concentrate, obtain AM control.

Azinphos methyl, Guthion, Imidan, Penncap-M, and Zolone are five of the more commonly used AM insecticides. If Vydate is used for spotted tentiform leafminer control, do not expect AM control. Add a full rate of another insecticide that will control AM.

APPLE RUST MITE (ARM)

Aculus schlechtendali (Nalepa)

Life History

The ARM is a cone-shaped, straw-colored mite that cannot be easily seen with the naked eye. It is most commonly found on the leaf undersurface, especially along the leaf midrib.

The ARM overwinters as an adult female under the bud scales of apple trees. As the trees break dormancy, the mites become active and remain so until late July or early August when the overwintering females are produced and the mites become difficult to find.

The broad spectrum organophosphate insecticides

The ARM feeds on the undersurface of apple leaves. Feeding injury from high populations can cause the leaves to take on a rusty appearance. The injured leaves may also roll longitudinally and give the appearance that the tree is under drought stress. Apple trees can normally withstand ARM populations up to 200 or more per leaf before injury becomes noticeable. Occasionally, the ARM will move to and can be found at the calyx and stem ends of the fruit. Even more infrequently, they will russet the fruit.

There are beneficial aspects to maintaining a moderate ARM population within an orchard. They are a good host for mite predators and help to build up and maintain predator populations before European red mite populations increase. Their feeding may also condition the foliage and make it less susceptible to attack by the European red mite.

Monitoring

A good hand lens is required to monitor ARM populations. Pick 10 leaves from 10 different trees in an orchard for a total of 100 leaves. Because low populations of the ARM tend to congregate along the basal third of the leaf midrib, this is a good place to look for the mite on a leaf. Without counting the exact number of mites, control is recommended if there are an average of 200 or more ARM per leaf. Control is also recommended at the first sign of leaf injury.

Control

Most insecticides and acaricides will suppress ARM populations with a single application. Suppression of the population is normally sufficient. For more complete ARM control, two applications of an acaricide (Plictran, 4-6 oz./100 gal.; Omite 1-1 1/2 lb./100 gal.; Carzol, 1/8-1/2 lb./100 gal.) with a 7-10 day interval between sprays is recommended.

BEES

For information on bees, see HONEY BEE in LIBRARY.

BLOOM

Orchards are in bloom atthistime. Although insecticides cannot be applied now, preparations should be made for the petal fall spray. During bloom, orchards should be inspected to determine what insect and mite pests will need to be controlled, and a decision should be made as to what materials to use at petal fall. For further information on what insects may require control and the recommended materials, see PETAL FALL in LIBRARY.

CODLING MOTH (CM)

Cydia (Laspeyresia) pomonella **(L.)**

Warning

In New York, we follow the Michigan model which

predicts CM first emergence to occur at 248 degree-days from March 1 with a base temperature of 50F. The first CM traps should be hung when the degree-day accumulation reaches 200 or at full bloom, whichever occurs first. CM pheromone traps should be ordered from the pest management program.

Life History

The CM has one and a partial second generation in New York. It overwinters within cocoons as full-grown larva. The cocoons can be found under loose bark on trees or in debris on the orchard floor. The overwintering larva pupates in the spring, beginning about mid-April. The length of the pupal period is dependent on spring temperatures and can range from a month or longer to as short as 10 days. First emergence occurs at about 248 degree-days from March 1 with a base temperature of 50F, or about the time apples are in full bloom. Peak flight occurs about mid-June, and flight can continue into July. CM flight and egg laying occur in the early evening, normally when evening temperatures at 8 PM are 60F or above.

A female can lay approximately 100 eggs. The eggs are laid singly, directly on the fruit or upper leaf surface. They are flat, slightly oval discs. Immediately after being laid, the eggs are translucent. They later take on a red ring, and 1 -2 days before hatching, the dark head capsule can be seen.

After hatching, the larvae seek out and enter the fruit where they feed and pass through five instars. The larvae are cream- to pink- colored and have dark speckling on their thorasic shield. The absence of an anal comb is a key characteristic in differentiating the CM from larvae of the other internal fruit-feeding Lepidoptera. To determine if the anal comb is present or absent, squeeze the internal body fluid from the head end of a larva toward the anal end. This will extend the anal end, and if present, the anal comb will be easily visible with the aid of a good hand lens.

The larvae of the CM and the other internal fruit-feeding Lepidoptera tunnel to the core of the fruit and enlarge an exit hole that they plug with frass. The majority of first generation CM larvae are mature and leave the fruit by mid- to late July. About 40 per cent of the larvae pupate and emerge as adults. Peak flight occurs about thefirstweek in August. The remaining larvae overwinter and pupate and emerge as adults the following spring.

The second generation follows a life history similar to the first. The larvae are active during the latter half of August and September. When mature, the larvae exit the fruit and construct cocoons in which they overwinter.

Monitoring

CM first emergence and flight are monitored with pheromone traps which should be placed in both commercial and abandoned orchards. In commercial orchards, a trap station should be placed for every 50 acres of orchard, and traps should be checked at least once a week. Traps and caps should be replaced during the last week in July in preparation for monitoring the second CM flight. It should also be pointed out that the flights overlap.

Although the CM has been a serious pest in the past and retains that potential, insecticides are no longer applied regularly to specifically control it. The insecticides applied to control the plum curculio at petal fall and the apple maggot later in the summer also control the CM in most instances. Therefore, the action threshold based on trap catches in New York is higher than in areas where these other insects are not present. Sprays directed specifically at the CM are not recommended unless pheromone trap catches within commercial orchards exceed the trap catch in a nearby abandoned block, or a total of 14 or more moths are trapped in a commercial orchard in a week.

Control

Guthion, azinphos methyl, Imidan, and Zolone are four of the more commonly used insecticides that will control the CM as well as the plum curculio and apple maggot. Penncap-M and Sevin will also give good control of all three insects. Sevin is also used as a fruit thinner and will control the white apple leafhopper, but may precipitate woolly apple aphid problems. Penncap-M, if used, will provide woolly apple aphid control if the aphids are present on the wood or terminals. Both Penncap-M and Sevin are highly toxic to honey bees. For precautions to take to help reduce bee poisoning, see HONEY BEE in LIBRARY.

EARLY LEPIDOPTERA (EL)

The term EL is used to collectively refer to the Lepidoptera that are out feeding as larvae by petal fall. It is frequently difficult to identify the species present, and it is difficult to differentiate the fruit injury at harvest. See GREEN FRUITWORM, OBLIQUEBANDED LEAFROLLER, and PETAL FALL in LIBRARY.

EUROPEAN RED MITE (ERM)

***Panonychus** ulmi* (Koch)

Life History

The ERM is a perennial apple pest with up to eight generations per year. It overwinters in red egg masses on the tree, frequently on or around the base of fruit spurs. The overwintering eggs begin hatching between tight cluster and pink; normally all have hatched by petal fall.

Upon hatching, the mite passes through three stages before becoming an adult. The first or larval stage is six-legged. The protonymph and deutonymh are progressively larger and are eight-legged. The time period from hatching to becoming an adult ranges from about 6 to 16 days. Normally, the ERM does not become a problem until mid-July or later. Overwintering eggs begin to be produced in mid-August.

Excessive ERM feeding on leaves can cause bronzing. If bronzing is excessive and occurs early, it can affect fruit maturation and yield. Under high populations, the mites will also move to and lay eggs at the calyx end of the fruit. This is particularly undesirable on the lighter colored varieties destined for the fresh fruit market.

There are a number of predators that feed on the ERM. In

the Hudson and Champlain Valleys, the mite, *Amblyseius fallacis,* is the most common predator and can be very effective in keeping ERM populations in check. In western New York, the mite *Typhlodromaspyri* is the most common predator. However, at best, it is inconsistent in controlling ERM populations. Both/A. *fallacis* and *T.pyri* are small, fast-moving, pear-shaped mites that may be tan to straw-colored or may take on a red tinge from their food source, the ERM.

Monitoring

If in inspecting 10 leaves per tree from 10 trees in an orchard, an average of six or more ERM per leaf are found and the average number of predator mites is below one per leaf, use of an acaricide is recommended.

Control

Dormant - Oil may be applied in the early spring to kill overwintering eggs. The oil application will also control San Jose Scale. Complete coverage is essential.

Pink- Plictran (4-6oz./100gal.) must be applied before newly hatched mites become adults.

Post Bloom - A reduced rate Vendex spray program (3 oz./100 gal.) at petal fall and first and second cover may be substituted for the oil spray. If used, all three Vendex sprays must be applied at 7-10 day intervals. The program has given seasonal control of ERM. Vendex is not recommended for the summer control of the ERM.

Summer - Plictran (4-6 oz./100 gal.) and Omite (1-11/2 lb./100 gal.) are two of the more commonly used summer acaricides. With either material, two applications 7-10 days apart are recommended. The split applications help kill the mites as they hatch from their eggs.

GREEN APPLE APHID (GAA)

Aphis pomi De Geer

Also see PETAL FALL in LIBRARY.

Life History

Although the GAA remains on apple trees throughout the year, it does not reach serious population levels, if at all, until summer.

The GAA overwinters as a small black egg on the bark of trees. It is difficult, if not impossible, to differentiate between GAA eggs and those of the apple grain aphid and the rosy apple aphid. Early New York literature states that the GAA eggs tend to be laid in groups while the eggs of the two other species are more uniformly distributed throughout the orchard. The eggs hatch as the apple trees break dormancy and after about two weeks the nymphs mature and begin producing living young.

The GAA has up to 17 generations per year. A portion of each generation develops into winged adults that fly off to start new colonies. The GAA favors new growth on which to develop and is most common on suckers and water sprouts late in the season.

The sexual forms are produced only in the fall. After they become adults and mate, the females lay their eggs on the bark of the trees.

The GAA is an indirect pest in that it does not feed on the fruit itself. Fruit injury occurs when the honey dew produced by the aphid colony drops onto the fruit.

There are a large number of beneficial insects (parasites and predators) and a disease that play an important role in controlling the GAA. Due to the relative lack of seriousness of a low GAA population and in order to promote the beneficial insects, growers need not spray until about 50 per cent or more of the terminals with tender growth are infested.

Monitoring

In checking 10 terminals with tender growth on each of 10 trees in a block, treatment is recommended if 50 per cent of the terminals are infested with healthy GAA colonies.

If parasites, predators, or the disease appear to be influencing the GAA populations, postpone spraying a week and resample to determine whether chemical control is required.

Control

Systox and Phosphamidon are two of the more commonly used materials for controlling the GAA during the summer. The GAA has developed resistance to many of the organophosphates in many apple growing areas of the state, and the materials will no longer even suppress the insect. If Vydate is used for controlling the second generation of the spotted tentiform leafminer, it will also control GAA and another material to control the aphid need not be added.

GREEN FRUITWORM (GFW)

GFW is a collective common name used in New York to refer to a number of Lepidoptera. The life history presented here is that of one of the more common members of that group, *Orthosia hibisci* Guenee. Also see PETAL FALL in LIBRARY.

Life History

The GFW'has a single generation per year and overwinters in the pupal stage in the soil. Adult emergence begins at about green tip and is complete by pinkfor McIntosh apples. The adults are about 2/3 of an inch long. They are grayish-pink in color and have two purplish-gray spots on the forewings.

Egg laying begins at about half-inch green. Eggs are laid singly or in pairs. They are white to grayish in color and have ridges radiating from the center.

GFW larvae begin hatching between tight cluster and pink. The larvae feed on new leaves, flowers, and developing fruit. Fruit feeding is normally restricted to larger larvae. The larvae mature between late May and late June, at which time they drop to the ground and pupate in the soil at a depth of two to four inches.

Monitoring

At pink and at weekly intervals through first cover, check

20 fruit clusters per tree on 5 trees per block. On each tree, look for larvae or evidence of fresh feeding on 6 clusters on the outside of the tree, 6 clusters in the center of the tree, and 8 clusters in the top of the tree. Treatment is recommended if there are an average of two or more larvae or fresh feeding sites per tree. Monitoring for the GFW is the same as monitoring for the obliquebanded leafroller and both species may be considered together in making a control decision.

Control

In the past, sprays were applied at pink and petal fall to control the GFW. Recent research has indicated that a single spray at petal fall provides comparable control to the two spray program.

Guthion, azinphos methyl, and Imidan are three of the standard insecticides used to control GFW; however, they are not providing adequate control in a few areas of New York. In those areas, Thiodan still offers control. If Thiodan is used, a full rate of one of the above materials should also be included to control the plum curculio.

If GFW populations are mixed with populations of obliquebanded leafroller, Lannate, Nudrin, or. Penncap-M should be used. Lannate and Nudrin are the preferred materials where they can be used. If Lannate or Nudrin is used at petal fall, a 1 /4 to 1*/2* rate of one of the first three insecticides should be included to pick up where Lannate and Nudrin fall down on plum curculio control. Lannate and Nudrin are labeled for peaches and apples, but should not be used on Early Mclntosh, Wealthy, or Dutchess varieties. They are not labeled for use on pears or cherries. Where Penncap-M must be used, care should be taken to reduce the threat of bee poisoning. Also see HONEY BEE in LIBRARY.

HONEY BEE (HB)

Apis me ll if era L.

HB play an important role in pollinating crops and are, therefore, beneficial insects to the fruit grower. It is important to protect HB from poisoning due to their exposure to insecticides applied to control insect pests.

The following precautions should be taken to help reduce the possibility of HB kills when insecticides are applied:

1. Cover or remove hives from the orchard before spray ing at petal fall.
2. Have 90 per cent of the petals off before spraying an in secticide.
3. If there are five or more flowers in bloom per square yard of ground cover, mow before spraying. This is im portant throughout the growing season.
4. Whenever possible, spray insecticides in the evening after the HB have stopped foraging and the flowers have closed.
5. Whenever possible, choose the insecticide with the lowest HB toxicity to get the job done.

Forfurther information on HB poisoning, pesticide toxicity to HB, HB as pollinators, HB behavior, etc., see the current edition of "The Cornell Recommendations for Commercial Tree Fruit Production."

MITES

For mite strategies see APPLE RUST MITE, EUROPEAN RED MITE, PEAR RUST MITE, and TWO SPOTTED SPIDER MITE in LIBRARY.

OBLIQUEBANDED LEAFROLLER (OBLR)

Choristoneura rosaceana (Harris)

Also see PETAL FALL in LIBRARY.

Life History

The OBLR has one or two generations a year; there are two generations in New York. OBLR overwinter as third instar larvae on the tree and become active at about pink. They begin feeding on the tender new foliage, flower buds, and after petal fall, on the fruit.

OBLR larvae have pale green bodies. Their head capsules may vary in color from black to light brown, and their thorasic shields vary from black to pale tan. The larvae are very active when disturbed and will drop from the tree on a silk thread. By petal fall, the first of the larvae are full-grown and shortly thereafter they pupate, frequently within a rolled leaf.

The first OBLR flight begins about three weeks after petal fall and continues for about a month. Females begin egg laying about 24 hours after emergence. The eggs appear as greenish-yellow masses of up to 200 or more eggs. As the females continue laying eggs, the masses become progressively smaller.

The eggs hatch in 10-12 days and the larvae begin feeding on new foliage, frequently on water sprouts or in the tops of the trees. The larvae often move to and feed on the fruit as they become larger. They complete their development in late July or early August and begin to pupate.

The second adult OBLR flight occurs from early August through early September. The young produced by these adults develop into the third instar overwintering larvae.

Monitoring

Pheromone traps may be used to determine OBLR flight. The OBLR has a wide host range; high trap catches need not indicate previous in-orchard problems, but may be from outside OBLR populations that may be a source of future in-orchard problems. The pheromone trap catches can, therefore, indicate when OBLR adults begin flying, their relative abundance in the area, and when peak flight occurs. The need to treat should not be based on pheromone trap catches, but should be determined by inspecting individual blocks for larvae or their feeding.

At late bloom or early petal fall, check 20 clusters per tree on 5 trees per block. On each tree look for larvae or evidence of fresh feeding on 6 clusters on the outside of the tree, 6 clusters inthecenterofthetree,and8clusters in the

top of the tree. Treatment is recommended if there are an average of.two or more larvae or fresh feeding sites per tree. Monitoring for the OBLR at this time is the same as monitoring for the green fruitworm, and both species may be considered together in making a control decision.

From about June 25 through August, monitoring of the summer brood should be conducted weekly by checking 10 fruit clusters and 10 terminals in the outside, center, and top of 5 trees per block. Treatment is recommended if there are an average of three or more OBLR larvae per tree.

Control

In the past, sprays were applied at pink and petal fall to control the OBLR. Recent research has indicated that a single spray at petal fall provides comparable control to the two spray program.

Guthion and azinphos methyl have not given adequate control of larger OBLR larvae. Where larger larvae (third instar or larger) are present at petal fall or in the summer, Lannate, Nudrin, or Penncap-M should be used.

Lannate and Nudrin are not registered for use on pears. Penncap-M is the only material available that will give acceptable control at petal fall. If Penncap-M must be used at this time, take every possible precaution to avoid bee kills. Also see HONEY BEE in LIBRARY.

OYSTERSHELL SCALE (OSS)

Lepidosaphes ulmi L.

Life History

Normally the OSS is not a problem in commercial orchards. It is believed that insecticides applied to control other pests are responsible for maintaining OSS at low population levels.

The OSS overwinters in the egg stage protected by the scale of its dead mother. The small, white eggs hatch in mid- to late May. The minute, pale yellow to white nymphs or crawlers crawl out from the scale and after finding a suitable site, settle down and begin feeding; soon after, they begin secreting a waxy covering. The scales become adults about mid-July when the winged, minute, non-feeding males emerge and mate with the female OSS that remain under this 1/8 inch brown, oyster-shaped scale covering. Each female lays between 30 and 150 eggs and then dies.

There are one or two generations of OSS per year.

Monitoring

The easiest time to find OSS infestations is in the winter while pruning. During the growing season, look for crawlers on the present year's growth in late May through early July. After that period, look for the developing scales in areas of the trees where poor coverage is likely.

Control

Most insecticides applied against other orchard pests will also control OSS crawlers. This is probably why the scale normally does not become a problem in commercial orchards.

OSS infestations found while pruning should be pruned and destroyed.

PEAR PSYLLA (PP)

Psylla pyricola Foerster

Life History

The PP is the most important pest of pears in New York and the nation. It overwinters as an adult that measures about .08 inches long and resembles a miniature cicada. During the first warm days of spring, the overwintered adults mate and lay their eggs on spurs, twigs, and around bud scales. As the foliage appears, the eggs are laid on the tender new growth, particularly on the undersurface of leaves along the midrib. The first eggs hatch at about the time foliage begins to appear. The nymphs pass through five instars and produce a honeydew that collects in droplets. The honeydew can burn the leaves under hot, dry conditions, or drop onto the fruit. It is an excellent media for sooty molds and trees that have had serious PP problems in the past are characterized by black bark. There are about four PP generations a year.

Monitoring

Pre-bloom:

A beating tray is used in the pest management program to sample adults. A less precise but acceptable method is to make a quick count of adults on several terminals.

In the early spring, terminals and spurs should be checked for the first signs of egg laying. It is particularly important to do this after temperatures have been above 50F.

Once foliage is present, eggs and nymphs may be monitored by looking on the tender new growth and, later in the season, on water sprouts.

Post bloom:

On each of five trees within an orchard, sample terminal growth rather than hardened-off leaves. The PP is a flush feeder and prefers to lay eggs and feed on new growth. In checking the leaves, look along the midrib, especially on the leaf undersurface. Only consider eggs and small nymphs in making the spray decision. If only eggs are present, hold off control until hatch begins. Treatment is recommended if three or more of the sample sites have 10 per cent or more of their terminals infested. Spot treatment within a block is recommended if an average of 5-10 small nymphs per terminal are found in a portion of an orchard. If hot, dry conditions prevail, tend to act on counts at the lower end of the range. If it is rainy, tend to act on the higher end of the range. The rain will wash the honeydew from the leaves and fruit and a higher PP population can be tolerated.

Control

The PP has developed resistance to all of the materials registered for its control in the past except oil. We have, therefore, had to rely on two newly registered materials (Pydrin, Baam) for the control of the PP.

Pre-bloom:

Oils have been used in the dormant stage to inhibit egg laying. The oil must be applied as the first eggs are laid. Although oil is effective, the pre-bloom use of Pydrin makes the oil spray no longer necessary. Pydrin should be applied to pear orchards between green cluster and white bud. It will kill adult PP and the nymphs, and is a long lasting insecticide and should kill additional nymphs as they hatch. Pydrin may precipitate mite problems later in the season, and particular attention should be given to monitoring pear rust mite following bloom.

Post bloom:

Baam is the recommended material for summer PP control. Quite frequently, growers who have applied Pydrin will not have to apply another PP spray until mid- to late July and in many cases, a single Baam application is all that is required for the summer. Baam is also an excellent acaricide for controlling the European red mite and the pear rust mite, and when used in PP control, should aid in the control of these pests. If the two spotted spider mite becomes a problem, another acaricide is recommended because Baam is inconsistent in its control.

Baam is a slow acting material and three to five days should be allowed for control. Baam should not be applied if daily maximum temperatures are below 70F.

PEAR RUST MITE (PRM)

*Epitrimerus **pyri*** (Naplepa)

Life History

The PRM is a very small, cone-shaped mite and, unlike the apple rust mite, it can cause damage at a very low population level. The most serious damage occurs when the mites feed on and russet the fruit. The extent of russetting will vary with the number of mites feeding and the length of time they feed.

The PRM overwintersas an adult female under the bud scales and becomes active in the spring as the trees break dormancy. The number of PRM a year in New York is not known, but they are present on the tree throughout the growing season.

In the early spring and on into the summer, PRM may be found on the leaves. They are most frequently found along the basal portion of the midrib on the undersurface of the leaf. PRM injury to leaves causes a gray to brown russetting which typically runs in a narrow band along either side of the midrib. A serious PRM level may be present before leaf russetting occurs. On the fruit, the PRM normally congregate at the calyx end, but with high populations will also move to the stem end of the fruit.

Monitoring

To sample PRM, use a good hand lens (10X or better) and good lighting. In sampling 25 fruit clusters throughout an orchard, treatment is recommended if 5 or more are found to have PRM.

Control

Use one of the standard acaricides registered for use on pears for the control of the PRM. Dr. Lienk obtained poor PRM control in tests with Sevin and Thiodan in 1979 and 1980 and they should no longer be relied upon to provide acceptable control.

Coverage is essential and spraying dilute is recommended. Two sprays with a 7-10 day interval are advised. Baam, when used to control the pear psylla, will also provide PRM control, and may be substituted for one of the two sprays.

PETAL FALL (PF)

Introduction

While apple trees are in bloom insecticides cannot be applied. During bloom, orchards should be inspected to determine what arthropod pests will need to be controlled, and the decision should be made as to what materials to apply at petal fall.

It is interesting and important to note that the petal fall spray is the only regularly scheduled insecticide application made in the pest management program, and, through intensively monitoring for rnsect pests, the Farm Advisors can delay this spray up to ten days past actual petal fall. Orchards not under an intensive monitoring schedule should not have their sprays delayed, but should be sprayed at petal fall.

Pests

The following is a list of the principal arthropod pests that may be present at petal fall:

1. Codling Moth (CM)
2. European Red Mite (ERM)
3. Green Apple Aphid (GAA)
4. Green Fruitworm (GFW)
5. Obliquebanded Leafroller (OBLR)
6. Plum Curculio (PC)
7. Rosy Apple Aphid (RAA)
8. San Jose Scale (SJS)
9. Spotted Tentiform Leafminer (STLM)
10. Tarnished Plant Bug (TPB)
11. White Apple Leafhopper (WALH)
12. Woolly Apple Aphid (WAA)

Insecticides

With few exceptions, three insecticides (Lannate, Guthion, Penncap-M) fit into practical petal fall spray strategies.

A. Lannate

Whenever Lannate is used throughout this text, Nudrin may be substituted.

The first thing to remember in the use of Lannate is to not even consider it for spraying Early McIntosh, Wealthy, and Dutchess varieties. Lannate has caused fruit and leaf injury and premature fruit drop on these varieties. These problems have not occurred with McIntosh, Red Delicious, Golden Delicious, Cortland, Rome, or Rhode Island Greeninq varieties.

Lannate is the petal fall insecticide to use if first generation STLM need to be controlled. With the varieties on which Lannate cannot be used, anticipation of a STLM problem should have led to a Vydate spray at pink where needed. Vydate should not be applied for 30 days after petal fall or thinning may result; we do not fully understand its thinning capabilities, and its label specifically does not allow for its use at this time. Lannate will pot only knock down the adult STLM, but will also kill the sap-feeding larvae. To adequately control the larvae, Lannate must be applied prior to the onset of the tissue-feeding stage.

Lannate is a carbamate insecticide atid will give good control of organophosphate-resistantWALH. Therefore, if Lannate is used at petal fall, Sevin need not be used as a thinner to give added WALH control.

Lannate can be expected to give good control of the majority of the other insect pests present at petal fall. It will fit in well in controlling the Early Lepidoptera (OBLR, GFW) where Guthion has begun to jail down.

Lannate will only give fair control of PC. To aid Lannate in controlling PC, add 1 /4 to 1*12* rate of Guthion to the tank. Do not cut back on the Lannate if you have a STLM problem.

Lannate will not control ERM, but will kill the predator mites. Therefore, if ERM is a problem, an acaricide could be added now or in the summer.

A final note on Lannate: although it will clean up the aphids (except RAA), growers using Lannate are more likely to experience WAA outbreaks later in the season.This is believed to be because it eliminates the WAA parasites. A similar problem may be precipitated with the use Sevin. Therefore, be prepared for potential secondary pest problems if carbamates are used at petal fall or later in the season.

8. *Guthion*

Although Guthion is specifically mentioned throughout this text, azinphos methyl, Imidan, and Zolone have similar properties and can be substituted wherever Guthion appears.

Guthion has been an old standby at petal fall and throughout the summer for a number of years. Although it is still good at controlling PC, it has begun to fall down in the control of OBLR and GFW in some areas. Guthion is still a good petal fall insecticide to use where the STLM is not a problem. Guthion can also be used where it still works on the Early Lepidoptera or if they are not a problem. The STLM has developed resistance to Guthion. Therefore, where the STLM is present and needs to be controlled, refer to the Lannate section. Where the STLM does not need to be controlled and Guthion is no longer adequately controlling the Early Lepidoptera, refer to the Penncap-M section.

When used in a regular seasonal spray program, Guthion will suppress but not control the GAA. Itshould not be counted on to even suppress RAA or WAA. If Systox did not clean the RAA up at pink, it may be added again, at full rate, at petal fall, but expect to see some RAA injury. Systox may be used now or later in the summer to control WAA. Where STLM needs to be controlled in the second generation with Vydate, a special Systox spray to control WAA normally will not be needed.

With the exception of ERM and WALH, Guthion will control most of the other insect pests present at petal fall. If WALH is a problem, consider thinning with Sevin to get the added benefit of WALH control. If ERM is a problem, add an acaricide now or in the summer.

C. Penncap-M

Penncap-M fits into the petal fall spray program when Guthion is not adequately controlling the OBLR and the GFW, and the STLM does not need to be controlled. A few extra precautions should be taken to avoid bee kills. Also see HONEY BEE in LIBRARY.

With the exception of STLM, WALH, and ERM, Penncap-M will control most of the insect pests present at petal fall. If first generation STLM needs to be controlled, refer to the Lannate section. If WALH is a problem, consider thinning with Sevin to get the added benefit of WALH control. If ERM is a problem, consider adding an acaricide now or in the summer.

An Added Caution:

If the SJS has been a problem in the past, Lannate, Guthion, or Penncap-M at petal fall should not be expected to alleviate the problem. The presence of SJS in an orchard is an indication of inadequate spray coverage. It may take 2 or more years to control this pest and require pruning, dormant oil applications, and seasonal spray programs with insecticides to kill emerging males and crawlers.

Mites:

Although the ERM was listed among the potential pests present at petal fall, none of the insecticides discussed will control this pest. One or two oil sprays before pink will act as an ovicide on overwintering ERM eggs. Coverage is then the key to control. If coverage was insufficient for adequate control or oil was not applied, there are two post-bloom strategies to cleaning up the problem.

If mites are present in number at petal fall, three Vendex sprays at 3 oz./100 gal. beginning at petal fall and again 10 and 20 days later will give seasonal control. In order to be successful once started, the Vendex program must be adhered to. This is the only time and method that we recommend the use of Vendex.

The second mite control program is the old standby utilizing two Plictran sprays at 4to6oz./100gal. at 7 to 10 days apart when the mites become a problem.

PLUM CURCULIO (PC)

Conotrachelus ***nenuphar*** (Herbst)

Also see PETAL FALL in LIBRARY. **Life**

History

The PC has a single generation peryear and overwinters as an adult in debris on the ground in woodlots and in hedgerows. The adults are about 1 /5 inch long, have four

pairs of humps on their wing covers, and are a mottled black, gray, and brown color. The adults become active in the spring when temperatures rise above 60F. After mating in the spring, the females lay their eggs under a crescent-shaped slit which they cut with their mouthparts. Each female may lay several hundred eggs.

The eggs hatch in about a week and the larvae begin tunneling to the center of the fruit. The larval period lasts about 16 days. The majority of the infected fruit fall to the ground with the June drop. Upon reaching maturity, the larvae leave the fruit and enter the soil where they pupate. About a month later, the adults emerge from the soil and will feed on the fruit until they are forced into hibernation as temperatures drop below 60F.

Monitoring

The seriousness of the PC as an orchard pest requires the use of an insecticide at petal fall. The petal fall spray can be delayed as much as ten days if maximum daily temperatures remain below 60F, PC feeding and oviposition wounds are not observed, and there are no other insect problems that require immediate action at petal fall. Because the PC is not normally an in-orchard problem, but migrates in from woodlots and hedgerows in the spring, it is wise to monitor unsprayed apple and cherry trees in your area and time your petal fall spray to coincide with the first sign of injury in the unsprayed trees.

In the summer, emerging adult PC are controlled by insecticides applied against other orchard pests and, therefore, a monitoring program for these insects is not required.

Control

Guthion, azinphos methyl, Jmidan, and Zolone are four insecticides applied at petal fall to provide PC control. Penncap-M will also provide control, but care should be taken to prevent bee kills. Also see HONEY BEE in LIBRARY. Lannate or Nudrin will provide fair PC control when applied at petal fall to control the Early Lepidoptera or the spotted tentiform leafminer. Growers may wish to add a half rate of another material to get additional PC control when using Lannate or Nudrin at petal fall. Sevin will provide good PC control and, if used in thinning, will help control any stragglers that migrate into the orchard.

Growers may wish to spray the edges of hedgerows and woodlots adjacent to their orchards at petal fall in order to help reduce PC migration into the orchards.

ROSY APPLE APHID (RAA)

Dysaphis plantaginea (Passerini)

Also see PETAL FALL in LIBRARY.

Life History

The RAA overwinters as a small, black egg on the bark of apple trees. The eggs of the RAA cannot be differentiated from the apple grain aphid or the green apple aphid. Overwintering RAA eggs usually hatch by half-inch green or tight cluster. The hatching nymphs are all females and move to fruit buds where they begin feeding. These nymphs mature into stem mothers during bloom and begin giving birth to living young which mature in 2-3 weeks and continue the cycle. If the RAA is present at petal fall or persists into June or early July, fruit injury proportionate to the population and duration of the infestation will result.

A few winged adults are produced in the second generation and proportionately more are produced in the third and fourth generations. These winged adults, produced between May and mid-July, leave the apple trees and move to weed host plants to spend the summer. Narrow-leaved plantain and dock are two of the more important summer hosts for the RAA.

In the late summer or early fall, winged adults are again produced and the RAA migrate back onto the apple trees. These adults produce offspring that in turn produce male and female offspring. This is the only time that male RAA are produced. When these males and females become adults, they mate and the females lay eggs to carry the species through the winter.

Monitoring

Monitoring of the rosy apple aphid should be conducted from tight cluster through petal fall. Check 100 fruit clusters in the middle of the most susceptible varieties in a block. Cortland, Rhode Island Greening, Monroe, Twenty Ounce, Golden Delicious, and Ida Red tend to be very susceptible, while the Red Delicious varieties are intermediate. McIntosh tend to be the least susceptible to RAA injury. Treatment is recommended if an average of one colony or more per tree of the susceptible varieties is found.

Treatment with a systemic aphicide at pink has been a standard practice. If for some reason RAA are not controlled at pink, a systemic insecticide with activity against the RAA should be applied at petal fall.

Control

Coverage is essential in the control of the RAA. Control is best achieved when the insecticide is applied dilute or at least no greater than 6X. Growers with sprayers that cannot go below 20X are often the first to find that they have a RAA problem.

Systox has been the standard insecticide applied at pink and, when need be, at petal fall for the control of RAA. Systox has been inconsistent in controlling RAA where growers have been spraying high concentrate. If a grower cannot spray at 6X or below, Vydate should be used at pink. Vydate has better systemic properties than Systox and will, therefore, redistribute itself better within the plant. Vydate applied at pink will also aid in the control of the spotted tentiform leafminer if it is a potential problem. Vydate should not be used at petal fall.

Several instances of Systox not working when applied at 6X or below were reported in 1979. Laboratory tests indicated the development of resistance to Systox in several colonies tested. If poor RAA control has been experienced with Systox applied at low concentrations, it is suggested that Zolone, Thiodan, or Phosphamidon be used at pink. These materials remained effective in controlling Systox-resistant colonies in the laboratory.

SAN JOSE SCALE (SJS)

Quadraspidiotus perniciosus (Comstock)

Also see PETAL FALL in LIBRARY.

Life History

The SJS attacks apple, pear, quince, peach, nectarine, plum, apricot, and sweet cherry trees. It frequently becomes a problem in larger, poorly pruned trees that prevent adequate spray coverage. On heavily infested trees, the scales are crowded together and give the bark a gray, roughened appearance. The fruit and bark around the scales are frequently reddened. If not controlled, a heavy infestation can kill a tree.

The SJS overwinters as a yellow second instar nymph under a gray, waxy scale covering. With the return of sap flow in the spring, the nymphs begin to feed and develop. By bloom, they are fully developed and the sexes can be easily differentiated. The male scale covering is oval with a raised dot near the larger end and is about 1 /25 inch long and half as wide. The female scale covering is circular with a diameter of about 1 /12 inch and has a raised dot in the center.

The males emerge from their scales as minute, yellow, two-winged insects at about bloom. The females remain immobile and sac-like in appearance undertheir protective scales. Mating occurs soon after the males emerge. The females can produce an average of 200 young in the six week period that they remain productive.

First instar nymphs, called crawlers, are yellow, six-legged, and resemble a mite. They crawl about until they find a place to settle and feed. Shortly after settling down to feed, they moult, lose their legs, and become yellow sacs attached to the plant by their mouthparts. A waxy, flaky secretion is produced that in two or three days is matted down to form the protective scale under which the nymph develops.

There are at least three broods of SJS each season in New York. By fall, all stages of the insect can be found, but only the second instar nymphs overwinter. Those scale in the other stages of developement die during the winter.

The SJS are carried from orchard to orchard in the crawler stage by birds and larger insects. They are also carried through the air by the wind.

Monitoring

It is difficult to detect the SJS on fruit before it has become a problem because of its small size and because it blends in with the color of the tree. The presence of the SJS on fruit at harvest indicates the need for special control measures the following season.

Control

Pruning is important in SJS control. It is important to cut out heavily infested branches in the winter to reduce the possibility of the infestation spreading the following summer. Pruning also opens the trees up and allows for better penetration and coverage of insecticides.

There are several beneficial insects that attack the SJS. They do not provide satisfactory control and are suppressed in commercial orchards by insecticides required to control the SJS and other insect pests.

Concentrate spraying is acceptable for general maintenance spraying, but complete coverage is important in controlling the SJS and dilute spraying is advised. An oil spray at half-inch green will provide excellent SJS control and kill overwintering European red mite eggs if coverage is complete.

From petal fall throughout the remainder of the season, SJS are suppressed by the insecticidal action of most broad spectrum insecticides on the adult males and the crawlers.

A serious SJS problem may take several years to clean up,

SPOTTED TENTIFORM LEAFMINER (STLM)

***Phyllonorycter hlancardella* (F.)**
Phyllonorycter crataegella Clemens

Also see PETAL FALL in LIBRARY. **Life**

History

Both *P. blancardella* and *P. crataegella* occur in New York and are similar in appearance, biology, and injury caused. They also possess the same common name, the STLM. P. *blancardella* is the only species occurring in western New York. It is present in the Champlain Valley and is the predominant species found on the western side of the Hudson River. P. *crataegella* occurs in the Hudson Valley and was found in the Champlain Valley in 1980. It is the only species found on the eastern side of the Hudson River and is the lesser species on the western side of the river.

The STLM has three broods a year. They overwinter in the pupal stage within their mines in leaves on the ground. Adults begin emerging at half-inch green or tight cluster. The adults are small, weak fliers that are commonly found at rest in the ground cover or on the trees. The moths become active in the evening, when both mating and egg laying occurs.

The eggs are very small and difficult to see with the naked eye. They have the appearance of small elliptical blisters on the leaf undersurface and hatch in 5 to 16 days depending on the temperature.

The STLM has five larval instars. The first three instars are referred to as the sap-feeding stage; they feed on the sap from the spongy mesophyll in the leaves. Injury from the sap-feeding stage is only visible from the leaf undersurface and appears as an area where leaf tissues have separated. The fourth and fifth instars are collectively referred to as the tissue-feeding stage. In this stage, the larvae begin feeding on the leaf tissues and the mines become visible on the upper leaf surface as an oblong green tent with whitish spots. Larval development takes about 24 days.

The STLM pupates within the mine and changes from

yellow when first formed to a dark brown color. The STLM remains in the pupal stage for about 1 -1*12* weeks for the first and second broods and overwinters in the pupal stage for the third brood. Prior to emerging as an adult, the pupa cuts a hole in the leaf undersurface and partially protrudes from the leaf. The pupal skin remains attached to the leaf after the adult emerges, until it is weathered off.

Monitoring

Monitoring for the STLM requires close observation of leaves at pink or shortly before petal fall and again as the second brood begins to hatch and mine the leaves. Control at pink is recommended if an average of six or more eggs are found per leaf. Control recommendations at petal fall and later in the summer are based on the number of sap-feeding mines present for any particular brood. An insecticide application is recommended prior to the larvae entering the tissue-feeding stage if there is an average of one or more mines per leaf for the first brood, and two or more mines per leaf for the second brood. Insecticide applications are not recommended against the third brood, no matter how serious the problem. A serious third brood STLM problem is normally due to a high second brood population that was not properly controlled. The injury to the leaves by the second brood would have been substantial, and any further injury should not add to the seriousness of the problem. The third brood larvae are normally well parasitized, and spraying against the STLM will reduce parasitization. The parasite, if protected, can significantly reduce the overwintering STLM population.

Control

STLM control is effected with four principal insecticides: Thiodan, Nudrin, Lannate, and Vydate. The choice of insecticide depends in part on the brood that is to be controlled.

A few additional comments about Lannate, Nudrin, and Vydate should be made. They are carbamate insecticides and can precipitate mite outbreaks, are harmful against predator mites, and can also precipitate other insect outbreaks, such as woolly apple aphid. If these materials are used to control STLM, be prepared for secondary pest outbreaks. Do not let the secondary pests get out of hand.

First Brood

The first opportunity to control the STLM is as they emerge as adults in the spring. Thiodan is the material to use solely for the control of adults. This control strategy, however, is not recommended as a standard practice for several reasons.

1. The preceding fall's STLM problem or population can not be equated with an expected spring problem forthe present season.
2. Pheromone trap catch numbers cannot be equated with the need to spray.
3. The adult stage is not the stage that treatment or con trol should be aimed at.

This spray is best suited forthe conservative grower who had a serious problem with STLM the preceding season. More than one Thiodan application will be needed. One Thiodan spray should be applied at half-inch green and another at pink. A third Thiodan spray may be required between the two if it turns cool and the period lengthens out.

The second strategy is to control the first generation miners within the leaves. There are two different timings and materials available for action against the first generation larvae. If Vydate is the preferred material by the grower, it should be applied at pink if there are an average of six or more eggs per leaf. The Vydate will enter the leaves and kill the hatching larvae as they begin to feed. It should not be applied for 30 days after bloom because it can thin the apples, and at present, we do not know enough about its thinning capabilities.

The recommended material and time of application to control first generation STLM larvae is Lannate or N udrin at petal fall. The action threshold for spraying at petal fall is an average of one or more mines per leaf. Lannate or Nudrin should be applied before the larvae go from the sap- to the tissue-feeding stage. Therefore, the mines that must be counted will only be visible on the undersurface of the leaf and will appear as a separation of the undersurface of the leaf. Lannate or Nudrin applied at petal fall will also control white apple leafhopper as well as most of the other insects out at that time.

Second Brood

Whether it is determined to spray or not to spray for the first brood, you should be prepared to monitor the second generation larvae which begin to appear in July. If your counts indicate that an insecticide application is required, you may use Lannate, Nudrin, or Vydate. Vydate is preferred because it has better systemic action within the leaf.

Vydate applied against the second generation of STLM larvae will suppress the white apple leafhopper and some of the other insects present at that time. Vydate will not control apple maggot.

Third Brood

The STLM has a third generation which first appears in August. No action is advised against the third generation,

TARNISHED PLANT BUG (TPB)

Lygus lineolaris (Palisot de Beauvois)

Note: A separate strategy for the TPB on strawberry may be found in the LIBRARY program for SFRUIT. Also see PETAL FALL in LIBRARY.

Life History

The TPB overwinters as an adult and with the onset of warm temperatures emerges to feed. Tree fruits are a very attractive early food source in the spring. Later in the spr-

ing, the TPB moves to weeds and a wide range of other crops. It is a serious pest of strawberries.

On tree fruits, the TPB prefers to feed on the developing flower buds beginning at about tight cluster and continuing after the fruit have set. The feeding done prior to bloom causes the buds to abort and therefore the insect acts as a natural thinner.

Feeding done after pollination does not drop the fruit, but causes the typical cone-shaped indentation or injury on apples and pears and cat-facing and scabbing on peaches.

Monitoring

From tight cluster through first cover, particularly during bloom and petal fall, attention should be given to looking for the TPB. It is difficult to monitor the TPB because it is a very active insect that can rapidly enter or leave an orchard depending on the availability of alternate food sources and climate conditions, and also frequently hides when approached. Therefore, no action thresholds have been developed.

Control

The standard recommendation in the past has been to apply up to two pre-bloom sprays (tight cluster and pink) and a petal fall spray. Even with these sprays, injury to the fruit can occur. The TPB is a very mobile insect and, once the plants are free of effective insecticide residues, new individuals can move into the orchard and begin feeding. The injury seen at harvest is caused by the feeding of insects that move into the orchard during bloom. During years of prolonged bloom, it is nearly impossible to prevent this injury. Therefore, we no longer recommend pre-bloom TPB sprays as a common practice. Pre-bloom sprays may be used if a grower feels that he has an unusally h igh TPB population pre-bloom and is concerned about having adequate fruit set. The pre-bloom sprays may kill the TPB that are present and reduce their fruit thinning effect.

Bloom is the best time to spray for the TPB. That, however, cannot be done. Insecticides cannot be applied during bloom.

Normally, a petal fall spray will not eliminate TPB injury, but it will keep it at a minimum. If a grower feels that he has a TPB problem during bloom, the petal fall spray should come as soon as possible after petal fall (be sure the bees are out) instead of trying to stretch the interval until the plum curculio are out.

Most of the commonly used insecticides will control the TPB.

TWO SPOTTED SPIDER MITE (TSM)

Tetranychus *urticae* Koch

Life History

Although a few immature TSM overwinter, the majority of the overwintering populations are gravid adult females. They overwinter under loose bark or protected under leaf litter on the ground. With the onset of warm weather in the spring, they begin feeding and egg laying.

The TSM is commonly found on weeds in the orchard ground cover and normally does not move into the trees until hot, dry conditions occur in the summer. When moving into the trees, the TSM either climb the trunk and first infest the lower shoots and water sprouts, or use weeds touching lower limbs as bridges to climb up to and infest the trees.

Feeding injury to pear leaves can develop rapidly under hot, dry conditions and causes the leaves to blacken and appear scorched. One or two TSM per leaf can cause this injury on pears. By the time the injury becomes apparent, the mites are frequently no longer present. On apples, TSM injury resembles European red mite injury.

The oval eggs of the TSM are white in color and are usually laid on the undersurface of leaves. The immature and adult mites can be white to dark green in color, depending on their food source; they have a dark spot on either side of their body. The mites produce a webbing which covers the leaves they infest.

Monitoring

Monitoring for the TSM in trees should begin in early summer and continue until harvest. From 10 trees in an orchard, pick a total of 100 leaves (10 per tree) from the lower shoots and water sprouts along the trunk. If the ground cover is high and touches the lower limbs, pick an additional 100 leaves from the lower limbs touched by the weeds.

On apples, control is recommended if there are an average of six or more TSM per leaf and the average number of predator mites is below one per leaf.

On pears, control is recommended if there are an average of one or more TSM per leaf.

Control

Keeping the ground cover mowed and climbing weeds out of the trees will help prevent TSM from climbing into the trees.

Plictran (4-6 oz./100 gal.) and Omite (1-1 1/2 Ib./100 gal.) are two of the more commonly used summer acaricides. With either material, two applications 7-10 days apart are recommended. The split applications help kill the mites as they hatch from their eggs.

WHITE APPLE LEAFHOPPER (WALH)

Typhlocyba *pomaria* (McAtee)

Also see PETAL FALL in LIBRARY.

Life History

The WALH has two generations per year. It overwinters as eggs deposited under the bark of one to five year old twigs. The eggs appear as very small, elongated blisters on the bark. Egg hatch normally begins during pink and is complete shortly after petal fall. The young nymphs are white with red eyes, and as they feed and develop, they

become creamy-white to a pale yellow-green color and lose the red color in their eyes. By early June, the wedge-shaped adults of the first generation (measuring about 1 /8 inch) begin to appear and lay their eggs in the leaf tissue. The second generation eggs begin hatching in late July and have developed into adults by late August or early September. These adults are present until early October and can be a nuisance to pickers.

The WALH is an active insect when disturbed. The nymphs will run to the opposite side of a leaf while the adults will either run or fly off. The WALH can be differentiated from the potato leafhopper, which can also be a periodic pest of apple, by the way they run when disturbed. The WALH will normally run straight ahead or backward, while the potato leafhopper normally runs sideways or in a crab-like manner.

The WALH normally remains on the undersurface of the same leaf or cluster of leaves as it develops. Its cast skins also remain on the leaf undersurface until they weather off. WALH feeding removes the chlorophyll from the leaf. Light feeding injury appears as white spots on the upper leaf surface, and as feeding increases, the loss of chlorophyll and evidence of leaf injury increases. The WALH also produces a honeydew which can drop onto the fruit and appear as tan to brown spots or streaks. The honeydew is an excellent media for the growth of sooty molds and both the honeydew and molds can russet the fruit. Fruit injury from honeydew deposits is more common from second generation infestations.

The following facts should be kept in mind while developing a control program for the WALH:

1. The first generation will be less strung out than the se cond generation and is, therefore, easier to control. (The second generation may require two sprays to control.)
2. The small nymphs are easier to kill than the large nymphs and adults.
3. WALH egg hatch normally peaks during bloom and the majority of nymphs have hatched by petal fall.
4. The WALH has developed a high level of tolerance to the organophosphate insecticides.

Monitoring

From bloom through petal fall, check 50 leaves per tree from 10 trees per block for the first generation WALH nymphs. Particularly check the leaves of clusters in the inside of the trees. Treatment is recommended if there is an average of 1/2 nymph or greater per leaf.

For the second generation WALH, check 50 leaves per tree from 10 trees per block for nymphs from late July through August. Treatment is recommended if there is an average of one or more nymphs per leaf. Due to the protracted egg hatch of the second generation, two treatments may be necessary to control this generation.

Control

The WALH is easiest to control in the small nymphal instars. In New York, the WALH is resistant to many of the insecticides used in tree fruit production. The insecticides Sevin, Lannate, Nudrin, Carzol, Vydate, and Thiodan remain effective materials.

If the spotted tentiform leafminer, obliquebanded leafroller, or green fruitworm are not a problem and you plan on thinning the orchard, Sevin is the preferred material to use to control the first generation WALH. For the second generation, Sevin has an added benefit over Lannate, Nudrin, and Vydate in that you can also expect to get apple maggot control from the two sprays that may be necessary to control the WALH.

When Lannate or Nudrin is applied at petal fall to control the spotted tentiform leafminer, obliquebanded leafroller, or green fruitworm, it should provide the needed control of the first generation WALH. When used to control the second generation spotted tentiform leafminer, Lannate or Nudrin also provide control for the early hatch of the second generation WALH. A second spray of Lannate, Nudrin, or Sevin may be required to control the late hatch of the second generation.

Vydate, when applied at pink to control the spotted tentiform leafminer, should also control the WALH nymphs that are out at that time. Unfortunately, we cannot rely on residual activity to carry through bloom. Therefore, Vydate may hold down the first generation WALH, but cannot be counted on to control it. When applied against the second generation spotted tentiform leafminer sometime in July, Vydate may control an early portion of the second generation WALH, but should not be expected to provide adequate control. A second spray of Sevin will normally be required.

CHERRY FRUIT FLY (CFF)

Rhagoletis cingulata Loew

A second species, the black cherry fruit fly (BCFF), *Rhagoletis fausta* Oster Sacken, occurs in New York. Growers frequently refer to both species collectively as CFF. The biology and control of the species are similar and will be covered together.

Warning

BCFF adults normally begin emerging at about the time McIntosh apples begin petal fall. The CFF adults begin emerging about a week later. Sticky boards should be ordered from the pest management program to monitor CFF and BCFF emergence.

Life History

Both the BCFF and CFF are native to North America, and along with the plum curculio, rank among the top insect pests of cherries. Both species have a single generation a year. They overwinter as pupae in the upper three inches of the soil. The BCFF adults begin emerging at about the time McIntosh apples begin petal fall and the CFF adults begin emerging about a week later. A number of factors, including soil type and moisture, play important roles in emergence. Adults of both species can be found into August.

There is a pre-oviposition period of about a week during which the flies mate and the females cut the fruit with their ovipositors and feed on the fruit juices. The females can lay

eggs for about 25 days and in egg laying puncture the skin and oviposit directly into the flesh.

The eggs hatch in five to eight days and the maggots pass through three instars in about two weeks. When mature, the maggots drop to the ground, pupate, and remain in the soil until the following spring.

Monitoring

Sticky boards can be used to determine first emergence of both the BCFF and CFF, but cannot be used to time or determine the need to spray commercial cherry blocks. Hang sticky boards near unsprayed cherry trees to determine first emergence in an area. The traps should be checked at least every three days and a regular maggot spray program should begin no later than four days after the first fly is caught in the area.

For futher information on fly identification and trap placement refer to "Using Sticky Traps to Monitor Fruit Flies in Apple and Cherry Orchards." Copies of this publication are available, along with sticky boards, through the pest management program.

Control

Parathion, Guthion, azinphos methyl, and Penncap-M are standard fruit fly insecticides. Imidan can also be used, but is labeled for tart cherries only. Mesurol, when used for bird control, will also provide fruit fly control.

BLACK CHERRY FRUIT FLY (BCFF)

Rhagoletis fausta Oster Sacken

See CHERRY FRUIT FLY in LIBRARY.

EUROPEAN APPLE SAWFLY (EAS)

Hoplocampa testudinea (Klug)

Life History

The EAS was first discovered in the United States on Long Island in 1939. In New York, its distribution is restricted to the Hudson Valley and the Champlain Valley. Although the EAS is not a serious pest of commercial orchards, it has persisted as an occasional problem.

The EAS overwinters as a mature larva within the soil. Pupation occurs in the early spring and adults normally begin emerging by bloom. During cool, cloudy weather the adults are inactive. Although they will mate and lay eggs at temperatures below 60F, higher temperatures combined wth sunny days favor EAS activity.

Egg laying normally begins during bloom and may continue for 20 days. The eggs are laid within the calyx cup and the hatching larvae burrow directly into the fruit. The larvae feed directly beneath the fruit surface and cause the typical spiralling scar seen at harvest. The larvae can continue to develop on the initially infested fruit or may move to a second fruit to continue development. The larger larvae bore into the center of the fruit and cause it to drop. The mature larvae leave the fruit and enter the soil, where they remain until pupation the following spring.

Monitoring

Effective monitoring of the EAS to determine the need to spray has yet to be developed. Dr. Prokopy (Univ. of Mass.) is working on this problem. One of the difficulties is that the best time to control the EAS is when the adults emerge during bloom, a period when insecticides cannot be applied. This undoubtedly is why the EAS persists as a pest. The petal fall sprays applied to control such pests as the plum curculio and the Early Lepidoptera do aid in controlling the EAS and maintaining its status as a pest of minor importance.

Control

The broad spectrum insecticides applied at petal fall are effective in controlling adult EAS and reducing injury to the fruit.

PEACHTREE BORER (PTB)

Synanthedon exitiosa (Say)

Life History

The PTB, a pest of all stone fruits, overwinters as larva within burrows under the bark of the trees at or just below soil level. While the majority of individuals complete their development in one year, some require two years. The larvae resume feeding on the cambium and inner bark of the trunk just below and above the soil surface when warm temperatures return'in the spring.

Prior to pupation, the larvae normally enter the soil, where they construct a cocoon of silk, trass, and soil. The combined period of cocooning and pupation is about a month. PTB adult emergence begins in early July, peaks in August, and can continue into October. The steel-blue moths have a single wide orange band on the abdomen of the female and three or four narrow yellow stripes on the male's abdomen.

Mating occurs soon after emergence and egg laying begins soon thereafter. A single PTB female may lay up to 800 eggs. Egg laying tends to be on trees previously infested with PTB or trees with mechanical injury to the trunk. The eggs take about ten days to hatch; hatch normally begins in mid-July.

Monitoring

Pheromone traps may be used to monitor PTB emergence and flight activity. Studies indicate the traps are most effective when placed at or near ground level in orchards free .of weeds. Orchards with high weeds will hamper dispersal of the pheromone at lower levels; therefore, under such situations the traps should be placed above the weeds. Insecticide sprays should begin after first trap catch.

Control

Preplant:

A preplant root dip in a Thiodan solution has been found to provide complete control the first season and a high degree of control the second season.

The WAA has a very effective parasite, *Aphelinus mali,* which normally keeps the aphid population in check. The use of carbamate insecticides to thin the crop or control such pests as the white apple leafhopper, spotted tentiform leafminer, obliquebanded leafroller, or the green fruitworm can eliminate the parasite from the orchard and may precipitate a WAA outbreak if the pest is present in the orchard. If carbamates must be used, particular attention should be paid to the monitoring and control of WAA.

Monitoring

WAA infestations on the trunk and scaffold limbs are not cause for control. These sites of infestation should be noted and checked periodically to determine if movement of the infestation to the current year's growth has begun. If carbamate insecticides have been used to thin your crop or control some other orchard pest, the periodic checks should become more frequent. WAA control with an insecticide is recommended at the first sign of the infestation moving to the current year's growth.

Control

Only Thiodan and Penncap-M are known to effectively control the WAA. If Penncap-M is used, even in the summer, precautions should be taken to help reduce the poisoning hazard to bees; see HONEY BEE in LIBRARY.

STRAWBERRY BUD WEEVIL (SBW)

Anthonomus signctus Say

The SBW is also known as the Strawberry Weevil or Clipper.

Life History

The SBW has one generation a year and overwinters as a dark reddish- brown adult, about 0.1 inch long, in fence rows and woods adjacent to strawberry plantings or beneath the mulch in the plantings themselves. The SBW becomes active at about 60F and can be found causing injury from when blossom buds appear through harvest. The female SBW lays an egg in a bud and then cuts it from its stem. The bud then either falls to the ground or hangs to the stem by a few threads of plant material. The eggs hatch in about a week into white, legless grubs that feed within the bud for three to four weeks. The SBW pupates within the bud it has fed upon and the adults appear in early summer and feed on the pollen of various flowers before seeking a hibernation site in midsummer where they remain until the next spring.

Monitoring

Since it is difficult to find the adult SBW, monitoring to determine the need for control is based on the first observation of buds being clipped. This normally occurs at temperatures at or above 60F when blossom buds are present. It is estimated that one cut bud per 1.5 linear feet of row justifies control. This level of injury can be caused by a single female SBW per 40 linear feet of row.

Control

Two insecticide sprays are required for SBW control. The first spray should be applied at the first sign of clipping and the second spray should be applied about ten days later. It is also helpful to spray adjacent hedgerows or woodlot borders. Guthion, azinphos methyl, and parathion may be used for SBW control. Phytotoxicity has occurred from time to time with the use of parathion.

CLIPPER

See STRAWBERRY BUD WEEVIL (SBW) in LIBRARY.

TARNISHED PLANT BUG (TPB)

***Lygus** lineolaris* (Palisot de Beauvois)

Note: A separate strategy for TPB on tree fruit may be found in the LIBRARY program forTFRUIT.

Life History

The TPB feeds on a wide range of hosts, with strawberries appearing to be one of their favorites. On strawberry, the TPB prefers feeding on the achenes located on the blossom tip. Injury from such feeding has been referred to as apical seediness, buttoning, nubbining, or cat-facing. Growers frequently attribute early TPB injury to frost injury or poor pollination.

The TPB overwinter as adults and become active in the spring when temperatures reach about 60F. The adults move to strawberries as the blossom buds appear and lay their eggs within the tender tissues of the plant. The nymphs are the important damaging stage on strawberries. They quite often confine their feeding to the achenes at the tip of the strawberry blossom. Due to their later bloom, the late and everbearing strawberry varieties are more susceptible to TPB injury than are the early-bearing varieties.

Monitoring

Dr. George Schaefers has found that a white, 6-inch pot saucer or plate makes an excellentTPB sampling tool. Tap a cluster of buds on the saucer and count theTPB nymphs that fall to the saucer. Disregard the adult TPB. An average of one nymph per cluster can result in about 30 percent fruit injury. Therefore, control is recommended at the first sign of TPB nymphs in the planting.

Control

Parathion, Thiodan, and malathion may be used to control the TPB. The insecticide should be applied at the first sign of nymphs in the planting. Do not spray during bloom. A post-bloom spray may be required. The days to harvest interval is fourteen for parathion, four for Thiodan, and three

for malathion. Parathion has been known to cause phytotoxicity on strawberry plants.

CYCLAMEN MITE (CM)

Steneotarsonemus pallidus (Banks)

Life History

The CM is normally not a problem in strawberries but can occasionally become serious in older plantings.

The CM is a minute mite that is not easily seen by the naked eye. They are white to light tan or pink in color and are found in crevices of new, expanding leaves and stems within the crown of the plant. CM injury causes the young expanding leaves to become distorted, stunted, and bronzed. Severe CM infestations may kill the leaves and cause fruit distortion. Infested plants frequently become unproductive within a season.

CM overwinter as adult females in protected areas within the crown of strawberry plants. CM populations begin to **rise** in late May and peak in July, followed by a sharp decline in numbers. A second population peak occurs in late September.

Monitoring

The appearance of stunted, disfigured, and/or bronzed leaves within the crown of the strawberry plant is an indication of the presence of the CM. This is frequently seen first at harvest. Young leaves from the crowns of strawberry plants suspected of being infested with CM should be examined under a binocular microscope or with a good hand lens. Teatment is recommended if CM are found in the sample taken.

Control

Planting material found to be infested with CM should be returned to the nursery.

Established strawberry plantings requiring CM control should be treated at the time the beds are renovated. Commercial growers should use Thiodan. Homeowners are limited to Kelthane. The material should be applied as a drench.