Strawberry Insects and Diseases – What to be ready for and IPM practices

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There are several important insect pests and diseases of strawberries that growers must be aware of in New England. Some are long established and others are new introductions. In order to manage them effectively, growers will need a good understanding of the life and growth cycles of the plants, pests, and beneficial organisms and how to correctly identify the cause of problems that may occur. For this growers will need a few tools and resources:

Item:	Why you need it:
• A good magnifier or hand lens	For better viewing of small details
• A flat white beating tray or plate	For sampling TPB and other pests
• A sweep net	For sampling flying insects in the canopy
• Some ziplock bags and small vials to collect specimens in	To collect examples from the field for closer examination or sending to Diagnostic Lab
• Map(s) of the field(s)	To record findings, special conditions, soil changes, hot spots, etc.
• A weather station or access to weather data	To employ the use of weather based models for management decisions
• A good ID guide	To help correctly identify findings in the field
• A copy of IPM scouting procedures and thresholds for your crop	To know the best way to sample for each pest and know when treatment is needed (action threshold)
• A current copy of the New England Small Fruit Management Guide, Cornell Organic Strawberry Production Guide, or similar guide for your area	To assist in deciding what action to take if a treatment is needed
• A good record keeping system	To help evaluate successes and failures from year to year

Key Strawberry Insect Pests and Diseases

Below are some short descriptions of the key insect pests and diseases that will be covered in this talk. The information presented here is basic and more detail will be provided in the talk. Also, some good web based resources are listed at the end of this paper.

Insects

Tarnished Plant Bug

ID/Life Cycle: The tarnished plant bug (TPB) is a small bronze colored insect with a triangular marking on its back. It is a 'true bug' with piercing/sucking mouthparts. The immature stage, or nymph, is smaller and bright green, resembling an aphid, but much more active. TPB is a ubiquitous feeder with a wide host range.

Tarnished plant bug overwinters in protected areas such as leaf litter, plant debris, hedge rows and brush piles. Adults become active and lay eggs in grasses, broadleaf weeds, and in strawberries in early to mid-May. The eggs hatch to nymphs in 7-10 days depending on the temperature. The nymphs may be present on the plants as early as the second week of May. The first observation of nymphs usually occurs during full-bloom period of mid-season flowering cultivars. Nymphs undergo 5 stages of development. There are several generations per year.

Damage: This is the most significant insect pest in strawberries. Both adults and nymphs feed on the developing flowers and fruit, sucking out plant juices with straw-like mouth-parts. This results in deformed fruit: typically “cat-faced” berries, also called nubbins or button berries. Such fruit are generally unmarketable. Damage can cause significant crop loss.

Monitoring and Management: Monitor for TPB nymphs by shaking flower trusses over a white surface and counting the number of nymphs present. At each of five sites per field, shake 10 flower clusters over a white pan or paper to dislodge the nymphs. The action threshold for nymphs is when 1 out of 4 flower clusters is infested with at least 1 TPB nymph. At this level, control measures can be applied to maintain quality and yield before too much damage occurs.

Strawberry Bud Weevil/Clipper

ID/Life Cycle: This insect is a very small beetle with a copper-colored body and a black head with a long snout.

Strawberry bud weevils overwinter as adults in protected areas such as fence lines, hedgerows and woods. They migrate into the strawberry field from overwintering sites in early spring when flower buds are visible and beginning to extend from the strawberry crown. After mating, the female deposits an egg inside an unopened flower bud and partially cuts off the blossom stalk. This is where the common name the "Clipper Weevil" comes from. The damaged bud will not open. It wilts, turns brown and dries up, providing a place for the egg and larva to develop. New adults emerge in mid-summer, feed on pollen from flowers and weeds until the fall, and seek out overwintering sites. They have only one generation per year. A resident population (one that becomes established inside the strawberry field) may develop in plantings older than 3 years.

Damage: Damage is cause by the clipping of flower buds, which then fail to develop as fruit. High levels of injury can lead to significant yield impact. However, some varieties seem to be able to compensate for lost buds by producing larger berries from remaining buds, a thinning effect. Infestations tend to be concentrated near the hedgerows, woods, and stonewalls that border strawberry fields.

Monitoring and Management: Early detection of clipper activity is important. Watch for clipper adults and damage when flower buds start coming out of the crown and when temperatures approach 65˚F. Check a 2 ft section of row at each of 5 sites per field. Sampling should be most intensive along field edges near woods or hedgerows or where weeds are heavy. The action threshold is 13 clipped buds per 2 ft of strawberry row.

If king blossoms are open, look for shot-holes in flower petals caused by females searching for pollen to feed on. This is an easy symptom to see.

Two-Spotted Spider Mite

ID/Life Cycle: Two-spotted spider mites are tiny arthropods that live on the underside of strawberry leaves. Females are slightly larger than males and both have two dark patches (spots) on their backs. They are best viewed with a hand lens as they are difficult to see with the naked eye and form colonies as the numbers build up.

They overwinter in cracks and crevices on the strawberry crowns or in the surrounding duff around the plants. There are many generations per year. Both adult and immature mites feed on plant sap and have a wide host range, feeding on many species of plants.

Damage: Under heavy infestations, mite feeding destroys leaf chlorophyll and causes leaves to have yellowish or whitish speckles, then an overall bronze color. Leaves will be covered in fine

webbing. Yield reductions may occur from repeated heavy infestations. The most serious reductions in yield may result from early season feeding, so scouting for overwintered mites in early May is especially important.

Monitoring and Management: Mites should be monitored weekly by sampling the field in 5 to 10 locations. Five to 10 leaves should be sampled at each location for a total of 60 leaves. Examine the underside of the leaves for the presence or absence of TSSM. Record the information on a field map so that "hot spots" can be identified and treated. The action threshold is when 25% (i.e., 15 leaves) or more of a 60 leaf sample is infested. When sampling a field, presence of predators as well as pest mites should be noted.

Root Weevils

ID/Life Cycle: There are several root-feeding weevils that are damaging to strawberries; black vine weevil, strawberry root weevil, and the rough strawberry root weevil are the best known. Additionally, green leaf weevils have been found feeding on strawberries in MA and CT.

The black vine weevil overwinters in the soil as a partly grown larva, or "pre-pupa". Larvae resume feeding on roots in the early spring, causing the heaviest damage. Larvae pupate in late May and June for about 10 days. Adults begin emerging in June (600 GDD) and continue through July. Adults feed at night and hide around the base of the plant during the day. After two to three weeks of feeding, egg laying begins, usually in late July (approximately 1400 GDD). Larvae hatch in August (Approximately 1700 GDD) and begin feeding on roots. They continue to feed and grow until winter.

Damage: Larvae feed on roots and crowns, which can weaken the plants or lead to root rots. Adult weevils feed on leaves from May through August, causing notching of the leaf margins, which rarely leads to significant weakening of the plants. Under heavy infestation by root weevils, the plants decline, appear stunted and bear poorly. Infestations are generally in patches in the field.

Monitoring and Management: Degree-day models can predict emergence and development. This can help guide scouting and management activities. Symptoms of adult feeding can be seen on leaf margins beginning in June. The nocturnal adults can be spotted at night with a flashlight. Traps can also be made by placing fold of burlap around the base of the plant, or by creating a pitfall trap by burying a paper cup at soil level. It is important to determine when the first adults are emerging so that control measures can be taken before they begin to lay eggs (2-3 weeks after emergence). Emergence is usually toward the end of harvest making chemical control difficult.

Diseases

Gray Mold

ID/Disease Cycle: Symptoms of gray mold include light brown areas on fruit; a powdery gray growth produced on rotted fruit and leaf tissue; and whole rotted berries that retain their general shape but become tough and dry.

The fungus overwinters in living plant tissue and proliferates in the spring as leaves die. Favored by cool, wet weather, the fungus infects new blossom tissue and remains latent until fruit starts to ripen. Then visible symptoms occur. Secondary infections may occur when spores that cling to ripening fruit germinate in moist packaging conditions after the fruit is harvested, causing uncontrollable storage rots.

Damage: The main damage to the crop is from reduced quantity and quality of yield. In years when wet weather prevails during bloom and ripening periods, significant crop losses can occur.

Monitoring and Management: Consult scouting records from previous years to determine if carry-over inoculum is likely to be present. Scout fields weekly in the current year starting in the pre-bloom period for symptoms. Monitor weather conditions especially during bloom to determine if infection periods are imminent or have occurred.

Black Root Rot Complex

ID/Disease Cycle: Above-ground symptoms of this disease are a general lack of vigor, stunted growth, reduced yield and eventual collapse of plants especially during dry weather. Root symptoms consist of blackened feeder roots and, eventually, structural and perennial roots. Structural roots will rot from the outside to the center, leaving the core white for a period of time, unlike red stele where the core is usually red.

Black root rot has no simple causes or remedies. It is a disease complex, involving several pathogens combined with plant stress. The key pathogens include *Rhizoctonia, Pythium,* and lesion nematode. These pathogens are commonly found in soils but don't usually cause disease symptoms on healthy plants. But stressed plants are susceptible to infection. Strawberry plants may be stressed in a number of ways, such as drought, winter injury, root feeding insects or nematodes, poor nutrition, soil compaction, or improper herbicide use.

Damage: Plants may be weakened by poor root function or may collapse completely. The impact range from a reduction of yield in affected areas or may shorten the life of an entire planting from what would normally be expected.

Monitoring and Management: Consult scouting records from previous years to determine if build-up of this disease is indicated. Scout fields after bloom to identify areas of weak vigor. Dig up plants in weak areas and examine the roots for possible cause.

Red Stele

ID/Disease Cycle: Symptoms of red stele infection are numerous: wilting; young leaves with a bluish-green tint; and older red, orange or yellow leaves. Severely diseased plants may die or remain stunted, producing few runners and small berries. When roots are cut open lengthwise, the core will show a reddish-brown discoloration. Plants showing symptoms usually occur in patches where the soil is wettest.

Red stele is caused by the soil-borne fungus that may be introduced by the movement of soil on tillage implements or runoff water from infested fields. This disease is very persistent and can survive in a field for many years, even if no strawberries are grown during that time. It persists in soil as thick-walled resting structures that are activated when the soil becomes wet. The fungus produces new spores within infected roots as they begin to rot and die, and these oospores are released into the soil when the roots decay, thus completing the disease cycle.

Damage: This fungus causes a root rot and wilt, and is a major disease of strawberries where cool, wet soil conditions occur. Depending on the extent of the infection and the plant's resistance, stunting or wilting and collapse of the plant will result.

Monitoring and Management: Consult scouting records from previous years to determine if build-up of this disease is indicated. Scout fields after bloom to identify areas of weak vigor. Dig up plants in weak areas and examine the roots for possible cause.