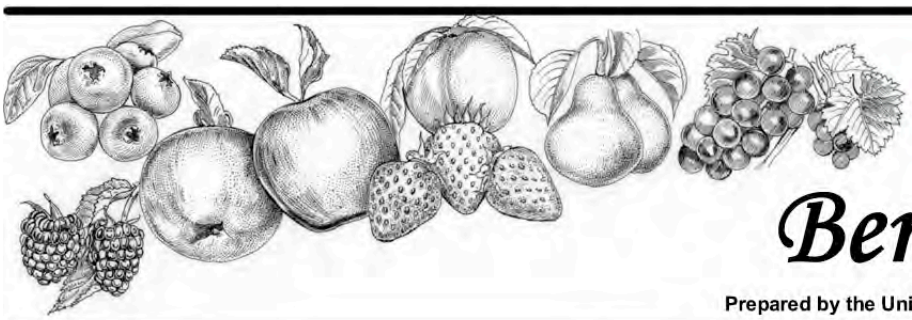

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Berry Notes

Prepared by the University of Massachusetts Fruit Team

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Massachusetts Berry Notes Underwriters:

NOURSE
Growers of the Finest Small Fruit Plants

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IN THIS ISSUE:

Message from the Editor

INDAR SECTION 18 APPROVAL FOR MUMMY BERRY IN MA FOR 2006 - The U.S. EPA granted an emergency exemption for the use of Indar 75WSP (fenbuconazole) to control mummy berry disease in blueberries in Massachusetts for 2006. This exemption is in effect starting April 1, 2006 and expires June 30, 2006. Fungicide applications should be made starting at early green tip and continuing at 10-14 day intervals through bloom to control the disease effectively. No adjuvants should be used. Once the flowers have been pollinated no further infection can take place. Follow label instructions for rates and other restrictions. The PHI is 30 days.

Dow AgroSciences, LLC is the registrant; however, existing stocks of Indar 75 WSP purchased previously from Rohm and Haas may be used. All applicable conditions and restrictions as appearing on the full federally-registered product label must be observed. Applications may not be made within 75 feet of streams, rivers, ponds, lakes or reservoirs.

Copies of the Section 18 Exemption label **must** be in the possession of applicator at the time of application. Applicators **must** have a pesticide license to apply Indar in blueberries **or** file an 'Emergency Exemption Registration Form'. In addition, anyone using Indar for mummyberry control in 2006 **must** submit a use report to MDAR by Sept. 30, 2006. Copies of all required labels and forms can be provided by me upon request. (413-545-4347 or sgs@umext.umass.edu).

Twilight Meetings: Spring and summer twilight meetings are being organized. I'll post them in this newsletter as I hear about them. The April series of Fruit Team twilights are listed at the end of this newsletter. Twilight meetings are a great way to hear the latest timely topic information and to get together with other growers to talk about the upcoming season. We hope to see you at some of these meetings.

ENVIRONMENTAL DATA

The following growing-degree-day (GDD) and precipitation data was collected for a two-week period, March 16, 2006 through March 29, 2006. Soil temperature and phenological indicators were observed on March 29, 2006. Accumulated GDDs represent the heating units above a 50° F baseline temperature collected via our instruments since the beginning of the current growing season. This information is intended for use as a guide for monitoring the developmental stages of pests in your location and planning management strategies accordingly.

Region/Location	2006 GROWING DEGREE DAYS		Soil Temp (°F at 4" depth)	Precipitation (2-Week Gain)
	2-Week Gain	Total accumulation for 2006		
Cape Cod	4	15	40	0.00"
Southeast	4	23	47	0.00"
East	6	17	39	0.10"
Central	4	4	35	0.00"
Pioneer Valley	3	8	44	0.01"
Berkshires	0	5	36	0.04"
AVERAGE	3.5	12	35.6	0.15"

n/a = information not available

(***Source**: UMass Extension 2006 Landscape Message #5, March 31, 2006*)

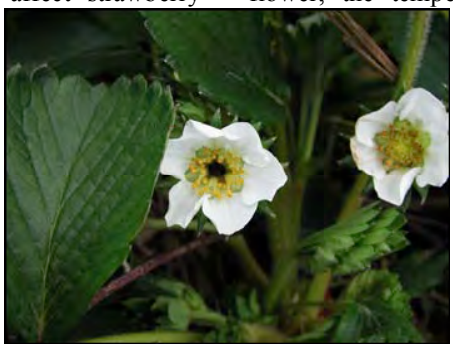
STRAWBERRY

Frost Protection in Strawberries

*Marvin Pri*tts *Cornell* University

*S*trawberry growers can ensure a full crop of berries only if they exert some influence on temperature during the year. Temperature control is especially important during the winter and early spring when flowers are susceptible to frost. Excessive summer temperatures inhibit growth as well.

Of all the factors that negatively affect strawberry production, frost can be the most serious. Frost can eliminate an entire crop almost instantaneously. Strawberries often bloom before the last frost free date, and if a frost occurs during or just prior to bloom, significant losses can result. The strawberry flower opens toward the sky, and this configuration makes the flower particularly susceptible to frost damage from radiational cooling. A black (rather than yellow) flower center indicates that frost damage has occurred.



Strawberry growers occasionally delay the removal of straw mulch in spring to delay bloom and avoid frost. Research has demonstrated, however, that this practice also results in reduced yields. Also, applying straw between the rows just prior to bloom will insulate the soil from the air. This will increase the incidence of frost injury as solar radiation will not be absorbed by the soil and re-radiated at night. If additional straw is to be applied between the rows in spring, delay its application for as long as possible before fruit set.

Overhead irrigation is frequently used for frost control because flowers must be kept wet during a freeze in order to provide protection. As long as liquid water is present on the flower, the temperature of the ice will remain at 32F because the transition from liquid to ice releases heat. Strawberry flowers are not injured until their temperature falls below 28F. This 4 degree margin allows the strawberry grower to completely cover a field with ice and yet receive no injury from frost. However, if insufficient water is applied to a field during a freeze event, more injury can occur than if no water was applied.

Several principles are responsible for the ability of ice to protect strawberry flowers from injury. First, although pure water freezes at 32F, the liquid in the strawberry plant is really a solution of sugar and salt. This depresses the freezing point to below 32F. Also, ice crystals need nucleators to allow them to form initially. Certain bacteria serve as nucleators. Sometimes, in strawberry flowers, the bacteria that allow ice to form are absent, allowing the freezing point to be lowered.

The temperature of the applied water is usually greater than the temperature of the plants, so this serves to warm the flowers before heat is lost to the air. As long as liquid water is continually applied to the plants, the temperature under the ice will not fall below 32F. When one gallon of water freezes into ice, 1172 BTUs of heat are released.

Several factors affect the amount of water that is required to provide for frost protection, and the timing of application. At a minimum, apply water at 0.1 - 0.15 in/hr with a fast rotating head (1 cycle/min.) Water must be applied continuously to be effective. A water source of 45 - 60 gal/min-acre is required to provide this amount of water. Choose nozzle sizes to deliver the amount of water required to provide protection under typical spring conditions in your location.

Under windy conditions, heat is lost from the water at a faster rate, so more water is required to provide frost protection. For every gallon of water that evaporates, 7760 BTUs are lost. The application rate then depends on both air temperature and wind speed (Table 1). Under windy conditions, there is less chance of flower temperatures falling below that of the air because of the mixing of air that occurs at the boundary of the flower. Winds are beneficial if the temperature stays above the critical freezing point, but detrimental if the temperature approaches the critical point. Less evaporation (and cooling) will occur on a still, humid night.

Under extremely windy conditions, it may be best not to irrigate because the heat lost to evaporation can be greater than the heat released from freezing.

Table 1. Water application rate (in/hr) for a given humidity and wind speed*

Wind Speed					
Temp (F)	0-1	2-4	5-8	10-14	18-22
Relative humidity of 50%					
27	0.10	0.20	0.30	0.40	0.45
24	0.10	0.30	0.35	0.45	0.60
20	0.15	0.35	0.45	0.60	0.75
18	0.20	0.40	0.50	0.65	0.80
Relative humidity of 75%					
27	0.05	0.10	0.20	0.25	0.25
24	0.10	0.20	0.30	0.35	0.40
20	0.10	0.25	0.40	0.45	0.60
18	0.15	0.30	0.45	0.55	0.70

**FROSTPRO model from North Carolina State Univ.*

Stage of development. Strawberry flowers are most sensitive to frost injury immediately before and during opening. At this stage, temperatures lower than 28F likely will injure them. However, when strawberry flowers are in tight clusters as when emerging from the crown, they will tolerate temperatures as low as 22F. Likewise, once the fruit begins to develop, temperatures lower than 26F may be tolerated for short periods.

The length of time that plants are exposed to cold temperatures prior to frost also influences injury. Plants exposed to a period of cold temperatures before a frost are more tolerant than those exposed to warm weather. A freeze event following a period of warm weather is most detrimental.

Flower temperature. The temperature of all flowers in a field is not the same. Flowers under leaves may not be as cold as others, and those near the soil generally will be warmer than those higher on the plant. On a clear night, the temperature of a strawberry flower can be lower than the surrounding air. Radiational cooling allows heat to be lost from leaves and flowers faster than it accumulates through conduction from the surrounding air.

Soil also retains heat during the day and releases heat at night. It is possible that on a calm, cloudy night, the air temperature can be below freezing yet the flowers can be warm. Wet, dark soil has better heat retaining properties than dry, light-colored soil.

Using row covers. Row covers modify the influence of wind, evaporative cooling, radiational cooling, and convection.

Because wind velocity is less under a row cover, less heat will be removed from the soil and less evaporative cooling will occur. Also, relative humidity will be higher under a row cover, reducing heat loss from evaporation. In addition, convective and radiational heat loss is reduced because of the physical barrier provided by the cover. Plant temperature under a cover may eventually equal that of the air, but this equilibration takes longer than with uncovered plants. In other words, row covers do not provide you with additional degrees of protection, but they do buy time on a cold night as flower temperatures will fall less rapidly inside a cover. Often the temperatures fall so slowly under a row cover that irrigation is not needed. If irrigation is required, less water is needed to provide the same degree of frost protection under a row cover.

Rules of thumb

- ❖ Store sufficient water for 2 or 3 consecutive nights of frost protection
- ❖ Use small diameter nozzles (1/16 - 3/16 in. diameter)
- ❖ A 30 X 30 ft. staggered spacing of nozzles is preferable
- ❖ Use metal sprinklers to minimize icing
- ❖ Minimum rotation of once per minute

Water can be applied directly over the row covers to protect the flowers inside.

Turning on the water. Since cold air falls to the lowest spot in the field, a thermometer should be located here. Place it in the aisle at the level of the flowers, exposed to the sky, and away from plants. Air temperature measured at this level can be quite different from the temperature recorded on a thermometer at the back of the house. The dewpoint temperature measured in the evening is often a good indication of how low the temperature will drop on a clear night, and is related to the relative humidity. Air temperature will fall less if the humidity is high. If the air is very dry (a low dewpoint), evaporative cooling will occur when water is first applied to the plants, so irrigation must be started at a relatively warm temperature.

Most local weathermen can provide the current dewpoint, or it can be obtained from World Wide Web-based weather information services (see article below).

If the air temperature falls below 34F on a clear, calm night, especially before 3 A.M., it would be wise to start irrigating since flower temperatures could be several degrees colder. On the other hand, if conditions are cloudy, it may not be necessary to start irrigation until the temperature approaches 31F. If conditions are windy or the air is dry, and irrigation is not turned on until the temperature approaches 31F, then damage can occur due to a drop in temperature when the water first contacts the blossom and evaporation occurs. Therefore, the range in air temperatures, which indicates the need for irrigation at flowering is normally between 31 and 34F, depending on cloud cover, wind speed and humidity, but can be as high as 40F. Admittedly, these numbers are conservative. Flowers can tolerate colder temperatures for short periods of time, and irrigation may not be needed if the sun is about to rise. Obviously, one does not want to irrigate too soon since pumping is expensive, and excess water in the field can cause disease problems.

Table 2. Starting temperature for frost protection based on dewpoint.

Dewpoint	Suggested starting air temperature (F)
30	32
29	33
27	34
25	35
24	37
22	38
20	39
17	40

Turning off the water. Once irrigation begins, it should not be shut off until the sun comes out in the morning and the ice begins to slough off the plants, or until the ice begins to melt without the applied water.

Waterless frost protection agents. Future solutions to frost protection could lie in waterless methods, such as genetically engineered bacteria that do not promote the formation of ice. However, to date, these materials have not been consistently effective, so they are not recommended as the sole basis for frost protection. (***Source**: New York Berry News, Vol. 5, No. 2, March 31, 2006*)

Strawberry Sap Beetle: an update on progress toward improved management

Rebecca L. Loughner and Gregory English-Loeb, Cornell University

The strawberry sap beetle (SSB) is a significant insect pest in strawberry in much of the Northeast. The small, brown adults are approximately 1/16 inch in length and appear in strawberry fields as the berries ripen. The adults and larvae prefer to feed on over-ripe fruit but will also damage marketable berries. Customers often report finding larvae after washing the berries at home. The beetles are widespread and present at all of 14 New York farms

sampled in 2002, but seem to be a significant problem only in certain locations. Concern regarding SSB centers on the lack of effective control measures.

Current recommendations for control include applying pyrethroids, improving field sanitation, and renovating promptly after harvest. Labeled pyrethroids (Brigade [bifenthrin] and Danitol [fenpropathrin] in NY) have not provided sufficient control and are broad spectrum, potentially disrupting predatory mite populations that provide spider mite control. The beetles are not resistant to pyrethroids but rather tend to feed underneath fruit where they are unlikely to be contacted by insecticide. Even dilute sprays using up to 200 gallons per acre have not proven to be very effective.

Results presented here are a summary of data from three years of examining how cultural practices (plant structure and time of renovation) and habitat surrounding strawberry fields (wooded areas and alternate food sources) influence the size of the SSB population. This work has led to some initial progress in understanding SSB biology needed to develop a trapand- kill management technique.

Overwintering habitat

A total of 5 adult SSB were found in the 220 soil cores collected from wooded areas in spring 2004, while no SSB were present in the 480 samples taken from fields of other crops during the same time period. All beetles in the samples came from wooded areas at one farm known to have high densities of SSB. More beetles were found after increasing the area sampled per field for overwintering SSB from 0.16 m^2 (wooded area) or 0.26 m^2 (crops) in 2004 to 2.03 m^2 in 2005.

Beetles were found in both of the two wooded areas sampled, in blueberry, and in raspberry for samples collected before fruiting occurred and after fruit residue was present (Table 1). No SSB were found in any of the three strawberry fields for the overwintering sample, but beetles were found in samples collected when fruit began to ripen in the field. Absence of SSB from early season samples in strawberry confirms that most, if not all, beetles spend the winter outside of strawberry fields and move into berry fields as fruit ripens.

Strawberry plant structure

Sampling and manipulative experiments were designed to better understand how variation in plant structure of strawberry cultivars could impact fruit resources available to the SSB population. A sampling of 14 strawberry cultivars showed the proportion of berries held off the ground does vary with cultivar. Although there was a significant correlation between fruit being ripe and in contact with the ground, certain cultivars did not fit this trend. The cultivar 'Serenity' had a high proportion of fruit touching the ground before most of the fruit had ripened, while 'Evangeline' had a low proportion of fruit in contact with the ground at peak ripeness. The finding that berries on 'Evangeline' are less likely to come in contact with the ground fits with anecdotal reports that the cultivar tends to hold fruit off the ground and thus is less damaged by SSB in the field.

The hypothesis that plant structure may be useful in developing control tactics is based on the assumption that berries in contact with the ground are more likely to be damaged by SSB. To test this assumption, clusters of fruit in a field plot were staked up off the ground or pinned down to the ground, covered with a cage, and inoculated with adult SSB. The beetles both damaged and were present on fruit clusters staked up off the ground, showing beetles can feed on fruit in the plant canopy. The proportions of damaged fruit suggest that berries in direct contact with the ground are more likely to be damaged by SSB than berries in the canopy.

While proportion of fruit touching the ground may vary with cultivar, some fruit in all cultivars is in contact with the ground. The beetles may preferentially feed on fruit touching the ground and only damage fruit in the canopy when densities of SSB are high. Damage to fruit in the plant canopy has been reported in such situations at commercial farms.

Overall, the potential is limited for directly impacting the SSB population by choosing a strawberry cultivar with a particular growth habit.

Time of strawberry plot renovation

A manipulative experiment was used to investigate the effect of time of renovation on the number of SSB emerging from strawberry. Plots within a strawberry planting were randomly assigned to either rototilling immediately after mowing (prompt renovation) or rototilling 7 to 10 days after mowing (delayed renovation). Emergence cages were placed in both treatments on the same day and the cages in the delayed rototilling removed briefly on the day tilling was done. Emerging adults were captured with attractive baits in the cages and the total number of adult beetles emerged over five weeks was determined.

Year was the primary factor contributing to variation in the total number of SSB adults emerging, while time of renovation had no statistically significant effect. Peak emergence occurred from late July to early August 2004, while emergence in 2005 resulted in much less of a peak with a smaller number of beetles overall. In contrast to data from Maryland (Dr. Galen Dively, University of Maryland) that showed significantly fewer beetles emerging from plots

renovated promptly following harvest, this study suggests that prompt renovation does not consistently reduce the number of emerging SSB, at least in New York. Although prompt renovation does not appear to reduce the number of beetles in the next generation, current recommendations to renovate promptly still have value given other benefits such as improved weed control.

Table 1. Mean total ± standard error and range for adult SSB collected in wooded areas and crops before and during fruiting in 2005.

Crop/Habitat	*n*	Mean total SSB[a] (before fruiting)	Range SSB (before fruiting)	Mean total SSB[a] (fruit present)	Range SSB (fruit present)
Blueberry	3	2.3 (1.2)	0 – 3	223.0 (52.3)	131 – 312
Raspberry (summer)	2	0.5	0 – 1	908.5	566 – 1251
Raspberry (fall)	1	1.0		194.0	
Strawberry	3	0.0 (0.0)		177.7 (148.7)	25 – 475
Wooded areas	2	21.5	5 – 38	na[b]	na[b]

[a]*Standard error of the mean shown only for crops with >2 fields sampled*

[b]*Late season samples were collected only from crops and not wooded areas*

Development of trap-and-kill technique

Modifying cultural practices seems unlikely to significantly reduce the SSB population or damage to marketable fruit. While selecting certain cultivars, applying a border spray, and changing the time of renovation may not be practical options for controlling SSB, the earlier capture of beetles along wooded edges near fields offers an alternative approach to SSB management. Sap beetles have a male-produced aggregation pheromone that could be included in a trap along with a food odor and insecticide. These traps should be attractive to male and female beetles and would be placed near fields in early spring to capture and kill SSB before they enter strawberry fields. In laboratory flight tunnel assays, female SSB are much more attracted to whole wheat bread dough when male SSB are present with the dough. We have also had some female response in the flight tunnel to volatiles collected from male SSB feeding on bread dough. We are currently working to collect enough of the attractive material to be able to identify the chemical components of the SSB specific aggregation pheromone and to begin testing blends of synthetic pheromone in our flight tunnel.

(***Source**: New York Berry News, Vol. 5, No. 2, March 31, 2006*)

RASPBERRY

Azinphos-Methyl (Guthion) uses for Caneberries Cancelled

EPA issued an order in the Federal Register on March 29, 2006, amending registrations of azinphos methyl (AZM) products to terminate the "Group 2" uses, which include **caneberries**, cotton, **cranberries**, peaches/nectarines, potatoes, and Southern pine seed orchards. This order follows up on an August 2005 notice of receipt of requests from the registrants to voluntarily cancel the Group 2 uses. **Under the existing stocks provisions, distribution or sale of AZM products for these uses is allowed until March 31, 2006, and use of these products is allowed until September 30, 2006.**

BLUEBERRY

Blueberry Disease Fast Fact Sheet; Mummy berry

Dena Fiacchino, Cathy Heidenreich, and Wolfram Koeller, Cornell University

What: Mummy berry is caused by the fungus, Monilinia vaccinii-corymbosi, and is one of the most important blueberry diseases in New York State. If left untreated, mummy berry can reduce yields by 30-40%. Early control and detection is necessary to reduce the impact of this disease.

When: The fungus overwinters in infected berries, or "mummies" on the soil under bushes. Mushroom-like structures (apothecia) grow out of the mummies (Figure 1). In early spring, ascospores are released from the apothecia to infect the newly emerging leaf tissue. These spores are disseminated by wind and rain. This step is the primary or shoot blight phase of the disease. Shoot blight symptoms typically develop 2 weeks after infection. Infected shoots and leaves wilt, turn brown, and die (Figure 2). Masses of secondary spores (conidia) are

Figure 1.

produced on infected shoot surfaces (Figure 3), which then infect flower blossoms, starting the second phase of the disease.

Where: Mummy berry occurs in most regions where blueberries are commercially grown. This fungus only infects cultivated blueberries and a few wild blueberry species. Generally, the disease is introduced from neighboring infected plantings or from wild blueberries in nearby woods.

How: Under moist conditions in early spring, apothecia begin to form from mummified fruit remaining on the soil surface. The apothecia slowly develop as moisture levels and temperatures rise. At low temperatures such as 35° F, spores mature slowly taking 10+ hours to release, however at an increased temperature of 61° F, apothecia take about 4hrs to fully mature.

Conidia form on infected shoots, then are carried to flower blossoms by wind and pollinating bees (who are tricked by color changes and sugar secretion into thinking that the infected leaves might be flowers).

Figure 2.

Once the fungus has been introduced to the flower, it will germinate with the pollen and slowly infect the developing fruit. Evidence of blossom infection does not appear until the fruit begins to ripen. As normal berries ripen, the infected berries begin to shrivel and turn a pinkish color. (Figure 4) These "mummy berries" become filled with fungus, and have a hard grayish white center.

They fall to the ground, shrivel up becoming pumpkin-shaped, and turn dark brown or black. These serve as an inoculum source the following spring when apothecia form and disease cycle begins again.

Control Strategies: Mummy berry can be a difficult disease to control. An integrated pest management program including both cultural and chemical control strategies is needed for best results. The best time to achieve control of this disease is during the primary infection phase.

• Rake or disk soil beneath the blueberry bushes or cover the

Figure 3.

fallen mummy berries with a 3-4 inch mulch layer before apothecia appear in the spring.

• Apply 200lbs/A of 50% urea to burn out apothecia.

• Fungicides may be used to control this disease during both disease phases. For control of the primary infection phase applications should begin at green tip and continue on 7-10 day intervals when conditions favor infection.

For secondary infection control, make applications beginning at bloom on the same type of schedule. Different fungicides are required to control primary vs. secondary infections.

For more information see *Cornell Pest Management Guidelines for Berry Crops* [or *2006 New England Small Fruit Pest Management Guide*]. Apply all pesticides according to label rates and instructions.

Figure 4.

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(***Source**: New York Berry News, Vol. 5, No. 2, March 31, 2006*)

Cankerworm and/or Winter Moth in Blueberries

Bob Childs and Deborah Swanson, UMass Extension
(adapted for blueberries by Sonia Schloemann, UMass Extension)

In recent years, many blueberry growers in eastern, and especially southeastern Massachusetts, have reported serious damage from early season feeding of a small green caterpillar originally thought to be green canker worm. Last year, we determined that this caterpillar is more likely the larval stage of an insect called Winter Moth and the potential for serious damage to blueberries and other host plants is high.

Photographer: Louis-Michel Nageleisen, Département de la Santé des Foréts - France

Winter Moth is a new pest in Massachusetts. Prior to its introduction, both spring and fall cankerworms were not uncommon in our area. However, the level of damage from Cankerworms was typically less severe and occurred less frequently compared to the damage we are now finding from Winter Moth. Cankerworms, both fall and spring, are native insect pests.

Cankerworm populations will appear in an area and exist in damaging numbers for several years before going into decline due to natural controls. Then they may not reappear in that area for one or more decades. The winter moth, however, is an introduced insect pest and as such does not have sufficient natural controls yet to cause the populations to decline. Here is what we know about Winter Moth, its life cycle, damage and how to control it.

Winter Moth (*Operophtera brumata* (L.))

Origin: Winter moth is an insect pest that was introduced to North America from Europe. Its introduction has been known for years in various regions of eastern Canada, including: Nova Scotia, Prince Edward Island, and parts of New Brunswick. It has also been a pest in the northwestern region, namely Vancouver, British Columbia.

Winter Moth was introduced into the United States and has warranted control measures in Washington and Oregon. This pest is now in Massachusetts in, at least, the southeastern region and parts of Cape Cod. It is the first known occurrence of it in outbreak proportions in New England. It is also, currently, a problem in the United Kingdom (England and Scotland).

Injury and Host Plants: Many different deciduous plants are susceptible. These include: oaks, maples, basswood, white elm, crabapples, apple, **blueberry**, and certain spruces such as Sitka spruce (Scotland). Young larvae or caterpillars, resembling inchworms, tunnel into and feed inside buds, especially on fruit trees (apple, **blueberry**, cherry, and crabapple) in the early spring before bud break.

These caterpillars move from bud to bud as they feed. Delayed bud opening due to cool weather conditions can lead to bud death as the caterpillars have longer time to feed. Older larvae feed in the expanding leaf clusters and are capable of creating defoliation in high populations.

Research in Canada has shown that four consecutive years of partial defoliation of deciduous hosts can lead to branch mortality while complete defoliation in each of those years leads to tree mortality. In certain regions of Nova Scotia, this pest is responsible for a 40% red oak mortality in forested stands.

Life Cycle: Moths, or the adult stage, of the winter moth emerge from the soil usually in late November and can be active into January. The adults are strongly attracted to light and can often be found flying around outside lamps or

holiday lights. The male moths are 4 cm , light brown to tan in color and have four wings that are fringed with small elongate scales that give the hind margins a hairy or fringed appearance. The female is gray, wingless and, therefore, cannot fly. She emits a sex pheromone or scent that often attracts clouds of male moths.

Females are usually found at the base of trees but can be found almost anywhere. After mating, the female deposits an egg cluster on tree trunks and branches, in bark crevices, under bark scales, under loose lichen, or elsewhere. The adult moths then die and the eggs over-winter. Eggs hatch when temperatures average around 55°F. It is believed that egg hatch in Massachusetts occurs when 20 – 50 Growing Degree Days (base 50) have accumulated. This means that this usually occurs in the spring, before bud break of most of its host plants. Newly hatched larvae often crawl up tree trunks and produce a long 8 silken strand of silk which makes them air buoyant. This larval dispersal method is known as "ballooning". In certain situations, winter moth caterpillars can arrive in areas where they have not expected to be a problem, given topography and wind patterns. Larvae are pale green caterpillars with a white longitudinal stripe running down each side of the body. Winter moth larvae are loopers or inchworms and have just 2 pairs of prolegs. At maturity, these caterpillars will be approximately one inch long. They will feed voraciously until mid- June, whereupon they migrate to the soil for pupation. They will stay in the soil in the pupa stage until they emerge in late November as adult moths.

Feeding: In certain years, winter moth eggs may hatch in March. After ballooning, the larvae will tunnel into buds, especially the flower buds of fruits (apple, blueberry, cherries, and flowering trees). They will feed on both fruit and foliar buds but fruit buds are preferred. Once a bud has been devoured from within, the caterpillar will migrate to other buds and repeat the process. Once leaf buds open, the small caterpillars can be found within the tight clusters of new leaves during the day. During cool springs, if weather hinders leaf expansion, the winter moth caterpillar can cause high levels of injury to these leaves. Winter moth caterpillars often leave these clusters to become free feeders at night. They may also "drop" or "balloon" to plants that are located beneath infested trees. These caterpillars may then feed on a whole host of herbaceous perennials, roses etc. that are near or beneath these trees. Winter moth caterpillars are often found in association with both the fall and spring cankerworms, which look and have similar feeding patterns to the winter moth caterpillar.

What can be done?

•- **Scout**: Orchardists need to be particularly aware of the winter moth. The potential exists for both apple and blueberry crops to be heavily damaged. By the time one realizes that the flower buds have been consumed, it will be too late for action. Therefore, favored host plants in susceptible areas should be monitored carefully. Bark crevices should be inspected for egg clusters. By late winter, winter moth eggs will be reddish-orange in color. Upon hatching, winter moth caterpillars climb high into the host plant and produce a long strand of silk to make themselves air buoyant. They will be carried by the wind to a new host plant. This process of dispersal is called "ballooning".

•- A **dormant oil spray** to the blueberry bushes may be helpful in killing the overwintering eggs before they hatch. However, some egg clusters are under bark flaps and loose lichen and may be protected from oil sprays. Eggs may also be in other locations on or off the host plant. Caterpillars may also invade host plants by ballooning onto them after treatment has been applied.

•- ***Bacillus thuringiensis*** (B.t. (kurstaki), a bacterium specific to caterpillars of butterflies and moths, works very well on the younger larvae of both winter moth and cankerworms while they are free feeders.

• **Spinosad** products (SpinTor® and Entrust®), both of which are labeled on blueberries are a biorational compound that works well against both of these species.

• **Insecticidal soap** may be effective against the younger caterpillars but only when they are exposed on the host plant.

• **Chemical insecticides.** Few compounds, are labeled for this pest although many are being tested and may receive supplemental labels in the future.

Confirm® insecticide is labeled for loopers, spanworms and other lepidopterous pests in blueberry and should be effective. Imidan® may also be effective. Consult your local supplier and always read, understand and follow all label directions for pesticide products.

• **Plants heavily defoliated** by winter moth caterpillars will be severely stressed. Blueberry bushes must put out a second flush of growth in order to survive. **Water is critical to the bushes at that time.** Supplemental watering of bushes will be necessary if a drought or little rainfall occurs naturally. (***Source****: Reprinted from Mass Berry Notes, Vol. 17, No. 2, Feb 2005*)

GRAPE

Introduction to Late-Season Fruit Rots

Ashley Meyers, Virginia Tech

The most common and usually serious, fungal disease outbreaks occur in Virginia due to a failure to control one or more of the three major fungal diseases: black rot, powdery mildew, and downy mildew. In the past little attention has been paid to late season rot diseases or "rot complex"; however, we are finding that control of late season diseases plays an increasingly important role in achieving good wine quality, and is of growing importance in the Mid-Atlantic states. In North Carolina, the "rot complex" has caused greater than 50% crop loss (T.B. Sutton, personal communication). In previous years in Pennsylvania, "bunch rot" was caused by sour rot or Botrytis (grey mold); now Pennsylvania growers are reporting ripe rot, and in one vineyard macrophoma rot or soft rot. As of yet, bitter rot has not been found in Pennsylvania (J.W. Travis, personal communication). In the 1990s we realized bunch rot may be caused by something other than botrytis by isolating ripe rot, macrophoma rot, and Phomopsis causing fungi from fruit and in Virginia, suspect that these rot complexes have been present, with little acknowledgement, for many years.

Figure 1. Ripe rot on grapes.

Figure 2. Bitter rot on grapes.

In reading the above, you may have gotten the impression that the nomenclature is a bit confusing – you would be correct. Growers in the Mid-Atlantic generally call these late season rot complexes secondary rots or bunch rot, and the meaning of the terms is rarely well defined. The traditional definition of bunch rot is provided by Dr. Turner Sutton of North Carolina State University as "anything that rots the grapes". At least 70 species of fungi and several bacteria are associated with bunch rot; including primary and secondary pathogens. Primary pathogens include the fungi causing phomopsis, black rot, bitter rot, botrytis, macrophoma rot, and ripe rot. Secondary pathogens are considered wound invaders and include Aspergillus, Penicillium, Rhizopus, Alternaria, and yeasts. Secondary rots refer to anything that rots the grapes except botrytis, black rot, phomopsis, and maybe anthracnose. These rots were coined "secondary" because generally they have not been common. The name has nothing to do with the primary or secondary biological status of the pathogens. I feel it is less confusing to call these diseases late season rots, which is the umbrella term for ripe rot, bitter rot, macrophoma rot, and sour rot.

Ripe rot is caused by Colletotrichum gloeosporioides, its sexual stage Glomerella cingulata, and C. acutatum – the most important fruit fungal pathogens worldwide. The three taxa are very different; however, they produce indistinguishable symptoms. The pathogens overwinter as mummies and infected pedicels. Ripe rot occurs on grapes as they mature and ripen, and tends to be a disease of warm, humid conditions. However, ripe rot has been found in surprising amounts in North Carolina's cooler climate vineyards (T.B. Sutton, personal communication). Conidia produced in abundance during spring rainy periods serve as the primary source of inoculum. Conidia are spread to other parts of the vine or other vines by splashing or blowing rain. Infection can occur throughout the season, however fruit infection is usually not observed until fruit reaches 20°Brix and symptoms do not develop until ripening. Sporulation on ripe fruit near harvest provides a source of secondary inoculum and frequent rains during this period can Figure 2. Bitter rot on grapes. Figure 3. Macrophoma rot on grapes. result in severe crop loss. Preliminary observations by Dr. Jim Travis at Pennsylvania State University revealed greater incidence of ripe rot on Scott-Henry trellising than on VSP (due to rain-splash of spores) and more ripe rot on the lower canopy of Scott-Henry than on the upper canopy. The most obvious symptom of ripe rot is the rotting of ripe fruit. Affected berries develop circular, reddish brown spots of decay on their skins. Spots later enlarge to encompass the entire berry. The rotting fruit is characteristically covered with salmon or orange-colored conidia. The berries eventually shrivel and decay, and may drop or remain attached to the vine. Foliar symptoms of ripe rot have not been observed in the United States.

Like ripe rot, **bitter rot** is a disease of ripe fruit and at times it can be difficult to distinguish between the two. Bitter rot

is caused by the fungal pathogen Greeneria uvicola that attacks tissue in humid, warm conditions. Berries affected by bitter rot have a bitter flavor (hence the name) that is carried through the winemaking process and gives the wine an unpleasant bitter or burnt taste. The pathogen overwinters in dead wood and mummies, and may infect any injured tissue. Around bloom the fungus invades the dead cells of the pedicel, where it remains latent until veraison to three weeks preharvest. It then invades the pedicel and moves into the berry, where conidia are produced within four days. Bird pecking, insect injury or cracking of berries will permit secondary spread by conidial infection of berries. In order for infection to occur, the fungus appears to need a 12 – 14 hour wetting period; however duration of wetness is not as important as temperature, where mid-70s to mid-80s is ideal. The period of fruit susceptibility is greatest from bloom until veraison. Occasional leaf flecking is observed (not a significant problem) but fruit rot characterized by the appearance of fruiting structures (dark spores) on the berry surface in concentric rings that radiate from the pedicel is most important. Early visual symptoms look like sunburn with a small, light brown lesion on the berry. Light colored berries usually turn brown and the surface of blue berries has a roughened, sparkly appearance. Within a few days the berry softens and is easily detached. Berries that shrivel look much like berries affected by black rot, ripe rot, or Phomopsis. In North Carolina a study was done to determine the relative susceptibility of varieties; Norton and Traminette were more resistant to bitter rot while Seyval, Petit Verdot, Viognier, Tannat, and others were more susceptible.

Figure 3. Macrophoma rot on grapes.

Macrophoma rot, caused by the fungus Botryosphaeria dothidea, is an important disease on muscadines in the southeastern United States, however it also affects Vinifera. Very little information is available about the disease. It overwinters on infected fruit or dead wood. The optimum temperature for growth and sporulation is 28°C or 82.4°F. Conidia are released during wet weather and are disseminated by wind and rain splash. Sporulation is not as common on the outside of the berries as with ripe rot and bitter rot. Symptoms appear as a very soft rot, where skin is easily removed by rubbing a finger across the berry. The fruit does occasionally rupture, providing an entrance for secondary invaders.

Sour rot appears as portions of rotten berries in a bunch or scattered rotten fruit within a bunch, but is often first detected by its characteristic, vinegar-like odor. Multiple secondary pathogens have been associated with sour rot including Alternaria, Aspergillus, yeast, Penicillium, Acetobacter, and Rhizopus. Hail damage, cracks, splitting, rain swell, and injury by birds, insects and primary pathogens allow secondary pathogens to establish and cause sour rot. Currently there are no effective chemical treatments, and control is approached by minimizing other diseases and injuries. Varieties vary in their susceptibility, with tight clustered varieties and high vigor vines being more susceptible.

Control of the late season rots involve cultural practices combined with appropriate fungicide applications. Vineyard sites that afford rapid drying of grapevines are preferred to those where air movement is impeded. Fungal spores overwinter in the cordons, canes, mummies, and on dried leaves on the vine and in the vineyard floor, therefore, minimize dead wood in the vine, remove mummies, and remove pruned canes or chop with a flail mower. There is some evidence in North Carolina that cane pruning (versus more traditional spur pruning) may reduce disease by ~60%, however making big cuts to remove cordons increases the likelihood of trunk diseases such as Eutypa and a pruning wound paint should be considered. Shoot positioning and leaf pulling are especially important, allowing sunlight and air to penetrate the interiors of the vines, improving air flow around the clusters, and maximizing fungicide penetration into clusters. Selecting varieties with loose clusters, thick skins, or those that have demonstrated resistance is also helpful. There is not one fungicide that can be considered the "silver bullet" for all late season rots; however Captan does a very good job controlling Phomopsis, bitter rot, ripe rot, and botrytis and has a much shorter preharvest interval than does mancozeb. The following is a table composed by Dr. Sutton outlining the relative effectiveness of fungicides on each of the rots:

Figure 4. Sour rot on grapes.

Fungicide	Phompsis	Bitter rot	Ripe rot	Macrophoma	Black rot	Botrytis
Qol[y]	++	+++	+++	++++	+++	++
Topsin	++	+++	+	+++	+	++
Captan	++++	+++	++++	++++	+	+
Vangard/Rovral						
Elevate/Endura	0	0	0	0	0	++++
DMI[z]	0	++++	0	++	++++	0
Copper	+	+?	+?	+?	+	0
Mancozeb	++++	++++	++++	++	++	0
Scala					++++	

[y]*Qol fungicides include Abound, Sovran, Flint, and Pristine*
[z]*DMI (or SI) fungicides include Nova, Elite, Rubigan, and Procure*

The 2006 Pest Management Guide outlines sprays for powdery mildew, black rot, downy mildew, and Phomopsis (http://www.ext.vt.edu/pubs/pmg/hf3.pdf); however, late season rots are not included. Black rot control begins at budbreak and continues until second cover (when berries are pea-sized but before cluster close); careful choice of black rot controlling fungicides will also help control the late season rots. The ball is dropped, however, from second cover until harvest when the fungi that cause these late season rot diseases are very much active and producing secondary infections. Remember that primary infections occur during the prebloom to postbloom period. In order to manage these late season rots, you should be prepared to extend the use of materials (captan for example) into harvest. Be careful planning your spray programs and be sure to consider resistance development, as well as preharvest intervals mandated by the label and possibly by the winery buying your fruit. Should growers have questions about disease problems they are seeing in their vineyards they may submit suspicious samples (via their Extension Office) to Virginia Tech's plant disease clinic. A Glossary of Disease Terms is provided on my website at http://faculty.vaes.vt.edu/ashley08. (***Source**: Virginia Viticulture Notes: March - April, 2006*)

General Information

Berry Varieties Worthy of Trial

Eric Hanson, Michigan State University

Newer berry varieties often require many years to fully test and recommend for commercial plantings. However, growers may want to purchase a few plants of promising new varieties to see if they fit on their farm. Here are a few types that are too new to recommend for large-scale planting, but have shown enough potential to plant on a trial basis.

Strawberries

New strawberry varieties become available regularly, but fewer trials are conducted to compare them today. Popular commercial varieties for Michigan growers include Annapolis, Honeoye, Cavendish, Allstar and Jewel. Sable and Brunswick are two newer early season varieties that are worthy of trial. Darselect and L'Amour are good mid-season varieties for trial. Newer late season types suggested for trial include Cabot, Mira and Ovation.

Day-neutral strawberries are types that can initiate flowers and produce fruit from June to October. In Michigan, these varieties tend to produce a flush of fruit in June and September, but produce little in mid-summer because temperatures are too high. Tribute and Tristar are two older day-neutral varieties that have performed moderately. Two newer types worthy of trial are Seascape and Everest. Both produce larger berries than Tribute or Tristar, although the plants may be less hardy.

Fall-fruiting raspberries

The recommended fall-fruiting (primocane-fruiting) raspberries for Michigan are Heritage, Autumn Bliss and Autumn Britten. Caroline is a promising newer type to try on a trial basis. It begins fruiting between Heritage and Autumn Bliss and is very productive and somewhat tolerant of gray mold. Jaclyn is a very new variety that we have not tested in Michigan. It also is worth testing because it is very early fruiting.

Summer-fruiting raspberries
Recommended varieties for Michigan have been Boyne, Canby and Latham. Two very promising early fruiting types are Nova and Prelude. Both appear hardy even for colder locations in the Lower Peninsula. Prelude is very early and produces some fall berries in southern Michigan. Two new late season types that have promise are Encore and K81-6. Encore may suffer some winter injury in very cold locations.

Blackberries
Blackberries have not been tested extensively in Michigan, so our information is limited. Fully hardy types are the thorny upright varieties Darrow and Illini Hardy. Several others offer improved berry size and yield potential, but they all appear marginally hardy, meaning they will suffer considerable winter injury if not on good "fruit sites." Chester Thornless, Triple Crown and Loch Nes are very productive, thornless, semi-erect types that would be good choices for a small test planting in southern Michigan or for protected sites along the Lake in northern Michigan. Apache and Arapaho are upright, thornless types that may tolerate protected sites in southern Michigan. In addition, two fall-fruiting blackberry varieties have been released; PrimeJim and PrimeJan. Although these are not high quality varieties, they may be of interest to some farm-marketers as a novelty. Fall berries appear to ripen along with Heritage red raspberries. (***Source**: Michigan Fruit Crop Advisory Team Alert, Vol. 21, No. 1, March 28, 2006*)

FREE Agricultural Pesticide Disposal Events

There will be a series of free pesticide collection and disposal events for agricultural operations, including nurseries, over the coming year. All events are funded by the Department of Agricultural Resources through a grant from EPA.

The first events are scheduled as follows:

Saturday April 22nd at Smith Vocational School in Northampton
For more details and to pre-register, agricultural operations must call the Northampton Department of Public Works at (413) 587-1059

Saturday, May 6th at the Town of Orange Transfer Station.
For more details and to pre-register, agricultural operations must call the Franklin County Solid Waste Management District at (413) 772-2438.

2006 Cape Cod
There will be at least twenty events on Cape Cod running from May 13 to October 28 where agricultural operations can dispose of pesticides. Events are also open to growers from off the Cape. For details, please call 1-800-319-2783 or 508-375-6699 or go to www.capecodextension.org/agpest

The Department is working to open up additional opportunities for growers in other parts of the state later in the year. Details to follow at a later date.

Department Contact: Gerard Kennedy at 617-626-1773.

GET ON TRACK WITH TRACBERRY SOFTWARE

Cathy Heidenreich, Cornell Cooperative Extension

What is Trac Software? Trac is an easy-to-use software program for growers to record their yearly spray and fertilizer treatments. From the master spray data sheet, Trac automatically generates the processor report forms, Eurepgap forms and EPA WPS Central Posting. Four Trac Software CDs are available: TracBerry© – Strawberry, Blueberry, Raspberry & Blackberry, and Ribes, TracApple© – Apple and Pear, TracGrape© – Grape. Each CD has a comprehensive, 22-page, Trac Software Manual. Use copy and paste to move information from 2004 or 2003 into Trac 2005. As always -Trac 2005 has the latest pesticide information, based on the 2005 Cornell Guidelines.

What hardware and software do I need? Microsoft Excel, a CD Rom Drive, and a printer.

How does Trac work? Those familiar with working on a spreadsheet will find it easy to use Trac Software, since it is written in MS Excel, a popular spreadsheet program. Very simply, the user "fills in the blanks." There are data entry worksheets, much like sheets of paper. One sheet asks for basic grower information, such as name and address. Another sheet allows the user to enter their spray information, such as the spray date and chemical used. From the data entry worksheets the program automatically completes the processor spray report forms.

Are there other benefits to using Trac? Trac has "drop down" lists for pesticides and pests that you can select from. This saves time and prevents typing errors. When you select a pesticide Trade Name from the drop down list the program automatically fills in the EPA registration number, REI, PHI and calculates the earliest harvest date. The

software also generates drop-down lists specific to your farm operation. And it will automatically fill out an EPA WPS Central Posting form.

How often is Trac updated? Trac software is updated on a yearly basis. This means you get the most up-to-date information on pest management materials. Trac software information is based on the Cornell Pest Management Guidelines that are updated yearly. Trac Software was developed and written by Juliet Carroll, Fruit IPM Coordinator, and, Judy Nedrow, Trac Programmer. Funding for Trac Software has been provided by: The New York State Department of Agriculture and Markets, The New York Wine and Grape Foundation, and the New York Agriculture Innovation Center

Orders may be sent to:
Michele Kaufman, 315 787 2419, mrk25@cornell.edu
Trac Software, NYS IPM Program, 630 West North St., Geneva, NY 14456
Online information is available at: http://www.nysipm.cornell.edu/trac/index.html
(***Source**: New York Berry News, Vol. 5, No. 2, March 31, 2006*)

Upcoming Meetings

April 3, 2006, 9AM – 1PM. *MA Practical Skills Workshop: Growing Organic Apples*, **Contact**: Tom Szekely (781) 894-4370, seedpotato@yahoo.com, http://www.nofamass.org/programs/skills.php

April 2006 Fruit Twilight Meetings

Program for all meetings:
5:30 PM Farm tour. *(Note: April 12 NH Meeting starts at 5:15!)*

6:30 PM Speaking program will include updates of current cultural practices and integrated pest management approaches. Pesticide-license re-certification credit (2 hours) will be offered. Please be there on time to receive pesticide credits. A $10/person ($20 maximum/orchard) registration fee will be charged (at the door) for the April 11 and April 12 meetings.

April 11 UMass Cold Spring Orchard (www.coldspringorchard.com)
391 Sabin Street, Belchertown, MA

DIRECTIONS FROM BELCHERTOWN CENTER: proceed on Route 181 toward Palmer for about two miles, bear left onto Cold Spring Road. In about 0.5 miles, bear left onto Sabin Street. From Route 9/Route 202 intersection take Route 9 East for about 2.5 miles, and turn right onto Sabin Street. In approximately 1.75 miles, you will see orchard on your right. If these directions are not clear, call Wes Autio at 413-545-2963; Jon Clements at 413-478-7219; Joe Sincuk at (413) 323-6647.

April 12 Mack's Apples of Moose Hill Orchards (www.macksapples.com)
230 Mammoth Road, Londonderry, NH

DIRECTIONS: From points south: Take I-93 north to Derry/ Londonderry Exit 4. Take a left at the end of the ramp. Take 102 west for approx. 3 miles to Rte. 128/Mammoth Road (7 traffic lights including ramp). Take a right on Mammoth Road by the Homestead Restaurant. From points north: Take I-93 south to Derry/ Londonderry Exit 4. Take a right at the end of the ramp. Follow directions 'Take 102 west...' above 'From points south:' From Manchester: Take South Willow to Londonderry. About a mile south of the Yard Restaurant, bear off to the right at the Mobil station onto Mammoth Road. The orchard farm stand is about 4 miles down, on the left. If these directions are not clear, call Wes Autio at 413-545-2963; Jon Clements at 413-478-7219; or George Hamilton at 603-641-6060.

April 13 Dame Farm
94 Brown Avenue, Johnston, RI

DIRECTIONS: from I 295, take exit 6 off I-295 for Route 6 West. Travel west on route 6 for 1.4 miles. Turn right at the traffic light for Brown Ave. and travel 1.1 miles. Dame Farm and stand is on the right. If these directions are not clear, call Wes Autio at 413-545-2963; Jon Clements at 413-478-7219; Heather Faubert at 508-865-6706; or Dame Farm at 401-949-3657.