Pests susceptible to control based on degree day forecasts (\(\square\)=degree day ranges [base 50])

- Bagworms (700-800)
- Birch leafminer (275-500)
- Black vine weevil adult (500-1000)
- Bronze birch borer (400-800)
- Oystershell scale (275-600)
- Taxus mealybug (300-500)
- Euonymus scale (500-700)
- European pine sawfly (200-600)
- Flatheaded apple tree borer (500-1600) apply 3 applications @ 3 wk intervals
- Hawthorn leaf miner (300-500)
- Peach Tree Borer (500-2100) 2-4 sprays
- Pine needle scale (200-600)
- Roundheaded apple tree borer (600-1600) apply 3 applications @ 3 week intervals
- San Jose Scale (500-1800)
- Two spotted spider mite (900-2100)

Source: Coincide by Don Orton, retired nursery inspector, IL Dept of Ag.

Resistance can develop in pest populations that are exposed to multiple applications of pesticides which belong to the same class; that is, where they attack the pest (mode of action). One of the keys to preventing resistance is to rotate classes of pesticides used against specific pests. This means that the applicator must be able to look at the active ingredient(s) in a product and recognize the class(es) represented, and then find the information.

A numbering system has been developed to make this task easier. Some companies have begun to place mode-of-action classification codes on the front panel of their pesticide labels. These designations appear as a three part box, shown in the examples below:

\[ \text{GROUP 1B INSECTICIDE} \]
\[ \text{GROUP 11 FUNGICIDE} \]

(\(\text{con't}\)
The classification schemes for insecticides and fungicides provide growers with an easy to recognize numerical group (or groups in the case of more than one active ingredient in a product). Users only need to read the numerical group on the label. For example, two different pesticides with the same numerical group belong to the same chemical class or classes that share the same mode of action. Those with different grouping codes attack the pest or disease in different ways. Applicators can use this information to make better pesticide selection decisions to manage pesticide resistance by avoiding the overuse of a single class of pesticide. (con’t)

Generally, the more frequently a grower sprays a pesticide or pesticides with the same mode of action to control a pest problem, the quicker a pest is likely to develop resistance. Many factors control the rate of pesticide resistance development and most of those are out of our control (development rate and number of annual generations of the pest, migration rate from susceptible populations, background levels of resistance). Judicious use of pesticides and alternation of chemicals with different modes of action is vital when repeated applications are needed.

Keys to using this system correctly:

--Read and recognize the numerical groups on the pesticide labels. Those with different designations have different modes of action.

--To delay and/or prevent the development of resistance by pests, growers must avoid the repeated use of the same pesticide or pesticides that share the same mode of action. Users need to alternate different pesticide classes periodically when repeated sprays are needed. Alternate to products from different numerical groups for repeated applications.

--Do not tank mix to pesticides from the same numerical group (same mode of action).

--As always, only use pesticides at labeled rates and according to labeled spray intervals.

Other factors that delay the development of pesticide resistance:

--Always time pesticide sprays when they will do the most good. Most pests have a stage when they are most vulnerable. Don’t wait too long to begin applications of pesticides. In the case of fungi, “rescue” applications of chemicals to severely diseased fields can lead to the development of resistance in pathogen populations (more of the pathogen population is exposed to the fungicide and therefore the odds of selecting for resistant individuals go up).

--Take an integrated approach to pest control and rely on proper cultural controls, crop rotation, resistant varieties, and natural enemies of pests.

--Use pest and weather monitoring and economic thresholds as guides when making decisions to make pesticide applications.

--Try to preserve natural enemies of pests through the use of selective pesticides or targeted applications.

--Mix and apply pesticides carefully to ensure correct dosage and coverage. Sprayers must be calibrated regularly to account for nozzle wear. Use the proper spray volumes and pressure to ensure adequate coverage.

--Eliminate crop residues after harvest when practical to remove overwintering sites for pests.

**Ramorum Blight: Deciding What Plants to Sample**

Patricia B. de Sá, Dept. of Plant Pathology

*Phytophthora ramorum* can infect oaks, causing the symptoms that are typically associated with Sudden Oak Death (S.O.D.), but causes cankers on the tree trunk that expand and girdle the stem leading to death of the tree crown within a few years.

*P. ramorum* can also infect many other plants, causing symptoms on leaves and shoots, and the diseases associated with this pathogen on plants other than oak trees are called Ramorum leaf blight and Ramorum shoot dieback, although cankers in the inner bark of stems are occasionally seen on some plants like viburnum and rhododendron. Infected plants often shed symptomatic leaves and the pathogen can survive on the plant for a long time without killing it. The infected plant does not necessarily die and it may look ugly at times following periods of mild, moist weather, environmental conditions that are favorable to pathogen development. Infected plants are a source of spores that can move in water in rain splash and irrigation water and infect other plants and oak trees. Ramorum leaf blight symptoms initially appear as water-soaked lesions on the leaves that turn brown and necrotic; they may be relatively small or may be large rounded lesions with uneven edges that tend to expand along the mid rib of the leaf. On camellias and rhododendrons, necrotic lesions may be seen on the edge of the leaves where water and spores accumulate.

*P. ramorum* spreads through the plant and can move from the
leaves into the stem and upwards or downwards in the stem. It can also move from the stem into the leaves. On the stems, it can cause stem necrosis. Ramorum tip dieback is characterized by wilting and necrosis of the tip of the stem and twig dieback; leaf bud death may also be seen.

During 2003, 2004 and early 2005 infected ornamental plants, particularly camellias, were shipped from nurseries in California across the country and by 2005, nurseries in 22 states were found to have infected plants. There are many common Phytophthora species that cause similar symptoms and symptoms may vary with the host and the climate conditions. Not all nursery plants are infected with P. ramorum, however, a few plants are at risk for infection and the plants of major interest at this time (con’t are: camellia, rhododendron, viburnum, pieris (or andromeda) and mountain laurel (also called kalmia). P. ramorum can only be identified correctly using laboratory assays, but you can pre-screen your recently acquired ornamental plants and request help if you think that the symptoms you see are similar to Ramorum leaf blight and Ramorum tip dieback.

Phytophthora ramorum and Sudden Oak Death (S.O.D.) have not been found in Kentucky and in order to protect Kentucky oak trees and forests it is important to detect P. ramorum early and eradicate it quickly.

The check list below was adapted for Kentucky from a list prepared by L. Chalker-Scott; it can help you determine if an ornamental plant needs to be sampled. Keep in mind that at the end of the growing season you will see many leaf spots on plants, not every spot or blotch is caused by Phytophthora ramorum, and that this check list does not apply to oak trees.

1. Does the plant display foliar blight or shoot dieback disease symptoms?
   a. No - no need to sample the plant.
   b. Yes - go to 2.

2. Is the plant a recently acquired camellia, rhododendron, viburnum, pieris or kalmia?
   a. No - go to 3.
   b. Yes - go to 5.

3. Is the plant near a recently acquired camellia, rhododendron, viburnum, pieris or kalmia?
   a. No - no need to sample the plant.
   b. Yes - a sample should be collected for testing.

4. Is the plant on the host list for P. ramorum? (view list on: www.aphis.usda.gov/ppq/ispm/sod)
   a. No - no need to sample the plant.
   b. Yes - go to 4.

5. Was the camellia, rhododendron, viburnum, pieris or kalmia purchased after December 2000?
   a. No - no need to sample the plant.
   b. Yes - go to 5.

For more information on P. ramorum and Sudden Oak Death you can visit these websites:
- APHIS/PPQ: www.aphis.usda.gov/ppq/ispm/sod
- California Oak Mortality Task Force: www.suddenoakdeath.org
- The Southern Plant Diagnostic Network: spdn.ifas.ufl.edu/sudden_oak_death.htm
- Task Force:
- O       California Oak Mortality
- O       APHIS/PPQ:
- O       The Southern Plant Diagnostic Network:

Managing Diseases of Flowering Crabapple
John Hartman, Extension Plant Pathologist, Univ. of Kentucky

Kentucky flowering crabapples, in bloom now, are enjoyed for their profuse flowers and for their attractive foliage and fruit. Experienced growers and homeowners are well aware that springtime is also the time of year that many of the important diseases of flowering crabapple are most active.

Many flowering crabapples are made unsightly or are severely injured by one or more of four common diseases-apple scab, fire blight, cedar-apple rust, and powdery mildew. Unless resistant crabapples are selected and grown, fungicide sprays used as disease preventatives must be included in the maintenance program, especially for susceptible crabapples growing in the nursery.

Managing apple scab caused by the fungus Venturia inaequalis.
- O While trees are dormant, rake up and destroy or chop up old, infected, fallen leaves where the fungus overwinters.
- O Remove and destroy abandoned apple and susceptible crabapples growing near the nursery.
- O On mature landscape trees, thin out crabapple foliage by pruning to allow improved ventilation and sunlight penetration.
- O To prevent primary infections, apply fungicides when the first green shoot tips are showing in early spring before flowers open and repeat 3 or 4 times at two-week intervals. If leaf wetness monitors and computer programs are used, "eradicant" fungicides can be applied on an "as needed" basis when infection periods are identified. Fungicide choices include protectants containing...
ingredients such as mancozeb, chlorothalonil, captan, or sulfur. Eradicant fungicides containing thiophanate-methyl, propiconazole, myclobutanil, triadimefon, or fenarimol.

o Nurserymen should be growing scab-resistant crabapples; use scab-resistant varieties in new plantings. These may include the following:


o Do not grow these in the nursery.


----Extremely susceptible: 'Almey', 'Eleyi', 'Hopia', etc.

Managing fire blight caused by the bacterium Erwinia amylovora.

o While trees are dormant, prune out shoots killed by fire blight the previous year.

o Remove water sprouts and root suckers when they are small.

o Remove nearby neglected pear and apple trees from the nursery because these trees can be a source of overwintering fire blight bacteria.

o Plant fire blight-resistant crabapples in new plantings. Ratings vary from one part of the country to the other, however, the following cultivars are thought to be more tolerant of fire blight.

----'Adams,' 'Adams Dwarf,' 'Callaway,' 'Candied Apple,' 'Christmas Holly,' 'David,' 'Dolgo,' 'Harvest Gold,' 'Indian Summer,' 'Jewelberry,' 'Liset,' Malus sargentii, M. yunnanensis var. veichii, M. zumi 'Calocarpa,' 'Pink Princess,' 'Pink Spire,' 'Prairifire,' 'Profusion,' 'Radiant,' 'Red Baron,' 'Robinson Dwarf,' 'Royalty,' 'Selkirk,' 'Sentinel,' 'Spring Snow Dwarf,' and 'Velvet Pillar'.

o Antibiotic sprays such as streptomycin can be used to protect open flowers from infection. Antibiotic sprays are best used in the nursery, and not in the landscape. Use of a computer program such as Maryblyt for timing of fire blight sprays is most useful.

o For all but the most susceptible trees, infections are normally halted by the tree before the bacteria actually kill the tree. Thus, infected branches are best removed in winter.

o Avoid promoting succulent growth that favors fire blight.

Managing cedar-apple rust and cedar-apple rust has been a serious problem.

----Cedar rust resistant crabapples: 'Adams,' M. baccata 'Jackii,' 'Beverly,' 'Candied Apple,' 'Centurion,' 'Dolgo,' 'Hopia,' 'Indian Magic,' 'Liset,' 'Mary Potter,' 'Molten Lava,' 'Professor Sprenger,' 'Red Baron,' 'Red Jade,' 'Red Splendor,' 'Robinson,' 'Royalty,' 'Ruby Luster,' M. sargentii, 'Selkirk,' 'Sentinel,' 'Silver Moon,' M. tschonoskii, 'Velvet pillar,' 'Winter Gold,' M. yunnanensis var veichii, M. zumi 'Calocarpa'.

o Where the disease seldom occurs or few leaves are infected, no control is necessary.

Managing powdery mildew caused by the fungus, Podosphaera leucotricha.

o Crabapple powdery mildew is normally not serious enough to warrant control measures except on the most susceptible cultivars.

o Prune out diseased shoots during the normal pruning period for flowering crabapples.

o Apply fungicides at weekly or biweekly intervals beginning at bud break until shoots have completed elongation. Effective fungicides include myclobutanil propiconazole, thiophanate-methyl, and triadimefon.

Mildew-resistant varieties should be considered in moist, shaded locations. Most cultivars are resistant or moderately resistant.

Susceptible cultivars include 'Adams,' 'Molten Lava,' and M. yunnanensis var. veichii.
All Miticides Are Not Created Equal
Raymond Cloyd, Extension Specialist, Univ. of IL at Urbana-Champaign

When it comes to selecting a miticide to control spider mites, or “mites” in landscapes and nurseries, there is sometimes confusion that all miticides are similar in terms of their use and the range of mites that they control. However, miticides are not all created equal because miticides may vary in where they can be used and the target mites on the label. Below are detailed descriptions of eleven miticides that are generally recommended for controlling mites both indoors and/or outdoors.

Talstar is a pyrethroid-based insecticide/miticide with the active ingredient bifenthrin. The product is labeled for control of the following mites: twospotted spider mite, broad mite, clover mite, and European red mite. There are a number of different formulations, and each has certain use requirements. However, in general, Talstar is registered for use on indoor and outdoor ornamentals. This includes greenhouses, lathhouses, shadehouses, outdoor nurseries, and ornamental trees. Talstar is a contact insecticide/miticide, so it is important to cover thoroughly all plant parts during application. The product provides between 7 and 21 days of residual activity. The label rate is 1.5 to 5.0 fl oz per 100 gal. Scimitar has the same mode of action as bifenthrin (Talstar; see previous), so avoid using these two products in succession in a rotation program. Scimitar, like many pyrethroids, is a restricted-use pesticide.

Hexygon contains the active ingredient hexythiazox and is labeled for control of twospotted spider mite, arborviteae spider mite, European red mite, honey locust spider mite, Pacific spider mite, Southern red mite, spuce spider mite, strawberry spider mite, and Willamette mite. Hexygon is registered for use on ornamental plants grown in nurseries, greenhouses, shadehouses, and Christmas tree plantations. In addition, it may be used on established ornamental landscape plantings, interiorscapes, residential areas, public areas, and commercial areas. Hexygon is a contact and stomach poison miticide, so thorough coverage of all plant parts is important. The product can provide 30 to 45 days of residual activity. The label rate is 1 to 2 oz per 100 gal. Hexygon is active on mite eggs and the immature stages. In fact, eggs deposited by adult females that contact treated surfaces are not viable. The product has no activity on adult mites. Hexygon has the same mode of action as fenpyroximate (Akari; see next), so it is important to avoid using these two miticides in succession in a rotation program.

Sanmite, which contains the active ingredient pyridaben, is labeled for control of twospotted spider mite, broad mite, European red mite, Southern red mite, and tumid mite. The material is registered for use on ornamental plants grown in greenhouses or outdoors. Sanmite is a contact miticide so thorough coverage of all plant parts is critical during application. It is active on mite eggs and the immature stages. Although Ovation is slow-acting, it may provide up to 45 days of residual activity. The label rate is 2 fl oz per 100 gal. Ovation has the same mode of action as hexythiazox (Hexygon; see previous), which means that the two miticides should not be used in succession in a rotation program. Ovation is toxic to fish.

Akari contains the active ingredient fenpyroximate. The product has a very general label stating control of “spider mites.” Akari is labeled for use on greenhouse ornamental crops and indoor ornamental plantings and plantscapes. This miticide is a contact and stomach poison, so thorough coverage of all plant parts is essential during application. The product is effective on all spider mite life stages including eggs. Akari works very fast, with rapid knockdown. In fact, treated mites immediately stop
mites, including twospotted spider mite. Avid is labeled for control of a wide range of mites, including twospotted spider mite, Pacific mite, strawberry mite, European red mite, citrus red mite, clover mite, southern red mite, spruce spider mite, and bamboo spider mite. It is not active on rust, broad, or flat mite. Floramite is labeled for use in greenhouses, shadehouses, nurseries, Christmas tree plantations, landscapes, and interiorscapes. This is a contact miticide, so thorough coverage of all plant parts is essential. This miticide is active on all mite life stages, including eggs. Floramite is fast acting and provides up to 28 days of residual activity. The label rate is 4 to 8 fl oz per 100 gal.

**TetraSan** contains the active ingredient etoxazole and is actually a growth regulator for mites, inhibiting the molting process. TetraSan is labeled for control of the following mites: twospotted spider mite, citrus red mite, European red mite, lewis spider mite, Pacific spider mite, Southern red mite, and spruce spider mite. TetraSan can be used to control mites in greenhouses, lathhouses, shadehouses, and interiorscapes and on outdoor ornamentals. Similar to abamectin (Avid) (described previously), TetraSan is a contact and translaminar miticide providing up to 28 days of residual activity from a single application. The label rate for controlling mites is 8 to 16 oz per 100 gal. The product is active on the egg, larvae, and nymphal stages. It has minimal effect on adult mites. However, adult female mites that are treated do not produce viable eggs.

**Pylon** is a miticide that is can be used only in greenhouses. It contains the active ingredient chlorfenapyr. Pylon is labeled for control of various mites, including twospotted spider mite, broad mite, cyclamen mite, citrus bud mite, and rust mite. Pylon is a contact and translaminar miticide. In addition, it works as a stomach poison when ingested. Pylon is only active on the mobile life stages, including larvae, nymphs, and adults. It has no activity on mite eggs. The product can provide up to 28 days of residual activity. The label rate is 2.6 to 5.2 fl oz per 100 gal.

**Vendex** is one of the older miticides and contains the active ingredient fenbutatin-oxide. The miticide is labeled for control of twospotted spider mite, clover mite, Southern red mite, and spruce spider mite. Vendex can be used in greenhouses, on outdoor ornamentals, and on established landscape ornamentals and nurseries. This is a contact miticide, so it is important to thoroughly spray all plant parts during application. Vendex is slower acting than most miticides, taking 7 to 10 days to eventually kill mites. However, it provides long-lasting control—about 30 days of residual activity. The label rate is 8 to 16 oz per 100 gal. Vendex is a warm-weather miticide providing better control when the ambient air temperature is above 70 degrees F. This product is a restricted-use pesticide.

For more information on the products mentioned, be sure to consult the label or the manufacturer.
Boxwood Pests
Clyde Gorsuch, Extension Entomologist
Clemson Extension HGIC 2052

Boxwood leafminer
(Monarthropalus buxi): This is the most serious insect pest that attacks boxwood. The leafminer is the larva (immature form) of a small, orangish mosquito-like fly. These flies are less than 1/8-inch long and can often be seen swarming around boxwoods in the spring. The adult female fly inserts eggs with her ovipositor (egg laying structure) into new boxwood leaves through the leaf’s upper surface. When the larvae hatch, they feed inside the leaf, creating a mine. Larvae are orange and about 1/8-inch in length. They overwinter (survive the winter) in the leaves. Adults emerge from the leaves the following spring, just after new growth occurs on boxwoods. There is one generation per year.

Boxwood leafminer attacks result in irregularly shaped swellings on the leaf. There may be a slightly blistered appearance on the leaf’s underside. Blistering may not be obvious until late summer. Infested leaves typically turn yellow or brown in splottsches, are smaller and drop sooner than healthy leaves. A heavy infestation can cause serious loss of leaves and result in death of the boxwood.

**Prevention and Control:** Use of insecticides against boxwood leafminer is not recommended unless damage is intolerable. Insecticides are most effective against this pest when adults have emerged and before they can lay eggs. Adults typically emerge over a three-week period but live only a few days.

Contact insecticides that are effective against boxwood leafminer adults and are labeled for homeowner use are malathion 5EC and carbaryl (Sevin 50WP). With these insecticides, begin treatment in mid-April-May when the adult flies are seen hovering around the box-

To determine whether insecticide use is needed, it helps to know how many mites are present. Hold a white sheet of paper under a branch and strike the branch. The mites that are knocked off will be seen crawling around on the paper. If more than 15 mites are seen per whack, serious damage can result.

Mites can be removed with a strong spray of water, if applied on a regular basis. Horticultural oil applied at the summer rate will kill eggs and adult mites. Insecticidal soaps can also provide control when applied before population numbers get too high. Insecticides labeled for homeowner use against boxwood mites include insecticidal soaps and hexakis (Ortho Systemic Insect Killer 0.5% EC or Ortho Ortheneex Garden Insect & Disease Control 0.75% EC). These products should be applied when mites are present and again in seven to 10 days. As with all pesticides, read and follow all label instructions and precautions.

Boxwood psyllid (Psylla buxi): The adult is a small, greenish insect, about 1/8-inch long. It has clear wings and strong legs adapted for jumping. It looks like a tiny cicada that hops or flies away when disturbed. Both the adult and nymph (the immature insect stage which resembles the adult) feed by piercing leaf surfaces and sucking plant sap.

Nymphs hatch from eggs in the spring. They produce a white, waxy material that often covers their bodies. Nymphs feed from buds and young leaves. This feeding results in the typical cupping of leaves and stunted twig growth that are seen with this pest. Plants tend to outgrow the injury by midsummer.

After further development during the spring, adults are formed. Adults also feed on boxwood, but are less damaging than the nymphs. Adult females lay eggs under bud scales. The immature nymphs develop within the eggs, where they
remain until spring. They emerge in spring to feed and complete development to adults. Only one generation occurs per year.

Prevention and Control: Insecticides should only be used if infestations are heavy. Those labeled for homeowner use are acephate (Ortho Bug-B-Gon Japanese Beetle Killer 9.4% EC or Ortho Systemic Insect Killer 8% EC or Ortho Orthene Garden Insect & Disease Control 4% EC) and carbaryl (Sevin 50WP). Soil treatment with imidacloprid (Bayer Advanced Tree & Shrub Insect Control 1.47%) will control psyllids, but may take one or two weeks to begin providing season long control.

New Summer Nursery Inspector

This summer, Beth Choate will be helping us with nursery inspections. She is originally from Somerset, KY where she graduated from Somerset High School in 1998. Beth then attended Centre College in Danville, KY where she received a Bachelor's of Science in Biology and Anthropology/Sociology in 2002. After finishing college in May of 2002, Beth worked in the UK Department of Entomology studying the prevalence of West Nile Virus on KY horse farms. Beth began her master's work in January of 2003 studying the life history and dispersal patterns of the eastern tent caterpillar. Beth will complete her master's degree in Entomology in May of this year. She is taking a break from academia this summer before she starts work on her Ph.D this fall.

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License renewals for nurseries will be mailed out in the coming weeks. Please watch for this in the mail and return it prior to June 17, 2005.

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Degree Day Totals through April 25, 2005
Bardstown—343
Bowling Green—396
Covington—277
Henderson—372
Huntington WV—388
Lexington—317
London—359
Louisville—339
Mayfield—353
Paducah—418
Princeton—451
Quicksand—369
Somerset—345

Degree Day Totals through April 26, 2004 (shown for comparison)
Bardstown—343
Bowling Green—406
Covington—262
Henderson—397
Huntington WV—384
Lexington—326
London—371
Louisville—357
Mayfield—371
Paducah—453
Princeton—465
Quicksand—380
Somerset—362