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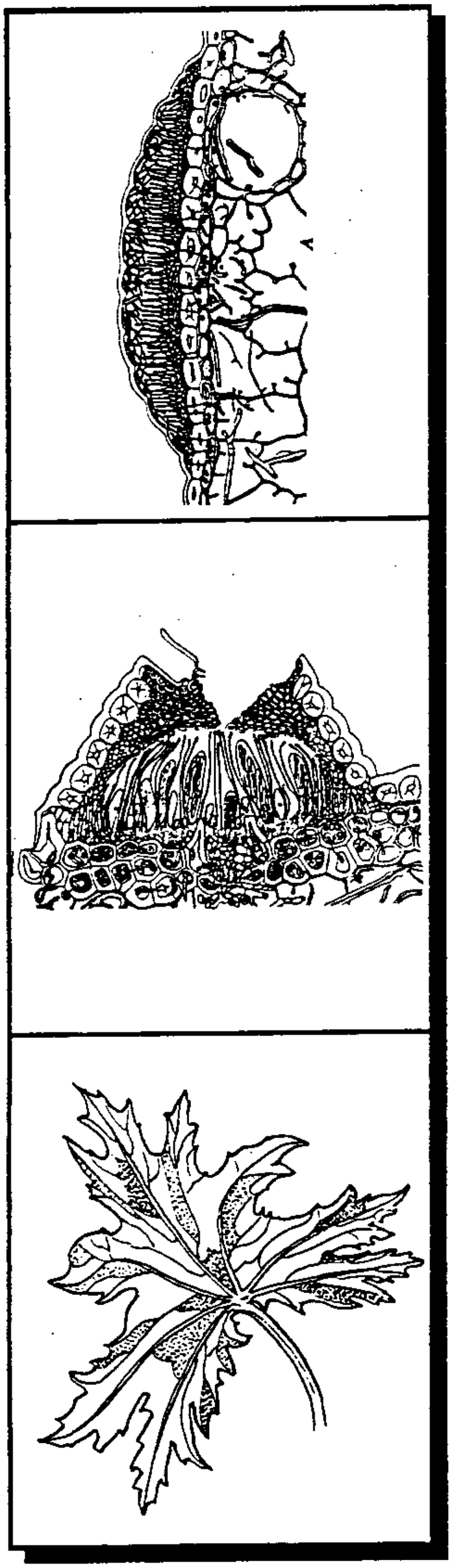

PLANT DIAGNOSTICS QUARTERLY

Features

Foliar Nematodes in Herbaceous Perennials

Conifer Needlecast Diseases

On the cover: Top = Pycnidium of *Lophodermium nitens* in vertical section.
Middle = Hysterothecium of *Soleella striiformis* (= *Bifusella striiformis*) in vertical section.
Bottom = *Ligularia przewalskii* with symptoms typical of those caused by foliar nematode

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PLANT DIAGNOSTICS QUARTERLY

FROM THE EDITOR

Hello again,

Try to keep back the tears and attempt to keep the hair-pulling to a minimum, but I have an announcement to make: I am stepping down as editor of this publication.

Gary Simone of the Plant Disease Clinic at the University of Florida in Gainesville has graciously offered to take the tiller from me. The March, 1993 issue will be Gary's first.

Dr. Simone has been active in promoting diagnostics for many moons. Gary was the person responsible for initiating the feature "Spotlight on Diagnosis" in *Plant Disease*. Gary also helped sponsor and run the recent workshop on using plant virus inclusions as a diagnostic tool (see *PDQ* XIII (2):82), as well as an earlier inclusion workshop held at the APS meetings in Orlando, Florida. I can't even remember all that Gary had done, but I do know that he is a concerned and thoughtful person who will bring professionalism and vision to *PDQ*. (I think he also has a nicer temper, but I know he's not as good looking or as modest as I am.)

If you ever had any comments or suggestions for PDQ during the last five years that you wished you had written to me about - well, I guess you've missed the boat.

Your Faithful Editor,

Melodie Putnam

REGIONAL REPORTS

Northwest Region

Colette Beaupré

Laura (Pickett) Pottorff in the Plant Diagnostic Clinic in Golden, CO, has seen a very successful summer season. The 30 Master Gardeners trained to work in the Clinic from May through September handled 727 plant samples! Those results justify the time spent training them.

Weather in Colorado this summer was strange (as usual): it rained when normally very dry and vice versa. As a result a few unexpected diseases showed up, such as Leptosphaerulina leaf blight on bentgrass greens. Also, some of the expected diseases, such as fire blight, were not as prevalent as in previous years. Other than that life continues with the expected powdery mildews, *Marssonina* on aspen, and melting out of Kentucky bluegrass. Crown gall on roses and Rhizoctonia stem rot of poinsettia and regal geraniums were of interest in the greenhouse area. And yes, the results of last October's killer freeze are STILL present . (Tree removal companies can't keep up with all the business.) One of the benefits from the freeze is that the Siberian elms were hardest hit!

The Oregon State University Plant Clinic has been operating at a limited capacity since August 1, 1992. The former diagnostician, Stacey Fischer, has left OSU for Ohio where she will work as a horticulturist. OSU is currently in the middle of a search for a chief diagnostician. Intentions are to upgrade the facility to provide expanded educational services in the areas of virology and advanced diagnostic tests. (Jay W. Pscheidt)

Karen (Shotwell) Flint reports that the two most significant "disease" problems encountered in Utah this season either were not technically "diseases" or were not technically in Utah. There was widespread psyllid yellows in garden potatoes, which is thought to be caused by a toxin produced by nymphal psyllids feeding on the potato leaves. Symptoms look very mycoplasma-like, however, and this possibility is being explored. It is important to note that no commercial potato fields were affected, as far as is known; in some cases this may be a result of routine insecticide applications to commercial potatoes. But much of Utah's potato acreage is not treated, which leaves the interesting question of the preference of psyllids for home gardens.

The second big disease find occurred just over the border in southeast Idaho. Large acreages of dryland barley are infected with barley yellow streak mosaic virus, vectored by the brown wheat mite. This was a new disease for the clinic; the virus has not yet been encountered in Utah - probably because there isn't much dryland barley. The virus also infects wheat, but symptoms are not as apparent. This virus is only reported from Montana and now Idaho; Montana pathologists are looking for control measures.

Other notable diseases encountered this season include wheat streak mosaic and barley yellow dwarf on small grains; Thielaviopsis root rot in okra; Phytophthora root rot decimating fields of squash and pumpkins; powdery mildew mimicking early blight in tomatoes; watermelon mosaic widespread in zucchini; AMV, PVS, PVX, and PVY in potato; *Coryneum* blight in peach and apricot, which is a little unusual in Utah; some fireblight, but not rampant, in pear and apple; dollar spot in turf (the first confirmation of this disease, thanks to ELISA test kits); and Dutch elm disease in some important landscape elms.

Finally, Karen would like to solicit a little diagnostic help from her counterparts elsewhere. She received a marigold sample from a greenhouse nursery. All over the plant were little tumors and growths, as if the plant had crown gall. She took it home and planted it in her flower bed, and it outgrew the symptoms, although existing galls did not disappear. Any ideas? Also, she has lately received several iris and gladiolus samples with various symptoms, none of which are described in any of her references, and all of which are extremely destructive to the plant. She would like to have a chat with anyone who has extensive experience with these flowers.

Western Washington, according to Carrie R. Foss, experienced an unusually dry spring and summer this year. Many broadleaf tree, shrub, and conifer samples submitted to the WSU Puyallup Plant Clinic had problems related to drought stress or heat injury. Bitter pit was severe on susceptible apple varieties. Shot hole and skeletonizing were common maladies of *Prunus* species. Necrotic ringspot, Rhizoctonia brown patch, *Curvularia*, and anthracnose were frequent disease problems on turf samples.

The Puyallup Plant Clinic operations were changed dramatically this summer by the addition of Master Gardeners. The volunteers assisted walk-in clients with sample submissions and bulletin purchases. Throughout the summer, a weekly diagnostic workshop was conducted for Master Gardeners volunteering at Puyallup. The "experiment" was a big success and Clinic staff look forward to continuing and improving this strategy next summer.

On the other side of the mountains, Ellen Bentley (WSU-Prosser) reports that the production season arrived three weeks early this year, and the number of clinic samples reflected this trend. Due to the continuing drought, irrigation districts were placed on reduced flows in May and some ran out of water by early September. Fortunately, plant growth never slowed and harvests were earlier than normal. Harvest is complete except for late apples, potatoes, field/sweet corn and late wine grapes. Where moisture is adequate, fall fumigation, alfalfa seeding and winter wheat planting are nearly done. Aphid numbers are already high, prompting control for probable barley yellow dwarf infection.

Disease highlights include abiotic problems due to drought and the last gasp of the injury from the 1990-1991 winter, especially in fruit and shade trees, conifers and ornamentals. Extensive insect damage has added to the stress as evidenced by early defoliation.

Insect pressure was extremely high on plants, leading to the worst beet curly top virus year since the mid-1970's. Beans, cucurbits, peppers, tomatoes, annual statice, and annual flowers were hard hit . Other cucurbit viruses (ZYMV, WMV2) never had a chance as many fields suffered seedling infection. Losses were greater than 75%, prompting a "pick your own" patch to import enough pumpkins to guarantee "14,000 to choose from" for Halloween.

Virologist Gaylord Mink reports that a high percentage of Columbia Basin radish and daikon seed crops expressed symptoms typical of those caused by the beet leafhopper transmitted viruscence agent (BLTVA). Tests with cDNA probes obtained from Dr. Bruce Kirkpatrick, UC-Davis, confirmed the occurrence of this mycoplasma-like organism in symptomatic plants. Diseased radish samples with similar symptoms were recently received from Madras, OR. This organism, which is also spread by the sugarbeet leafhopper, *Circulifer tenellus*, appears to be widespread in the arid Pacific North West. No information yet on its overwintering hosts.

Potato production suffered two periods of unseasonably cool, moist weather. This contributed to numerous problems. As predicted, there were widespread outbreaks of late blight (*Phytophthora infestans*) following the mild winter. Metalaxyl use was discouraged upon determination of high resistance in most isolates. Storage problems may develop if fields were harvested improperly (green vines).

Other vine and tuber quality problems included *Erwinia carotovora* causing a rot of vines not typical of black leg, early dying syndrome, *Sclerotinia*, net necrosis (potato leaf roll virus), corky ringspot (tobacco rattle virus), internal defects, pink rot, pink eye (*P. erythroseptica*), and water leak (*Pythium* spp.)

Several late (mid-June) sweet corn plantings sustained more than 50% loss from a bacterial stalk rot attributed to *E. chrysanthemi*. All diseased fields were irrigated from shallow holding ponds which are believed to have encouraged high bacterial numbers. Susceptible varieties are all super-sweet lines.

The University of Wyoming established a fee system for services rendered, effective July 1, 1992, reports Collette M-S Beaupré. The plant disease clinic set the diagnostic fee at $10.00 per specimen. Subsequently, there was a 66% reduction in sample volume this season (330 of the usual 500).

Bacterial disease was common in the bean fields; mostly halo blight, with common blight occasionally found. Normally these are rare due to the dry climate.

As with Colorado, the effects of last October's freeze continue to show, both for deciduous and coniferous trees and shrubs. In addition, *Marssonina* and *Venturia* leaf spots were both at moderate levels due to a second successive wet growing season. The inoculum potential is high for next year.

Southwest Region

Steven Koike

Oklahoma has continued to experience cooler temperatures and above average rainfall throughout the summer, contributing to many common disease problems. Cucurbits have been particularly affected. Some of the more prevalent cucurbit reports are the following: downy mildew (*Pseudoperonospora*), Cercospora leaf spot, powdery mildew (*Erysiphe*), Alternaria leaf spot, anthracnose (*Colletotrichum*), angular leaf spot (*Pseudomonas*) and Fusarium wilt. Zucchini yellow mosaic and watermelon mosaic 1 are two virus diseases of note. On tomatoes, Septoria leaf spot, early blight (*Alternaria*), bacterial leaf spot (*Xanthomonas*), and late blight (*Phytophthora infestans*) have all been occurring. Pecan diseases include scab (*Cladosporium*) and liver spot (*Gnomonia*). Tar spot (*Phyllachora*) has been identified on lespedeza. Miscellaneous ornamental plant diseases are: Verticillium wilt on Chinese pistache, Phytophthora root and stem rot of Oregon grape, tar spot (*Rhytisma*) on tulip tree, Phytophthora collar rot on dogwood, tip blight (*Sphaeropsis*) on pine, Phytophthora blight on vinca, bacterial soft rot (*Erwinia*) of iris, Fusarium wilt of chrysanthemum, Dutch elm disease in elm, and Cylindrosporium leaf spot on oak. Virus identifications include prunus necrotic ringspot and apple mosaic in rose; and tomato spotted wilt in impatiens.

New Mexico likewise had an unusually mild, wet summer, but lately it has been extremely hot. This has resulted in a complex of diseases of many crops. *Phytophthora capsici* root rot of peppers has been severe and continues to be the most important pepper disease in the state. Bacterial leaf spot of peppers continues to be a problem due to poor seed quality and the unusually wet summer. There has been an outbreak of pepper mottle virus that affected a large number of farmers. Quality losses from pepper mottle have been modest so far this year, but researchers and industry are concerned that the disease may become established in the area and cause more losses in the future. Other viruses such as curly top and alfalfa mosaic appeared at low levels again this year. Verticillium wilt remains the most widespread soil-borne disease of peppers. Other problems include Pythium pod rot of beans (eastern region of the state), cotton rust, and web blotch of peanuts (widespread, but of low severity).

In Nevada, common bean blight (*Xanthomonas campestris* pv. *phaseoli*) has been confirmed for the first time in the state; the find was made in a certified pinto bean seed field in northern Nevada. A leaf spot of unknown etiology has been observed on numerous Chitalpa (*Chilopsis* X *Catalpa*) in the southern part of the state. Call the Department of Agriculture if you have some ideas (Kathy, 702-688-1180). The state wide *Allium* survey for *Sclerotium cepivorum* found only one field with the pathogen. This field was later fumigated.

In western Arizona, some cauliflower plantings (direct seeded or transplanted in September) have been experiencing root and stem rot. A *Pythium* species has been associated with these problems. Unusually high day and night temperatures may be a factor in this development, in which up to 30% to 40% of the plants may be lost. In southeastern Arizona, heavy summer rains have resulted in prolonged saturated soil conditions. In these situations stem and root rot caused by *Phytophthora capsici* has been occurring on chile pepper and pumpkin. Severe losses have been seen in these crops. Septoria leaf spot of pistachio also is prevalent in the southeastern region. This disease appears annually after the onset of the summer rainy season.

Rainless California has had a few disease outbreaks of significance. Powdery mildew of pepper (*Oidiopsis taurica*) has been severe in numerous coastal and inland counties. Crop loss is substantial due to the defoliation of plants and subsequent burning of pepper fruits. Powdery mildew of lettuce (*Erysiphe cichoracearum*) has been surprisingly common in some of the coastal areas, though not causing economic concern (it is limited to the older wrapper leaves). *Septoria petroselini* on parsley and the non-fluorescent *Pseudomonas syringae* on cilantro continue to be problematic due to sprinkler irrigation practices associated with these crops.

Central Region

Karen Rane

Once again unusual weather has had an impact on disease problems seen in clinics across the region. Two late freezes (one in late May, one in mid-June), and a cool, wet July have contributed to an increase in weather-related stress problems and leaf spot diseases in many states. Increased incidence of anthracnose diseases and unusual fungal leaf spots in various trees and shrubs were reported from most states in the region. The effects of last November's sudden deep freeze (as indicated by cambial injury and opportunistic canker diseases) continue to be seen in woody plants as well. Other disease problems on woody ornamentals include increases in Verticillium wilt of ash (Minnesota, Iowa), Dutch elm disease (Indiana, Ohio, Iowa, Kansas), oak wilt (Illinois, Indiana) and Diplodia tip blight (Illinois, Kansas, Ohio). *Phytophthora* dieback of fragrant sumac (*Rhus aromatica*) was found in Ohio this summer. A problem with death of new growth on white pines was reported in Ohio, Indiana, and Missouri. In Indiana, the occurrence of this disorder was related to a period of hot, dry winds in mid-June. The same weather conditions were also found responsible for leaf scorch on many deciduous trees in the state.

Root rot, leaf spot and Botrytis blight problems were common on herbaceous ornamentals this summer, due to cool soil temperatures and excess rainfall. Unusual diseases reported from the region include *Sclerotium rolfsii* on pansy in Indiana and on snapdragon in Ohio; Stemphyllium leaf spot and blight of dwarf balloonflower (*Platycodon*) in Ohio, and foliar nematodes on chrysanthemum in Indiana and Iowa. Tomato spotted wilt virus (lettuce strain) was also found in chrysanthemum in Ohio.

Patch diseases were not prevalent on turf in the Central region this summer. Several states reported an increased incidence of rust diseases and slime molds on turf. In Ohio, *Stemanitis* slime mold was found covering untreated wooden decks and windowsills above ground level. The severity of this slime mold was another indication that Ohio experienced the wettest July on record this summer.

Vegetable diseases of note included late blight on tomato (Minnesota), downy mildew and leaf spots on pumpkin (Illinois), bacterial canker on tomato (Kansas, Ohio), and *Sclerotinia* on green peppers (Illinois) and tomato (Ohio). Fusarium wilt continues to be a problem on resistant tomato cultivars in Kansas. Pith necrosis, caused by *Pseudomonas corrugata*, was found for the first time in Ohio this summer. Bacterial wilt of cucurbits was a serious problem in Indiana, where incidence of the disease was the highest seen in the past ten years. An outbreak of bacterial fruit blotch of watermelon occurred in Indiana. The disease was first observed as leaf spots on seedlings in greenhouses, and appeared to be seed associated.

In soybeans charcoal rot and *Sclerotinia* were found in increased amounts throughout the region. Corn in some parts of Indiana was severely damaged by late spring frosts. In Missouri and Indiana, weather-related pollination problems are believed responsible for incomplete kernel set in corn, known as the "beer can" or "beer bottle" effect. Another disorder related to adverse weather conditions was observed in high amylose corn in Indiana. Certain high amylose lines showed delayed drying of kernels (possibly due to cool wet weather), with a subsequent build-up of pressure and breakage of kernel pericarps. Ears affected by this disorder had a high number of collapsed kernels and a foul, fermenting odor. Maize chlorotic dwarf and maize dwarf mosaic viruses were present in Indiana corn. Corn lethal necrosis continues to be a problem in southwest Nebraska.

Rhizomania, caused by beet necrotic yellow vein virus vectored by the soil-inhabiting fungus *Polymyxa betae*, was found in sugar beets in the panhandle region of Nebraska this summer. This is the first confirmed case of the disease in Nebraska and it poses a serious threat to sugar beet production.

Mary Francis Heimann, O.S.F., diagnostician at the University of Wisconsin, asked that this question be passed on to *PDQ* readers, and hopes that someone can provide an answer. She received a water sample from a tile drainage system under a sod field. The water is full of a rusty-colored fungus that appears to be a basidiomycete. If anyone knows what this is (the client was told it was "iron ochru"), please contact Mary Francis at 608-262-2863 (Fax: 608-263-2626).

Northeast Region

Anne Bird Sindermann

Rust diseases were numerous in the northeast this summer. Those reported from Pennsylvania alone make a nice who's who of rusts. Spruce needle rust, caused by *Chrysomyxa weirii* was reported in Lackawana County on 15 year old spruce. Another *Chrysomyxa* sp., causing rhododendron rust on the variety 'Nova Zembla,' was not known to previously occur in Pennsylvania and the stock was quarantined. *Chrysomyxa ledi* var. *rhododendri* was determined to be the cause of azalea rust after 1 mm. diameter orange flecks were observed on leaves of deciduous azaleas. The alternate host is Sitka spruce. Hemlock rust was diagnosed from aeciospores of new growth of *Melampsora abietis-canadensis* found on twisted, distorted stems in new growth of hemlock. The alternate host of this rust is *Poplar* spp. Fuchsia leaf rust was detected in Blair County Pennsylvania on the fuchsia variety 'Blue Eyes.' Rooted cuttings contained urediospores of the fungus *Pucciniastrum epilobi.*

Problems from *Sclerotinia* were reported in many states. White mold, also called timber rot, of tomatoes was reported in Maryland and Pennsylvania. Greenhouse seedlings were blighted and affected plants had white mold visible on stems and leaves, as well as sclerotia. In Maryland, the above symptoms were observed in greenhouses of Amish growers; the disease may have been encouraged by the lack of ventilated greenhouses, as the Amish do not use electricity. It is suspected that clover overwintering in areas adjacent to greenhouses was the source of inoculum (ascospores). White mold was also reported on perennials in Pennsylvania, including new hosts for this disease, *Perovskia atriplicifolia*, Russian sage, and *Boltonia asteroides* 'Pink Beauty.' Symptoms on infected plants included stem and leaf rot with 1/8" diameter black sclerotia inside stems. In New Hampshire, *Sclerotinia* caused losses of peppers, beans, squash and tomatoes.

Downy mildews were widespread due to cool, wet weather. Diagnosticians in Maryland saw downy mildew of rose for the first time. Distorted new leaves, leaf crinkling and very red lesions were observed on hybrid tea roses in late May to early June. The underside of the red to purple-red leaf spots contained sporangiophores. They were hard to find but typical of the candelabra-type structure of *Peronospora sparsii.* The disease did not spread during more seasonal warm weather. Downy mildew was also reported on some herbaceous perennials. Interveinal yellowing of leaves on greenhouse grown potentilla contained *Peronospora potentillae. Plasmopara geranii* was found in containerized *Geranium maculatum.*

Blue mold of tobacco, caused by *Peronospora tabacina*, was reported in mid-August following periods of cool, wet weather and overcast skies, ideal for development and spread of this disease. It caused damage in the Burley tobacco producing areas of West Virginia and western Virginia. In Pennsylvania there was a low incidence of disease on cigar-type tobacco.

Bacterial stripe blight, a rare disease of barley caused by *Pseudomonas syringae* pv. *striaformis*, was detected by Ethel Dutky in Maryland. Symptoms consisted of lesions in the center of leaves, with black necrosis the entire length of blade. Bacteria poured from tissue sections of symptomatic leaves.

Angular leaf spot of zucchini, pumpkin and summer squash was a problem in New Hampshire. *Pseudomonas syringae* pv. *lachrymans* quickly spread in the heavy mid-July rains. The main symptom was a melt-down of foliage within two to three days. In other cucurbit fields there was so much rain that gummosis resulted in insect wounds. For example, early harvests of zucchini were good but then abundant gummosis resulted in squash bug wounds following excess moisture. Dense planting may have been a factor as well. There was also widespread fruit rot due to *Fusarium* and a lot of secondary bacterial soft rot.

Southeast Region

Jackie Mullen

Summer, 1992 was cooler than usual for many parts of the Southeast and rainfall, for the most part, ranged from adequate to abundant. State reports indicate that most of the Southeast experienced a plethora of the common summer time diseases including woody ornamental problems of: mushroom root rot, Botryosphaeria dieback, Phomopsis dieback, and Phytophthora root rot; herbaceous ornamental problems (greenhouse and bedding plants) included southern blight, Rhizoctonia root/lower stem rot and Phytophthora root/lower stem rot; turf damage from *Pythium*, *Rhizoctonia*, *Sclerotinia*, and *Helminthosporium*; vegetable problems of downy and powdery mildew, leaf spots, and southern blight; and fruit damage from the usual array of anthracnoses, fruit rots, leaf spots, and powdery mildew.

In Tennessee, Beth Long reported that many woody ornamentals showed dieback often associated with Botryosphaeria cankers thought to be the result of environmental stress and winter injury. White pine decline, believed to be associated with environmental stresses, was also widespread. Rose rosette disease was identified for the first time on multiflora rose in 17 counties in western and middle Tennessee.

Blue mold of tobacco was widespread in middle and eastern Tennessee. Two samples were positive for a Ridomil-resistant strain of blue mold. Many virus problems were reported in tobacco including tomato spotted wilt, cucumber mosaic, tobacco etch, tobacco ringspot, tobacco vein mottling, alfalfa mosaic and potato virus Y (PVY). An intensive virus survey was conducted for PVY-N in tobacco growing counties in Tennessee; all samples tested negative for this virus. Continued summer rain allowed late season fungal leaf spot diseases to develop. These leaf spots were a problem in many fields, causing leaf shredding and premature leaf drop.

Late blight was a problem in field tomatoes (for the second year in a row), especially in the Cumberland Plateau region in middle Tennessee. Beth reported that a Ridomil-resistant strain of *Phytophthora* was believed to be responsible for the late blight as Ridomil was not controlling the disease. Fungicide trials at the Plateau Experiment Station indicated that Bravo applied on a seven-day spray schedule provided good control of the late blight, whereas mancozeb did not.

Microdochium blight (*M. tabacinum*) was found on cucurbits in several new counties (Cheatham, Hickman, Knox, McNairy, Rutherford) this summer. It was first identified in 1988 as a new state record (possibly a new US record) by Dr. Steve Bost, University of Tennessee Extension Service, in Cumberland county.

Fungal leaf spots were also a problem in late sweet corn and field corn this year. Northern corn leaf blight, common rust and southern rust caused severe losses in some cases. There were significant occurrences of sudden death syndrome and stem canker in soybeans in western Tennessee.

Brian Eshenaur in Kentucky cited early blight and Septoria leaf spot as causing widespread problems on tomato early in the season, with late blight coming in later. With bell peppers, bacterial spot developed into a serious problem in some fields. Tobacco throughout Kentucky experienced severe problems with the aphid-borne tobacco virus complex. Blue mold and black shank (*Phytophthora parasitica*) were also seriously damaging on the tobacco crop. In addition, Brian reported a common problem of transplant shock on newly planted trees and shrubs. Excessive soil moisture is believed to have been a contributing factor to the problem.

In North Carolina a computer-generated list of summer problems showed that many diseases were alive and well this past summer. Pythium root rot on soybean and black shank on tobacco were especially common problems. Root rot due to *P. parasitica* was also a problem in Frasier fir. Tobacco mosaic virus and foliar nematodes were found on *Hosta*. Aerial Phytophthora blight was unusual and especially abundant on Madagascar periwinkle (*Catharanthus roseus*), and was also found on one sample of impatiens. In turf *Pythium* and *Rhizoctonia* were both active. In vegetables, Tom Creswell noted downy and powdery mildew, leaf spot diseases, late blight on tomato, Microdochium blight of pumpkin and gourds, and southern blight. Ron Jones commented that black root rot (*Thielaviopsis*) was causing recent serious problems with pansy and that *P. parasitica* crown rot on pansy was causing damage in some locations. Ron also noted that their weekly computer-generated disease report sent out to counties had resulted in (very) positive comments from many counties.

South Carolina's report (James Blake) resembled North Carolina's in general content. Phytophthora root rot and Botryosphaeria dieback were common on a number of woody ornamentals. Also Phomopsis dieback was reported on azalea, dogwood, and juniper. Both Carolinas reported bacterial scorch (*Xylella*) on sycamore. Several turf diseases were reported including brown patch, dollar spot, Helminthosporium leaf spots and Pythium blight on bermudagrass. Gray leaf spot was reported on St. Augustine and centipedegrass. In addition to the usual abundance of summer disease problems, James noted the occurrence of *Tranzschelia* sp. rust on peach, plum, and nectarine.

Richard Cullen and Gary Simone in Florida noted *Phytophthora* and *Fusarium lateritum* as the most outstanding disease problems this summer. *Phytophthora* spp. continue to be problematic across a wide host range throughout the state. The Florida clinic has diagnosed *Phytophthora* diseases 118 times in 1991 and 98 times thus far this year. This summer has accounted for 44 *Phytophthora* spp. disease diagnoses across 24 different plant species.

One of the clinic's more interesting diagnoses was *Fusarium lateritum* contamination of hydroponically grown oat sprouts. These sprouts were being used as feed for the Caribbean manatees at a Florida tourist attraction. Considering the serious toxic effects that may arise when grain infected with *Fusarium* species is fed to farm animals, it was advised that contaminated feed should not be fed to the manatees. The clinic is currently looking into the source of this contaminant.

Other diseases of interest included the following: tomato spotted wilt virus (L-strain) in testae of peanut seeds; cucumber mosaic virus in cantaloupe, tobacco, ground-cherry, and southern pea; *Thielaviopsis paradoxa* root rot in imported palms; and *Cristulariella* sp. leaf spot in tomato as well as several trees and weeds in and around tomato fields in North Florida (Dr. Dan Chellemi).

In Georgia, Gene Moody mentioned a recent problem with black root rot on pansy and a severe problem with rust on greenhouse *Calendula*. He noted that root knot nematode (mostly southern) was causing damage in some tree nurseries, especially on dogwood. Danny Gay reported two unusual vegetable diseases this past summer. First, early harvesting of onions resulted in a *Botrytis* neck rot of the onions in storage. But more interesting were the exploding watermelons, which resulted in an estimated loss of 5-10% of the crop. The lethal eruptions were due to a build up of gas inside melons infected by the fruit blotch bacterium (*Pseudomonas* sp.), resulting in actual explosions. In some locations whole fields were destroyed.

Steve Vann in Arkansas reported that prominent diseases of soybeans included aerial web blight, sudden death syndrome, bacterial blight, charcoal rot, and stem canker. Aerial blight appeared to have been more of a problem this year than in previous years. Rice problems of importance included blast, narrow brown spot, straight head, sheath blight and black sheath rot. Sheath blight and black sheath rot caused an increased amount of damage this summer. Especially common and damaging vegetable diseases were anthracnose, Phytophthora crown rot, and Fusarium wilt. Evidence of freeze injury last March was present this summer on fruits, small fruits, and woody ornamentals.

In Louisiana (C. Hollier) sweet potatoes, cotton, soybeans, bell peppers, and rice were noted as crops with especially common or damaging diseases. There was a high incidence of root knot and reniform nematodes on sweet potato. Cotton showed high reniform nematode populations early in the season, with little or no recovery of the crop later in the season. Red crown rot was found in soybeans in northern Louisiana, where it has not been previously reported. Greenhouse grown bell peppers showed a high incidence of *Phytophthora* seedling blight. Initial infection occurred in the greenhouse, but blighting occurred after transplant into the field. With rice, there was a high incidence of blast mid-season to harvest. Yield losses were great in some areas.

M. V. Patel in Mississippi reported that tomato spotted wilt virus was a major problem in tomato all over the state. Another virus problem was blackeye cowpea mosaic virus on southern peas, with about 400 - 450 acres affected. As every plant was infected with the virus, total loss resulted. All the southern pea acreage in Monroe county of Mississippi was lost. Other notable problems were the following: spotted wilt virus on tomato, pepper, and peanut; mosaic virus complex on southern peas, squash, and pumpkin; bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*) on bell pepper; sudden death syndrome (*Fusarium solani* form A) on soybean; rust (*Uromyces phaseoli typica*) on snapbean; rust (*Puccinia melampodi*) on *Calendula* (pot marigold); and buckeye rot (*Phytophthora parasitica*) on tomato.

Early summer in Alabama (J. Mullen) brought spring diseases (powdery mildews, Septoria leaf spot) that lingered on as cooler than normal temperatures prevailed. As summer progressed temperatures were definitely warm and moist, so that we experienced an abundance of the usual summer diseases. Bacterial wilt was common on tomato. Tomato spotted wilt virus on tomato was received from all areas of the state, and was confirmed on three pepper samples. A normally unusual *Phytophthora* foliage blight of periwinkle was fairly common this summer. Bacterial scorch on sycamore and oak was confirmed by ELISA. Phytophthora root rot was common on many different types of plants. There was an increase in take-all patch of St. Augustine, zoysia and bermudagrass. Sudden death syndrome on soybean was diagnosed in a few locations in the state. The biggest disease news in Alabama was a severe outbreak of cucumber mosaic virus, potato virus Y and tobacco etch virus in the commercial tomato production areas of the state (Blount and Cullman counties), with severe and widespread losses resulting. Symptoms were variable, with stunting, yellowing, and plants showing mosaic patterns, leaf twisting, tissue puckering and leaf distortions. Extensive sampling and testings were conducted by Ed Sikora and Bob Gudauskas, respectively. The most aggravating problem seen was a foliar witches' broom accompanied by root galls of unknown etiology on container-grown Helleri holly. This problem has been reported before in Virginia, Georgia, and Alabama.

DIFFUSION

Zonate leaf spot: A new disease of tomato in Arkansas. *Cristulariella moricola* was found by J. C. Correll, *et al.* (Univ. of Arkansas, Fayetteville) to be causing a zonate leaf spot on commercial tomato plants in June of 1991 in Arkansas. The lesions were similar to early blight, but with zonate leaf spot the concentric rings in the lesions were more symmetrical, there was no chlorosis associated with lesions, and the leaf spots were not localized near the bottom of the tomato canopy. Koch's postulates were completed on greenhouse tomatoes. (Abstr.) HortScience 1992, **27**:140.

Studying the cause and cure of 'Rome Beauty' apple russetting. E. Fallahi *et al.*, Univ. of Idaho in Parma, tested the effects of growth regulators and mineral nutrient sprays on 'Rome Beauty' apples. Zinc (Zn-50), calcium as a 12% liquid (Stopit-6), the fungicide (polyram), and GA (Provide) were tested in 1990. Provide slightly decreased the incidence of russetting, whereas the other treatments slightly increased the incidence of russetting. In 1991 Bayleton was also found to increase the problem. Trees treated for powdery mildew (it was a wet year) has higher incidence of fruit russetting regardless of treatment. The authors conclude that "it is believed that interaction between relative humidity, temperature, and systemic sprays used for powdery mildew control contribute to 'Rome Beauty' russetting. (Abstr.) HortScience 1992, **27**:149.

Plant Diagnostics Quarterly (PDQ)

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Minutes, Diagnostics Committee Meeting American Phytopathological Society, Portland, Oregon, 1992

Introduction

The APS Diagnostics Committee met on August 9th, 1992 in Portland, Oregon. The meeting was conducted by Chairman Charles R. Semer, IV with Vice-Chairman Jackie Mullen. There were 32 people who signed the attendance sheet.

I. Minutes of the Meeting in St. Louis (1991)

- The minutes of the meeting in St. Louis were introduced as prepared by Jackie Mullen. After review the minutes were approved by the committee and chair.

II. Election of Vice-Chair

The Vice-Chair for 1993 would preside as Chair for the 1994 meeting (Albuquerque, NM. Larry Brown nominated Paul Bachi with a second from Margery Daughtrey; as no other nominations were made, the Vice-Chair for 1993 (Chair in 1994) will be Paul Bachi. Paul acted as secretary for the remainder of the meeting.

III. Diagnostics Committee Membership

The role of the committee members was called. Larry Barnes, Colette Beaupré, James Blake, Sharon Douglas, Brian Eshenaur, Paula Flynn, Jan Hall, Mike Likins, Melodie Putnam, and Chet Sutula were present. Members absent included Barbara Corwin, Bobby Haygood, Lori Highley, R. J. McGovern, Nancy Pataky, Karen Rane, and James Sherald. Rotating off the committee at the end of the 1992 meeting were Larry Barnes, Bobby Haygood, Lori Highley, Nancy Pataky, Melodie Putnam, and Chet Sutula. The former members were thanked for their work on the committee. New members for 1993-1995 are Karen Flint, Beth Long, Dave Roberts, and Paul Bachi (chair officers have to be committee members).

IV. Reports, Topics of Discussion

A. Plant Pathologist Certification

Chairman Chuck Semer mentioned the Plant Pathologist Certification program that will be explained at during the APS meeting by Larry Stowell, Chair of the American Registry of Certified Professionals in Agronomy, Crops and Soils (ARCPACS) Plant Pathology Sub-Board. Chuck urged attendance at this discussion by any interested persons. More information can be found in an article in *Phytopathology News*, August, 1992 Volume 26/No. 8.

B. Interpretation of Fungal and Bacterial ELISA Results Discussion Session

Jackie Mullen gave a brief report of results of the discussion session on "Interpretation of Fungal and Bacterial ELISA Results" and reminded the group that a more in-depth discussion of the results was published in the June issue of *Plant Diagnostics Quarterly* (*PDQ*).

C. Diagnostic Lab Roster

An update on the Diagnostic Lab Roster was given by Chet Sutula. The roster could provide an international listing of about 500 labs with address, phone and fax numbers, as well as electronic mailing address. Chet also mentioned the possibility of the roster being available in database form (e.g. dBase III or others). Those present thought the idea was worth Chet's continued pursuit.

D. Tomato Spotted Wilt Colloquium

A brief report on last year's "Tomato Spotted Wilt Virus" colloquium, in which over 50 people were in attendance, was given by Margery Daughtrey. The colloquium was cosponsored by the Ornamental and Turf, Virology, and Diagnostics Committees. Funds came from industry.

E. Diagnostics Committee Funds

Chairman Chuck Semer reported he received word from the APS Accounting Office the committee has funds totaling $2707.39.

F. Diagnostic Manual Subcommittee Report

Diagnostic Manual Subcommittee Chair Chuck Semer presented a brief history of the Diagnostic Manual subcommittee. The subcommittee was formed in 1986 with Seong Hwan Kim as Chair. Chuck Semer took over in August 1987 and served until 1991; Jack McRitchie took over as head of the subcommittee while Chuck became Diagnostics Committee Chair. After discussion with APS Press, a proposal for publication was sent to APS Press in December 1991. The proposal was accepted in February 1992. Gail Schumann will be the APS Editor for this project. Chuck stated the subcommittee had reached its goal to develop the concept of the diagnostic manual and has published several sets of diagnostic sheets in *PDQ* in 1990 and 1991. A written proposal was submitted by Chuck to reorganize the subcommittee from 15 to four people (Mary Ann Hansen, Jack McRitchie, Jackie Mullen, and Rob Wick) and to have as their task the editorial work of the manual. After much discussion, language was inserted into the proposal further defining the editorial responsibilities of the proposed subcommittee; the motion was eventually approved.

G. *Plant Diagnostics Quarterly* (*PDQ*)

Melodie Putnam reported on the status of *PDQ*. Financially *PDQ* is in good shape, and Gail Ruhl suggested leaving the subscription rate at the current price of $10.00 for USA and Canada and $25.00 for overseas mail. Melodie stated she has been editor of *PDQ* for five years and would like to step down in order to have someone with some new ideas and energy take over. Gary Simone volunteered the extension group at Univ. of Florida to take over as editor(s) of *PDQ*. The members thanked Melodie for her outstanding contribution over the last five years.

H. Diagnostic Reference Pathologist Listing

The Diagnostic Reference Pathologist Listing was reviewed by Jackie Mullen and was voted a valuable asset to be updated. The listing was started by Jackie three years ago.

I. "Spotlight on Diagnosis"

The future of the special section in *Plant Disease*, "Spotlight on Diagnosis," was discussed after an update by Mary Ann Hansen. Wayne Pedersen, Editor-In-Chief of *Plant Disease*, mentioned to Mary Ann that "Spotlight" might be dropped due to lack of material; future articles could be published as "Special Topics." After a lengthy discussion covering the initial purpose and past history of "Spotlight on Diagnosis," a motion was made by Melodie Putnam and seconded by Mary Ann Hansen to have an *ad hoc* committee work on proposing a renewed focus for the special section, which ultimately would be given to the *Plant Disease* Board. A request for volunteers was made and Chuck Semer asked Mary Ann Hansen, James Blake, and Mike Likins as well as any other interested persons, to work on the *ad hoc* committee.

J. Rapid Diagnostic Assays for Plant Pathogens Workshop

Sally Miller reported on last year's workshop and mentioned a program format change for this year's event. The workshop has been very well attended since its initial session and appears likely to continue in the same fashion. Sally volunteered to once again coordinate the workshop for the meeting in Nashville (1993) along with the same subcommittee members (Steve Nameth, Larry Brown, Melodie Putnam, and Chet Sutula).

K. Diagnostics Committee Poster

The Diagnostics Committee poster for the 1992 meeting was prepared by Jackie Mullen and Ethyl Dutky. APS is encouraging committee posters at the annual meetings. The committee poster will be updated by Paul Bachi and Mike Likins for next year's meeting in Nashville.

L. Plant Disease Diagnostic Contest

Brian Eshenaur encouraged everyone to 'take the challenge' of this year's Diagnostic Contest and thanked Paula Flynn and Margery Daughtrey for their help in coordinating the slides and questions; he also thanked those who volunteered to help administer the contest at the booth.

V. Proposal for a Doctor of Plant Medicine Degree

Special guest George Agrios explained the reasoning behind a proposed Doctor of Plant Medicine Degree to begin in the fall of 1995, if approved by the Univ. of Florida's Board of Trustees. A very detailed proposal was handed out to those in attendance. George said he believes the time for such a professional degree has come and that he predicts the demand for persons possessing this degree will grow dramatically in the future.

VI. Possible Future Events

The 1993 APS meeting will be held in Nashville, Tennessee. The theme for the meeting will be "Plant Pathology: Beyond 2000". There was some discussion about the number of items the Diagnostics Committee could sponsor in light of APS's decision to limit each committee to sponsorship of one special session. Chuck Semer noted that Randall Rowe, speaking at the Program Committee meeting, mentioned the Diagnostics Committee's sponsorship of the Rapid Assays workshop would not preclude the committee from sponsoring another event. Chuck also noted it was mentioned that a committee could co-sponsor as many sessions at it wanted.

A list of possible future events and their coordinators was read by Chuck Semer:

- Turfgrass Disease Workshop, Karen Kackley-Dutt
- *Pythium* Workshop, Jackie Mullen
- *Phytophthora* spp. Workshop
- Xylem-limited Bacteria Discussion
- *Fusarium* spp. Workshop
- Applications of Molecular Techniques to Diagnostic Situations and Diagnostic Clinics

After some discussion the group asked Karen Kackley-Dutt to look into the possibility of hosting a Turfgrass Disease Workshop for sometime in July or August, 1993. Karen said she would check into the costs and arrangements and would get information to the group via *PDQ*.

The committee agreed on having a *Pythium* Workshop just before the Nashville meeting, with Jackie Mullen and Beth Long as the coordinators.

Marty Draper from the Seed Pathology Committee asked for the committee's support as a co-sponsor for a discussion session to be entitled "Seed Health Testing and World Trade." A consensus of approval for joint sponsorship was given.

Brian Eshenaur read a proposal from the Environmental Quality and Plant Health Committee asking for joint sponsorship of a teach-in on Abiotic Stresses to Plants. Consensus was given for this proposal as well.

VII. Proposal for Use of Committee Funds

Chuck Semer made a proposal, in writing, for authorization to use $300 of committee funds to cover expenses incurred by setting up an information booth at the 6th ICPP meeting in Montreal, Canada (July 28 through August 6, 1993). The booth would highlight the Diagnostic Manual, *PDQ*, and other aspects of the committee's work. The request was approved.

Respectfully submitted,
Paul Bachi

October 1992

Paul R. Bachi
Plant Diagnostician
UK Research and Education Center
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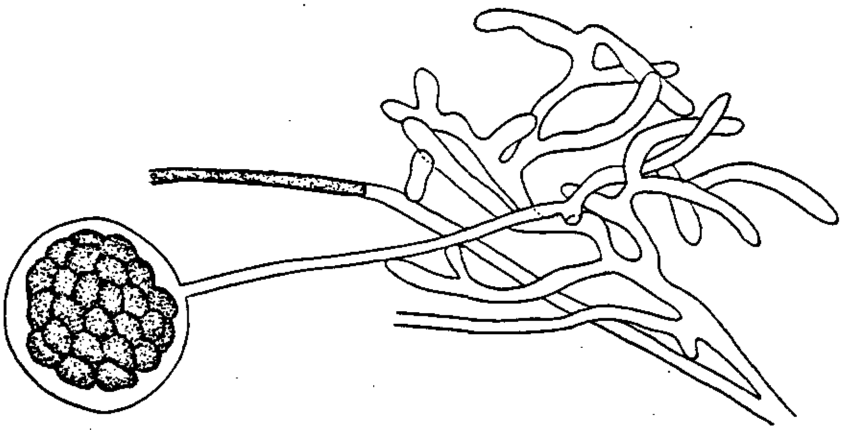


Attention all who need help identifying *Pythium* species:

A *Pythium* Species Identification Workshop is being scheduled for November, 1993. Tentative plans involve a one and one-half or two day workshop scheduled just prior to the APS Meeting in Nashville. The location of the workshop will be the Ellington Agriculture Center which is located about 10 miles from the meeting headquarters at the Opryland Hotel. Workshop instructors will include Joe Hancock, Bob Lumsden, David Shew, and Z. G. Abad. Registration for this workshop will be limited to 20 due to facilities and the nature of the hands-on activity. Details--including the registration fee--are still to be settled. If you think you are seriously interested in attending this workshop, please fill out the form below and return it to:

Jackie Mullen
Department of Plant Pathology
102 Extension Hall
Auburn University
Auburn, AL 36849-5624.

This is NOT the registration form for the workshop. This is a preliminary serious-interest questionnaire to give us an indication of the level of interest in this activity. Actual registration will be filled on a first-come basis. (This notice will also appear in *Phytopathology News*.)

Workshop Coordinators:
Jackie Mullen
Beth Long
Paul Bachi

***Pythium* Species Identification Workshop**
Interest Questionnaire

Name________________________________

Address________________________________

Phone________________________________

FAX________________________________

Internet or bitnet: (please circle) ________________________

Foliar Nematodes in Hosta and other Herbaceous Perennials

Ethel M. Dutky
Department of Botany, Cooperative Extension Service
Maryland Institute for Agriculture and Natural Resources
University of Maryland System, College Park Campus
and
Anne B. Sindermann
Plant Protection, Maryland Department of Agriculture

Recently, the Journal of the Hosta Society published an article alerting members to the damage caused by foliar nematode in *Hosta*. The University of Maryland's Plant Diagnostic Laboratory and the Maryland Department of Agriculture have confirmed the diagnosis of foliar nematode from *Hosta* and a variety of other plants including lilies, *Iris*, ferns, Japanese anemone, *Ligularia*, garden peony, *Polygonatum, Hepatica, Tricyrtis* and *Trillium*. Other commonly infected ornamentals are phlox and begonia. Dr. Lorin Krusberg, Professor in the Department of Botany, has identified the nematodes in *Hosta*, ferns, *Trillium* and *Anemone* as *Aphelenchoides fragariae*. This species also attacks strawberry. Different species of foliar nematode are pests on chrysanthemum and rice.

Most plant parasitic nematodes reside in the soil and attack the roots of plants, producing symptoms such as stunting, off-color and poor yield. In contrast, foliar nematodes feed in the leaves, buds and flowers, producing off-color blotches and eventually foliar blight. The widespread use, until recently, of systemic insecticide/nematicides such as Temik in nursery and greenhouse production provided good control of foliar nematode, so many diagnosticians are not familiar with it. We confess that we were not in the habit of looking for the nematode whenever we saw foliar yellowing and areas of blight, except in ferns, where the nematode is a chronic problem. This article is intended to alert diagnosticians to this common pest.

Symptoms and nematode life cycle:

Foliar nematodes can be ectoparasites, feeding on the outside of the young foliage, stems and buds. This external feeding causes curling, twisting, and stunting damage to new growth. They can also be endoparasites, moving into the leaf and feeding mostly on the spongy mesophyll cells. The nematodes reproduce inside the leaf, reaching very large numbers by late summer. The pattern of necrosis in foliage, clearly bounded by veins, is diagnostic. The symptoms of nematode feeding inside the leaf start as yellow areas which progress to brown areas. The nematodes do not easily move across the main leaf veins while inside the leaf; therefore the affected areas are clearly bounded by leaf veins. In monocots such as lilies, *Hosta* and *Liriope* (see figure 1), the damaged areas appear as distinct stripes, bounded by the parallel veins. In dicots such as ferns, chrysanthemum, garden peony, *Begonia*, Anemone and Ligularia, the damaged areas look like a patchwork (see figure 2). Perfectly healthy-looking areas are often right next to brown, necrotic areas. Infected leaves may rapidly collapse or may remain intact and simply appear to senesce prematurely.

Interactions of the foliar nematode with bacteria and fungi can result in much more severe foliar blight symptoms.

In *Hosta*, the infected leaves appear healthy in spring, and are normal in shape, size and color until mid-summer, when yellowish stripes begin to appear. These yellow stripes progress to brown, the necrosis often extends down the petiole, and the leaf may collapse. The early loss of foliage seldom kills the plant, but does make it unattractive and reduces vigor and increase of stock. Late summer is a good time to check stock for symptoms of foliar nematode, as symptoms are expressed clearly. Plants can be infected and show no symptoms, possibly contributing to spread in nursery and landscapes.

Foliar nematodes can move around on the surface of plants, and enter the tissues by crawling through the stomates. The nematodes are very tolerant of drying, and can remain viable in dried plant debris for years. They persist in infected plant parts, but do not persist well in soil. Wet conditions are favorable for the nematodes, since they need a moist surface to move around on the plant. They can crawl up into flowers and infest the seeds of some plants. They can easily be propagated along with most vegetatively propagated plants. At the end of the growing season, many nematodes migrate down into the dormant crowns.

Diagnostic techniques:

Often the nematodes can be seen in pieces of yellow or necrotic tissues placed on a slide in water and examined under low power with a compound microscope. The nematodes are fairly long, so we find it better to gently tease apart the tissue, rather than to cut it into thin strips, which often cuts the nematodes. In plants with succulent tissues, this is easy to do, and the nematodes will readily move out of the tissue as you watch. In dried samples or plants with stiff, firmer tissues, it is better to place the bits of tissue in small dishes in water overnight. The nematodes will take time to revive and migrate into the water. They can be seen and fished out under the dissecting microscope, and placed on a slide for identification as you would do with other nematodes such as the pine wood nematode. You really do need to look closely at the nematodes because there are other nematodes found in rotting plant tissues which feed on bacteria and fungi but are not plant parasites.

Control Options:

Foliar nematodes are easily killed by heat. Soaking seed or infected plant parts in hot water at a temperature of 55 to 61 C (130 to 140 F) for 10 to 15 minutes has long been used to "clean up" infected seed and plant parts. Chemical control is somewhat of a problem at this time on landscape ornamentals because effective nematicides are not registered for landscape use. In nurseries, the systemic nematicide Oxamyl (Vydate) may be used, and application to the foliage will provide good control. Soaking stock in Oxamyl also works well. Oxamyl is a highly toxic pesticide which must be applied by a certified pesticide applicator. Oxamyl is not available to home gardeners. Currently, testing is underway to determine the usefulness of other insecticides/nematicides to control this nematode.

Systematic sanitation might provide some control. Certainly, plants known to be infected should not be used for propagation or grown near healthy, susceptible plants. The problem with reliance on sanitation is that the nematode can be present in low numbers in foliage which lacks any symptoms. In home landscape plantings, removal of the stems and foliage, cutting them off at the soil line soon after the first hard frost, and removal of all symptomatic foliage during the growing season, may be helpful because the nematode overwinters on debris. Unfortunately, the nematodes probably also overwinter in the crown and bud scales. Infected plant material should not be added to compost unless the compost will be heated prior to use on healthy plants. In the laboratory, *Aphelenchoides fragariae* may be grown in fungal cultures. It is therefore possible that this species of foliar nematode could persist in compost.

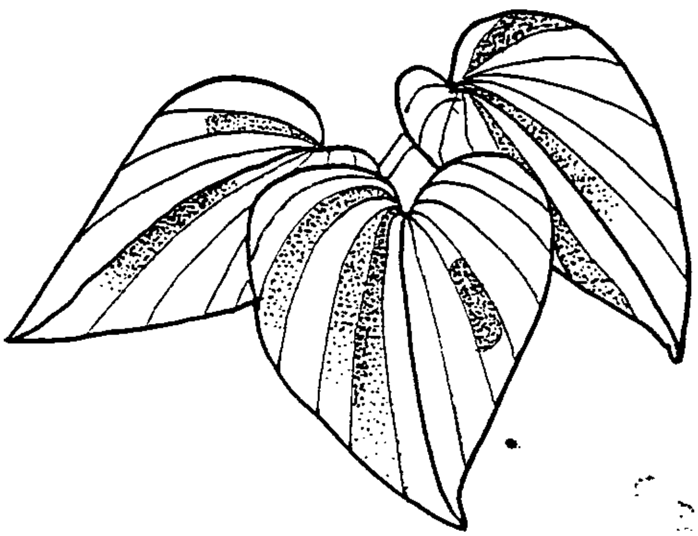


Figure 1- Typical symptoms of foliar nematode in *Hosta*, and other monocots. Note stripes bounded by the parallel veins.

Figure 2- Foliar nematode symptoms in a typical dicot leaf, *Ligularia przewalskii*. Note the "patchwork" pattern, with net-veins bounding the discolored areas.

Conifer Needlecast Diseases

William Merrill
Department of Plant Pathology, Penn State
211 Buckhout Lab, University Park, PA 16802

Numerous foliage diseases occur on conifers. Generally these are of little consequence in the forest, except on exotic tree species. However, on ornamentals, nursery stock or Christmas trees, these diseases often discolor and/or destroy the foliage, usually the latter. This renders the tree undesirable or unsaleable. These diseases often occur on nursery stock at infection levels below the threshold of detection, and hence have been, and still are being, shipped all over the country in diseased seedlings. This is the primary means by which the pathogens get into new plantings. The pathogens may continue to develop below the threshold of detection for several years until favorable environmental conditions allow them to flourish. Then the diseases appear to have suddenly developed out of nowhere.

Conifer foliage diseases can be grouped into six type-diseases:

1. Brown felts
2. Snow molds
3. Sooty molds
4. Needle rusts
5. Needle blights
6. Needlecasts

Of these six type-diseases, sooty mold is by far the most common, but in most conifer species needlecast is the most damaging. Due to needlecasts, susceptible trees often retain only the most recent year's needle complement instead of the two to seven or more complements that various species normally maintain. Thus, diseased trees appear "thin" or "hollow". Such trees often do not make attractive ornamentals, and in the Christmas tree industry usually are unsaleable. Growth rate of severely affected trees is reduced and the stressed trees may become predisposed to other problems, such as twig and branch canker diseases. Severe needlecast on lower branches often results in bud mortality and lower crown dieback. Uncontrolled tall grass or weeds maintain moisture in the lower crown, increasing the incidence and severity of lower crown dieback. Such trees cannot be sold for landscaping purposes or for Christmas trees unless harvest time is delayed several years and the trees are then "high-stumped."

There are over 100 species of needlecast fungi in 20 (or more) genera, and new species still are being described. Some existing "species" appear to be complexes of two or more closely related species. Other than for their taxonomic description, host range and distribution, little is known about most species. The majority are Ascomycetes that have been placed at various times in the Hysteriales and Hysteriaceae, the Hypodermatales and Hypodermataceae, or more recently in the Rhytismatales and Rhytismataceae.

Some needlecast fungi are thought to be saprophytic, occurring only on senescing or dead needles. However, in the absence of inoculation studies or any information on the timing of infection, this is supposition. Likewise, some species are thought to be endophytic, inhabiting "healthy" or at least symptomless needles, and sporulating only when the needles begin to senesce or have abscised. Again, this is supposition or speculation. Fir needlecasts routinely have two-year life cycles and disease cycles, and it is thought that *Lirula macrospora* may have a three- or four-year cycle. Perhaps the so-called endophytes merely have prolonged disease cycles. Considerable research needs to be done on most needlecast fungi.

Characteristics of the Type-disease

Needlecast diseases have several things in common:

1. All but seven of the common genera form **hysterothecia** (Hypodermataceae = Rhytismataceae).
   Exceptions: *Didymascella, Fabrella, and Keithia* (Phacidiaceae, apothecia), *Cyclaneusma* and *Rhabdocline* (Hemiphacidiaceae, apothecia), *Phaeocryptopus* (Loculoascomycetes, perithecium) and *Rhizosphaera* (Sphaeriales, pycnidium).

2. All but two are **simple interest** diseases, ie, they have a single infection period per year.
   Exceptions: *Cyclaneusma* and *Rhizosphaera*

3. Inoculum consists of **wind-disseminated ascospores.**
   Exception: *Rhizosphaera.*

4. Most pathogens **infect succulent first-year needles on elongating shoots.**
   Exceptions: *Cyclaneusma* , *Rhizosphaera,* and *Lophodermium seditiosum.*

5. Nearly all of the pathogens have prolonged **incubation periods** (period from infection until formation of visible symptoms) ranging from **6 to 9 months.**

The key phrases listed above in boldface summarize these beasties very well: **hysterothecia, simple interest diseases, with wind-disseminated ascospores infecting succulent first-year needles on elongating shoots, and incubation periods of 6 to 9 months.** Thus, if you know the details of one needlecast you can extrapolate this information to about 90 other needlecasts and be correct much of the time. You only need to be aware of the major exceptions to the "typical" disease cycle. And there are exceptions! Indeed, the most serious problems frequently are those exceptions to the general "rules" listed above.

Isolation

Most needlecast fungi have not been cultured; indeed, some cannot be cultured and are considered to be obligate parasites. Most of those that can be cultured do not sporulate in culture. Many species grow like "*Pullularia*" in culture, and usually are discarded as contaminants. (Over 40 genera of fungi, including several major conifer foliage pathogens, grow like "*Pullularia*" in culture.) Thus, even if a fungus is cultured from infected needles, usually there is no way to ascertain if it is a needlecast fungus.

When we isolate from needles for pathogens such as *Cyclaneusma minus*, we collect infected needles in the field and refrigerate them until isolations are made. We routinely use acidified malt agar (15 g Difco malt extract and 15 g Difco flake agar per liter of distilled water, 1 ml 88.3% lactic acid per liter of medium added after autoclaving). Needles are surface sterilized for 90 seconds in 0.52% aqueous sodium hypochlorite, and then rinsed three times with distilled water. Pine needles then are cut into three sections; needles of other species are cut in half. It is important that the needle pieces be pushed slightly down into the agar so that the cut ends are below the agar surface. The needlecast fungi grow primarily out of the cut ends of the needles; if these ends are above the agar and dry out, frequency of isolation is seriously reduced.

Isolations from infected needles often yield various Fungi imperfecti. Of these, *Hendersonia* sp., especially *H. acicola*, are common. These appear to co-inhabit needles with the needlecast fungi, and often sporulate within the hysterothecia. These fungi are thought by some to be hyperparasites on the needlecast fungi; others think that they are competitors that follow in a metabiotic succession. *Sclerophoma pityophila* also is frequently encountered. This fungus grows in culture as a *Hormonema* sp.. On acidified malt agar it forms a mat of shiny black hyphae, most of which grow within the agar and the rest closely appressed to the agar surface. This fungus is a weak parasite, especially on foliage of stressed plants. Saprophytic fungi, especially species of *Truncatella*, also may be isolated. For many years our isolations also have routinely yielded a slowly-growing, fluffy, pinkish-white, nonsporulating Hyphomycete; we have no idea of its identity or role.

Sexual and Asexual Reproduction

In nature the majority of needlecast fungi form tiny asexual fruiting bodies (pycnidia) that apparently function only as spermagonia. Most of these belong to the form-genus *Leptostroma*. The conidia of most species are small and bacilliform, and dimensions of conidia of different species overlap sufficiently that they are of limited use in species determination. These spores are not infectious.

Hysterothecia range in color from concolorous with the browned needle tissues to dark brown and black, and are elliptical (football-shaped) to linear structures (short to long stripes) that open with a longitudinal slit (Figure 1). These are often interpreted as apothecia modified by the formation of a clypeus covering the hymenium. The clypeus differentiates to form the longitudinal slit-like opening, frequently with a prominent pair of labia, over the center of the fruiting body. Cells at the outer edges of the clypeus absorb water and swell, forcing the clypeus upwards and spreading the labia apart, allowing spores to be ejected (Figure l, 2). As the fruiting body dries, these cells shrink and the clypeus flattens, bringing the labia together to close the opening. The fruiting body goes through this process each time it is wetted.

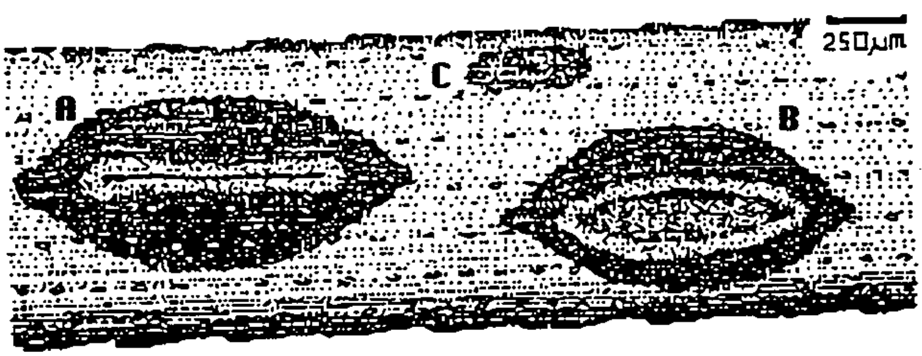


Figure 1. Closed (A) and open (B) hysterothecia, and pycnidium (C) of *Lophodermium seditiosum* on a pine needle. (Redrawn via computer from Minter)

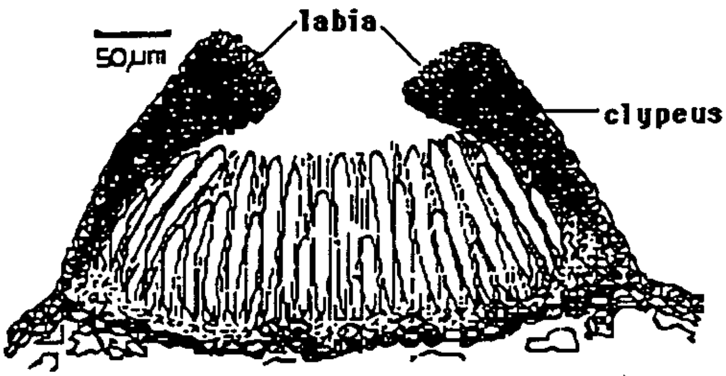


Figure 2. Cross section of a mature hysterothecium of *Meloderma desmazierii*, showing subepidermal development of the fruiting body, the clypeus with prominent labia, and sequential development of the asci. (Redrawn via computer from Minter)

For teaching or demonstration purposes, needles with mature hysterothecia can be collected, air-dried, and stored for years in an herbarium cabinet. Preserve these needles under moth balls so that fungus-feeding mites and insects do not destroy them by eating the hymenium. Remove a few needles, sandwich them between two sheets of sopping wet filter paper in a petri dish for 20-30 minutes, and the fruiting bodies will swell and open. We have collections of *Lophodermium* sp. and *Ploioderma* sp. that remain active after 10 years in storage.

Primary diagnostic features of the hysterothecia (and hence genera and species) include:

1. Location of ascomata formation: subcuticular, intraepidermal, subepidermal, or subhypodermal.
2. The shape of the ascomata: elliptical or linear.
3. Shape of the asci: clavate or cylindrical.
4. Size and shape of the ascospores: symmetrical ovate or rods, bifusiform, filiform, or clavate. Spores of the latter two shapes may be septate or aseptate.
5. Dimensions of the ascospores.
6. Host genus and species

Secondary diagnostic features include:

1. Size, shape and ornamentation of the paraphyses
2. Size, shape and distribution of the pycnidia.
3. Size and shape of the pycnidiospores.
4. Presence of zone lines in affected needle tissues.
5. Size of the asci.
6. Development of asci: sequential or synchronous.
7. Thickness of the gelatinous layer surrounding the ascospore. (Ascospores of many species are surrounded by a gelatinous layer.)

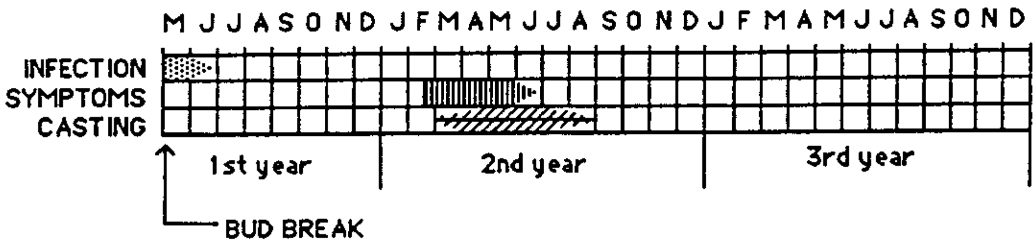
Key to the Common Genera of Needlecast Fungi
(Modified in part from Funk, 1985)

1a	Fruiting body a true apothecium, brown to blackish, reddish-orange to brick red or whitish to cream-colored	2
1b	Fruiting bodies appearing to the eye as two rows of "dirt", consisting of hundreds of tiny, round, stalked black structures, each emerging from a stoma	3
1c	Fruiting body a hysterothecium	4
2a	Apothecium brick red to reddish-orange, on Douglas-fir	Rhabdocline
2b	Apothecium whitish to cream-colored, on hard pines	Cyclaneusma
2c	Apothecium brown to blackish, on cedars	Didymascella or Keithia
2d	Apothecium brown to blackish, on hemlock	Fabrella
3a	Fruiting body a perithecium, asci bitunicate, on Douglas-fir	Phaeocryptopus
3b	Fruiting body a pycnidium, on spruces or hard pines	Rhizosphaera
4a	Hysterothecia linear or nervisequious, brown to black	5
4b	Hysterothecia elliptical, concolorous to black	6
5a	Ascospores filiform	Virgella
5b	Ascospores bifusiform	Isthmiella
5c	Ascospores clavate	Lirula
5d	Ascospores bifusiform OR symmetrical ovate or rods	Ploioderma**
6a	Asci clavate	7
6b	Asci cylindrical	8
7a	Ascospores clavate, hysterothecia subcuticular	Hypodermella
7b	Ascospores clavate, hysterothecia subepidermal	Davisomycella
7c	Ascospores clavate, hysterothecia subhypodermal	Lophodermella
7d	Ascospores elongate-fusiform, 1-septate	Elytroderma
7e	Ascospores bifusiform	Bifusella
8a	Ascospores fusiform or ovate	Meloderma
8b	Ascospores filiform, nonseptate	Lophodermium
8c	Ascospores filiform, septate	Lophomerum

**This genus remains somewhat confused and probably will be separated into two or more genera. The two common species, *P. lethale* and *P. hedgecockii*, are separated on other characteristics. See Minter (6).

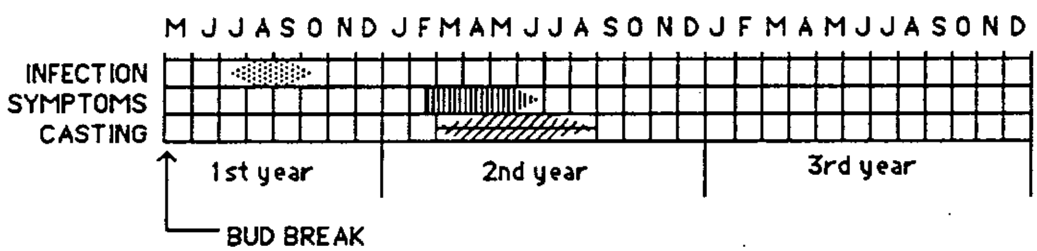
Variations in Needlecast Disease Cycles

(All charts indicate the cycle for a single complement of needles)



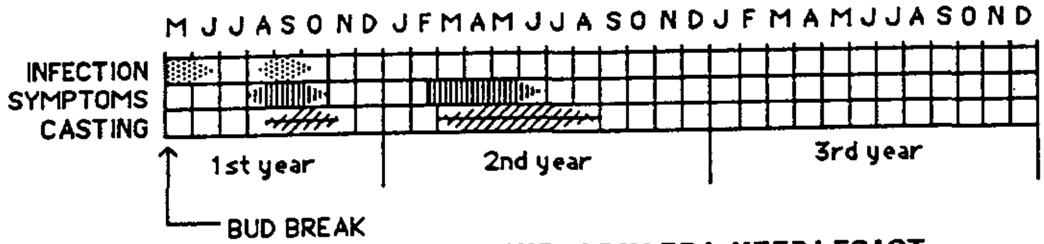
DISEASE CYCLE FOR A TYPICAL NEEDLECAST

In typical needlecasts, such as *Rhabdocline pseudotsugae* needlecast of Douglas-fir or *Ploioderma lethale* needlecast of Austrian and pitch pines, succulent young needles are infected from budbreak through shoot elongation (Douglas-fir) or from needle emergence from the fascicle sheath through needle elongation (pines). Symptoms develop about 8-9 months later. Fruiting bodies are produced on these needles from just before budbreak through shoot and needle elongation. Casting of severely infected needles may occur as soon as symptoms develop, but more typically begins about budbreak or needle elongation and continues through early summer of the second year. Timing of formation of pycnidia is variable, but usually occurs just prior to the formation of hysterothecia. Hysterothecia form prior to budbreak. Rhabdocline begins to release some ascospores 7-10 days prior to budbreak, with peak release during the first two weeks of shoot and needle elongation if weather is favorable.



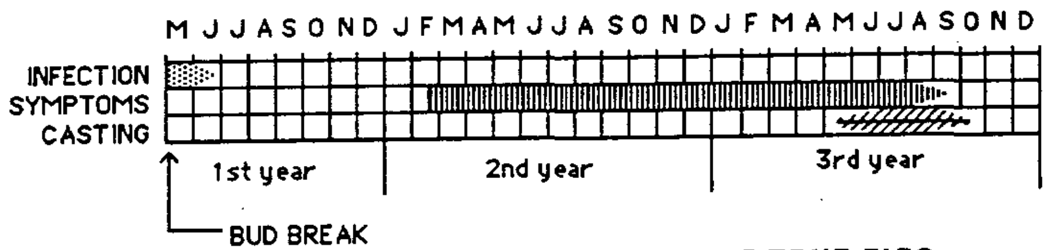
DISEASE CYCLE FOR LOPHODERMIUM NEEDLECAST

The disease cycle for needlecast of Scots pine caused by *Lophodermium seditiosum* varies from the typical cycle in that first-year needles do not become infected until they have begun to harden off about mid-July. The infection period may continue through early fall, depending upon weather. Note that the only difference between this cycle and the first is the timing of infection. During dry summers the fruiting bodies usually remain viable and release their ascospores during fall rains, often in late September and early October.



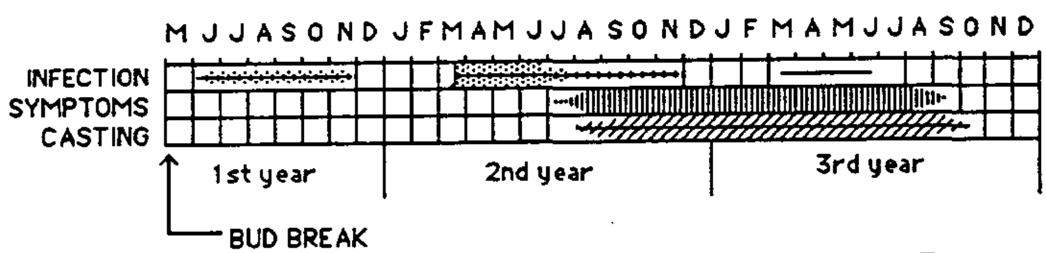
DISEASE CYCLE FOR RHIZOSPHAERA NEEDLECAST

Rhizosphaera needlecast of spruce often has a typical needlecast disease cycle, as diagrammed for Rhabdocline needlecast. However, on Colorado blue spruce there frequently are two cycles of disease per year. Needles infected during shoot elongation may become symptomatic and bear fruiting bodies in mid- to late summer of that year. These fruiting bodies release spores which infect previously uninfected current-year needles which then become symptomatic the following spring. First-year needles that become symptomatic in mid- to late summer cast in early fall, often leaving bare current-year shoots in the sides of trees. This latter syndrome often is confused with damage caused by the spruce needle miner.



DISEASE CYCLE FOR NEEDLECASTS OF TRUE FIRS

Needlecasts of the true firs have a two-year cycle. Succulent young needles are infected from budbreak throughout shoot elongation. Early the following spring these needles turn brown, but remain firmly attached to the tree for another year. <u>Asexual</u> fruiting bodies form on the upper surfaces of these brown needles. These often are concolorous with the browned needle tissues and difficult to see. In the spring of their third year these brown needles bleach to a straw color, and bear <u>sexual</u> fungus fruiting bodies on their undersides, usually long, linear hysterothecia developing along the mid-vein of the needle. Once the sexual spores have been released, these needles then cast during their third summer.



DISEASE CYCLE FOR CYCLANEUSMA NEEDLECAST

The disease cycle for needlecast of Scots pine caused by *Cyclaneusma minus* is totally unlike the disease cycle of any other needlecast; indeed, the cycle really is typical of a **needle blight**. Needles of any age can be infected any time of the year that the temperature is above freezing and moisture is present. In Pennsylvania Scots pine, up to 65% of the needles may become infected during the summer and fall of their first season; more typically about 15-25% of the needles are infected during that time span, depending upon the weather. The greatest amount of infection usually occurs from late March through mid-May of the second season prior to budbreak. Often about 90% of the needles have been infected prior to elongation of the next year's shoots. Symptoms usually develop on second-year needles in late summer or early fall, and may continue to develop throughout the spring of their third year. Casting, often severe, usually begins late in the second season. Casting may continue through the summer of the third season.

Needlecast Fungi Commonly Encountered

(* = major problems. For more complete information on host ranges consult Darker and Hunt & Ziller))

On Pine:

**Cyclaneumsa minus*: the widespread "fall-yellower" of second-year needles of Scots, mugo, ponderosa pines; rarely Austrian, Virginia pines

**Lophodermium seditiosum*: the destructive "spring-reddener" of previous-year needles of Scots pine; occasionally on eastern white pine.

Lophodermium nitens: widespread on needles of eastern white pine lying in the litter; thought to be saprophytic.

**Ploioderma lethale*: widespread on previous-year needles of Austrian, loblolly, pitch, slash, Virginia pines; reported on western white pine.

Ploioderma hedgecockii: apparently widespread on southern pines. This species has four normal ascospores and four tiny aborted ascospores.

Bifusella linearis: occasionally on eastern white pine (this fungus reported to be widespread but has been confused with an as yet undescribed but very widespread fungus)

Meloderma desmazierii: reported on eastern white, jack, red, Scots pines but uncommon or perhaps mis-identified.

Davisomycella ampla: widespread and frequently severe on jack pine.

Lophodermella concolor: widespread and serous pathogen on lodgepole and jack pines; also attacks Scots pine in Canada.

On Douglas-fir:

**Rhabdocline pseudotsugae*: the most widespread and destructive foliage disease of Douglas-fir in eastern North America.

**Phaeocryptopus gaumannii*: widespread on Douglas-fir; in northeastern US common at higher and colder sites.

On Spruce:

**Rhizosphaera kalkhoffii*: widespread on spruces, especially Colorado blue; also attacks some hard pines, probably Virginia as well as Japanese red and black pines.

**Lirula macrospora:* Colorado blue, white spruces; widespread in the Northeast on natural regeneration of black and red spruces and lower branches of larger trees.

Lophodermium nanakii: widespread on spruce needles in the litter throughout the Northern Hemisphere ; thought to be saprophytic.

On True Firs:

**Isthmiella faullii*: on balsam fir throughout its range; common on natural regeneration throughout the Northeast; occasional problem on Christmas trees in northern Minnesota and New England. Usually occurs as a mixed infection with the following pathogen:

**Lirula nervata*: see comments above.

On Hemlock:

Fabrella tsugae: occasional outbreaks on eastern hemlock, sometimes defoliating younger trees or regeneration or lower limbs of larger trees; asci four-spored.

On Cedar:

Didymascella thujina: occasional outbreaks on arborvitae, especially on lower branches; western red cedar; asci two-spored.

Keithia juniperi: widespread on eastern red cedar; a related species occurs on Rocky Mt. juniper; asci eight-spored.

On Larch:

Hypodermella laricis: eastern and western larches; pathogen kills both the needles and the short spur shoots upon which they are borne.

Useful Needlecast Literature

The needlecast literature is extensive and diffuse. However, only references 1, 2, 4-6 listed below are really useful to a diagnostician. The basic reference remains Darker's monograph (1), which must be updated with his later revision of the genera (2). These are the two best sources of complete descriptions and botanical illustrations. However, several new species have been described since these were published. More complete illustrations of selected species are provided by Minter (6). The best overall key is that of Hunt and Ziller (5), which is best used in concert with Darker (1, 2). A simple but excellent key to western species is provided in Funk (4). (The two booklets by Funk listed below are indispensable to any North American diagnostician working with conifers.)

1. Darker, G.D. 1932. The Hypodermataceae of Conifers. Contrib. Arnold Arborteum 1:1-131.

2. Darker, G.D. 1967. A revision of the genera of the Hypodermataceae. Can. J. Bot. 45:1399-1444.

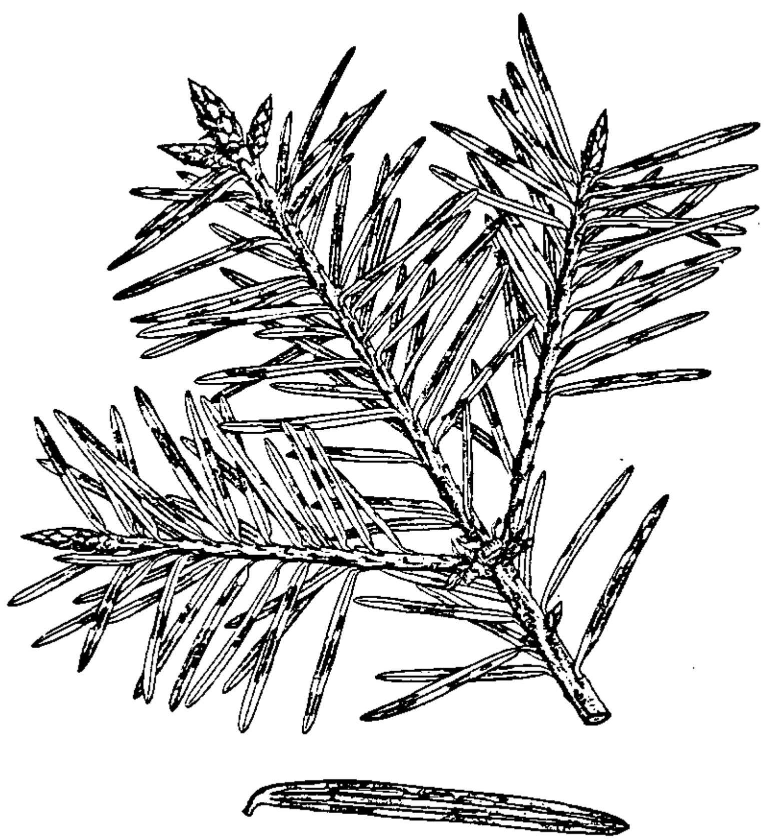
3. Funk, A. 1981. Parasitic Microfungi of Western Trees. Forestry Canada BC-X-222, 190p.

4. Funk, A. 1985. Foliar Fungi of Western Trees. Forestry Canada BC-X-265, 159p.

5. Hunt, R.S., and W.G. Ziller. 1978. Host-genus keys to the Hypodermataceae on conifer leaves. Mycotaxon 8:481-496.

6. Minter, D.W. 1986. Some members of the Rhytismataceae (Ascomycetes) on conifer needles from Central and North America. pp. 71-106 In: G.W. Peterson (tech. coord.) Recent Research on Conifer Needle Diseases. USDA For. Serv. Gen. Tech. Rept. WO-50, 106p.

Contribution No. 1913, Dept. Plant Pathology, The Pennsylvania Agricultural Experiment Station.



A2699

URBAN PHYTONARIAN SERIES

Maple *(Acer)* Disorder: Maple Petiole Borer

D.L. Mahr

Symptoms and Effects

The maple petiole borer [*Caulocampus acericaulis* (MacGillivray)] causes large numbers of leaves to drop to the ground in June, due to larval tunneling. The leaf stems (petioles) usually break off near the leaf blade and the breaking point is often darkened in color.

This disorder usually affects only sugar maples and often occurs very suddenly. However, only a few of the tree's leaves are actually involved, so this disorder has little effect on the health of the tree.

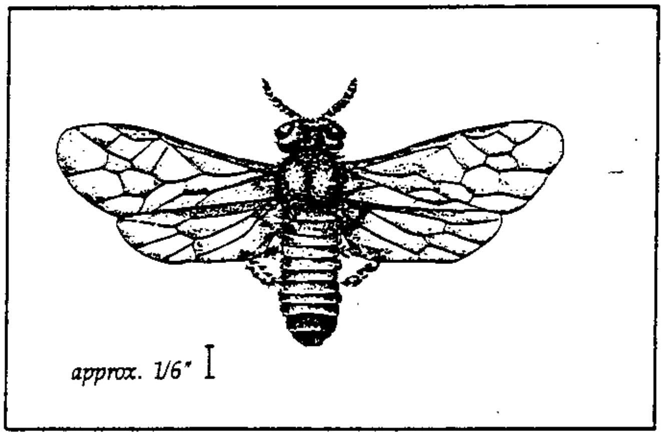
You can usually accurately identify an infestation of maple petiole borer in the field. The time of year that it occurs and the green coloration of the leaf blade distinguishes this disorder from drouth, aphid or scale infestations, or other problems that cause some leaf drop. However, squirrels may occasionally cause leaf and twig defoliation in early or midsummer. Thus, to identify maple petiole borer damage, cut a petiole near the leaf blade and examine the interior carefully for larval tunneling.

Life Cycle

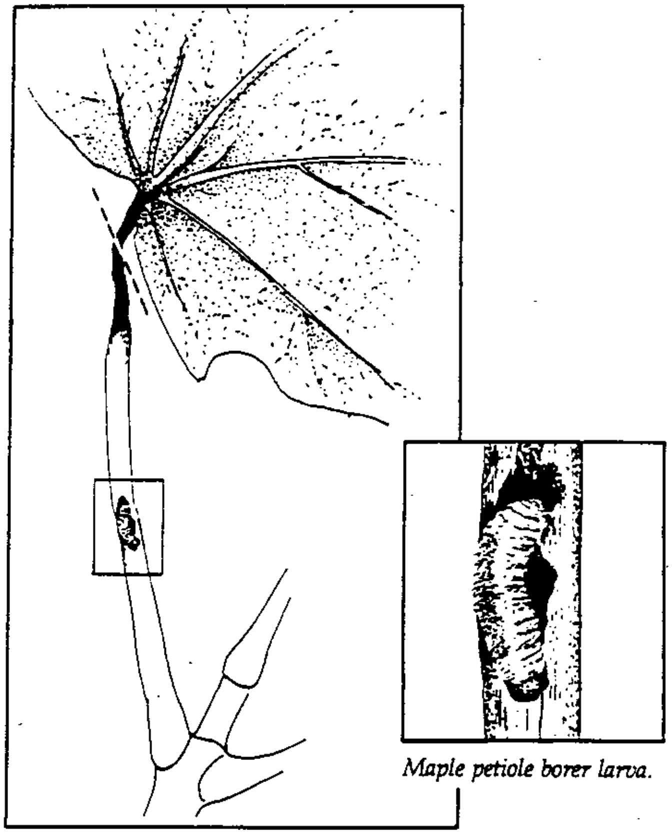
Adult petiole borers are sawflies that appear in May and deposit their eggs in the maple petiole near the leaf blade. After hatching, larvae tunnel into the petiole for 20 to 30 days. Because of this tunneling, the stem breaks off near the leaf blade and the leaves drop. Larvae remain in the portion of the petiole still on the tree for about 10 days more—larvae are about 1/3 inch long at this time. This portion then drops to the ground and the larvae move into the soil to pupate. They overwinter in the soil until the following spring.

Distribution and Frequency

The maple petiole borer is an introduced species that has extended its range from the northeastern states to the Great Lakes area and the Midwest. It is commonly found in southern Wisconsin, although it generally occurs at low levels and is usually overlooked. Occasional outbreaks can appear, though, and leaf drop can be substantial. However, leaf drop rarely exceeds 25 to 30% of the leaves on a tree, even during peak years.



The adult female maple petiole borer is a sawfly and appears in May to lay eggs.



Maple petiole borer larva.

This petiole has been severed by the borer, which remains in the part of the petiole still attached to the tree. This attached portion later falls off and the larva exits through a hole in the side of the petiole.

Control

Chemical treatment is not recommended because attack by the maple petiole borer occurs infrequently and is unpredictable, and because this disorder does not significantly affect tree health and appearance. Also, damage occurs over a short period of time, and it probably is too late for effective chemical control by the time you notice the leaf drop.

However, you can reduce maple petiole borer populations the following year if you pick up and destroy infested leaf stems (especially the short sections without leaves) about 7 to 10 days after first leaf drop. Continue this stem cleanup throughout the leaf drop period. For such cultural controls to be effective, they must be practiced on all infested maples in the vicinity.

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This is a revision of a previous publication by C.F. Koval.

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A2699 Maple *(Acer)* • Disorder: Maple Petiole Borer 1989 R-12-89-1.5M-20-E

A2759

URBAN PHYTONARIAN SERIES

Gladiolus *(Gladiolus hortulanus)* and Related Plants Disorder: Stromatinia Disease, Dry Rot, Neck Rot

G.L. Worf

Symptoms and Effects

Stromatinia disease can affect the roots, corm (bulb), and the lower area or neck of leaves, generally near the soil line. Under Wisconsin conditions, the neck rot phase is the most common symptom. During cool, moist weather, the foliage may suddenly turn yellow or brown, beginning with the older (outer) leaves. If the disease continues, the younger leaves die, too.

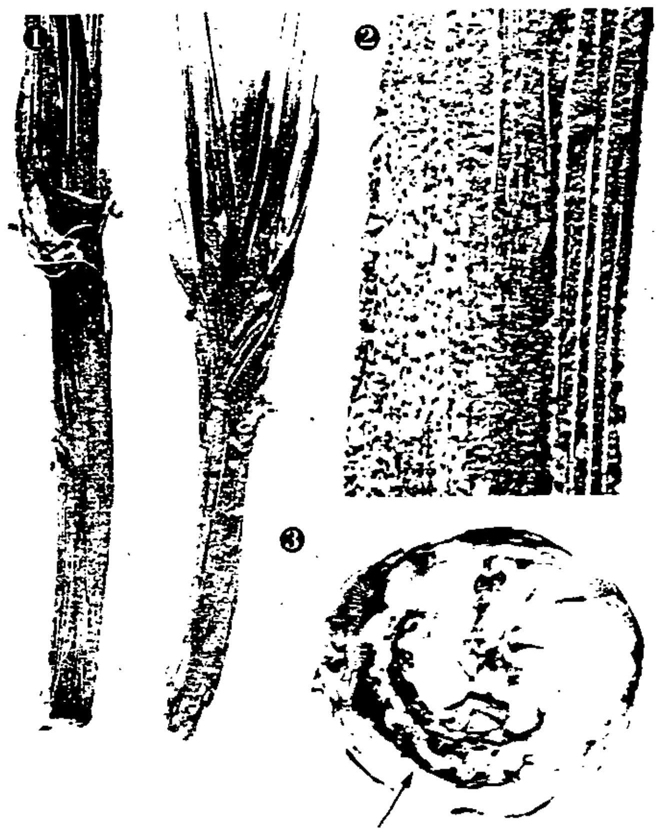
You can diagnose neck rot by closely examining the leaf tissue near the soil line. During early stages, the rotted areas are yellow or brown. Occasionally, there is gray to white mold between infected leaf sheaths, causing them to stick together. The neck tissue shrinks and shreds, and easily pulls away from the corm. You can find many tiny black fungal structures, sclerotia, scattered within the rotting tissue near the soil line. The shredding tissue and the sclerotia are diagnostic of the disease. Plants from small corms or cormels are more susceptible to neck rot than those from larger corms.

Neck rot may move down to the corms, turning black the point of leaf attachment on the corms. Eventually, small to large brown or black sunken lesions may develop on the upper surface of the corms, mainly along the lines of husk attachment. Husks may have circular brown spots, but the corm decay usually remains too insignificant to notice. As a result, infected bulbs are frequently planted, spreading the disease.

Roots may also become infected. The cortex, or "bark" of the roots, sloughs off readily, so you must dig the roots carefully for proper examination.

The dark brown, rotting roots often have the pimple-like black sclerotia described above, providing positive identification in the field. Root rot may also cause poor flower production and plant death.

You could easily confuse Stromatinia with Fusarium disease. For more information, see publication A2600, *Gladiolus* (Gladiolus hortulanus)—*Disorder: Fusarium Yellows and Bulb Rot*. Since control methods differ for the two diseases, positive identification is helpful for proper treatment. Sclerotia are not formed by Fusarium, which frequently causes more intensive decay of the corms. A third disease occasionally encountered in Wisconsin is bacterial scab, which often produces a wet, brown or black rot near the soil line. In the event you need diagnostic assistance, carefully collect diseased leaf, corm and/or root tissue and take it to the county Extension office for examination or submission to a disease diagnostic laboratory.



(1) Dry rot symptoms on the lower stems include darkened and shredded tissue. (2) The most diagnostic characteristic is the large number of minute black structures (sclerotia) embedded in the affected tissue near the soil line. (3) When corms show infections, look for dark, sunken "dots" concentrated along the nodes. (See arrow.)

Cause

Fungus—Stromatinia *(Sclerotinia)* gladioli

The fungus survives for many years in the soil as dormant sclerotia, or resting structures. The fungus is spread by diseased corms. Acidanthera, Crocus, Freesia and a few other related plants are also susceptible and have been observed infected in Wisconsin.

Severity and Distribution

Stromatinia is a rather common disease of glads in Wisconsin, having been observed in most parts of the state. However, its development is greatly influenced by weather patterns. Periods of extended cool, wet weather are necessary for the development of the disease. Although the disease is not considered as serious or prevalent as Fusarium, it occasionally can be very damaging.

There is some evidence that glads planted in sandy soils are more Stromatinia-prone than those in heavier soils.

Individual plants along the row show symptoms when the source of inoculum is infected corms or cormels. The fungus can spread from plant to plant through the soil quite readily. If the soil is infested, entire blocks of plants die abruptly during weather periods favorable to the disease. Large plants may recover from a brief infection and produce respectable flowers.

Control

Amateur glad producers with Stromatinia problems may be able to control the disease satisfactorily with cultural measures. Commercial producers, particularly those producing corms for sale, will probably need to use a combination of cultural and chemical measures.

Cultural

Rotation of the garden or production site is one of the best ways to prevent buildup of the disease. Ideally, you should not grow gladiolus in the same location more than once in every 4 to 6 years.

Select disease-free planting stock, particularly for gardens or fields where the disease has not already been introduced. Larger bulbs are less likely to be badly damaged by the disease, especially if you plant them at a time when the soil temperature is likely to remain above 70° F during the first 6 to 8 weeks. Planting in warm soil, then, is an additional means of reducing effects of Stromatinia disease.

If you find a diseased plant, it may help to carefully dig it out and also remove the surrounding soil from the garden.

Hot Water Treatment

Commercial or serious producers who want to make sure planting stock is disease-free should consider hot water treatment of small corm or cormels, a system developed and used with considerable effectiveness in Florida. However, you can injure the planting stock unless you follow directions closely. Only cormels or small corms can be treated safely. Perform trial treatments before you treat substantial quantities. Hold (cure) the cormels and small corms at 70-82° F for 8 to 10 weeks after harvest. Then soak them in running water for 2 days. Discard those which float. Then submerge the wet cormels for 30 minutes in water held at 127-128° F. Add a fungicide such as benomyl (Benlate) + captan to the hot water to obtain control of Fusarium disease. Cool and dry the cormels in thin layers in clean trays. Store at 39-50° F until 1 to 3 weeks before planting time. Allow the cormels/corms to warm before planting.

Chemical

Where long rotations are not feasible, you may fumigate infested soil to reduce or eliminate the fungus, if desired. Special directions for soil fumigation are contained in publication A2612, *Selecting and Using Chemical Fumigants and Soil Sterilants for Seedbed and Garden Disease Control.* Follow directions closely for treatment and subsequent planting. For 2 weeks prior to fumigation, moisten and prepare the soil as for planting.

Two soil fungicides are registered and have some effectiveness against Stromatinia disease. Pentachloronitrobenzene (Terraclor) either rotary-tilled after broadcasting before planting, or placed in the row at planting, can be used instead of soil fumigation. Or, treat the planting stock and row with dichloran (Botran) according to the manufacturer's directions on the label.

Botran acts as a barrier to the spread of the disease from one corm to another through the soil. Neither chemical will eradicate the fungus from infected stock, but they should be effective in protecting large corms sufficiently for flower production.

A third fungicide, Benlate, is registered as a gladiolus corm dip, though for different diseases. Its use may be helpful in stopping dry rot disease, too. Suggestions for use are on the label.

References to pesticide products in this publication are for your convenience and are not an endorsement of one product over other similar products. You are responsible for using pesticides according to the manufacturer's current label directions. Follow directions exactly to protect the environment and people from pesticide exposure. Failure to do so violates the law.

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A2759 Gladiolus *(Gladiolus hortulanus)* and Related Plants • Disorder: Stromatinia Disease, Dry Rot, Neck Rot (1986)

25¢

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R-05-86-2M-S

Plum, Cherry, Apricot and Peach Pest Management for Home Gardeners

D.L. Mahr, S.N. Jeffers, and T.R. Roper

General Suggestions

Improve stone fruit pest management by keeping trees pruned and orchard and fence rows free of brush and trash.

Mix together the fungicides and insecticides listed in the Spray Schedule and apply at one time. Be sure to read the directions and all precautionary statements on pesticide containers.

Harvest intervals (time between last application and harvest) are listed on product labels.

NOTE: In case of accidental poisoning from pesticides, call your doctor immediately. Be sure that the pesticide label or labeled container is given to the doctor.

Special Directions

If **brown rot** is a problem (generally fruit rots before ripening), spray with captan or benomyl 50% WP at full bloom stage. Collect and bury peach and plum mummies (rotted and dried fruits) to reduce brown rot.

If **black knot** is prevalent on plums, prune and burn all infected branches.

In addition to preharvest sprays, a postharvest fungicide spray is sometimes necessary to control **cherry leaf spot** and prevent defoliation. Spray right after harvest with 1 tsp benomyl 50% WP plus 1 tbsp captan 50% WP per gallon of water.

Control **peach leaf curl** with a spring or fall dormant spray using liquid lime sulfur (1 qt/5 gal water), dry lime sulfur (1 lb/5 gal water) or Bordeaux mixture (3 oz copper sulfate plus 3 oz hydrated lime per 5 gal water).

If no dormant spray was applied, **aphids** may be prevalent. Use malathion (2 tbsp 25% WP/gal water) or nicotine sulfate (2 tsp plus 5 tsp dissolved soap/gal water) when aphids first appear. Approved insecticidal soaps available in many garden centers also effectively control aphids.

Reduce **peachtree borers** and **lesser peachtree borers** by spraying or painting the trunks and lower limbs with Dursban about July 1 to 10. Follow label directions on rates and limitations. University of Wisconsin research has shown that asphalt-based tree wound paints effectively reduce borer problems. Carefully clean any existing wounds—such as winter cracks, lawn mower injury or borer sites—down to sound wood and then thoroughly paint them with tree wound dressing as soon as weather conditions allow. Treat fresh wounds as soon as they occur.

Weed Management

Weeds or other vegetation are not typically thought of as pests, but they may reduce yields and fruit quality by competing for light, water and nutrients, and they may also harbor insect or disease pests. Keep a vegetation-free area of two to three feet in radius around each tree.

Vegetation may be controlled either mechanically or chemically. Mechanical methods include shallow (1-2 inches) cultivation every few weeks with a sharp hoe or shovel, being careful not to damage the trunk or roots. A mulch of shredded leaves, wood chips, sawdust, straw, or other organic materials that will stop weeds may also be used. Do not mound mulches up around the trunk. Apply them in a "donut" fashion around the trunk. Mulches need to be renewed each year to remain effective.

Chemical herbicides are registered for use on specific crops. Crop information is given on the label. For controlling weeds that are already growing, apply glyphosate. Glyphosate kills actively growing annual and perennial weeds. It is a non-selective, non-residual herbicide and will kill desirable plants as readily as weeds. It is selective only through selective application. Before spraying glyphosate, thoroughly wrap trunks of young trees with plastic wrap or aluminum foil. Remove and discard the wrap shortly after treating. Glyphosate must be used according to label directions.

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Suggested Spraying Schedule

When to spray	Pests	Material per gallon water*
Dormant—before growth in spring	Aphids, mites, peach leaf curl, black knot	1 cup lime sulfur (liquid)
At petal fall—when 90% of blossoms have fallen	Brown rot, curculio, eyespotted bud moth, destructive prune moth, fruittree leafroller, redbanded leafroller	2 tsp benomyl[1] 50% WP; or 2 tbsp captan[2] 50% WP; *plus* 2 tbsp carbaryl 50% WP; or 2 tbsp methoxychlor 50% WP; or 3 tbsp Imidan 12.5% WP
10 days after petal fall	Brown rot, leaf spot, curculio, cherry fruitworm	2 tsp benomyl[1] 50% WP; or 2 tbsp captan[2] 50% WP; *plus* 2 tbsp carbaryl 50% WP; or 3 tbsp Imidan 12.5% WP
Continue to spray at 10- to 14-day intervals until fruit begins to ripen	Brown rot, leaf spot, cherry fruit flies, leafrollers	Same as 10 days after petal fall

*tbsp = level tablespoon; tsp = level teaspoon; WP = wettable powder.

[1] Although benomyl 50% WP can also be used as the fungicide for disease control in the remaining spray applications listed in the spray schedule, it is better to alternate the use of this with another fungicide such as captan to prevent possible buildup of resistant organisms. Benomyl has a 1-day re-entry period.

[2] Captan has a 4-day re-entry period.

Use Pesticides Safely

1. Check label directions and safety recommendations every time you use pesticides.
2. Keep pesticides in original, labeled containers in a place secure from children and animals.
3. Store in a place where the pesticide cannot be accidentally mistaken for food or cleaning products.
4. Put away or carefully cover all foods, dishes and utensils before spraying.
5. Don't smoke, eat or drink when using pesticides.
6. Keep people and animals away from places being treated.
7. Avoid unnecessary exposure when using pesticides.
8. Wash hands and face thoroughly with soap and water after using pesticides.
9. Triple rinse empty containers and throw them in the trash. Do not leave containers where children or animals can come into contact with them.

References to pesticide products in this publication are for your convenience and are not an endorsement of one product over other similar products. You are responsible for using pesticides according to the manufacturer's current label directions. Follow directions exactly to protect the environment and people from pesticide exposure. Failure to do so violates the law.

Authors: D.L. Mahr is professor of entomology, S.N. Jeffers is assistant professor of plant pathology, and T.R. Roper is assistant professor of horticulture, College of Agricultural and Life Sciences, University of Wisconsin-Madison and University of Wisconsin-Extension, Cooperative Extension. Produced by the Department of Agricultural Journalism, University of Wisconsin-Madison.

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A2130 Plum, Cherry, Apricot and Peach Pest Management for Home Gardeners — 1990 R-12-90-2M-15-E

A2127 URBAN PHYTONARIAN SERIES

Strawberry Pest Management for Home Gardeners

D.L. Mahr, S.N. Jeffers, and T.R. Roper

Chemical Pesticide Use

- When using sprays or dusts, apply enough to thoroughly cover the foliage including the undersides of leaves. Do not use dusts after berries start to ripen.
- Read and observe the directions and precautionary statements on each pesticide container.
- Mix all materials together and apply at one time.
- For specific chemical controls and timing, see the spray schedule on the back of this publication.

Weed Management

Keep plant rows narrow and free of weeds, because weeds not only inhibit growth by competing for water, light and nutrients, but they also harbor pests. Chemical weed control is not suggested for home strawberry gardens. The best weed control agent for strawberries is a sharp hoe and a strong back! Do not allow weeds to flower and set seeds or weed problems will get worse each year.

Mulch materials such as clean straw or shredded leaves may be used to control weeds between strawberry rows. If you use straw as a winter mulch, rake it between the rows in the spring after frost damage is past to keep berries clean and to inhibit weed growth.

Disease Management

As the best safeguard against disease, choose healthy plants grown from pathogen-free stock.

Apply fungicide sprays as broadcast applications on established plantings. Spray new plantings with one of the fungicides listed in the spray schedule at 10- to 14-day intervals, starting about 3 weeks after plants have been set out.

If you see **black centers on blossoms**, they are probably caused by freezing temperatures at or shortly before bloom, not by disease.

For **leaf scorch**, spray plants with benomyl or a copper fungicide 1 week after removing mulch in spring. Spray every 10 days until plants start to bloom, then switch to captan, benomyl or thiram. You can spray captan or benomyl up to harvest, and thiram within 3 days of harvest. Copper materials may cause foliage on certain varieties to turn slightly yellow.

To control **gray mold berry rot**, apply benomyl, captan or thiram when plants start to bloom and spray every 10 days. Apply thiram up to 3 days before harvest. You can spray with captan or benomyl during the picking season at 7- to 10-day intervals, applying immediately after a picking. Use benomyl only in combination with another fungicide.

Leather rot is a fungal disease that appears in some plantings. Infected berries have light to dark brown colored areas. Maturing berries show a "bleaching" effect resulting in shades of color from light lilac to purple, to nearly normal berry color. Infected fruit have a bitter flavor. Fixed (insoluble) copper sprays help control leather rot somewhat but mulching with marsh hay or straw under the plants and between the rows is probably the most effective way of reducing leather rot infections.

Note: Benomyl and captan products *may* have substantial re-entry periods. Check the label.

Insect Management

Unless certain pests are present every year in the garden, preventive sprays are not recommended on strawberries. However, carefully monitor your garden throughout the growing season to control pest problems which may develop.

If you are going to plant strawberries in areas previously in sod or weeds, first treat the soil with diazinon to control soil insects. Follow the label directions. Immediately after application, mix the insecticide with the upper 4 to 6 inches of soil.

Aphids transmit viruses that can reduce size and number of berries over the course of several years. Once production diminishes nothing can be done to improve it, and replanting with new virus-free stock is recommended. Plants can be protected from aphids with diazinon or malathion sprays.

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Suggested Spray Schedule

When to spray	Pests	Material per gallon water*
Just as first blossom buds appear in spring	Leaf scorch, leaf spot, leather rot[1]	1 tbsp. basic copper 45-53% WP; or 2¼ tbsp. captan[2] 50% WP; or 2 tbsp. thiram 65% WP; or 1 tsp. benomyl[3] 50% WP
	Aphids, spittlebugs, plant bugs, leafrollers, weevils	2 tbsp. methoxychlor 50% WP; ***plus*** 2 tbsp. malathion 25% WP
Every 10 days following first spray until blossoms appear	Gray mold, leaf spot, leaf scorch	Same as above; **do not use thiram closer than 3 days to harvest.**
	Aphids, plant bugs, leafrollers, weevils	Same as above
Every 10 days starting in early bloom until 3 days before first picking	Berry mold and rot, leaf spot	2¼ tbsp. captan[2] 50% WP; or 2 tbsp. thiram 65% WP; or 1 tsp. benomyl[3] 50% WP
		Do not apply insecticide during bloom.
Post-bloom: As soon as blossom petals fall and every 10 days until 3 days before harvest	Fungus diseases	Refer to those listed for first spray (above), and footnotes 1, 2 and 3 (below).
	Leafrollers, aphids, plant bugs	2 tbsp. methoxychlor 50% WP; ***plus*** 2 tbsp. malathion 25% WP

* tbsp = level tablespoon; tsp = level teaspoon; WP = wettable powder.
[1] Application of fixed (insoluble) copper sprays may help reduce leather rot infection. It is also effective against leaf scorch and leaf spot.
[2] Captan has a 4-day re-entry period.
[3] Benomyl is effective against leaf spot, Botrytis berry mold, powdery mildew and leaf scorch. Avoid using benomyl as the only fungicide during the season to prevent buildup of fungi tolerant to it. Benomyl has a 1-day re-entry period.

There is no effective chemical approved for use in Wisconsin that gardeners can use to control **cyclamen mites.** If you have cyclamen mites, pull up the strawberry plants and replant the following spring. See Extension publication A2059, *Growing Strawberries in Wisconsin*.

For **spider mites**, you can use insecticidal soap, malathion or diazinon. Follow label instructions carefully.

To control **slugs**, use a prepared bait containing metaldehyde or Mesurol.

Remove overripe or damaged fruit from the garden that attracts **sap beetles** (small black beetles with orange markings). Control sap beetles with carbaryl (Sevin) 50% WP, using 2 tbsp/gal water. Do not harvest berries for at least 1 day after application. You can prepare a sap beetle attractant by mixing 3 qt dark corn syrup, 2 qt water and 1 cake yeast. Place the mixture plus a small amount of insecticide in cans outside the strawberry planting.

Postharvest Sprays: Use any of the insecticide-fungicide sprays listed in the spray schedule. Apply about Sept. 1 and Oct. 1 to reduce insect and disease buildup.

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