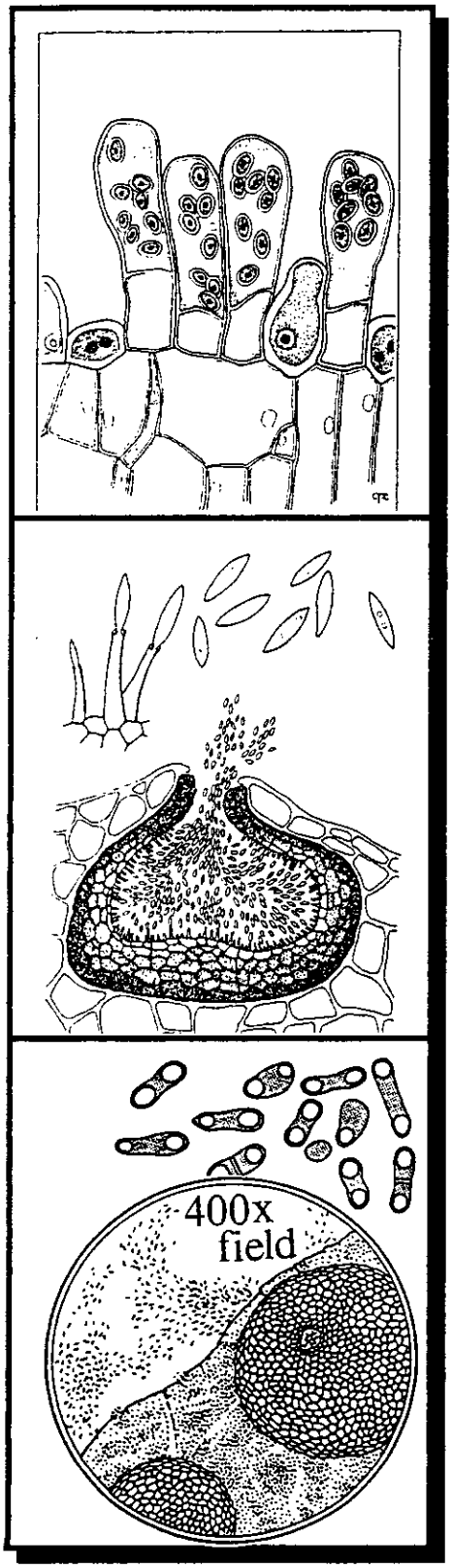
March, 1995
Volume XVI Number 1



PLANT DIAGNOSTICS QUARTERLY

Features

1995 PDQ Cooperating Reference Pathologists

Diagnosis of Bacterial Blight of Geraniums

On the cover: (top to bottom)

Taphrinic deformans
Stylized *Phomopsis* sp.
Phoma lycopersici
Courtesy of Merald Clark

Plant Diagnostics Quarterly (PDQ) is a nonprofit publication which serves plant pathologists in extension, regulatory and industrial clinical laboratories, private consultants, and other interested persons. PDQ is published four times a year. Yearly subscription fees are:

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Volume XVI, Number 1
March, 1995

PLANT DIAGNOSTICS QUARTERLY

FROM THE EDITOR

The 1995 first issue of PDQ is finally out and I am struck with an overriding sense of "déja vu". I am facing a featureless second issue unless I sit down and generate another article. Why not? I can't possibly be as busy as everyone else!....

Believe it or not, we in Florida do have a small measure of agriculture, a modest diagnostic facility and occasionally a recognizable Extension program effort. There are times (like now) that I can barely stay afloat like some of the rest of the PDQ readership. What I suggest is that some of the readers re-examine their "hardships" that seem to prevent authoring a feature article. Perhaps they will realize that many diagnosticians have the same "hardships", heavy workloads, and an impossible onslaught of activities to perform. Somehow, it all seems to get done plus a few more unscheduled tasks. PLEASE volunteer for a feature topic SOON. It does not look like I'll be attending APS in Pittsburgh this year, so you will not be badgered by me in the Diagnosticians' Reception. So .... consider yourself badgered now. I need some articles for the rest of the year.
Call (904) 392-1795, FAX (904) 392-3438 or electronic mail IN%"EXTPPCLINIC@GNV.IFAS.UFL.EDU".

Thanks

Gary W. Simone, Editor

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Guidelines to Contributors

Submission Format

Articles are preferred submitted on diskette (5.25 or 3.5) -- especially the longer Feature Articles. Electronic submission will allow greater consistency among type fonts and sizes and improve the appearance of the publication. We use Word Perfect 5.1 on IBM hardware, but have the capability of converting most word processing software. Please send a copy of the article on the software you use (be sure to identify the software); please also send an ASCII file to use in case we have problems with the conversion. Label disks with your name and address and job file name. All disks will be returned. Please include a hardcopy printout as well.

Articles will also be accepted in a hardcopy format by surface mail or FAX. Where secretarial time allows, shorter articles will be retyped. Longer articles, however, may be used camera-ready. Please follow the Manuscript Format instructions that follow.

Manuscript Format

The title of the article is printed in bold letters (mixed case), is placed 1 1/2 inches from the top of the page, and is centered. Skip one line then center your name, then center the institution of your affiliation on the following line. Your name and affiliation should be printed in mixed case.

The top margin will be 1 1/2 inches on the first page and 1 inch for each page thereafter. One inch margins should be used on the remaining sides. Page numbers should be lightly pencilled in at the bottom of each page.

Paragraph or section headings should be in bold print or underlined. Skip the next line and then begin the paragraph; paragraphs are separated by blank lines.

Lines are single-spaced. The article should be printed on a letter quality printer or typewriter; dot printing will not reproduce well and should be avoided.

Latin binomials should be italicized rather than underscored if possible.

Length

Feature articles should be a minimum of 5 pages. Aside from this limitation, articles may be of any length as long as they remain focused on the topic selected.

Illustrations

Our ability to reproduce illustrations is limited; line drawings reproduce most faithfully. Original black and white photographs (prints only) may be used if they are of high quality. Illustrations should be mounted on a separate page, with their captions mounted below.

Fact Sheets

Contributed Fact Sheets from states extension/research units or other agencies for inclusion with PDQ are gratefully accepted. Send two (2) originals to Gary W. Simone (Editor) for appropriate listing in the next issue. If sufficient copies of the publication are available, send 225 copies to Gail Ruhl -- Managing Editor so that they can be compiled with the issue.

References

Use at your discretion. If articles are referred to in the text, please cite them at the end of your article using a standard format such as that used in Plant Disease. If references are not cited, related articles may be listed under the heading "Bibliography".

Plant Diagnostics Quarterly (PDQ)

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Please limit following information to 5 lines.

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DIFFUSION

Compiled by Melodie Putnam

Index of plant hosts of *Sclerotinia sclerotiorum*. G.J. Boland and R. Hall (Univ. Guelph, Ontario) have compiled from published reports a host list for *S. sclerotiorum* comprising 408 species, 278 genera and 75 families. Canadian J. Plant Pathology 1994, 16:93-108.

Transfer of *Pseudomonas plantarii* and *Pseudomonas glumae* to Burkholderia as *Burkholderia spp.* and description of *Burkholderia vandii* sp. *nov.* In 1992 Yabuuchi et al. (Microbiol. Immunol. 36:1251-1275) proposed the erection of the new genus Burkholderia and transferred to it *Pseudomonas cepacia, P. mallei, P. pseudomallei, P. caryophylli, P. gladioli, P. pickettii,* and *P. solanacearum* (= members of Pseudomonas rRNA group II). Placement of these species in the new genus was supported by the current work, reported by T. Urakami (Biochemicals Div., Mitsubishi Gas Chem. Co., Shibaura, Tokyo) et al. Five of the species mentioned above, as well as 5 unnamed isolates obtained from orchid roots, and past and present members of the genus Pseudomonas were examined. Compared were morphological, biochemical, and physiological characters; fatty acid composition; DNA base composition; DNA-DNA hybridization; and production of and resistance to antibiotics. Members placed in the genus Burkholderia differed from Pseudomonas species in physiological characters and cellular and hydroxy fatty acid composition. Two plant associated (not pathogenic) pseudomonads were moved to the new genus as well. International J. Systematic Bacteriology 1994, 44:235-245.

A papillate Phytophthora species with specificity to Rubus. D. M. Kennedy and J. M. Duncan (Scottish Crop Research Inst. [SCRI], Invergowrie, Dundee, UK) evaluated the morphology, physiology, protein patterns, and pathology of a papillate *Phytophthora sp.* found widely distributed in raspberry stocks at the SCRI. The species was compared to other Group I Phytophthora species as well as *P. citricola* and *P. syringae,* which are both known to attack raspberry. The papillate species could be distinguished from named species on all criteria examined. It was concluded that the papillate isolates from raspberry represent a new species which has been named *Phytophthora idaei sp. nov.* Mycological Research 1995, 99:57-68.

Ophiostoma himal-ulmi sp. nov., a new species of Dutch elm disease fungus endemic to the Himalayas. Another species of *Ophiostoma* has been found to cause "Dutch elm disease". C. M. Brasier (Forest Res. Sta., Farnham, Surrey, UK) and M.D. Mehrotra (Fores t Res. Inst., Dehra Dun, India) have surveyed northern Himachal Pradesh in the western Himalayas in an effort to determine the origins of Dutch elm disease. A fungus similar to *Ophiostoma* was isolated from inner elm (*Ulmus wallichiana)* bark around scolytid breeding galleries and from frass. The isolates obtained were crossed with *O. ulmi* and *O. novo-ulmi* to determine relatedness. The Himalayan isolates exhibited unique physiological and morphological characteristics and were found to be reproductively isolated from *O. ulmi* and *O. novo-ulmi.* The Himalayan isolates had moderate to strong ability to cause vascular wilt of *U. procera,* comparable to *O. novo-ulm* in virulence. This is interesting as the authors found no evidence

of wilt disease in the elms of the region of the Himalayas surveyed; *O. himal-ulmi* may be mainly confined to a 'bark to bark cycle'. Speculation on the origins of Dutch elm disease include the following: all three species are of ancient affinity; *O. novo-ulmi* has evolved directly from *O. himal-ulmi* as a result of the latter's accidental introduction to Europe; or that, following such an introduction, *O. himal-ulmi* hybridized with resident *O. ulmi* to give rise to *O. novo-ulmi*. Mycological Research 1995, 99:205-215.

REGIONAL REPORTS

NORTHEAST REGION

Richard J. Buckley and Ann B. Gould

The new growing season has arrived. It seems that we have had a very mild winter. In New Jersey, everyone is already out in the landscape, and the samples are flying, unimpeded, into the diagnostic laboratory. Help! The reports for this quarter go something like this .....

.... on vegetables

This winter, the Cornell laboratory diagnosed several samples of late blight in potato tubers. More are expected. Bob Mulrooney in Delaware has been spending a lot of time preparing for possible problems with late blight. He has not had any infected tubers to date, but he is establishing weather stations to help predict late blight outbreaks in Delaware's 6000 acres of potato production.

In Connecticut, serious outbreaks of powdery mildew were diagnosed in greenhouse tomatoes for several commercial growers. Another spring tomato crop was destroyed by SO_2 from a cracked furnace. Rob Wick in Massachusetts came across yellow and stunted alfalfa sprouts that were infected with *Pseudomonas chlororaphis*. This bacterial disease is, apparently the most common problem of alfalfa sprouts. Rob said he would be happy to take referrals on the subject. In Delaware, difficulties of note include Cladosporium leaf spot and seed corn maggot in overwintering spinach.

The Rutgers diagnostic laboratory received an excellent case of sour skin of onion, caused by the bacterium *Pseudomonas cichorii*. The onions, shipped from Uruguay, were apparently not handled properly in transit. Several days after we received samples from the importer, we began to get them from a supermarket chain. Sour skin is an excellent name for this post-harvest disease -- it took a couple of weeks for the smell to dissipate from our lab!

.... on fruit

Sharon Douglas mentions that Leucostoma canker on Rome apples has resulted in a fairly extensive dieback of leaders and branches. White rot of sapwood, caused by *Schizophyllum commune,* was common on Cortland and Rome apples in Connecticut and was also on unidentified varieties in Pennsylvania. Further apple problems in Pennsylvania were caused by *Botryosphaeria* and *Phomopsis*.

.... on herbaceous ornamentals (and there were a lot of these!)

On Long Island, many geraniums have been brought to the laboratory and were diagnosed with Verticillium wilt, geranium rust, and bacterial blight. Bacterial blight of geranium is still

a problem in Connecticut. The variety 'Tango' was the common culprit. In New Hampshire, the main geranium problems occurred in cuttings shipped from the Canary Islands; two large growers lost stock to Botrytis cutting rot. The New Hampshire report also mentions that Thielaviopsis root rot is showing up on more than a few geraniums. The disease appears to be more common in artificial planting media. At Cornell, Thielaviopsis root rot appeared on poinsettia and viola plugs. Bacterial fasciation of geranium, caused by the bacterium *Rhodoccocus fascians*, was confirmed in the New Jersey laboratory just yesterday. The grower uses a soil-based mix, and we suspect that the mix is the source of inoculum.

The only freesia grower in New Hampshire continues to have problems with Fusarium wilt. He steam sterilizes the beds between crops, so the bulbs are the suspected inoculum source. Tulip bulbs infected with *Botrytis* and *Penicillium* were identified in the Rutgers laboratory. John Peplinski (Penn State) reports that Alternaria leaf spot and bacterial blight (*Erwinia chrysanthemi*) were identified on chrysanthemum. Other greenhouse problems throughout the region included Pseudomonas leaf spot on gerbera and double-flowered impatiens, Cercospora leaf spot on pansy, downy mildew of snapdragon, *Fusarium* on carnation and cyclamen, Ramularia leaf spot of Ranunculus, and powdery mildew on pansy and florist's hydrangea. Pythium and Rhizoctonia root and crown rots were mentioned by everybody on one plant or another.

In New Jersey, we have been inundated with samples of spray burn on several different types of plant material. In Connecticut, ivy geraniums appeared crinkled and distorted following the misuse of granular trifluralin applied to soil under benches in a greenhouse. Bob Mulrooney reports that WP formulations of Orthene and Kelthane caused phytotoxicity in a greenhouse of mixed plant species. What is with these guys? Maybe we need a little more pesticide training in our states. Oedema on ivy geranium and fluoride injury on Easter lily were other abiotic problems diagnosed this period.

Who would have guessed that impatiens necrotic spot virus and/or tomato spotted wilt virus have been reported by almost every laboratory in the region! Agdia just gave us a pretty nifty test kit that is designed for testing six samples at a time! They hope to market the kits to growers. The INSV/TSWV host list includes: *Ranunculus, Anemone, Cineraria,* impatiens (both types), Surfinia petunia, *Primula, cyclamen,* begonia, snapdragon, pocketbook plant, peppers, *Senecio cruentus*, and chickweed. Yes chickweed. Rob Wick reports that symptomless chickweed was found growing on the floor of a problem greenhouse. Although there were no distinct, there were plenty of thrips. The New Hampshire laboratory is anxiously awaiting the confirmation of the virus in fuschia and exacum.

Margery Daughtrey reported that *Pythium irregulare* was causing black streaks on stems and petioles of New Guinea impatiens. Let's hope that this does not lead to any misdiagnosed virus problems! Other virus diseases of note include: Cymbidium mosaic virus on an Epidendrum orchid in the University of New Hampshire greenhouse, and cascade petunia 'Casablanca' with AMV and PVY in New York.

.... on woody plants

Diane Karasevicz is continuing to get samples that have been diagnosed as "boxwood decline". In her samples, the symptoms generally appear as a necrotic streaking of the vascular tissue in the roots and in the crown area. It appears as if this leads to the decline of the plant. She suggests that she is consistently isolating the same unidentified fungus. Can anybody help her?

In Connecticut, Sphaeropsis tip blight is still causing extensive dieback of pines. In Connecticut Christmas trees, Rhizosphaera needlecast is common in spruce, and Rhabdocline is showing up in a number of plantations. In New Jersey, we have had several cases of Rhabdocline needlecast submitted to the laboratory, and Ann Gould visited a Christmas tree plantation this week that was loaded with the disease. Beautiful Rhabdocline needlecast is also quite common in Pennsylvania. Apparently, last spring was especially kind to this troublesome fungus.

Bob Mulrooney has had several samples of sooty mold on beech twigs that resulted from colonies of wooly alder aphids. We had the same sooty mold in New Jersey in December.

In container grown plants, bacterial leaf spot caused by *Xanthomonas* was reported from Connecticut on cherry laurel. In New Jersey, Helleri holly plants from an overwintering house were severely damaged by *Botrytis*. *Botrytis* also caused extensive dieback and tip blight of Boulevard cypress.

.... on turf

In New Jersey, the usual compliment of pink snow mold (*Microdochium nivale*) and yellow patch (*Rhizoctonia cereallis*) were submitted from golf course greens. Cheryl Smith has begun receiving samples of pink and gray snow mold, but nowhere near the volume of last winter. Gail Schumann says that not much is happening in Massachusetts' turf.

.... of particular interest

Margery Daughtrey is puzzled by unidentified galls on *Ilex helleri* associated with yellowing and severe stunting. The problem is not crown gall, supposedly, and seems to pop up fairly often in the industry. Tests for dsRNA at Ohio State were negative. Comments?

Slime mold on the lower leaf surface of New Guinea impatiens. Sounds like a bit of a humidity problem. One to three inch, black, chewed up wood fragments in a boat? Green, crystalline material in the same boat? Entomological, I presume.

.... questions

Has anyone noticed strapped leaves accompanied by white variegation in pansies from

southern states? Margery Daughtrey observed this phenomenon on multiple cultivars in plug trays or after transplanting.

Diane Karasevicz is interested in finding out about record keeping software for her clinic. Is anybody using PClinic with success?

.... one more question

Can you say peridioles (again)? Siding damaged by *Sphaerobolus* is being replaced by several insurance companies, under the assumption that the damage was done by an insect. Apparently they will not replace siding that is "moldy". Are peridioles a mold? What is your opinion?

Thanks to everyone who tried the internet this time. Diane Karasevicz thinks the northeast region should communicate regularly by E-mail and we concur. Let us know if you are interested.

SOUTHEAST REGION

Jackie Mullen

Winter was especially mild in most parts of the Southeast this year. Cold damage on landscape plantings may be reduced in comparison to many years, but occasional freezing (and subfreezing) temperatures of January-February and of March 8-10 in the northern half of the Southeast has caused some damage.

In KENTUCKY, Brian Eshenaur and Paul Bachi reported on bacterial blight of geranium, impatiens necrotic spot virus, orchid viruses, winter injury, and Sclerotinia stem rot of alfalfa and red clover. Bacterial blight on geranium was confirmed in two separate cases. In one case the characteristic leaf spotting was not apparent, but in both cases a systemic wilt was present. Impatiens Necrotic Spot Virus has been confirmed on greenhouse grown cyclamen, impatiens, new guinea impatiens, phlox and primrose. Virus infections were confirmed via electron microscopy on some recent orchid samples. Infected plants exhibited mosaic type coloration patterns in the younger leaves. They also reported winter injury on a few types of landscape plants. Even though the winter temperatures were on the mild side, some plants such as rhododendrons and boxwoods were affected by the fluctuations in temperature. The symptoms of winter injury included leaf scorch and dieback. Sclerotinia stem rot on alfalfa and red clover plantings was also noted.

In TENNESSEE, Beth Long noted diseases of landscape ornamental, greenhouse/commercial turf/nursery settings, field crops, and vegetables. With landscape ornamentals, Phytophthora root rot was found on many types of plantings including boxwood, holly, juniper, yew and rhododendron. Black root rot was commonly found in Japanese holly plantings. Also, Seiridium canker (*Seiridium cardinale)* was found on Leyland cypress in Hamilton county (Chattanooga) by Dr. Alan Windham. This is a new state record in Tennessee. Common

homeowner problems included anthracnose on English ivy, Entomosporium leaf spot on photinia, crown gall on euonymus, Volutella blight on pachysandra and boxwood, and black knot on plum and cherry trees. With greenhouse/commercial turf/nursery ornamentals, Pythium root rot was isolated on a wide variety of greenhouse bedding plants. In addition to Pythium root rot, black root rot and Phytophthora crown rot have been found in greenhouse pansies. Tomato spotted wilt virus (Impatiens necrotic leaf spot) has been found on various greenhouse bedding plants across the state. TSWV-L was found four times in greenhouse crops (vs. 20+ positives for TSWV-I). Nursery problems included Phytophthora root rot on many ornamentals (especially boxwood, holly, juniper, yew, and rhododendron) and black root rot on Japanese holly. With field crops/commercial vegetables, powdery mildew on wheat was unusually heavy this early spring. Dr. Melvin Newman, field crops plant pathologist, says that this is the most severe episode of powdery mildew in wheat in the last 20 years in Tennessee. Other problems in wheat included barley yellow dwarf virus. Also, a lot of *Septoria nodorum* (glume blotch) is already developing on the lower leaves. Pythium root rot and high soluble salts have been early problems on tobacco float bed seedlings. Beth also reported still seeing a lot of Sclerotinia crown and stem rot on alfalfa and clover, especially in fall seeded fields.

In ARKANSAS, Stephen Vann reported a significant increase of wheat diseases as compared to the same period last year. As a result of the mild winter, the aphid population was quite high during February and March resulting in a high incidence of barley yellow dwarf virus (BYDV) across several wheat varieties. Typical purple tipped-yellow stunted plants were common through many fields in the state. Powdery mildew *(Erysiphe sp.)* was also widespread. Cool damp environmental conditions contributed to the high incidence. Normally, powdery mildew has been considered a low priority disease; however, levels of the disease this spring are prompting growers to consider fungicide treatments. Leaf rust is common throughout the state, especially on the varieties Saluda and Wakefield, where pustules are commonly observed on the flag minus 2 leaf. Septoria leaf blotch is also prevalent in Arkansas where levels are also expected to rise as the wheat crop approaches maturity. Overall disease pressure is expected to be greater this growing season compared to 1994. Preparations are underway for the rice crop in many areas of the state. The diagnostic lab expects to see more root and stem diseases due to cool soil temperatures and frequent showers. Winter injury manifested as twig and foliage blights has been observed on many woody ornamentals such as azaleas, aucuba, and gardenia. Despite the cold conditions which existed in January and February, spring colors abound in the Natural State.

In NORTH CAROLINA, Tom Creswell reported samples numbers were up about 5% over this time (April 5) last year and they had received 972 samples by the end of March. With field crops, tobacco seedlings from greenhouse float tray hydroponic systems were diagnosed with Pythium and Rhizoctonia damping-off, Sclerotina stem rot, target spot (Rhizoctonia) and numerous cultural problems. With small grains, oat red leaf, barley yellow dwarf, powdery mildew, wheat spindle streak and powdery mildew were the most common problems. In the tree and woody ornamental category, Phytophthora root rot and root rot symptoms were common on Fraser fir sent from the commercial Christmas tree areas. Many of the seedling and line-out beds received heavy rains and some were flooded this winter/spring. Cytophoma was identified

causing a canker on Ash. Several Indian hawthorn samples had Entomosporium leaf spot or another similar but unidentified fungal leaf spot. Secondary leaf spots, normal senescence of older broadleaf evergreen leaves and cold injury have generated numerous samples. Crown gall was seen on rose and weeping willow. With herbaceous ornamentals, black root rot *(Thielaviopsis)* was noted on astilbe, pansy and lupine; anthracnose on hellebore, ludovia and English ivy. Penicillium blue mold was found on Dutch iris and amaryllis bulbs. Leaf withering (*Fusarium* and/or *Trichoderma*) was found on 2 tulip samples. Downy mildew and Rhizoctonia stem rot have plagued a couple of growers of snapdragons for bedding plants and cut flowers. Heavy losses to bacterial blight were experienced by one geranium grower while edema, Botrytis stem rot, Pythium root rot and cultural problems were responsible for most of the damage on other geranium sites. Fruits and vegetable problems included strawberries with angular leaf spot (*Xanthomonas*), anthracnose, common leaf spot, and powdery mildew. Sclerotinia disease was found on rape; downy mildew on cabbage; and black mold (*Aspergillus niger)* on onion. Pythium root rot, fertilizer injury and powdery mildew were identified on lettuce from a hydroponics grower in Puerto Rico.

James Blake in SOUTH CAROLINA reported ornamental, turfgrass, and vegetable diseases. He noted unusual ornamental diseases included viburnum with downy mildew; daphne with Phytophthora root rot, fasciation, unknown galls; lobelia with impatiens necrotic spot virus, Botrytis blight; Loropetalum with Phomopsis canker; forsythia with Phomopsis gall; and solidago with rust. Some other ornamental disease samples seen were wax myrtle with Septoria leaf spot, Phytophthora root rot; white pine with Botryosphaeria and Phomopsis cankers; Japanese holly with black root rot, Botryosphaeria and Phomopsis cankers; Chinese holly with *Pseudomonas syringae* associated with spine spots; arborvitae with Sphaeropsis canker/dieback; and podocarpus with Botryosphaeria and Phomopsis dieback. With turfgrass samples, James noted *Poa trivialis* with yellow patch. Vegetable diseases included rosemary with Phytophthora and Pythium root rots; Austrian winter pea with Ascochyta leaf and stem spot.

Wakar Uddin and Julie Balsdon in GEORGIA noted diseases seen in the Commercial Clinic and the Homeowner IPM Clinic. Commercial Clinic: Pythium root rot was prevalent in the greenhouse industry during the past winter. Some shipments of begonias and vincas in plugs from original suppliers showed high disease incidence and severity. Pythium root rot on pansies also continued to be seen throughout the winter. Fusarium blight was diagnosed on some turf species following periods of warm days in February and March. In fruit crops, infection of peach by *Phomopsis sp.* (twig blight) occurred in March during the flower bud break and the level of disease incidence varied with the cultivar. Moderate to high disease incidence of this primary infection of susceptible cultivars is likely to cause significant loss of twigs and some tree decline at the end of summer, particularly after the secondary cycle. (W. Uddin) Homeowner IPM Clinic: Insect samples provided most of the interest in the Homeowner Clinic over the last quarter. Disease samples consisted primarily of leafspots common to their respective host plants--nothing unusual to report. We are starting to see problems associated with spring weather conditions: spot anthracnose and Botrytis petal blight on dogwood blossoms, warm-season turf samples with no associated disease organisms but showing symptoms, nonetheless, as they begin to come out of dormancy. (J. Baldon)

In FLORIDA the disease report was compiled by Richard F. Cullen/Gary W. Simone and includes disease information from the Gainesville lab and also the Homestead and Quincy Labs.

In early February a county agent submitted a tomato sample from a greenhouse located in north central Florida. He suspected it had powdery mildew. The specimens had typical powdery mildew symptoms, i.e. superficial white circular blotches on the leaf surfaces. These blotches were observed on both leaf surfaces, petioles and stems in the growers greenhouses. Having seen the powdery mildew *Leveillula taurica/Oidospsis taurica* once before on a tomato sample in Florida, the initial opinion was this is what it would be again. However, upon microscopic examination it became apparent this was not the case. Based on the taxonomy of the conidial, state this powdery mildew was identified as the *Oidium sp.* state of *Erysiphe sp.* Infection has only occurred in the greenhouse on the tomato varieties Trust and Jumbo. The fungus was successfully inoculated back onto Trust, Solar Set, and Bonnie Best tomato varieties in the initial host range test. These were the only tomatoes in this test. The occurrence of an *Oidium sp.* on tomato represents the first U.S. report of this disease.

Another disease that has garnered much attention from growers, county agents, seed companies, and diagnosticians is watermelon fruit blotch (WFB). Many of the watermelon seed suppliers are again selling seed to growers in FL, i.e. growers who will sign a disclaimer. Seed companies are growing out 30,000 to 50,000 seeds per lot to assay for WFB to assure clean seed. WFB has not been diagnosed in this early growing season. However, diagnosis of the WFB bacterium has become more complicated with the report of a closely related bacterium that has all the physiological characteristics of the WFB bacterium but it does not produce fruit symptoms. There are two ways to differentiate these organisms. One methods is fatty acid analysis and the other is differential pathogenicity reactions. Watermelon seedling hypocotyls are inoculated by piercing with a toothpick which has been dipped in the bacteria to be tested. The WFB bacterium produces a rapidly expanding lesion whereas the closely related non-WFB bacterium produces a local lesion.

The use of native species in the landscape has been promoted as almost culturally care-free, pest-free, and pathogen-free. However, with the widespread use of wax myrtle in the landscape, we have seen a corresponding increase in wax myrtle samples and diseases. There has been significant damage done by the wood- decaying, canker producing, dieback fungus *Inonotus rickii (anamorph:Ptychogaster cubensis)* associated with pruning of wax myrtle. Another disease of interest on wax myrtle in this reporting period was the isolation of *Xylocladium sp.* state of *Hypoxylon sp.* from stem dieback.

The Forth Annual Virus Inclusion Workshop was hosted by the plant disease clinic in Gainesville this winter quarter. All nine spots for the workshop were filled and a waiting list for the fifth workshop was started. Fifteen viruses from eight virus groups were available for study, as well as, mycoplasma and Xylella-incited diseases.

Bob McMillan Jr. of the plant disease clinic in Homestead, FL reported: 1) the number of Bean Golden Mosaic Virus infected snapbeans is low this season due to a *Paecilomyces sp.*

attacking the vector *Bemisia argentifolia,* 2) epiphytotic of *Drechslera sp.* on *Chrysalidocarpus lutescens,* 3) epiphytotic of *Xanthomonas campestris* pv. *malvacearum* on *Hibiscus rosa-sinensis.*

Hank Dankers of the plant disease clinic in Quincy, FL reported the following diseases of interest: *Puccinia coronata,* crown rust of oats; Sclerotinia sp., stem rot of marigolds; *Ascochyta graminicola,* leaf spot of St. Augustinegrass; *Erwinia carotovora,* hollow stem of tomato; and TMV in tomato.

In MISSISSIPPI (M.V. Paatel) reports that tomato greenhouse producers continue to have problems with early blight (*Alternaria solani*), late blight (*Phytophthora infestans*), root-knot nematode, Botrytis gray mold, bacterial pith necrosis, and Fusarium crown rot diseases. Powdery mildews were prevalent on ryegrass, wheat, and African violets. Other diseases diagnosed were Pythium root and crown rot on watermelon seedlings, Rhizoctonia brown patch on Centipede and St. Augustine grasses, crown gall on peach tree seedling, boron deficiency (heart rot) on turnips, and nematode problems on golf course greens.

In ALABAMA (J. Mullen), winter was unusually mild, and many lawns did not go dormant until February. Brown patch was observed on bermuda, centipede, St. Augustine, and zoysia in January. In February and March, brown patch turf problems involved samples of bentgrass and perennial ryegrass and St. Augustine. Take-all patch was diagnosed on a St. Augustine sample in March. With field crops, crown rust (*Puccinia coronata)* was noted as a problem in many oat fields. Older leaves developed orange pustules and then withered and dried. Barley yellow dwarf virus on oats in January was confirmed in 3 fields with the use of ELISA assays. Powdery mildew and leaf rust on wheat was a common problem in March. Phomopsis blight problems on strawberries, anthracnose on blackberry and crown gall on blackberry have been seen this past winter. A watermelon seedling sample with brown water-soaked spots on leaves and stems was severe and had caused some seedlings to collapse where stems were girdled. Fatty acid analysis of bacteria isolated indicated *Pseudomonas gladioli* and (2) *Pseudomonas syringae or cichorii or viridiflava.* Isolations and tests will be repeated on fresh samples. The watermelon blotch *(Acidovorax avenae)* was not identified. Greenhouse/nursery samples included an Alternaria leaf spot on impatiens, and Botrytis and Nectria canker on hybrid tea rose, Pythium root rot on Boston Fern, bacterial leaf spot *(Pseudomonas syringae;* identified by fatty acid analysis) on Foster holly, Phytophthora parasitica crown rot of petunia. Landscape problems included apple and Bradford pear problems of suspect fireblight, root-knot nematode on *Paulownia*, camellia with Sclerotinia flower blight, and Entomosporium leaf spot on Indian hawthorne.

CENTRAL REGION

compiled by Karen Rane

It's early spring, and Central Region Diagnosticians' thoughts turn to ...wheat! For several state clinics, wheat samples make up the largest single host species at this time of year. In Kansas, Judy O'Mara reports that leaf rust overwintered on wheat, and the potential exists for an epidemic later this spring, if spring weather conditions are conducive for infection. Some

Septoria tritici has been observed in Kansas, Indiana (reported by Gail Ruhl) and Nebraska (reported by Diane Merrell). Tan spot has also been observed in Kansas and Nebraska. Take-all root rot has been frequently diagnosed on wheat samples showing severe root rot in Indiana. Wheat viruses have also been reported in the region. Wheat streak, soilborne mosaic and yellow mosaic are common in Kansas this spring. Yellow mosaic and soilborne mosaic viruses were also reported from Indiana. Barley yellow dwarf virus has been found in several Indiana wheat samples, and is also reported from Wisconsin (by Mary Francis Heimann, OSF). Iron chlorosis, an unusual wheat problem, was diagnosed in Kansas this spring. Judy O'Mara reports that the symptoms were yellow and green stripes which appeared uniformly over the leaf. The affected wheat had a high soil pH, and the tissue tested deficient in iron, confirming the diagnosis.

Greenhouse ornamentals are common clinic samples this time of year. Bacterial blight of geranium has been diagnosed in Indiana, Ohio (reported by Nancy Taylor), and Nebraska. Nancy also found *Xanthomonas campestris* pv. *pelargonii* in a perennial geranium. Unusual greenhouse ornamental diseases include tobacco streak virus on impatiens (Iowa, reported by Paula Flynn), Myrothecium blight on blue salvia (Ohio), pansy and New Guinea impatiens (Indiana), Thielaviopsis on dusty miller (Kansas) and Sclerotinia rot of cyclamen (Nebraska) and alyssum (Indiana).

Pine samples with last year's Dothistroma needle blight are still being received by clinics in Kansas, Iowa and Wisconsin. Nancy Taylor diagnosed *Potebniamyces coniferarum* causing cankers on small branches of Swiss stone pine in Ohio. She'd like to know if anyone else has seen this fungus. Kabatina has been common on juniper samples in Kansas. Other landscape and turf problems in the region include pine wood nematode in Kansas, pink snow mold on turf in Kansas and Ohio, and yellow patch (*Rhizoctonia cerealis)* on bentgrass greens in two golf courses in Ohio.

While fruit and vegetable samples are usually few at this time of year, Mary Francis Heimann reports that she is still receiving potatoes from storage that are positive for late blight in Wisconsin. In Kansas, Botrytis blight was found causing significant damage to greenhouse tomatoes, and crown gall was diagnosed on blackberry (one-third of a large planting was affected).

SOUTHWEST REGION

Steven Koike

Arizona (M. Matheron). While normal weather conditions for the winter vegetable production period usually include generally dry days with low relative humidity, this winter season was the opposite with extensive periods of high relative humidity. This has undoubtedly influenced the severity of several vegetable diseases this year. Downy mildew of lettuce developed rapidly throughout the area. Downy mildew of broccoli and cauliflower also was much more prevalent than normal. Lettuce drop, caused by Sclerotinia minor and *S. sclerotiorum*, was present in many lettuce plantings. *Phytophthora infestans* was detected on tomato seedlings and potatoes.

Black rot (*Xanthomonas campestris* pv. *campestris*) was observed on broccoli. By mid-March, lettuce already infected with downy mildew was also subjected to powdery mildew. In the area of homeowner disease problems, rust was found on roses and Alternaria fruit rot detected on oranges and grapefruit.

California (S. Koike). The big news in California has been the heavy winter rains and the resulting flooding in many regions of the state. The coastal area was particularly affected as large regions in the Salinas and Pajaro valleys were covered with flood waters. Such flooding caused millions of dollars of damage in property damage, structural damage, and crop loss. Commercial agriculture as well as private homes were severely affected. When the Salinas River overflowed its banks, the resulting flood waters literally washed away as much as two feet or so of top soil, leaving behind the hard, lower profiles of the fields. Low lying areas were covered with many feet of standing water which in some cases has yet to drain away. Winter planted annuals such as broccoli, cauliflower, and spinach were washed away or subjected to prolonged periods of standing water, resulting in crop death. Early planted lettuce, still at the young seedling stage, likewise was unable to withstand the flooding. Perennial artichoke plantings, if subjected to standing water, basically melted and collapsed within days. Strawberry plantings, if not washed away, withstood somewhat. However, the early flowers and fruits were lost and plant growth will surely be delayed.

Oklahoma (B. Hudgins). Oklahoma experienced a mild winter and early spring this year. Diagnoses included: pine wilt (nematode *Bursaphelenchus xylophilus*), Dothistroma needle blight of pine, Lophodermium needle cast of pine, juniper scale of juniper, Phomopsis blight of juniper, Pestalotiopsis leaf blight of mangrove, *Agrobacterium tumefaciens* crown gall of euonymus, *Entomosporium mespili* leaf spot of photinia, anthracnose (*Colletotrichum graminosum*) of turf, *Botrytis cinerea* grey mold of rose, rose rosette of rose, bacterial leaf rot of *Philodendron*, *Thielaviopsis basicola* root rot of petunia, Botrytis stem canker of tomato, *Ditylenchus dipsaci* stem nematode of alfalfa, root lesion nematode of wheat, and leaf rust of wheat.

New Mexico (N. Goldberg). A recent outbreak of downy mildew, *Peronospora trifoliorum*, has occurred on non-dormant alfalfa in the Mesilla Valley of New Mexico. This disease is relatively uncommon in New Mexico; however, prolonged periods of ideal environmental conditions (high humidity and temperatures around 65°F) triggered the disease. Other alfalfa diseases recorded include: Rhizoctonia crown rot, Fusarium wilt, and Phytophthora root rot. Some onion varieties exhibited severe symptoms of curling and deformed leaves. No biotic disease organisms have been found associated with these onion samples. The disorder is presumed to be caused by micronutrient deficiencies or chemical (herbicide?) toxicity.

PACIFIC NORTHWEST

Ellen Bentley

Temperatures in western Washington have been unusually variable with blossoming of *Prunus* in February followed by freezing temperatures. Despite these fluctuating weather

conditions, which began during early November, there have been few winter injured plant samples submitted to the WSU Puyallup Diagnostic Laboratory (Carrie Foss). Significant bud death has however, been observed on rhododendron and camellia in the field.

Fusarium patch has been common on turf samples this winter and basal anthracnose on golf courses continued into 1995. Less common diseases diagnosed recently include broom rust on incense cedar, downy mildew on *Platycodon grandiflorum* (balloon flower), Spermospora leaf spot on turf, and Coniothyrium on *Daphne odora.*

Winter has been mild in eastern Washington (Ellen Bentley, WSU-Prosser) with moderately cold temperatures and little snow. The excellent Cascade snow pack has provided the best irrigation outlook in three years. However, cold snaps have damaged apricots, some stone fruits and winter wheat. Cherries, pears and apples are in bloom and recent mild, wet weather has provided fire blight infection periods. Active firelight was found in late January so inoculum is definitely present. Eutypa dieback of a home orchard apricot was an unusual finding.

Late blight developed in several potato storages. The fungus has also been confirmed in seed potatoes from ND and ID. A current study is evaluating the presence of silver scurf (*Helminthosporium solani)* on seed potatoes.

'Stephens' winter wheat is already displaying physiologic leaf spot. Dryland winter wheat straddling the OR-WA border experienced emergence failure following late October planting in dry soil, soaking rain and subsequent frozen soil. Initially feared to be a failure of the new seed treatment Dividend (CIBA), Pythium was determined to be the culprit by both my lab and Dick Smiley at OSU-CBARC, Pendleton.

Spring has sprung! Greenhouse diseases are hopping in Colorado (Laura Pottorff, CSU). Testing for TSWV/INSV is busy; I run these ELISAs almost daily. One interesting find is a seed geranium that tested positive for INSV (I ran it twice to make sure). How common is INSV on zonal geraniums, anyway??? Others that have tested positive for TSWV/INSV include gloxinia, lobelia, tomatoes, etc. Petunia plants from one grower were loaded with *Thielaviopsis*; roots had the classic "black" or charcoal look to them. Tulips had the usual Pythium and Rhizopus bulb rots.

In the ornamental and turf area we have had such a mild, dry winter that the lack of moisture is expected to bring on lots of winter kill. Turfgrass abounds with mite damage. In terms of disease our old friend necrotic ring spot also is running rampant. Turfgrass from our new Colorado Rockies baseball field (Coors Field) was sodded last fall and obviously mismanaged. A problem developed with the sod in late February and we worked closely with the architect before the stadium was turned over to the Rockies. Fairy ring started occurring "every where." They overdid the fertilization with a dried poultry waste product. According to our Turfgrass Specialist some of the organic amendments applied to turf can lead to fairy ring when over applied. I will be on maternity leave this summer. Hope you all have interesting seasons.

Karen Flint (USU) reports that most of Utah is still snow covered and samples have been few with none of interest.

Few exciting samples have come into the OSU-Corvallis Plant Clinic (Melodie Putnam) this winter, but we did get a couple of strange ones. One example was *Sclerotium rolfsii* from table beets kept in cold storage. This fungus is not common in Oregon, and seeing that it had formed sclerotia while in the cold was interesting. We are finding aerial Phytophthora in various places, such as on branches of hardwood trees (*Pyrus calleryana* 'Chanticleer' and *Fraxinus pennsylvanica* 'Cimmeron'). The symptoms on the Pyrus were dark, sunken cankers that caused branch dieback. On the ash, the cankers were only slightly sunken, were medium brown, and occurred on the main stems two to four feet from ground level. We are currently in the process of speciating the isolates we have obtained. *Mycocentrospora* was found causing a stem and crown rot at different times on pansy and larkspur.

APS UPDATE

APS DIAGNOSTICS COMMITTEE UPDATE

James H. Blake, Chair

The Diagnostics Committee has received approval for the following events for the 1995 APS Annual Meeting in Pittsburgh, PA:

Workshop - Rapid Diagnostic Assays for Plant Pathogens
contact person - Sally Miller
(see the list of presentations at the end of this update)

Teach-In - Diagnosis of Abiotic Diseases/Disorders
co-sponsor with Environmental Quality & Plant Health Committee

Workshop - Pathogenic Coelomycetes Workshop (pre-meeting)
co-sponsor with Mycology Committee
contact person - Rich Baird

Diagnostics Committee Poster
contact person - Diane Karasevicz

Diagnosticians Reception
contact person - James Blake

Additional meeting information - proposed presentations of interest to diagnosticians:

Colloquia: The New Threat of Late Blight
Nematode Problems on Turf

Discussion: Identification of Plant Pathogenic Bacteria: Accuracy & Pitfalls of Various Techniques

New Diagnostic Committee members are being selected from a list of nominees submitted by the committee and the APS membership at large. If you are interested in serving on the committee in the future, please let a committee member know or ask someone to nominate you.

An additional update will appear in the June issue of PDQ. I hope to see many of you in Pittsburgh.

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WORKSHOP X : RAPID DIAGNOSTIC ASSAYS FOR PLANT PATHOGENS

Speaker # 1:

TaqMan: Gel-free fluorescent PCR assays for plant pathology.
Dave Knorr and Stephen Bates, Perkin-Elmer/Applied Biosystems Division, Foster City, CA 94404

Speaker # 2:

PCR and nonradioactive detection of plant viruses.
Laurene Levy, USDA APHIS PPQ, Methods Development, Beltsville, MD 20705
Ed Podleckis, USDA APHIS, PPQ BATS, Riverdale, MD 20737-1236

Speaker # 3:

Virus ELISA: a rapid and sensitive test for TSWV and INSV.
Chet Sutula and Jun Xia, Agdia Inc., Elkhart, IN 46514

Speaker # 4:

Detecting mycoplasmalike organisms by PCR.
Andrea Harness, Agdia Inc., Elkhart, IN 46514
Dawn E. Gundersen and Ing-Ming Lee, USDA-ARS, MPPL, Beltsville, MD 20705
Sally A. Miller, Dept. Plant Pathology, The Ohio State University, OARDC, Wooster, OH 44691

Speaker # 5:

Quick ELISA for detection of Xanthomonas fragariae.
Vernon DeHerrera, BIOREBA, Inc., South Bend, IN 46619
Walter Bitterlein, BIOREBA AG, Reinach, Switzerland

Speaker # 6:

Culture-enhanced ELISA for *Xanthomonas campestris* pv. *pelargonii*.
Karmen Kelly, Agdia Inc., Elkhart, IN 46514

Speaker # 7:

InSight test for rapid field (greenhouse/nursery) detection of *Xanthomonas campestris* pv. *pelargonii*.
Jim Adams, Agro Dynamics, East Brunswick, NJ 08816

Norm Lalancette, Neogen Inc., East Lansing, MI 48912

Speaker # 8:

Cellulose-acetate electrophoresis for rapid identification of *Phytophthora infestans* allozyme genotypes.

Stephen B. Goodwin, Dept. of Plant Pathology, Cornell University, Ithaca, NY 14853-5908

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FEATURES

1995 PDQ COOPERATING DIAGNOSTIC REFERENCE PATHOLOGISTS

The purpose of this reference listing is to provide diagnostic workers with a reference resource whereby those needing diagnostic advice will be able to locate a pathologist/diagnostician (1) who has the appropriate experience with a particular disease or technique and (2) who is willing to advise or consult by phone or mail. A little well-placed advice from one with experience can go a long way to eliminate unnecessary pit falls and wasted time one often encounters with new techniques and diseases. Do not expect the reference pathologists in this listing to do the procedures/diagnoses for you. But, on the other hand, some of those in this listing may be willing to offer more than advice. If this is the case, be sure to inquire about possible fees. Many clinics do charge for diagnoses and an out-of-state diagnosis might also require payment. Also, be aware of state regulations if plant material or potential pathogens are to be transported across state lines. And finally, let me caution you to be considerate of the time constraints of the reference pathologist/clinic. If all the above cautions are recognized, I believe- hope - this reference list could be a valuable addition to the resources of every diagnostic clinic.

In order to keep this listing current, it will be updated annually. PLEASE CONTACT ME IF YOU NEED OR WOULD LIKE TO MAKE ANY CHANGES/ADDITIONS IN THIS LISTING. The new 1996 listing will appear in early 1996.

1995 PDQ COOPERATING DIAGNOSTIC REFERENCE PATHOLOGISTS
Indexed By Reference Pathologist

Pathologist	Disease	Technique	Address
Paul Bachi	Barley Yellow Dwarf Virus, strains PAV, RPV, MAV	ELISA[1]	PO Box 469 University of Kentucky Princeton, KY 42445 ph:(502)365-7541 E-Mail:pbachi@ca.uky.edu
	Phytophthora on Tobacco (Black Shank)	Deionized Water for Sporangia	
	Fescue Endophyte (*Acremonium coenophialum*)	Microscopic Stain[1]	
	Xylella Scorch Disease	ELISA[1]	
	Tomato Spotted Wilt Virus, I strain, and Impatiens Necrotic Spot Virus (formerly known as TSWV I)	ELISA[1]	

Pathologist	Disease	Technique	Address
Larry Barnes	Fescue Endophyte (*A. coenophialum)* Bacterial Pathogens *Xanthomonas campestris oryzae* *Ceratocystis fagacearum* Pierce's Disease, Xylella Scorch Diseases Certain Viruses	Microscopic Stain[1] Fatty Acid Profiling[1] Fluorescent Antibody[1] Phage Typing[1] Tissue Culture[1] ELISA[1]	Rm. 101, Lf.Petersen Texas A&M University College Station, TX 77843 ph:(409)845-8032 E-Mail:barnes@ppserver.tamu.edu
Margery Daughtrey	*Discula destructiva* (Dogwood Anthracnose) *Xanthomonas campestris pv. pelargonii* (Bacterial Blight on Geranium)	Microscopy;Culture Microscopy;Culture; Pathogenicity Tests	L.I.H.R.L. 39 Sound Ave. Riverhead, NY 11901 ph:(516)727-3595 FAX:(516)727-3611 E-Mail:mdaughtr@cce.cornell.edu
Brian Eshenaur	Phytophthora on Tobacco (Black Shank) or Ginseng Xylella Scorch Disease Tomato Spotted Wilt Virus, Impatiens Necrotic Spot Virus Dutch Elm Disease (*Ophiostroma ulmi*)	Deionized Water for Sporangia ELISA[1] ELISA[1] Tissue Disk Incubation	S-305 Agric. Science Bldg. N University of Kentucky Lexington KY 40546-0091 ph:(606)257-8949 E-Mail:beshenauca.uky.edu
Diana Fogle	Identification of Fungi Imperfecti & Ascomycetes *Verticillium* speciation *Verticilium albo-atrum* seed disease in Alfalfa	Various media Canadian seed wash test & isolation techniques	California Dept. of Food & Agric. Plant Pathology 1220 N. Street Sacramento CA 95814 ph:(916)262-1100
Joe Kloepper/John McInroy	Bacterial Pathogens	Fatty Acid Profiling for Bacterial Identification[1];Biolog Analysis[1]	Dept. of Plant Pathology 209 Life Sciences Bldg. Auburn University AL 36849-5409 ph:(334)844-1950/844-1984 E-Mail:jmcinroy@ag.auburn.edu
Michael Matheron	Soilborne Phytophthora Disease	Isolation & Culture Techniques	Yuma Agricultural Center 6425 W. Eighth Street Yuma AZ 85364 ph:(520)726-0458 FAX:(520)726-1363
Dennis Mayhew	Virus Diseases of Vegetables & Ornamentals	T.E.M.;Serology; Nucleic Acid Technology	California Dept. of Food & Agri. Plant Pest Diagnostics Branch Division of Plant Industry 3294 Meadowview Rd. Sacramento CA 95832-1448 ph:(916)262-1190 FAX:(916)262-2290

Pathologist	Disease	Technique	Address
Gaylord Mink	Seedborne Viruses	ELISA	ELISA LAB WSU-Prosser Irrigated Agri. Res. & Ext. Center Rt. 2 Box 2953-A Prosser WA 99350 ph:(509)786-9250 FAX:(509)786-9370
Jackie Mullen	Speciation of Phytophthoras Associated with Azaleas *(P. cacotrum, P. cinnamomi, P. citricola, P. parasitica)* and some other plants	Culture Techniques	Plant Diagnostic Lab Dept. of Plant Pathology 101 Extension Hall Auburn University AL 36849-5624 ph:(334)844-5508 FAX:(334)844-4072 E-Mail:jmullen@acenet.auburn.edu
	Phytophthora Detection	Sigma Chemical ELISA Kits[1]	
–	A Variety of Virus Identifications (TMV, TSWV, CMV, WMMV, ZYMV)	Agdia ELISA Kits[1]	
Robert Norgren and others	Verticillium Wilt (maple, ash); Oak Wilt; Dutch Elm Disease	Cuture Isolations	Dept. of Agric., Trade & Consumer Protection 4702 University Ave., PO Box 7883 Madison WI 53707-7883 ph:(608) 266-7132/267-0963 FAX:(608)266-1560
	Soil Analysis for Cyst Nematodes	Soil Cyst Washer	
Richard Shelby	Fescue Endophyte (*Acremonium coenophialum*)	Microscopic Stain[1]	Dept. of Plant Pathology 209 Life Sciences Bldg. Auburn University AL 36849-5409 ph:(334) 844-1971 E-Mail:rshelby@acenet.auburn.edu
	Mold Counts and Identifications in Feed	Culture Techniques[1]	
	Aflatoxin, Fumonisin, Ergot Alkaloids in Feed & Fescue (*Aspergillus, Fusarium, Claviceps purpurea* in feed; *Acremonium coenophialum* in fescue)	HPLC[1]	
G.W. Simone R.E. Cullen et al.	Viral Diseases	Plant Virus Inclusion, Indirect ELISA, Hypersensitivity, Biolog Analysis, Physiological characterization	Plant Disease Clinic Bldg. 78, Mowry Rd. PO Box 110830 University of Florida Gainesville FL 32611-0830 ph:(904)392-1795 FAX:(904)392-3438 E-Mail:extppclinic@gnv.ifas.ufl.edu
	Bacterial Diseases		

Pathologist	Disease	Technique	Address
Nancy Taylor and Others	Impatiens Necrotic Spot Virus Tomato Spotted Wilt Virus Verticillium Wilt, Dutch Elm Disease, Oak Wilt Bacterial Isolates Bacterial Wilt of Geranium Plant Virus Detection & Identification Nematode ID (genus) Soybean Cyst Nematode	ELISA[1] Cultures[1] Fatty Acid[1] Profiling ELISA (Neogen)[1] dsRNA Analysis[1] or ELISA Pie Pan[1] Washing, Sieving, and Bioassay[1]	Plant & Pest Diagnostic Clinic 110 Kottman Hall, 2021 Coffey Rd. The Ohio State University Columbus OH 43210-1087 ph:(614)292-5006 FAX:(614)292-7162 E-Mail:ppdc@agvax2.ag.ohio-state.edu E-Mail:taylor.8@osu.edu
Sherman Thomson	*Erwinia amylovora* (Fireblight)	Selective Media	Utah State University Dept. of Biology UMC 53 Logan UT 84322-5305 ph:(801)797-3406 FAX:(801) 797-1575 E-Mail:shermt@ext.usu.edu
Rob Wick	Bacterial Diseases Phytophthora speciation Nematode Assays	Bacterial Identification Using Physiological/ Biochemical/ Pathological Methods[1] Culture Techniques Wet Sieving, Sugar Centrifugation	University of Massachusetts Dept. of Plant Pathology Amherst MA 01003 ph: (413)545-1045 E-Mail:rwick@pltpath.umass.edu

[1]Diagnostic Fees May be Charges: Arrangements Will Depend on the Individual Situation.

Listing Compiled by:

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PDQ (1995) 16(1):25

Diagnosis of Bacterial Blight of Geraniums: When Being Sure is Very Important

Margery Daughtrey
Cornell University

Bacterial blight of geranium, caused by *Xanthomonas campestris* pv. *pelargonii* (Xcp) is the one disease no grower ever wants to face. Although culture indexing procedures were intended to free the geranium industry from the twin threats of Verticillium wilt and bacterial blight, the latter disease is still frequently a problem. Geraniums with this disease are being submitted for diagnosis every year (see Table 1), and fear of this disease is often the motivation for geranium sample submission.

In the past two years, two major geranium propagators supplying the U.S. market have temporarily ceased all cutting production from stock discovered to be contaminated with Xcp, and have instructed growers to discard plant material already received. These responsible actions have decreased the incidence of bacterial blight for U. S. geranium growers, but the need for clinics to be prepared to accurately diagnose this disease still exists.

The nature of geranium production, a giant pyramid in which contamination at the top can lead to trouble for many individual growers, is one reason for the impact that this disease has on the geranium industry. Bacterial blight is a very contagious disease, and ultimately causes a vascular wilt which renders plants unsaleable.

Precise diagnosis of this disease is essential: false negatives may allow the disease to spread to a larger percentage of the crop before it is correctly identified, while false positives may lead to the needless destruction of all or part of a geranium crop. State horticultural inspectors may quarantine bacterial blight infected geranium crops. Court cases have arisen over issues relating to the sale of bacterial blight-infected geraniums. Careful testing and detailed reporting and record-keeping are critical. Any clinician providing services to the greenhouse industry should be well-versed in the facts and fallacies related to the pathogenicity of Xcp on geranium.

Table 1. Geranium Diagnoses, L. I. Horticultural Research Lab, 1989-1994

Year	Geranium samples submitted*	Samples positive for bacterial blight
1989	28	4
1990	73	30
1991	56	6
1992	85	20
1993	92	30
1994	62	12

*geraniums received from one grower, on one date; both in-state and out-of-state samples included

NAMES

Bacterial blight is perhaps the best common name for the disease caused by Xcp on geranium, as this term suggests the extensiveness of the infection, without indicating that wilting is the only possible symptom. The disease is also known as "bacterial wilt" or "bacterial leaf spot & stem rot." Most modern-day growers refer to this disease familiarly, by the genus of the pathogen: "Xanthomonas." For this reason, it is not sufficient to tell a grower that they have "bacterial blight" on their geranium. . . unless you tell them they have "Xanthomonas," many will not understand the message. Likewise, if you isolate a yellow bacterium, but determine that it is not the pathogen, it may confuse the grower to report that you found a "*Xanthomonas* sp." Not knowing the fine points of bacterial identification and nomenclature, the grower may go into full-fledged panic at this statement, and discard geraniums unnecessarily. Xcp is not the only yellow bacterium you will isolate from surface-sterilized geranium tissue; beware of reporting other xanthomonads or other yellow-pigmented bacteria in such a way that you needlessly panic the grower.

HOST RANGE and SOURCES OF INFECTION

Xcp is, as far as we know, quite host-specific. It can infect the three most common species of greenhouse-grown Pelargoniums: *Pelargonium* x *hortorum*, the florists' geranium (or zonal geranium), *P. peltatum*, the ivy geranium and *P.* x *domesticum*, the regal or Martha Washington geranium. Other *Pelargonium* spp., including *P. graveolens* (scented geraniums) are sometimes grown as specialty plants, and are also likely to be hosts.

You will find older literature mentioning *P. domesticum* as a "carrier" rather than a host. Recent observations by S. H. Kim have verified the ability of Xcp to cause leaf spots of *P. domesticum*, but vascular wilt has still not been reported in this host. Hybrids from new breeding lines of *P. domesticum* being introduced from Europe may have different susceptibility from those reported in the literature (Knauss & Tammen, 1967). Many *Pelargonium* and *Geranium* spp. are known to be hosts of Xcp. With the addition of *P. frutetorum* to the list of susceptible species (Dunbar and Stephens, 1992), all of the parents of the hybrid florists' geranium are known to have susceptibility to Xcp.

Outside of the genus *Pelargonium*, the only other known hosts of Xcp are certain members of the Geraniaceae, hardy *Geranium* spp. grown as perennials. Usually different growers are engaged in the production of *Pelargonium* and *Geranium*, but occasionally the same nursery operation may produce both crops. *Geranium* spp. are often infected with the bacterium, but the leaf spotting present is usually disregarded, as these plants do not get a vascular wilt from Xcp infection. Bacteria causing leaf spot on *Geranium* spp., may, however cause vascular wilt on greenhouse *Pelargonium* crops. For this reason, greenhouse geranium crops should be carefuly isolated from perennial garden plants or perennial production areas that include *Geranium* spp.

Xcp has been observed to overwinter in garden plants in Ithaca, NY (Burkholder, 1937) and West Lafayette, IN (Karen Rane, personal communication). It is possible that wildflowers in the genus *Geranium* might also harbor the bacteria, but at this time it appears that cultivated species in the Geraniaceae are much more likely sources of infection. Although *Geranium* spp. in perennial gardens or nurseries may at times have been the source of Xcp infection in a nearby greenhouse crop, conveyed perhaps by a whitefly, the pathogen has usually been introduced via symptomless cuttings of ivy or zonal geranium.

SYMPTOMS

Both florists' geranium and ivy geranium can develop leaf spots, vascular wilt symptoms or both. Regal geraniums and hardy geraniums may show leaf spots. Spots are brown, round, sunken 1/16 -1/8 " in diameter, and may coalesce. They occur at leaf edges or at wounds or stomatal openings on the leaf blade. V-shaped wedges may also appear in leaves, sometimes with the silhouettes of the small round leaf spots showing within them. Occasionally blackened veins are noted in chlorotic areas on infected leaves (Kim and Kim, 1994). Systemically infected plants may show wilting, yellowing and necrosis of leaves, often but not always beginning with lower leaves. The petiole of a wilting leaf is a particularly good area for isolation from tissue, as there is

minimum contamination from saprophytes. Cross sections of the stem base, however, are commonly sources of saprophytes and may interfere with pathogen recovery. Ivy geranium leaves, because of their relative stiffness, do not wilt as readily as the thinner leaves of the florists' geranium. Instead, ivy geranium leaves tend to turn off-color, eventually becoming cupped and dry. For published symptom illustrations in color, see *Ball Field Guide to Diseases of Greenhouse Ornamentals* and *Geraniums IV.*

CONFOUNDING SYMPTOMS

On ivy geraniums, since leaves are rarely seen to wilt, any factor causing chlorosis or leaf dessication may be confused with bacterial blight. Oedema is often very severe on ivy geraniums, causing yellowing, corky excresences and necrosis of the leaf blade. The feeding of spider mites or larval thrips may also cause chlorosis and necrosis of leaves. Deficiency of iron or magnesium may also cause leaf chlorosis. Ivy geraniums grow best at a pH of 5.0 to 5.5, which is lower than the optimum for florists' geraniums.

On florists' geranium, thrips feeding may cause irregular-in-outline necrotic patches on leaves. Excessively low pH (below 6.0) may cause dark speckling of lower foliage, and possibly a necrotic perimeter to the leaf. High soluble salts or high ammonium levels may lead to a chlorotic or necrotic leaf edge. Necrotic wedges in leaves may be due to nutrient deficiencies or Botrytis infection.

On both florists' and ivy geraniums, Pythium root rot frequently causes yellowing and wilting of foliage as well as stunting of the plant. Of the other foliar pathogens, Botrytis leaf lesions may resemble Xcp before they expand into typically larger zonate spots, *Pseudomonas cichorii* or *P. syringae* may mimic the leaf spot phase of the disease; Alternaria leaf spot is rare but may look similar to bacterial blight. Other foliar pathogens have been reported (e. g. *Cercospora*), but do not appear to be commonly circulated within the trade at present.

TECHNIQUES FOR DIAGNOSIS

What is sufficient for diagnosis of bacterial blight of geraniums? The most common question raised is whether a strongly positive ELISA test (using polyclonal antiserum) is sufficient for Xcp diagnosis. For an experienced diagnostician, along with classic symptoms and bacterial streaming, a positive ELISA Ê is a strong verification of a tentative diagnosis. If a geranium is symptomless or has atypical symptoms, or if the root system is so decayed that it could be causing the symptoms, additional testing (proof of pathogenicity of a bacterial isolate with the appropriate morphology) is strongly advised.

Growers concerned about bacterial blight often request labs to test symptomless geraniums. In symptomless plants, it is difficult to detect Xcp by ELISA, since roughly 10^6 bacterial /ml must be present for a positive reaction. A cutlture-enhanced ELISA procedure using monoclonal antibody for Xcp recognition approaches the sensitivity of a culture method, and has much greater operational simplicity (C. Sutula, personal communication). A monoclonal ELISA test is much more specific, and successfully separates Xcp from other *X. campestris* pathovars. However, tests with monoclonal antibodies have thus far been effective only with purified bacterial isolates. Attempting to test symptomatic geranium tissue directly in a monoclonal ELISA test does not work because the tissue blocks adherence of bacteria to the plate.

Polyclonal ELISA tests are available from Agdia, BioReba, Neogen and Sanofi, in formats including membranes, microwells, pins and cylinders. All of these tests regardless of format, detect XcpÑtheir limitation is that they also detect other xanthomonads. A xanthomonad detected in a symptomatic geranium is usually, but not always, Xcp. These tests thus have utility because of the short time investment for testing and their potential to motivate a grower to obtain more tests for confirmation and to initiate a "disease alert" in the greenhouse. ELISA tests with polyclonal antisera are thus helpful, but should not be considered definitive.

Table 3 shows data from tests of yellow bacterial isolates from *Pelargonium* spp. run by Darryl Thomas, Goldsmith Seeds, comparing a multiwell format polyclonal ELISA, a multiwell monoclonal ELISA, and a pathogenicity test using a cutting-base inoculation of geraniums. Note the occasional weak positives (+) or false

positives (++) in polyclonal ELISA tests. A diagnostician dismissing a weak positive (from a pathogenic isolate) would result in a delay in the grower's appropriate responses to Xcp detection. On the other hand, false positives (in which the test is recognizing xanthomonads other than Xcp) could result in needlessly discarded crops.

Although polyclonal ELISA tests usually lead to the same conclusions as the more tedious and time-consuming isolate-and-reinoculate methods, clinicians should safeguard themselves against the few times that these convenient tests will give a "wrong" answer. Incorrect diagnoses through the sole use of ELISA are most likely for inexperienced clinicians, not familiar with the symptoms or with Xcp colony morphology. Remember that growers may discard thousands of geraniums if they believe that their plants are diseased with bacterial blight. A casual diagnosis may have major negative financial impact.

Some suggestions for data collection and diagnostic procedure for bacterial blight follow. Other diagnosticians are invited to write in to PDQ to share their amendments to these procedures, or to offer additional helpful advice to those wishing to improve their skill at identifying bacterial blight on geraniums.

Table 3. Tests on Bacterial Cultures from *Geranium* and *Pelargonium* spp.*

Culture	Source	Polyclonal	Monoclonal ELISA	Pathogenicity test
5-3-1	P. x hortorum	+++	+++	+++
5-4-7	P. x hortorum	+	+++	+++
7-1-1	G. endressii	++	+++	++
7-1-6	G. sanguineum	+++	+++	+++
7-2-1	P. x hortorum	++	-	-
7-2-2	P. x hortorum	++	-	-
7-3-7	P. x hortorum	+++	+++	+++
5-1-5	P. x hortorum	+	+++	+++
5-1-10	P. x peltatum	+++	+++	+++

*tests conducted by D. Thomas, Goldsmith Seeds, on strains isolated by M. Daughtrey and M. Macksel, Cornell University.

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Is This Bacterial Blight?
Suggested Steps in Diagnosis and Extension for This Disease

1. Record cultivars, source of material, other sources of geraniums on the premises, whether any material was held over from previous growing seasons.

2. Record symptoms, on a cultivar-by-cultivar basis.

3. Examine leaves microscopically for edema, thrips or spider mites.

4. Look for bacterial streaming from leaf spots or from petiole sections of a wilting or chlorotic leaf.

5. Examine root health: culture for *Pythium, Rhizoctonia, Cylindrocladium* if indicated, or run soluble salts/pH tests if symptoms indicate a physiological disorder.

6. (optional) Run a polyclonal ELISA test for detection of *Xanthomonas* in symptomatic tissue. In our experience, these tests will sometimes miss a positive, and will also sometimes give a "false positive" because they are not specific at the pathovar level.

7. Isolate from surface-sterilized leaf, petiole and/or stem tissue. In our lab, pieces of geranium tissue are added to water in a beaker and then a 1:9 dilution of bleach:water is added in an equal volume (resulting in 0.26% sodium hypochlorite). We plate onto potato dextrose agar (PDA) immediately after adding the bleach solution. When a geranium is systemically infected and symptoms are advanced, the sap from a petiole can be directly squeezed onto a plate and then streaked to dilute to single colonies. We use PDA solely because we are most familiar with the distinctive, highly mucoid texture and faint yellow coloration of Xcp on this medium. Xcp is not as highly pigmented as many other xanthomonads. Other bacteria that we have isolated from geraniums are less mucoid, are watery rather than uniformly pigmented, and/or are much more yellow than Xcp on PDA.

   As an alternative, Rob Wick (U. Mass) suggests the following protocol:
   a) Examine a longitudinal freehand section from a petiole. If positive for bacterial streaming, remove another piece and place in a drop of sterile water. Allow to sit for several minutes.
   b) Streak out on KB (in order to eliminate fluorescent pseudomonads). Xcp grows slowly; small colonies develop in about 3 days
   c) Transfer 4 or 5 colonies to KB or YDC to check for purity (uniformity of colony morphology)
   d) For Xcp ID, check for: yellow, mucoid colonies on YDC; utilization of asparagine as a sole carbon and nitrogen source; very poor growth and slow clearing on SX; H_2S production and pathogenicity.

8. Pathogenicity test: Choose single-colony isolates which have morphological traits indicative of Xcp, and inoculate with a toothpick into the stems of 3 geranium cuttings, while at the same time stabbing three cuttings to serve as controls. We use *P.* x *hortorum* 'Yours Truly' for pathogenicity tests. Cover wounds with strips of Parafilm, or leave the toothpicks in to seal the wounds. Incubate these cuttings in flasks of water near a window or in the greenhouse. Within about 1 week, Xcp-inoculated stems develop a brown soft canker with watersoaked edges at the point of inoculation; this reaction should be considered positive only if it is clearly different from the wounded control cuttings. The wounded controls should show a slight watersoaking or a dry tan edge to the wound, but no decay.

   Alternative: Rob Wick suggests a whole-plant inoculation technique for pathogenicity testing: place one drop of cloudy bacterial suspension onto a freshly-excised geranium petiole stump. On a sunny day, the suspension will be taken up in 15 seconds. In spring and summer greenhouse conditions, the geranium will show vascular wilt symptoms in 8 or 9 days. The response is delayed in winter.

9. Report to the sample submitter in writing, specifying symptoms observed, tests performed, and conclusions drawn. Recommend roguing out symptomatic plants and those immediately adjacent. We do not recommend spray treatments. Growers who use copper-containing spray treatments must also rogue out infected plants. Delays in isolation of Xcp from tissue have at times been noted in cases in which copper sprays have been used by the grower (G. Simone, personal communication). Growers whose geraniums are diagnosed as having bacterial blight should not under any circumstances consider keeping geranium stock over to the following season.

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Wick, R. L. and M. Daughtrey. 1993. Bacterial Blight. pp. 237-242 in Geraniums IV, J. W. White, ed. Ball Publishing, Batavia, IL 412 pp

SLIDE REQUEST for Plant Disease Diagnostics slide set

Dear PDQ Readers:

In the March 1994 issue of PDQ, there was a description of a proposed slide set for APS Press entitled "Plant Disease Diagnostics". The slide set had been suggested at the APS Press Illustrations Committee meeting in Nashville, November 1993. The project has been officially approved by the Illustrations Committee.

Gail Schumann said it was so difficult to find good slides of many basic techniques and apparently she was very much correct. We have had very little response to our requests made verbally or written.

Please search your slide collections for scenes of the depiction of the many techniques used in diagnosing plant diseases. For a description of the slide set and examples of the various techniques, see the information on the next page. We appreciate any contributions you can make.

Beggingly,

Jackie Mullen (Auburn University)
Paul Bachi (University of Kentucky)

Slide Set Title: Plant Disease Diagnostics PDQ (1995) 16(1): 32

Description:

The subject of the slide set is plant disease diagnostics. Techniques of diagnosis and laboratory procedures will be illustrated. Procedures will be shown for the identification of plant diseases caused by fungi, bacteria, viruses, and mycoplasma-like organisms. Techniques will range from macroscopic study to the use of highly specialized procedures.

Intended audience:

Teachers of graduate, undergraduate, and high school students when subjects of plant pathology and microbiology are covered; extension specialists; plant diagnosticians; and private practitioners.

Expected date of completion:

April 1995

[NOTE: see PDQ (1994) 15(1) 46-47 for a SAMPLE SYLLABUS]

SLIDE SET OUTLINE
PLANT DISEASE DIAGNOSTICS

1. General Visual Exam with Reference to Provided Information
- a. Foliage
- b. Roots
- c. Vascular

2. Fungal Diagnostics
- a. Macroscopic Evidence and Tests
- b. Microscopic (Dissecting, Compound)
- c. Culture Isolation - General
- d. Selective Media For...
  1.
  2.
  3.
  4.
  5. ....etc
- e. ELISA
- f. Molecular Techniques

3. Bacterial Diagnostics
- a. Macroscopic Exam and Tests
- b. Microscopic Exam
- c. Culture Isolations - General
- d. Culture Work - Selective
  1.
  2.
  3.
  4. ...etc.
- e. Other Physiological Tests
- f. The BIOLOG System
- g. Fatty Acid Analysis

4. Viral Diagnostics
- a. Visual Exam
- b. Microscopic - Inclusion Bodies
- c. EM
- d. Serology
  1. ELISA
  2.
  3. ..etc
- e. Host Range
- f. Molecular Techniques

OFF THE SHELF

Blancard, D.
A Colour Atlas of Tomato Diseases: Observation, Identification and Control.
1994. London: Manson Publishing. (available from John Wiley & Sons). 212pp.
ISBN: 1-874545-31-6 $89.00

At first glance, this title seems like an overpriced version of the APS Compendium of Tomato Disease in hardback format. When you spend some time in the Table of Contents, you realize this book is not a pathogen-driven treatment as in the compendium. This is one of the few books that is compiled for a diagnostician dealing with tomato problems. The actual scope of this pictorial atlas include biotic and abiotic problems, presented by plant-based irregularity. Chapters deal with irregularities to leaves and leaflets, roots, collar, stem, and fruit. All possible causes are listed (abiotic and biotic) for particular symptoms. Pathogens like *Botrytis cinerea*, that invade many plant parts are included in each "Possible Causes" list by plant part. There are excellent, large (4 X 2.5in.) color plates for most if not all plant irregularities. Besides the superb illustrations, there are black and white line drawings depicting sampling strategies and location of pathogen signs for particular diseases. The final third of this text is devoted to plant pathogen descriptions that includes pathogen binomial, authority, common disease name, inoculum sources, dissemination, favorable conditions for disease development and an integrated presentation of control information. These pathogen capsules are cross-indexed to illustrations throughout the book. This text ends with three excellent appendices that summarize: 1) insect/mite damage on tomato; 2) resistant/tolerant germplasm for specific problems suited for the Mediterranean basin area; and 3) a list of illustrations and descriptive text for all causal agents or factors. This text exemplifies the support literature and the proper format for that literature needed by diagnosticians. Inclusion of pathogen micrographs would have made the publication a stand-alone reference for tomato problems.

Browning, H.W., R.J. McGovern, L.K. Jackson, D.V. Culvert and W.F. Wardowski. **Florida Citrus Diagnostic Guide.**
1995. Lake Alfred, FL: Florida Science Source, Inc.: 244 pp.
ISBN 0-944961-01-0 $64.00

For those diagnosticians who function in the citrus belt, a multitude of diagnostic references are needed to effectively deal with the array of disorders that occur on citrus. Most of these sources are long out-of-print and thus unavailable unless you are an avid used book collector. This title represents an update on Dr. R.M. Pratt's "Florida Guide to Citrus Insects, Diseases and Nutritional Disorders in Color" published in 1958. The new format presents insects, mites, disease, post-harvest, horticultural and nutritional problems in discrete order without chapters per se, with each text section accompanied by one or more excellent color plates (approximately 235 plates in the book). The text reads quite well, providing general biology and practical integrated control information. Apart from some out-dated taxonomy, this text is a comprehensive visual diagnostic reference for citrus

problems in the Southeast U.S. citrus production area.

Myren, D.T. (editor).
Tree Diseases of Eastern Canada. 1994. Ottawa, Canada K1A 059. Canada Communication Group - Publishing. 153pp. ISBN 0-660-14936-2 ~$52.00

Somewhere buried within me is a frustrated Forest Pathologist. Any book on tree diseases becomes a "must have" situation - perhaps because of the diverse hardwood and conifer species included that I hardly ever see down in Florida except when I vacation in the North! This effort has organized the tree diseases by plant part affected: leaves & needles, stems and branches, roots, cones and finally coverage of abiotic factors. This is a spiral bound, soft-cover format with good color photographs, making this a desirable book for nurserymen and ground maintenance personnel. Comparing photograph quality, coverage and price with "Diseases of Trees and Shrubs" by W.A. Sinclair et al, a clinic library would be better served by Sinclairs' book, but if budget is not limiting, add this title to the collection.

Staff: National Collection of Fungi: Biosystematics Division, Plant Protection Research Institute.
Elementary Keys to Common Fungi in South Africa. Handbook No. 2
1994. Pretoria, South Africa: National Collection of Fungi. 55 pp.
ISBN 0-620-17150-2 ~$10.00

This doesn't sound very relevant as a reference title for many northern hemisphere labs! Ordering this title might be hard to justify considering its geographical isolation. This spiral bound, soft cover publication offers some 18 pages of fungal keys beginning with the *Zygomycotina* and ascending through the *Basidiomycotina*. The keys are followed by a current mycological glossary both written and illustrated in a style reminiscent of the illustrations in R.B. streets "Diagnosis of Plant Diseases". This title has to be ordered directly from:

National Collection of Fungi
Biosystematics Division
Plant Protection Research Institute
Private Bag X134
Pretoria, 0001 South Africa

Those of us involved with some teaching, might appreciate the illustrated glossary to justify the effort in ordering. The majority of clinics can afford to pass this title by.

CLASSIFIED

Minnesota is planning to host a diagnosticians workshop/get-together this fall. Entomologists, pathologists and anyone dealing with plant problem diagnosis is invited. Tentative dates are October 2-3. Plans are to meet for 1 1/2 days at the Cloquet Forestry Experiment Station (near Duluth, MN). The agenda is open at this time but expect presentations from different clinics and discussion and problem solving in addition to camaraderie and perhaps some sight seeing. For more information and suggestions contact Cindy Ash at 612-625-7022, or e-mail at - cynthia@puccini.crl.umn.edu.

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DEPARTMENT OF PLANT PATHOLOGY
College of Agriculture
University of Kentucky
Lexington, Kentucky 40546

POSITION ANNOUNCEMENT

POSITION: Plant Disease Diagnostician/Research Specialist

LOCATION: Department of Plant Pathology, University of Kentucky, Lexington, Kentucky 40546

RESPONSIBILITIES: Successful candidate will assume responsibility for a Plant Disease Diagnostic Laboratory and will be expected to diagnose and make control recommendations for plant samples. The candidate will work in cooperation with, and receive supervision from, four state Extension Plant Pathologists and assist the extension programs of the Department when requested.

QUALIFICATIONS: Required: M.S. in Plant Pathology or closely related field. Desirable: Training, especially in disease diagnosis including a strong background in mycology, plant anatomy and physiology, and horticultural and field crop pathology. Additional training in plant virology, phytobacteriology, and nematology. Experience in modern techniques for identifying plant pathogens, and willingness to work with students, the public, and as part of a team.

SALARY: Commensurate with experience, but not less than $27,500.

APPLICATION: Send letter of application, resume, transcripts and three letters of reference to:

Dr. John R. Hartman, Department of Plant Pathology, S-305
Agricultural Science Bldg.-N., University of Kentucky,
Lexington, Kentucky 40546-0091.
Telephone:606-257-5779. Fax:606-323-1961.
E-mail: jhartman@ca.uky.edu

DEADLINE: Applications will be accepted until June 30, 1995, or until a suitable applicant is found.

AVAILABLE: Position will be available July 1, 1995

EQUAL EMPLOYMENT OPPORTUNITY: The University of Kentucky is an equal opportunity employer. The address of the College of Agriculture EEO Coordinator is Room S-101, Agricultural Science Building-North, Lexington, Kentucky 40546-0091.

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THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

Plant Pathology, 2021 Coffey Road, Columbus, OH 43210-1087

Orange Rust of Brambles

Michael A. Ellis
Department of Plant Pathology

Orange rust is the most important of several rust diseases that attack brambles. All varieties of black and purple raspberries, and most varieties of erect blackberries and trailing blackberries are very susceptible. Orange rust *does not infect red raspberries.*

Unlike all other fungi that infect brambles, the orange rust fungus grows "systemically" throughout the roots, crown and shoots of an infected plant, and is perennial inside the below ground plant parts. Once a plant is infected by orange rust, it is infected for life. Orange rust does not normally kill plants, but causes them to be so stunted and weakened that they produce little or no fruit.

Figure 1. Black raspberry plants showing early season symptoms of orange rust. Note the "spindly" elongated shoots. Soon orange pustules will develop on the underside of these infected leaves.

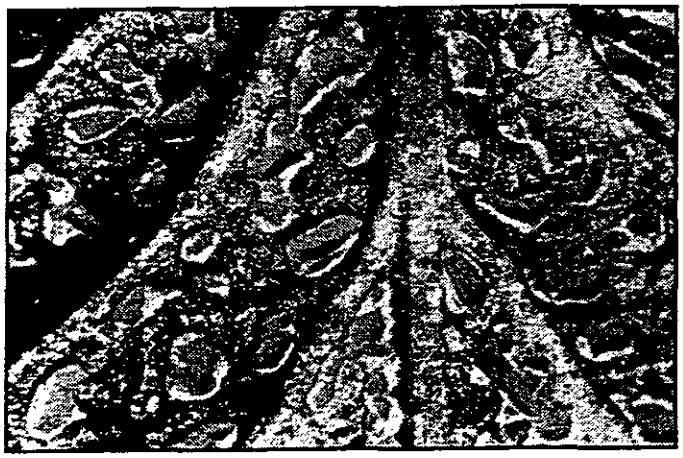

Figure 2. Close-up of blister like pustules on the lower surface of infected black raspberry leaves. Pustules contain bright orange masses of fungus spores.

Symptoms

Orange rust-infected plants can be easily identified shortly after new growth appears in the spring. Newly formed shoots are weak and spindly. The new leaves on such canes are stunted or misshapen and pale green to yellowish. This is important to remember when one considers control, because infected plants can be easily identified and removed at this time. Within a few weeks, the lower surface of infected leaves are covered with blister-like pustules that are waxy at first but soon turn powdery and bright orange. This bright orange, rusty appearance is what gives the disease its name. Rusted leaves wither and drop in late spring or early summer. Later in the season, the tips or infected young canes appear to have outgrown the fungus and may appear normal. At this point, infected plants are often difficult to identify. In reality, the plants are systemically infected, and in the following years, infected canes will be bushy and spindly, and will bear little or no fruit.

Causal Organism and Disease Development

Orange rust is caused by two fungi that are almost identical, except for a few differences in their life cycles. *Arthuriomyces peckianus* occurs primarily in the northeastern quarter of the United States and is the causal agent for the disease in Ohio. *Gymnoconia nitens* is a microcyclic (lacks certain spores) stage

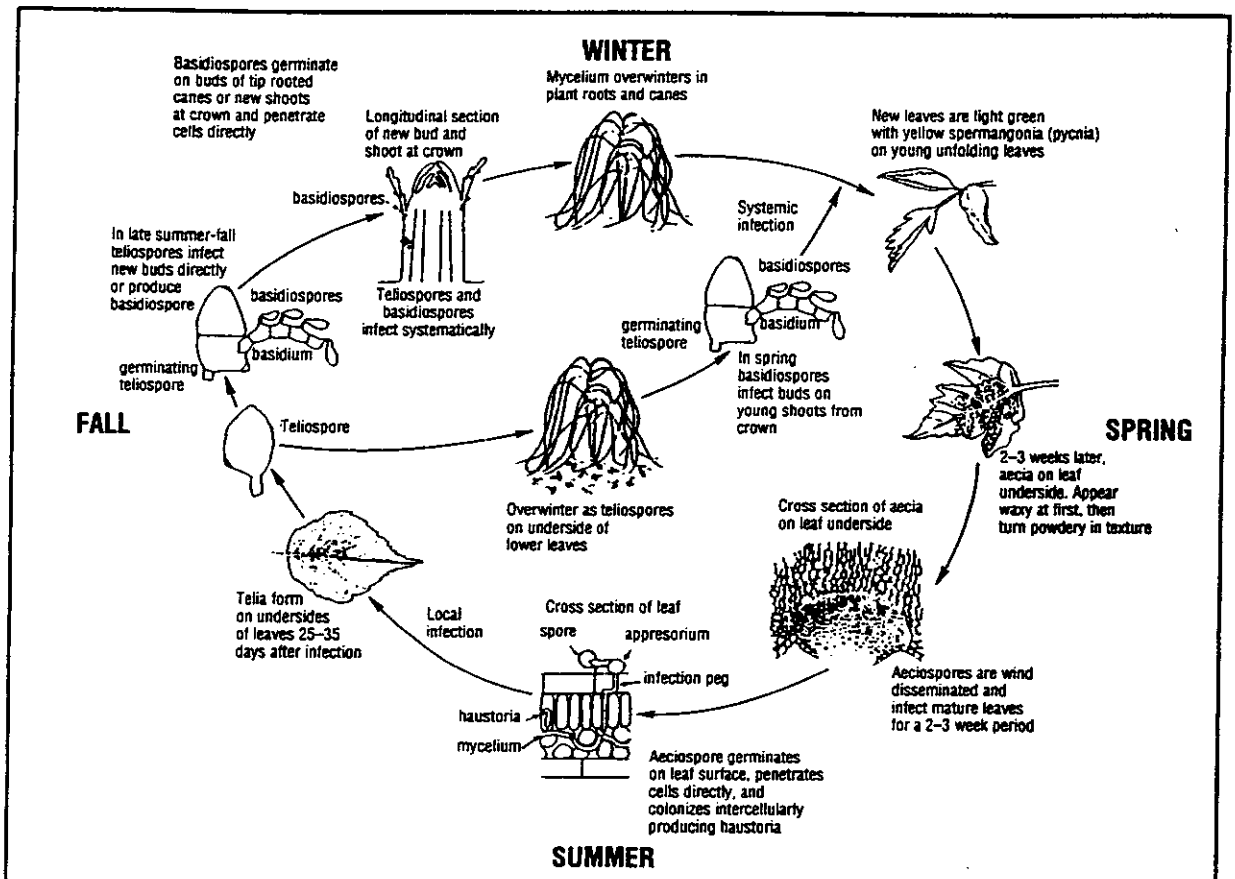

Figure 3. Disease cycle of orange rust. We wish to thank the American Phytopathological Society for the use of this figure. Taken from the APS Compendium of Raspberry and Blackberry Diseases and Insects.

of *A. peckianus*. *G. nitens* is the more common orange rust pathogen on erect and trailing blackberries in the Southeast.

In late May to early June, the wind and perhaps rain-splash spreads the bright orange aeciospores from the pustules on infected leaves to healthy susceptible leaves where they infect only localized areas of individual mature leaves. When environmental conditions favorable for infection occur, the spores germinate and penetrate the leaf. About 21–40 days after infection, small, brownish black telia develop on the underside of infected leaflets. The teliospores borne in these telia germinate to produce a basidium, which in turn produces basidiospores. These basidiospores then infect buds on cane tips as they root. They also may infect buds or new shoots being formed at the crowns of healthy plants in the summer. The fungus becomes systemic in these young plants, growing into the crown at the base of the infected shoot, and into newly formed roots. As a result, a few canes from the crown will show rust the following year. The fungus overwinters as systemic, perennial mycelium within the host.

Orange rust is favored by low temperatures and high humidity. Temperatures ranging from 43 to 72°F favor penetration and development of the fungus, but higher temperatures decrease the percentage of spore germination. At 77° F, aeciospores germinate very slowly, and disease development is greatly retarded. Spore germination and plant penetration have not been observed at 86° F. Aeciospores require long periods of leaf wetness before they germinate, penetrate, and infect plants.

Control

1. Whenever possible, start with disease-free, certified nursery stock.
2. When diseased plants first appear in early spring, dig them out (including roots) and destroy them before pustules form, break open, and discharge the orange masses of spores. If plants are not removed, these spores will spread the disease to healthy plants.
3. Remove all wild brambles from within and around the planting site. Wild brambles serve as a reservoir for the disease.
4. Maintain good air circulation in the planting by pruning out and destroying old fruited canes immediately after harvest, thinning out healthy canes within the row, and keeping the planting free of weeds.
5. Fungicide sprays are generally not considered an effective control method for orange rust.

12/94—460

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Keith L. Smith, Director, Ohio State University Extension.

TDD # 1 (800) 589-8292 (Ohio only) or (614) 292-1868

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THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

Plant Pathology, 2021 Coffey Rd., Columbus, Ohio 43210

Verticillium Wilt of Strawberry

Michael A. Ellis
Department of Plant Pathology

Verticillium wilt of strawberry can be a major factor limiting production. When a plant is severely infected by the Verticillium wilt fungus, the probability of it surviving to produce a crop is greatly reduced. The Verticillium fungus can infect about 300 different host plants, including many fruits, vegetables, trees, shrubs and flowers, as well as numerous weeds and some field crops. The fungus can survive in soil, and, once it becomes established in a field or garden, it may remain alive for 25 years or longer.

Cool, overcast weather interspersed with warm, bright days is most favorable for development of Verticillium wilt. Infection and disease development may occur when soil temperature is from 70° to 75°F (21 to 24 degrees C).

Many soils in Ohio contain the Verticillium wilt fungus. The fungus can be introduced into uninfested soil on seed, tools and farm machinery, and in the soil and roots of transplants.

Figure 1. Strawberry plant infected with Verticillium wilt.

Symptoms

The first symptoms of Verticillium wilt in new strawberry plantings often appear about the time runners begin to form. In older plantings, symptoms usually appear just before picking time. Symptoms on above-ground plant parts may differ with the susceptibility of the cultivar affected. In addition, above-ground symptoms are difficult to differentiate from those caused by other root infecting fungi. Isolation from diseased tissue and culturing the fungus in the laboratory are necessary for positive disease identification.

On infected strawberry plants, the outer and older leaves droop, wilt, turn dry and become reddish-yellow or dark brown at the margins and between veins (Figure 1). Few new leaves develop, and those that do tend to be stunted and may wilt and curl up along the midvein. Severely infected plants may appear stunted and flattened, with small yellowish leaves. Brownish to blueish-black streaks or blotches may appear on the runners or petioles. New roots that grow from the crown are often dwarfed with blackened tips. Brownish streaks may occur within the decaying crown and roots (Figure 2).

If the disease is serious, large numbers of plants may wilt and die rapidly. When the disease is not so serious, an occasional plant or several plants scattered over the entire planting may wilt and die.

Casual Organism

Verticillium wilt is caused by the soilborne fungus *Verticillium albo-atrum*. The fungus overwinters in soil or plant debris as dormant mycelium or black, speck-sized bodies (microsclerotia). These microsclerotia can remain viable in the soil for many years. Under favorable environmental conditions, they germinate and produce threadlike fungal structures (hyphae). Hyphae can penetrate root hairs directly or through breaks or wounds in the rootlets. Once inside the root, the fungus invades and destroys the water-conducting tissue. The destruction of water-conducting tissue results in reduced water uptake by the plant; thus, the plants wilt and wither. As fungal colonies get older they produce microsclerotia in infected host tissue. As these infected tissues die and return to the soil, the disease cycle is completed.

Control

1. Do not plant susceptible strawberry cultivars in soil where tomato, peppers, potato, eggplant, melons, okra, mint, brambles, stone fruits, chrysanthemums, rose or related susceptible crops have grown for the past five years.

2. Plant in fertile, light, well-drained soil. Avoid low, wet spots.

3. **In Verticillium-infested soil, set out only certified, disease-free strawberry plants of tolerant or resistant cultivars.** Several old and new cultivars have natural resistance to the Verticillium fungus. The following junebearing varieties are reported to be resistant to Verticillium wilt: Allstar; Catskill; Delite; Earliglow; Guardian; Lester; Rechief; Scott; Sunrise; Surecrop and Tennessee Beauty. The everbearing varieties, Tribute and Tristar, are also reported to be resistant. The use of resistant varieties is one of the most important control methods for this disease.

4. **Verticillium-susceptible cultivars may be grown in infested fields if soil fumigation is done as a preplant treatment.** Soil fumigation is not an option in home or backyard plantings. If properly done in commercial plantings, fumigation kills soil insects and weed seeds as well as disease-causing bacteria, fungi and nematodes. Fumigation is usually done by commercial applicators who are licensed to handle restricted chemicals, and not by the grower. The soil fumigant that is most effective is a mixture of chloropicrin (tear gas) 33% and methyl bromide 66%.

For more information on soil fumigation refer to Bulletin #L-249 *Soil Fumigation.* This publication can be obtained from your country extension agent or the Extension Publications Office, The Ohio State University, 385 Kottman Hall, 2021 Coffey Rd. Columbus, OH 43210-1044.

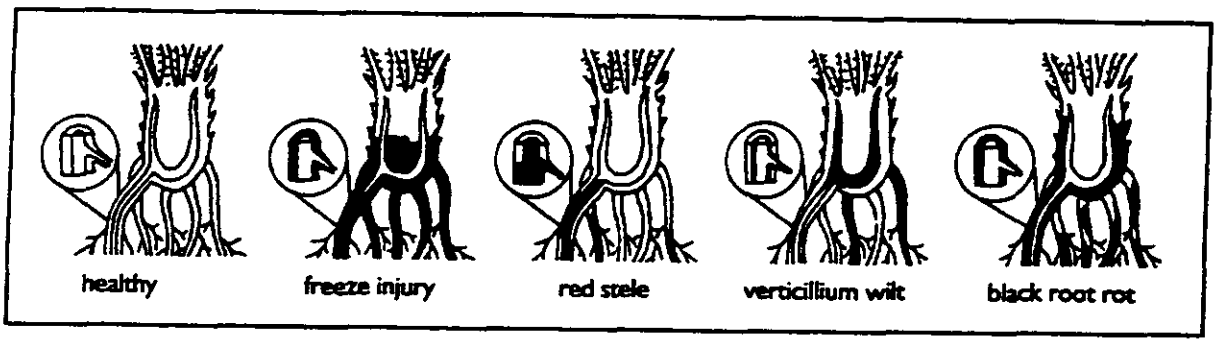

Figure 2. Some common strawberry root problems and typical symptoms.

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PLANT DIAGNOSTICS QUARTERLY