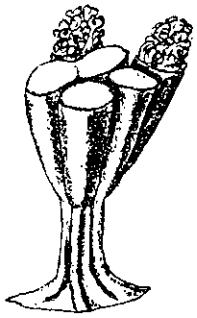
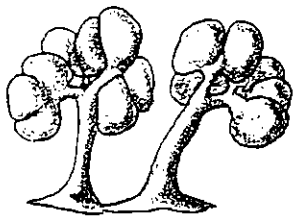
1987 INDEX

Volume VIII Number 4

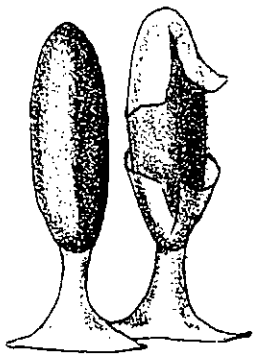
Slime Molds



Yellow-fuzzCone Slime
Hemitrichia clavata



Many headed slime
Physarum polycephalum



Whitefooted Slime
Diachea leucopodia

Scrambled Egg Slime
Fuligo septica

PQ

PLANT DIAGNOSTICIAN'S QUARTERLY

December, 1987

Features

Illustrations by Ethel Dutky

The Plant Diagnostician's 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, in March, June, September and December. Yearly subscription fees:

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Send manuscripts, announcements and letters to the editor: Melodie Putman, Maryland Department of Agriculture, Plant Protection, 50 Harry S. Truman Parkway, Annapolis, MD 21041.

PDQ is an equal opportunity publication with a policy of nondiscrimination regarding race, color, religion, age, national origin, sex or handicap.

Contents Volume VIII Number 4

Editor's letter December, 1987

This is my last issue as PDQ editor. I am pleased to announce that the new editor is Melodie Putnam. Melodie works in the plant protection section of the Maryland Department of Agriculture in Annapolis, Maryland. Gail Ruhl will continue as PDQ managing editor.

I am confident that under Melodie's leadership that PDQ will continue to serve diagnosticians as a vehicle for the exchange of ideas and information.

This issue has two features, and the Index for 1987. I am grateful to Paul Bachi (Kentucky) for doing the index. Steve Nameth wrote the first feature dealing with Tomato Spotted Wilt Virus, a problem we are seeing (recognizing) more in the past few years. Steve is the Diagnostic Committee chairman for 1988, so we will be hearing more from him regarding activities planned for the national meeting. In the second feature, Mary Ann Hansen reviews a successful program of Agent Internships she conducted in Virginia's Diagnostic Laboratory. This program illustrates one way that the diagnostician may improve the quality of samples submitted. The experience of being in the laboratory for several days shows agents how important good samples and information are to a good diagnosis. Thanks to both feature writers for good work.

I have enjoyed my three years as PDQ editor. I am especially grateful to the managing editor Gail Ruhl for her advice, encouragement and help at all times. I also appreciated the efforts of all of the feature writers and book reviewers who produced the "meat" in each PDQ issue. Keep up the enthusiasm.

Warm regards to all

Ethel M. Dutky
Editor

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encl.

TOMATO SPOTTED WILT VIRUS: A DIAGNOSTICIAN'S NIGHTMARE

S. T. NAMETH

Assistant Professor, Department of Plant Pathology

The Ohio State University

Columbus, Ohio

It's not bad enough that diagnosing diseases caused by plant pathogenic viruses is tough enough, now comes along a plant pathogenic virus which makes diagnosing most virus-induced diseases of plants seem like child's play. The virus is Tomato Spotted Wilt Virus (TSWV) and it's quickly becoming one of the most important virus problems associated with the greenhouse and floral crops industry in the United States.

TSWV is a ssRNA-containing virus with membrane-bound isometric particles 70-90 nm in diameter. Its primary vector in a greenhouse situation is the western flower thrips (Frankliniella occidentalis). It is transmitted in a persistent manner and there is a direct relationship between the number of thrips present and the incidence of the virus. Thus, a primary method of control for TSWV is a good thrips control program. Well, as we all know, you can't control it until you've diagnosed it, and that's where the problem comes in.

Host Range of TSWV

Like most good diagnosticians, one of the first things we look at is the host index. Is the plant I'm concerned with a reported host of TSWV? The host range for TSWV is quite large. It is known to infect some 170+ species of plants covering some 35 different families. As far as greenhouse grown crops are concerned, the list of hosts include: african violet, ageratum, amaranthus, anemone, begonia, calceolaria, calendula, christmas peppers, chrysanthemum, cineraria, coleus, cyclamen, dahlia, exacum, geranium, gloxinia, impatiens (including New Guinea Impatiens), marigold, petunia, primrose, snapdragon and zinnia. If your plant isn't one of these you still could be dealing with TSWV in that most people working with this virus feel there are many hosts not yet identified. If the symptoms suggest TSWV, it's best to continue with the diagnosis even though the plant may not be a reported host.

Symptoms of TSWV

So, just what are the symptoms of TSWV? Well, like its hosts, the symptoms induced by TSWV are many and varied. Depending on the host, symptoms can range from stunting to ringspots to dark purple-brown sunken lesions to stem necrosis to flower breaking and the list goes on and on. In many cases the symptoms of TSWV can easily be confused with symptoms induced by other viruses or even some fungal or bacterial pathogens. For example, young gloxinia plants infected with TSWV show

symptoms similar to those seen with Phytophthora root rot. Infected plants show a central or basal rot symptom with plant collapse and death immediately there after. The key diagnostic clue here is that the roots look fine. In other hosts a one-sided wilt symptom may develop similar to that seen induced by some vascular wilt types of pathogens, but you'll find no vascular discoloration.

In certain hosts there are symptoms induced by TSWV which tend to show some degree of consistency. Chlorotic ring spots which in most cases progress into dry necrotic brown rings or spots (cyclamen and begonia), leaf midrib necrosis (gloxinia and impatiens) and stem necrosis (chrysanthemums) are all symptoms of the virus which when associated with these hosts should give you some indication of TSWV infection.

Lab Confirmation of TSWV

So, now that you have the indications, how can you be sure? At a recent research symposium on TSWV held on Sanibel Island, Florida the area of diagnosis was heavily discussed. Of the roughly 50 scientists involved, it was the overhwelming consensus of the group that in order to be certain about your diagnosis, one should not just rely on just one method of virus identification. This is especially true when your diagnosis is based solely on symptomatology. The alternate methods suggested include the use of indicator hosts, nucleic acid probes, serological techniques, electron microscopy and inclusion bodies. Depending on where you are located, one should have a diagnostic laboratory or clinic located near them which would have some expertise in one or more of these diagnostic techniques. One of the objectives of the Sanibel meetings was to put together a list of labs or clinics which have expertise in two or more of these areas. This would allow diagnosticians not able to do a complete identification information on the location of a facility where the TSWV sample could be sent. Obviously, special arrangements should be made between the two labs which could benefit both parties involved.

But what if you don't want to send your sample to another lab? What could you do to make your own lab or clinic self-sufficient in the area of TSWV identification? Probably the two easiest methods to incorporate into your diagnostic system would be the use of indicator hosts (bio-assay) and serological tests, particularly the enzyme-linked immunosorbent assay (ELISA). Currently the only commercially available ELISA based "kit" for the identification of TSWV is produced by Agdia Inc. The "kit" can be purchased as a complete kit (precoated ELISA plate, reagents, etc.) or as a component set of ELISA reagents. If you can't justify the purchase of the "kit" or the components, Agdia also offers an individual sample testing service. You may want to contact Agdia to discuss your individual needs (Agdia Inc., 1901 North Cedar Street, Mishawaka, Indiana 46545; Phone: (219) 255-2817).

As far as a bioassay is concerned, in my opinion one of the best indicator hosts for TSWV I know is Nicotiana benthamiana. Within one week after sap inoculation with TSWV (host sap plus buffer) onto the leaves of N. benthamiana the inoculated leaves show large purple brown

lesions. Within a day or so after that, the inoculated plant shows symptoms of stem necrosis and wilt. The plant declines very rapidly from that point and dies. The virus can also be inoculated onto Petunia hybida cvs Pink Beauty or Minstral. Within 2-4 days after inoculation local necrotic local lesions will develop in the inoculated leaves.

Although TSWV is a tough virus to diagnose, with a little effort most diagnostic clinics could be set up to do an adequate job of virus identification. If not, it's important to get the sample to a clinic or lab which can. This virus has the potential to become a very serious economic problem in our greenhouse industry. In some places it already is.

Hopefully this article will give the diagnostician a better understanding of the Tomato Spotted Wilt Virus, the symptoms it induces, and the methods needed to perform an adequate diagnosis.

Editor's Note

For those interested in keeping up with developments on TSWV and the Greenhouse Industry, a newsletter entitled "The Tomato Spotted Wilt Newsletter" is now being published by Yoder Brothers Inc. To obtain back issues and get on the mailing list contact Jane Trolinger or Joe Begley. Yoder Brothers Inc., P.O. Box 68, Alva, Florida 33920.

AGENT CLINIC INTERNSHIP 1987

Mary Ann Hansen
Plant Disease Clinic, Virginia Tech
(phone: 703/961-6758)

This year's Clinic agent training program at Virginia Polytechnic Institute and State University was conducted in August and September 1987. Several improvements were made over last year's program and, judging from written comments submitted by the agents who attended, I think the results were favorable. We were able to accommodate agents from ten different counties during the two-week period this year.

One of the improvements made to the program was the addition of a session in the Insect Identification Laboratory. This year the first day and a half was spent studying diseased plant specimens; a half-day was spent in each of the Nematology and Weed Clinics; one day was spent in the Insect Identification Laboratory, and a half-day was spent touring some of the plant pathology research field plots.

The plant disease session was conducted in one of the Department's teaching laboratories, since space in the Plant Disease Clinic itself is limited. Each agent had his/her own stereoscope and compound microscope to use to examine specimens. The agents were provided with individual specimens and copies of attached forms that had actually come to the Clinic. (I had saved samples in a cold room over the course of the previous few months.) References were available and, with some guidance from me, the agents tried to diagnose the disease or problem of the specimens provided. When everyone had at least made a stab at his/her own diagnosis, we all examined and discussed each specimen as a group.

One of the nice things about the approach we used in the plant disease session was that everyone had to remain very open-minded about the problems they saw. Since the Clinic receives plant specimens with environmental, cultural, and/or insect problems in addition to disease problems, the specimens the agents had to work with represented the whole range of problems. In this way the session resembled the day-to-day experience of agents in their offices. Samples used in the session ranged from broccoli with wirestem to tomatoes with a severe mite problem to junipers covered with slime mold. Many of the samples were tricky and could easily be misdiagnosed without careful examination. The tomato sample with mites, for example, was so severely infested that it appeared to have a wilt disease.

Agents also had a chance to use Clinic references firsthand so they could determine whether certain references might be useful to them in their offices. A good collection of references is, of course, essential for making accurate diagnoses.

A drawback of the approach we used was that the agents were able to examine fewer samples than they would have been able to if they were simply told what each diagnosis was. However, I think the agents will remember more of what they learned from having performed their own diagnoses. Another drawback was that I was unable to provide the agents with a large number of samples in any one crop category, so the session

could not be tailored to each agent's needs. However, I think the agents will be able to apply the general techniques they learned to the diagnosis of diseases of their crop specialties.

In the Nematology Clinic agents learned about the types of disease symptoms that can be caused by plant parasitic nematodes. Ms. Enkenyelesh Bekele, manager of the Nematology Clinic, demonstrated the elutriator machine we use to extract nematodes from soil samples. The agents examined specimens of different types of nematodes that cause damage to plant roots in Virginia, including root knot, cyst, lance, lesion, dagger, stunt, stubby root, ring, sting and spiral nematodes. They also learned how to pick root knot females out of galled roots to confirm presence of root knot nematodes.

With Dr. Jeff Derr, one of the Plant Pathology, Physiology, and Weed Science Department's weed scientists, the agents examined potted specimens of about 40 common Virginia weeds and learned how to identify them. The group also went on a mini-field trip to identify weeds on campus. Jeff showed slides of weeds and herbicide injury and the group discussed herbicide use and symptoms of injury. The agents learned which types of symptoms are associated with which herbicides.

The emphasis of the insect identification session, conducted by Mr. Eric Day of the Entomology Department, was on techniques used in the identification of insects and insect damage. The first part of the session was devoted to looking at some of the major characteristics used to distinguish the different orders of insects. This part of the session was conducted in a classroom setting. Many of the specimens used were insects preserved in alcohol. The rest of the session, which was conducted as a lab, was devoted to looking at specific insect specimens and plant samples with insect damage. The samples used were ones that had actually been submitted to the Insect Identification Laboratory. During this part of the session the emphasis was on specific characters and types of damage associated with certain groups of insects and/or specific insects.

On the last day, agents toured the research fruit tree orchard and chestnut and elm plantations with Dr. Charles Drake. This provided the group with an opportunity to examine several diseases firsthand. The agents learned about ongoing programs on disease control, both cultural and chemical. In the elm and chestnut plantations they saw various stages of chestnut blight and Dutch elm disease (DED) and learned about methods for controlling DED with fungicides.

After the agents had finished their training we solicited their opinions on the program. We received many constructive comments, both pro and con, on the format and content of the training session. We were encouraged by one agent's comment: "I will rate this in-service training as the best in-service training that I have attended in my 24 years as an employee of the Virginia Cooperative Extension Service". We will consider all the comments when we plan the program for next year as we feel it is important to be flexible to meet agents' needs. Please feel free to contact me at the Plant Disease Clinic if you have questions about the program.

Crop Genetics International

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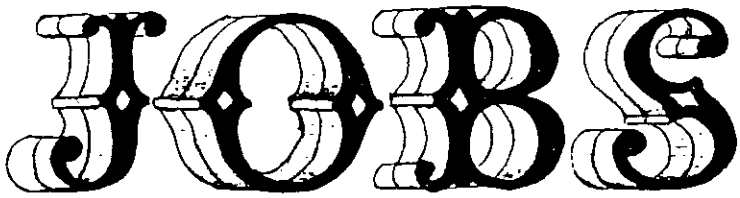
(301) 621-2900 • TELEFAX (301) 796-1104 • TELEX 380988

POSITIONS AVAILABLE

Crop Genetics International is seeking energetic, innovative individuals to join its microbial agchemical program. The successful candidates will join a multidisciplinary team developing an exciting, novel, microbial technology for "in-planta" production of agricultural chemicals. CGI is located in the Washington, D.C. - Baltimore, MD corridor, near BWI airport.

RESEARCH TECHNICIANS

- Position to provide technical support to a program in host-pathogen interactions / plant biology.
- Previous experience with sterile technique; bacteria, fungi, plant or animal tissue culture required. Preference will be given to candidates with strong laboratory background.
- Requires successful completion of a degree program in the biological or agricultural sciences.
- Contact Jed Fahey at: 796-4633 (Baltimore area)
  621-2900 (Washington area)
  1-800-556-8733 (elsewhere)



BOOKS

Bulb Pests. A. Lane. 1984. London: Her Majesty's Stationery Office. 81 pp. $11.95. Paperbound.

Do you know what symptoms stem nematodes produce on narcissus bulbs? Could you recognize bulb mite damage on freesia leaves? If not, you may be interested in Bulb Pests, a publication that covers "the recognition, life history, damage, and control of pests of ornamental bulb crops in the field, under protected cultivation, and in storage." This signature bound paperback from Britain's Ministry of Agriculture, Fisheries and Food discusses lesion, cyst, stem, and bulb and leaf nematodes: also covered are mites; aphids, thrips and other insects; and slugs. The amount of information afforded each pest appears proportional to its importance. Nematodes, being the primary pest problem in British bulb production, are covered much more thoroughly than flower thrips, which are described as "occasionally troublesome" and given a five line treatment. The plants covered are narcissus, hippeastrum, snow drop, nerine, eucharis, tulip, hyacinth, lily, gladiolus, bulbous iris, freesia, and crocus. Eight pages of color and four pages of black and white plates adequately illustrate the symptoms and signs described in the text. In areas where nematodes are limiting bulb production, this book should be a good reference. .

Diagnosis of Mineral Disorders in Plants. London: Her Majesty's Stationery Office.

Volume 1. Principles. C. Bould, E.J. Hewitt, and P. Needham. 1983. 174 pp. $26.25. Clothbound.
Volume 2. Vegetables. A. Scaife and Mary Turner. 1987. 98 pp. $34.25. Clothbound.
Volume 3. Glasshouse Crops. G. Windsor and Peter Adams. 1987. 168 pp. $40.00. Clothbound

Another publication from the Ministry of Agriculture, Fisheries, and Food is a five volume set entitled Diagnosis of Mineral Disorders in Plants. The individual volumes (in order starting with volume one) are Principles, Vegetables, Glasshouse Crops, Fruit, and Arable and Forage Crops.

The books were written with the intention to "inform at an appropriate level, advisers, final-year students, graduates with an interest in plant nutrition and well informed farmers and growers." These farmers and growers would have to be well informed indeed as volume one plunges into the molecular mechanisms of assimilation and metabolism of the "unequivocally essential elements". This book takes a biochemical approach and explains in wonderful detail, backed by hundreds of references, exactly what each element is used for, why nutrient toxicity or deficiency symptoms occur, how to detect them (visually, backed up by leaf analysis) and the occurrence and treatment of mineral disorders in the field. Specific examples are used to demonstrate general principles and 32 pages of color and black and white photographs (some of them looking rather old,) are used to illustrate salient points. This volume is meant to be a companion to whichever of the commodity volumes is of interest. It provides solid in-depth information that is not repeated in the other volumes.

Volume 2, Vegetables, is composed of 63 pages of color photographs illustrating nutrient disorders; these photographs are obviously more recent than many of those in Volume 1 and are of good quality. The remaining pages are devoted to written descriptions of mineral disorders. Sixteen of the common vegetable crops are covered, with the exception of potatoes, including a few rarely included in American publications (watercress, parsnips).

Volume 3, Glasshouse Crops, has about the same number of photograph pages but has a greater number of text pages. The latter deal in more detail with the individual nutrient disorders for each crop. Only seven crops are covered: cucumber, lettuce, pepper, tomato, carnation, chrysanthemum, and poinsettia.

Volumes 4 and 5 are not yet available.

These books are printed on heavy, semi-gloss paper and will bear up well under use. While nutritional information is available from plant physiology texts, the essential photographs needed to illustrate typical symptoms on a range of plants are usually not included. These volumes fill that gap and will be of interest to those who want an in-depth treatment of plant nutritional disorders.

All of the above books can be purchased from your local book dealer or through HMSO Books/Bernan Associates, 4611-F Assembly Drive, Lanham, Maryland 20706-4391. Additional charges for postage and handling will be assessed.

OHIO DIAGNOSTICS WORKSHOP

Mary Ann Hansen
Plant Disease Clinic, VPI&SU
Blacksburg, Va.

In November I attended a plant diagnostic workshop in Columbus, Ohio. This workshop was designed to bring together people who regularly diagnose plant problems. Plant pathologists were able to commiserate about all the "stumpers" they experienced during the year and report on some of the common problems they have encountered. Participants this year included diagnostic people from tree, turf, and landscape companies, nurseries, plant clinics, the Forest Service, the Extension Service, and several researchers from the Ohio State University.

Tomato Spotted Wilt

One of the pathogens addressed by workshop participants was the tomato spotted wilt virus, a potential pathogen of a number of agriculturally important crops in Ohio and neighboring states. This destructive virus has become a problem in several greenhouses in Ohio in the past several years. Potential sources of the virus are infected New Guinea impatiens, geranium, dahlia, and gloxinia purchased from southern states where the virus has been detected. The virus is also a pathogen of field crops, such as peanut, tobacco, tomato and pepper. The host range of this virus is very broad and it is not possible to list all its known hosts here.

Symptoms of the disease caused by tomato spotted wilt virus vary greatly depending on the host, titre of the virus, and environmental conditions. They include sudden wilt and rapid death of terminals, ring spots on leaves, mosaic, leaf puckering, and/or bronzing of leaves. Tomato spotted wilt virus is transmitted primarily by the western flower thrips. Mechanical transmission is possible but is probably not the major means of transmission in nature. Thus far, the virus has only been found in some greenhouses in Ohio and not in the field. This is presumably because the western flower thrips cannot survive Ohio's winters.

To illustrate the severity of the disease and the rapidity of transmission, Dr. Steve Nameth of the Ohio State University reported a case of infection of gloxinia by virus transmitted from nearby New Guinea impatiens. The gloxinias were apparently disease-free when purchased and were placed in a greenhouse across from infected New Guinea impatiens with a heavy infestation of western flower thrips. The gloxinias developed symptoms of ringspots and rapid death of terminals, and within 5 days of being placed in the greenhouse, they died.

Unfortunately, conclusive diagnosis of this destructive virus disease is very difficult. Dr. Nameth, who is conducting research on the disease, reports that antibody testing, one of the currently used techniques to detect the virus, may detect the virus one week, but may fail to detect the virus the following week, especially if the plant shows remission of symptoms. All of the foliage on an infected plant may die back but regrowth may appear symptomless if conditions are not favorable for symptom expression when regrowth occurs. Thus, a positive result with the antibody test would mean the virus is present, but a negative test may not necessarily mean that the plant is **not** infected. This is what makes detection of the virus so difficult. Dr. Nameth is currently conducting research on the use of another technique to detect tomato spotted wilt virus. It is hoped that this will lead to a more consistent detection of the virus.

Very few samples have come into the Clinic in Blacksburg with symptoms of this disease and tomato spotted wilt virus has been detected only once in Virginia. We do need to keep our eyes open for this disease in Virginia, however. The one case of the disease in Virginia was detected in dahlia. The diagnosis was performed by the Plant Disease Clinic at North Carolina State University. The Plant Disease Clinic at VPI&SU does not currently have the facilities to detect this virus; however, through collaboration with other laboratories we will be able to test samples for tomato spotted wilt. The infected dahlias submitted to our clinic had severe mosaic on the leaves and terminals wilted and died overnight in the laboratory. The plants submitted to N.C. State showed ringspots on the leaves instead of mosaic.

Other topics discussed at the diagnostic workshop were effects of the severe drought of 1987, which was also experienced in Ohio, a virus disease of dwarf pumpkins, ash yellows disease, scorch caused by xylem-limited bacteria on several species of landscape trees, and rose rosette disease of multiflora rose.

Drought Stress

Drought has been a problem in Ohio as well as Virginia in 1987. Symptoms of drought stress have been and will continue to be apparent in trees. Aboveground symptoms of drought stress on trees often do not become apparent until long after roots have been damaged by the lack of water. Thus, many symptoms of dieback that we will continue to see in trees may stem from drought in 1987 or from the cumulative effect of 3 subsequent years of drought in Virginia. The situation in Ohio is apparently worse than that in Virginia because Ohio received very little snow last winter. Participants in the workshop reported that in many areas dryness extended several feet into the ground. In heavily trafficked areas with compacted soil, water percolation is **very slow** and even water supplied continuously for 2-3 hours does not penetrate the soil more than a depth of 2-3 inches. Most people cannot afford to water for longer periods, so this makes the situation very severe indeed.

Watering trees deeply before the first hard freeze in winter is recommended. Foliage on evergreens will be less severely desiccated by winter winds if the trees can take up water before the ground freezes. Deciduous trees may benefit from this practice as well.

Watermelon Mosaic Virus-2

The causal agent of a virus disease of dwarf pumpkins submitted to the Plant Disease Clinic at the University of Kentucky was identified as Watermelon Mosaic Virus-2 (WMV2). Symptoms included mosaic on young leaves and ringspot or mosaic patterns on fruit. WMV2 is a rod-shaped virus that is transmitted primarily by aphids. Strain 2 affects cucurbits and a few other plants, including peas, alfalfa, vetch, crimson clover, and snow-on-the-mountain, whereas strain 1 affects only cucurbits. Damage can be severe on watermelon, winter and summer squash, and cucumbers.

Ash Yellows

Ash yellows disease, caused by a mycoplasmalike organism, was also discussed at the meeting. Mycoplasmalike organisms (MLO's) are microscopic to submicroscopic organisms that lack a cell wall and a membrane-bound nucleus. They are difficult to isolate and difficult to see with the light microscope, so they can be accidentally overlooked as the cause of a tree's decline. I have not seen ash yellows in Virginia; however, researchers studying the disease have reported it in

many eastern states. Symptoms are a light green to yellow color of the foliage and witches' brooming of sprouts on the trunk. Sometimes the only foliage that is yellow is that in the witches' broom. Infected trees suffer a gradual decline and dieback. Both white and green ash are susceptible. The pathogen is transmitted by leafhoppers and colonizes the phloem. No effective controls for the disease are known.

Scorch Diseases

Scorch diseases of various landscape trees were also discussed. This group of diseases is caused by pathogens known as fastidious or xylem-restricted bacteria. These organisms are also very difficult to culture and the diseases they cause may often be erroneously attributed to drought or other stresses. These bacteria invade the water-conducting vessels of the tree and disrupt the flow of water from roots to leaves. Symptoms are wavy marginal necrosis on leaves, sometimes coupled with a bright chlorosis just inside the brown tissue, and dieback. The leaf scorch symptoms may be seen on all or just part of the tree. The disease has previously been confirmed in elm, sycamore, mulberry, and, at this meeting, Dr. John Hartman from the University of Kentucky reported it for pin oak. The report for pin oak is especially interesting since scorch symptoms in pin oak are commonly attributed to drought stress or iron deficiency. As for ash yellows, no effective control methods are currently known.

Rose Rosette

Rose rosette of multiflora rose is a disease that shares several characteristics with diseases caused by MLO's; however, the causal agent of this disease has not yet been isolated or identified. Witches's brooming or "rosetting" and chlorosis of shoots occurs. Leaves may also take on a reddish color and may be smaller than normal or strap-shaped. The pathogen is known to be transmitted in nature by grafting and by eriophyid mites that feed on and colonize the buds. Several scientists have interest in researching this disease as a potential method of biological control for multiflora rose; however, a potential danger to garden roses would have to be assessed before such a control could be put to use. Rose rosette has been found in multiflora rose in several counties in Ohio and appears to be moving eastward. It has not, however, been found in garden roses in Ohio.

May 26-29, 1988. CONTINUOUS CELL LINES AS SUBSTRATES FOR BIOLOGICALS. National Clarion Hotel, Arlington, Virginia, (Washington, D. C.), USA. Contact: Cell Substrates Conference Registrar, Talley Management Group, Inc., 22 Euclid Street, Woodbury, New Jersey 08096 USA.

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A conference on CONTINUOUS CELL LINES AS SUBSTRATES FOR BIOLOGICALS will be held at the National Clarion Hotel, Arlington, Virginia, (Washington, D. C.), USA, May 26-29, 1988. This conference is sponsored by the International Association of Biological Standardization (IABS), Cell Culture Committee (CCC), European Society of Animal Cell Technology (ESACT), and the World Health Organization (WHO).

Conference Objectives:

- To provide a forum to discuss the use of continuous cell lines for the production of biologicals.
- To report on experiences with continuous cell lines in the production of biologicals.
- To form working groups that will produce consensus documents on minimum standards for the use of continuous cell lines in the production of biologicals.

Program Topics:

- History and Definition of the Problem
- Results of the WHO Study Group
- Veterinary Vaccines
- Hybridomas
- Hepatitis B Vaccine
- TPA
- Erythropoeitin
- Dominant Markers
- Expression Vectors
- Viral Vectors Carrying Recombinant DNA in Animal Cells
- Interferon
- Polio and Rabies Vaccines
- Others

Hotel Information:

National Clarion Hotel
300 Army/Navy Drive
Arlington, Virginia 22202, USA

A full American plan (breakfast, lunch, and dinner) will be available with hotel registration.

Conference Information and Registration Forms:

Cell Substrates Conference Registrar
Talley Management Group, Inc.
22 Euclid Street
Woodbury, New Jersey 08096, USA

609-845-7220; 800-338-1921

PDQ INDEX 1987 (Vol. VIII)*

FACT SHEETS (cont'd)

General

Disease Picture Sheets and Booklets (IL) - JUN/2 (31)

Ornamentals

Deciduous Trees - Disorder: Springtime Weather Injury to Foliage (WI) - JUN/2 (27)

Vegetables

Fusarium Wilt Resistance in Muskmelon and Watermelon Varieties (IN) - JUN/2 (25)

FEATURES

Caution --- Unknown Worm Inside (OH) - JUN/2 (4)
Clinic Internships for County Agents (VA) - DEC/4 (4)
Ohio Plant Diagnostic Workshop (OH) - JUN/2 (1)
Programmed Disease Control for Geraniums and Chrysanthemums (IL) - MAR/1 (1)
Phytophthora (Detection, Isolation, etc.) - SEPT/3 (1)
Scab Test (Wheat) (MN) - SEPT/3 (12)
Tomato Spotted Wilt Virus (OH) - DEC/4 (1)

HELP REQUESTED (notices)

Cultures Wanted (USDA, Beltsville) - SEPT/3 (18)
Computer Database Mgmt. Program Wanted (MN) - SEPT/3 (18)

JOB ANNOUNCEMENTS

Director, Pest Diagnostic Clinic (Guelph) - MAR/1 (attached)
Supervisor, Diagnostic Lab (OK) - SEPT/3 (19)

LETTERS TO PDQ

Computer Systems for Diagnostic Labs (F. McElroy) - SEPT/3 (iv)
Diagnostics Manual (C. Semer IV) - SEPT/3 (ii)
(from Rick Wukasch) - SEPT/3 (45) (Appendix 5)

LISTS

1987 PDQ Subscribers - SEPT/3 (39) (Appendix 4)
Plant Pathology & Related Newsletters (by Institution) - JUN/2 (20)

NOTICES

Chemlawn Diagnostic Lab (Closing) - JUN/2 (11)
Spotlight on Diagnosis (Plant Disease) - SEPT/3 (47)

PLANT DIAGNOSTICIAN'S QUARTERLY (PDQ)

1987 Financial Report - SEPT/3 (38) (Appendix 3)
1987 PDQ Subscribers (list) - SEPT/3 (39) (Appendix 4)

Product Announcement

Agdia, Inc. Tomato Spotted Wilt Virus Test - JUN/2 (15)
Products and Services - JUN/2 (17)

SLIDE SET

Phytophthora ID Workshop (OH) - SEPT/3 (11)

TECHNIQUES

Phytophthora (Detection, Isolation, etc.) - SEPT/3 (1)
Scab Test (Wheat) (MN) - SEPT/3 (12)
Tomato Spotted Wilt Virus (OH) - DEC/4 (1)

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* References are indexed as follows: month/number of issue and page number. For example, Mar/1 (5) refers to the March or number 1 issue, page number 5. (UK) refers to a book published in the United Kingdom. (Paul Bachi, ed.)