

New, Emerging, and Threatening Plant Diseases and Crop Biosecurity ¹

Carrie Lapaire Harmon, Tim Momol, Jim Marois, and Pam Roberts ²

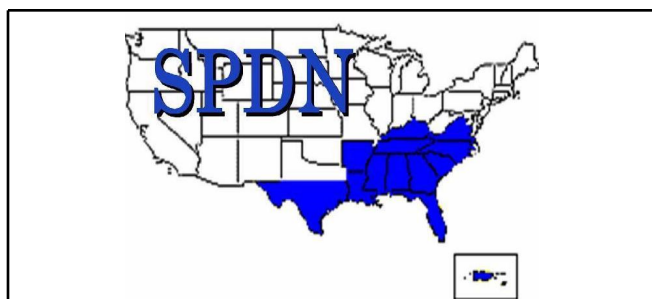


Figure 1. Southern Plant Diagnostic Network (SPDN)
"Educate to detect"

SPDN: Regional Network for Crop Biosecurity

In 2002, the USDA-NIFA began its support of the National Plant Diagnostic Network, a national project and part of the USDA Homeland Security initiative to help protect agriculture by quickly detecting and accurately diagnosing and identifying new introductions of pathogens, insects, nematodes, and weeds.

Five land grant universities (University of California at Davis, Cornell University, University of Florida, Kansas State University, and Michigan State University) in the United States have been designated

as the coordinating institutions for their Plant Diagnostic Regions for the U.S. National Plant Diagnostic Network (<http://www.npdn.org>). The **Southern Plant Diagnostic Network (SPDN)** at the University of Florida (UF) established this network with 11 other southern states and two U.S. territories (Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Texas, U.S. Virgin Islands, Virginia -see Figure 1). This network's main objective is to improve regional capabilities for rapid and accurate identification and diagnoses to safeguard against newly introduced and re-emerging pests and pathogens and natural or man-made changes in endemic organisms.

The mission of SPDN as a regional network is to promote the health and security of plants by identifying, intercepting, and providing management recommendations for plant diseases and pests that could threaten U.S. agriculture. In response to national concerns for the security of our food supply, the Diagnostic Networks are accomplishing their missions by working with partners throughout the U.S. to (i) enhance diagnostic capabilities and

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2. Carrie Harmon, Associate In, Plant Pathology Department; Tim Momol, Extension Director, Central region; Jim Marois, Professor, Plant Pathology Department, North Florida Research and Education Center, Quincy; Pam D. Roberts, Associate Professor, Southwest Florida Research and Education Center (SWREC), Immokalee; Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

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establish a secure, regional network for the detection and diagnosis of plant health problems, and better track the health of crops and/or the spread of pests, (ii) extend and support sound public policies, (iii) implement rapid and accurate diagnoses, and (iv) provide leadership and training for First Detectors and others.

New plant diseases caused by fungal, bacterial and viral pathogens have appeared at an alarming rate in Florida in the last two decades (Harmon, C. L., Harmon, P. F., and Momol, M. T. 2006. Florida: A Sentinel State for New and Emerging Plant Pathogens. *Phytopathology* 96:546) Plant pathologists have described those findings in scientific journals, and the media has shown great interest in this issue. Citrus diseases such as canker and greening in Florida, for example, have been highly visible disease problems discussed, sometimes daily, in the popular media. Legitimate concerns on citrus canker raised by citrus growers in Florida received immediate attention by all state and federal agricultural organizations. The eradication efforts of FDACS in collaboration with scientists from UF/IFAS and USDA, have been aimed at limiting and recovering from serious disease and pest introductions.

In light of national concerns for crop biosecurity, new, emerging and threatening plant diseases have received more attention from all interested parties. Geographically, the state of Florida is uniquely at risk for the introduction of new pathogens and pests of plants and animals, and the climate is highly conducive to maintaining disease-inducing organisms year-round. Due to its location, heavy visitor traffic and climate, Florida has experienced at least 4-5 new plant diseases per year. UF/IFAS Plant Disease Clinics and plant pathologists in Florida actively assist the agricultural industry in Florida and the US by rapid and accurate detection, diagnosis, and development of management recommendations for these new diseases.

Disease Categories

The American Phytopathological Society (APS) is taking a leadership role in the US to increase awareness of crop biosecurity issues. In an *APSnet*

feature article, Damsteegt (1999) described five pathogen categories. We are suggesting a similar approach:

1. *New Disease*. Disease described on a new host within last five years in a new geographic area.
2. *Emerging Disease*. Disease incidence has increased within the last 10-15 years.
3. *Re-emerging Disease*. Previously known disease in an area, but gaining importance due to pesticide resistance, vector shift, changes in cultivars or culture, or natural changes in endemic pathogens, and other reasons.
4. *Threatening Disease*. Disease not reported or very limited in distribution in a new geographic area.
5. *Chronic/spreading Disease*. Known for a longer period in an area but still causing outbreaks.

Lists of new and emerging diseases in Florida (Table 1) and elsewhere have been developed. See these Web sites :

1. NCSU site:
<http://craven.ces.ncsu.edu/files/library/25/hortnews506.pdf>
2. Damsteegt (1999) APS site:
<http://www.apsnet.org/online/feature/NewViruses/Top.html>
3. Madden (2001) APS site

Crop Biosecurity

Literature on crop biosecurity and biological warfare (BW) related to plant pathogens is limited. An *APSnet* feature article by Schaad et al. (1999) summarized the subject and presented references. Schaad et al. (1999) mentioned the difficulties of determining precise causes for the emergence of new diseases, and added “the remote possibility that some new diseases could have occurred as a result of deliberate introduction.”

For further information please visit these web pages:
<http://www.apsnet.org/online/feature/NewViruses/>

Top; html

<http://www.apsnet.org/online/feature/BioSecurity/>

Top.html

Plant pathologists and personnel in plant disease clinics, County Extension offices and private sector are the first line of defense against new diseases (Miller, S., Beed, F., and Harmon, C.L. 2009. Plant Disease Diagnostic Capabilities and Networks. Annual Review of Phytopathology.). In the state of Florida, the four official plant disease clinics, many plant pathologists at several RECs, and 67 County Extension offices are networked against a potential threat from introduced plant pathogens. The Florida Plant Diagnostic Network (FPDN, <http://fpdn.ifas.ufl.edu>), UF/IFAS's Web-based Distance Diagnostic and Identification System (DDIS, <http://ddis.ifas.ufl.edu>) and the Plant Diagnostic Information System (PDIS, <http://www.pdis.org>) are playing an important role in the accomplishment of this goal. Improvement in the infrastructure of plant disease clinics and the DDIS capabilities of County Extension offices is essential for defense against new diseases.

Scientists at UF/IFAS, USDA, and FDACS are providing research support for discoveries, rapid detection, identification, and mitigation of plant pathogens. For a more secure future of Florida's crops and food supply, research in epidemiology, molecular biology, and in all disciplines of plant pathology needs further enhancement. This investment is still needed to maintain the competitiveness of Florida's agricultural sector. Specific areas that need further research are the following:

- Improvements in basic identification of and discrimination between new pathogens
- Molecular and immunological detection methods, PCR, realtime PCR
- epidemiology and management of new and exotic plant diseases
- molecular fingerprinting techniques
- development of disease resistant genotypes through classical breeding and genetic engineering

- enhanced distance diagnostics, training, and communications regarding new and high-impact diseases

County Extension Faculty (First Detector Educators) and First Detectors

Our educators and First Detectors are our first line of defense against new, emerging, or other high-impact plant diseases. If you encounter an unfamiliar disease symptom on any plant, immediately take digital images of the symptoms and send them to multiple plant pathology specialists through DDIS. You may also send samples to the closest plant disease clinic or plant pathologist. Diagnostic fees may not be charged for samples associated with crop biosecurity and high-impact diseases in Florida; call your diagnostic clinic or extension office before sending the sample to confirm this. Prepare newsletter and media articles on the subject of emerging and high-impact diseases to increase awareness among your clientele and Florida citizens. For further information, or in an emergency situation, contact one of the plant disease clinics and offices listed below.

Gainesville: Florida Extension Plant Disease Clinic. P.O. Box 110830, U.F., Bldg. 78, Mowry Rd., University of Florida, Gainesville, FL 32611-0830. **Note:** For overnight mail or package delivery service (UPS, Fedex, etc.) be sure to include the physical street address: "UF, Bldg. 78, Mowry Rd." **Phone: (352) 392-1795** FAX: (352) 392-3438, E-mail: pdca@ufl.edu

Quincy: Florida Extension Plant Diagnostic Clinic-Quincy. North Florida REC, 155 Research Road, Quincy, FL 32351. **Phone: (850)-875-7140**, FAX (850) 875-7148

Homestead: Florida Extension Plant Disease Clinic-Homestead. Tropical REC, 18905 S.W. 280th St., Homestead, FL 33031-3314. **Phone: (305) 246-6340**, FAX (305) 246-7003, E-mail: ajp@ufl.edu

Wimauma: Florida Extension Plant Disease Clinic-Wimauma. Gulf Coast REC, 14625 CR 672, Wimauma, FL 33598. **Phone: (813) 634-0000**, FAX (813) 634-0001, E-mail: nperes@ufl.edu

Southern Plant Diagnostic Network, Plant Pathology, 1453 Fifield Hall, P.O. Box 110680, Gainesville, FL 32611-0680. **Phone (352) 273-4645**, FAX (352) 392-7348, E-mail: clharmon@ufl.edu

Contacts in the Southern Region and U.S. for University Plant Diagnostic Clinics

American Phytopathological Society Web site:
[http://www.apsnet.org/directories/
univ_diagnosticians.asp](http://www.apsnet.org/directories/univ_diagnosticians.asp).

Table 1. List of important new and emerging diseases in Florida. This is a dynamic list and subject to change.

Disease	Pathogen	Major Hosts	Internet Source
Bacterial Fruit Blotch	<i>Acidovorax avenae</i> subsp. <i>citrulli</i>	Watermelon	http://www.doacs.state.fl.us/pi/enpp/pathology/fruit-blotch.html
Citrus Canker	<i>Xanthomonas axonopodis</i> pv. <i>citri</i>	Citrus spp.	http://www.doacs.state.fl.us/pi/canker/
Daylily Rust	<i>Puccinia hemerocallidis</i>	Daylily	http://www.doacs.state.fl.us/pi/enpp/pathology/daylily-rust.html
Tomato Yellow leaf curl (TYLC)	TYLCV (new strains or New Begomoviruses)	Tomato Ornamentals	http://www.doacs.state.fl.us/pi/enpp/pathology/pathcirc/pp366.pdf
Tomato spotted wilt (TSW)	TSWV (new strains) New Tospoviruses	Tomato, Peanut, Tobacco, Potato, Pepper	http://plantpath.ifas.ufl.edu/takextpub/FactSheets/circ0914.pdf
Impatiens necrotic spot (INS)	INSV	Ornamentals	http://www.oznet.ksu.edu/tospovirus/
Bacterial Wilt	<i>Ralstonia solanacearum</i> especially race 3	Tomato, Potato, Tobacco, Geranium, Ornamentals	http://plantpath.ifas.ufl.edu/takextpub/FactSheets/circ1207.pdf http://edis.ifas.ufl.edu/PP103
Karnal Bunt	<i>Tilletia indica</i>	Wheat	http://www.aphis.usda.gov/plant_health/plant_pest_info/kb/index.shtml
Bacterial streak & bulb rot of onion, sourskin of onion, slippery skin of onion, Pantoea blight of onion, and Erwinia and Pseudomonas soft rots of onion.	http://www.apsnet.org/online/common/names/onion.asp	Onion	http://www.plant.uga.edu/faculty/gitaitis.htm
Chrysanthemum White rust	<i>Puccinia horiana</i>	Chrysanthemum	http://spdn.ifas.ufl.edu/Top_Exotic_Pathogens_of_Concern_SPDN.pdf
Citrus variegation	Citrus variegated chlorosis ilarvirus (CVC)	Citrus	http://www.agls.uidaho.edu/ebi/vdie/descr223.htm
Citrus Greening	<i>Liberobacter</i> spp.	Citrus	http://edis.ifas.ufl.edu/pp133

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Pierce's Disease	<i>Xylella fastidiosa</i>	Grape, ornamentals, and more	http://www.cnr.berkeley.edu/xylella/
Potato Cyst Nematode	<i>Globodera pallida</i>	Potato family, including tomato, eggplant, and some weeds	http://www.aphis.usda.gov/newsroom/content/2006/06/pcnematode.shtml http://www.aphis.usda.gov/plant_health/plant_pest_info/potato/pcn.shtml
Plum Pox	Plum pox virus (PPV)	Stone fruits	http://sharka.cas.psu.edu/ http://www.aphis.usda.gov/plant_health/plant_pest_info/plum_pox/index.shtml
Potato mop-top	Potato mop-top virus (PMTV)	Potato	http://plant-disease.ippc.orst.edu/disease.cfm?RecordID=1439
Soybean Rust	<i>Phakopsora</i> spp.	Soybean	http://www.aphis.usda.gov/plant_health/plant_pest_info/soybean_rust/index.shtml