Pests in Brief

Pest review
We continue our review of “Not Wanted” pests and diseases featured in previous newsletters. This quarterly review presents three diseases of bananas. One is a fungal disease called Fusarium wilt or Panama disease. The other two, Moko disease and Xanthomonas wilt, are caused by bacteria. Two other severe diseases, banana bunchy top and black leaf streak (black Sigatoka), are already widespread and not included.

For more information, see back issues of the PPD News at https://www.wpdn.org/newsletters.

Leaf spot diseases of noni/nonu
In October 2012, two fungi were recorded for the first time on noni (Morinda citrifolia) in Hawaii. They were found during a Cooperative Agricultural Pest Survey (CAPS) conducted by USDA APHIS Plant Protection and Quarantine.

*Phyllosticta morindae* causes “frog-eye” or “shot-hole” leaf spots and was found on Hawaii Island, Molokai, and Oahu. It is usually not a problem, but can cause severe leaf loss during long periods of wet weather. This disease has been reported previously from most of the Pacific Islands, including American Samoa, Guam, Palau, and the Federated States of Micronesia.

*Mycosphaerella morindae* is considered a minor leaf spot pathogen, but is thought to be a new state record for Hawaii. It was found during the same month on Hawaii Island, Maui, Oahu, and Kauai.
Two viruses, unreported on the mainland U.S. or in Hawaii, were recently detected on cuttings of edible fig (*Ficus carica* L.) imported from California. Mature leaves had a mild “shoestring-like” distortion and patchy mosaic color pattern with “green islands” (Fig. 1). These symptoms are typical of many virus infections. New leaves had light green areas around some veins, but no distortion (Fig. 2). Molecular analysis identified two viruses, Fig mild mottle-associated virus (FMMaV) and a novel virus that appears closely related to Citrus tristeza virus. Both are in the genus Closterovirus, family Closteroviridae. The virus is transmitted by grafting and by aphids, but not by tools or other mechanical means. The origin of these viruses is unknown and it has yet to be proved that one or both caused these symptoms.

All information and photos courtesy of Mike Melzer, University of Hawaii at Manoa.
Unwanted Pests of Banana

Panama disease (Fusarium wilt), tropical race 4

(A) Bright yellow color of lower leaves is an early symptom of Panama disease (Fusarium wilt). (B) “Skirts” of dead, wilted leaves hang on the pseudostems of dead plants. (C) Xylem (water conducting) vessels in the pseudostem turn reddish-brown late in the disease. (D) Healthy pseudostem.

Origin and Distribution. Southeast Asia, Indonesia, Peninsular Malaysia, Taiwan, Australia.

Symptoms. Early symptoms: wilting, lower leaves are light yellow, especially around the edges, becoming bright yellow with dead edges (Photo A). Dead leaves hang from the plant, forming a “skirt” (Photo B). Brown rings form inside of roots, rhizome, pseudostem (Photo C). Fruits are not affected.

 Likely Locations. Wherever bananas are grown and Fusarium oxysporum f. sp. cubense tropical race 4 is present in the soil.

Host Range. Race 4 affects most dessert, cooking, and plantain bananas, but the Cavendish subgroup (e.g., ‘Williams’) is only susceptible to it in certain areas of the subtropics. Tropical race 4, however, attacks all bananas, including Cavendish, in the subtropics and tropics.

Impact. When ‘Gros Michel’ plantations were decimated by Panama disease race 1 in the mid-1900s, the resistant Cavendish subgroup became the world’s leading export banana. If tropical race 4 becomes widespread and destroys Cavendish production, there are no resistant banana varieties to take its place.

For more information

Contact Your Local Diagnostic Clinic, Department of Agriculture, or University — Page 8
Banana Xanthomonas wilt \textit{(Xanthomonas campestris pv. musacearum)}

(A) Reddish-brown internal fruit rot. (B) Cuts through vascular tissues produce a thick, pale yellow ooze.

**Origin and Distribution.** First report in 1939, on \textit{Ensete ventricosum} (false banana) in Ethiopia. Now on banana species and cultivars throughout Central and Eastern Africa.

**Symptoms.** Similar to Moko disease (see below) except:
- bracts and male flower buds wilt.
- fruit has a red-brown internal rot (Photo A).
- it produces yellow ooze on fresh-cut plant surfaces (Photo B).

**Host Range.** \textit{Ensete} and various species and cultivars of banana (\textit{Musa}).

For more information:
Xanthomonas Wilt (select PDF or PDF with links), [http://apsjournals.apsnet.org/doi/abs/10.1094/PDIS-93-5-0440](http://apsjournals.apsnet.org/doi/abs/10.1094/PDIS-93-5-0440)

**Moko disease** \textit{(Ralstonia solanacearum} race 2 biovar 1)

**Origin and Distribution.** Trinidad (1890s), Mexico, Central and South America, Jamaica, the Philippines.

**Symptoms.** Similar to Panama disease (see page 3), except:
- it will affect plants and suckers younger than 4 months old.
- fruit may ripen prematurely, or split.
- fruit pulp is firm, turns brown and then gray (Photo A).
- it produces cream to black bacterial ooze on cut plant surfaces.

**Host Range.** Ornamental \textit{Heliconia} spp., most dessert bananas (\textit{Musa} \textit{accuminata} and cultivars), plantains and cooking bananas (\textit{M. accuminata} x \textit{M. balbisiana}).

**Impact.** The bacteria live in the plant and soil and are easily spread. Control measures to prevent disease spread on commercial farms are a major expense. Losses up to 75% have been reported by subsistence farmers.

For more information
(A) Healthy mango fruit. (B) Fruit infections decrease marketability and provide entry points for other pathogens. (C) Close-up of raised, crater-like bacterial lesions. (D) Gummy exudate contains live bacteria that can enter openings in the fruit, or be spread by wind-blown rain to other fruits on the same or nearby trees.

**Origin and Distribution.** First described in South Africa (1915), but found on herbarium specimen from India in 1881. Also reported from Reunion Is., China, Mexico, Central and South America, Indonesia, Australia, Japan, Taiwan, and the Philippines. First U.S. record, September 2012 on the Hawaiian Islands of Maui and Oahu.

**Symptoms.** Leaves—small (5 mm), black, raised, angular spots limited by veins, often with yellow borders; can expand forming larger dead areas.

Fruit—small water-soaked spots become black, star-shaped, erupting lesions, often with gummy ooze; a “tear-stain” infection pattern is common.

Twigs, branches—elongated cankers with oozing can cause twig and branch dieback on susceptible cultivars.

Flowers—infected buds, petals, or flower clusters
(A) Plant exudate and bacteria ooze from an infected stem. (B) Bacterial leaf spots are often limited by veins and appear angular, or flat-sided (arrows). (C) Young lesions and yellow borders on lower leaf surface. (D) Don’t confuse bacterial black spot with these large, rapidly growing spots caused by a fungal disease called anthracnose.

**Host Range.** Mango (*Mangifera indica*); cashew (*Anacardium occidentale*); ambarella, or golden/sugar apple (*Spondias dulcis*); mombin or yellow mombin (*Spondias mombin*).

**Impact.** Mangoes are one of the most cultivated fruits, fifth in production worldwide in 2004. Premature fruit drop and reduced market values have caused financial losses of 50–80% in orchards with mango bacterial black spot. There are no effective treatments for this disease.

**Likely Locations.** Anywhere mangoes are grown. Warm temperatures and moisture intensify disease symptoms. Wind-blown rain increases spread of the bacteria.

**For More Information**
**Pests of Concern**

**ARTHROPODS**
- **Africanized honey bee** (*Apis mellifera scutellata*) [http://www.invasivespeciesinfo.gov/animals/afrhonbee.shtml](http://www.invasivespeciesinfo.gov/animals/afrhonbee.shtml)
- Red imported fire ant (*Solenopsis invicta*) [http://entnemdept.ufl.edu/creatures/urban/ants/red_imported_fire_ant.htm](http://entnemdept.ufl.edu/creatures/urban/ants/red_imported_fire_ant.htm)
- Silverleaf whitefly (*Bemisia argentifolii*) [http://www.entnemdept.ufl.edu/creatures/veg/leaf/silverleaf_whitefly.htm](http://www.entnemdept.ufl.edu/creatures/veg/leaf/silverleaf_whitefly.htm)

**DISEASES**
- **Citrus greening** (*Candidatus Liberibacter asiaticus*) [http://www.crec.ifas.ufl.edu/extension/greening/index.shtml](http://www.crec.ifas.ufl.edu/extension/greening/index.shtml)
- Iris yellow spot virus [http://aces.nmsu.edu/pubs/h/H-255.pdf](http://aces.nmsu.edu/pubs/h/H-255.pdf)
- **Lethal yellowing of palm** (*Candidatus Phytoplasma palmae*) [http://edis.ifas.ufl.edu/pp146](http://edis.ifas.ufl.edu/pp146)
- **Sudden oak death** (*Phytophthora ramorum*) [http://hawaii.gov/hdoa/pi/pq/QPA04-02_Sudden_Oak_Death.pdf](http://hawaii.gov/hdoa/pi/pq/QPA04-02_Sudden_Oak_Death.pdf)

**PLANTS**

Pests listed in **BOLD** are not, to our knowledge, present in the American Affiliated Pacific Islands.

**IF A LINK IS INOPERABLE, TRY COPYING AND PASTING IT DIRECTLY INTO YOUR BROWSER**
Websites

PEST INFORMATION
American Samoa: http://www2.ctahr.hawaii.edu/adap2/ascc_landgrant/technical_papers.asp#brochures
Bugwood (images): http://bugwood.org/
Crop Knowledge Master: http://www.extento.hawaii.edu/kbase/Crop/crop.htm
Hawaii Invasive Species Council: http://www.hawaiinvasivespecies.org/pests/
Hawaiian Department of Agriculture (new pest advisories): http://hawaii.gov/hdoa/pi/ppc/NPA
Hawaiian Ecosystems at Risk (Pacific invasive species): http://www.hear.org/
Master Gardeners (national pest list): http://wiki.bugwood.org/npdn-mg-training
Western Micronesia Regional Invasive Species Council: http://guaminsects.net/gisac/index.php?title=Main_Page

DIAGNOSTIC CLINICS AND DIAGNOSTICIANS
American Samoa Comm. College, Land Grant: Mark Schmaedick m.schmaedick@amsamoa.edu (684) 699-1575; Ndeme Atibalentja (plant diseases) n.atibalentja@amsamoa.edu (684) 699-1575
University of Guam: Robert Schlub (plant diseases) rlschlub@uguam.uog.edu (671) 735-2089; Aubrey Moore (insects) amoore@uguam.uog.edu (671) 735-2141
Hawaii Department of Agriculture: Bernarr Kumashiro (insects) Bernarr.R.Kumashiro@hawaii.gov (808) 973-9534; Mann Ko (plant diseases) Mann.P.Ko@hawaii.gov (808) 973-9546
University of Hawaii at Manoa (diagnostic clinic): Honolulu adsc@ctahr.hawaii.edu, (808) 956-6706; Komohana Research Extension Center, Hilo komohana@ctahr.hawaii.edu, (808) 981-5199

ORGANIZATIONS
Pacific Islands Distance Diagnostics and Recommendation System (PIDDRS): http://dddi.org/pacific/
Western Plant Diagnostic Network https://www.wpdn.org/index.php
Western Pacific Tropical Research Center (Guam) http://www.wptrc.org/
National Plant Diagnostic Network http://www.npdn.org/

EDUCATION AND TRAINING
Extension Disaster Education Network http://eden.lsu.edu/Pages/default.aspx
NPDN First Detector Training Sites; http://www.npdn.org/first_detector
NPDN First Detector Newsletter: http://www.npdn.org/newsletter
Protect U.S. invasive species network http://www.protectingusnow.com/
WPDN Homepage: https://www.wpdn.org/index.php
WPDN and Pacific First Detector Newsletters: https://www.wpdn.org/newsletters

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