

2021: Observed Chile Pepper Diseases from the field and Plant Diagnostic Clinic



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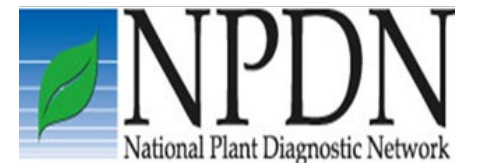
Outline

- Plant clinic introduction
- 2021 Disease observations
- How to submit a sample



Plant Clinic Introduction

- Main Objectives:
 - To provide plant diagnostic services for the state of New Mexico and the Southwestern region of the United States
 - To be a support lab/facility for the National Plant Diagnostic Network Western Region
 - Overall objective: Establish a functional **national network** of existing diagnostic laboratories to rapidly and accurately **detect** and **report** pathogens, pests and weeds of national interest, whether intentionally introduced or not



Plant Clinic Introduction

- NPDN STAR-D Accredited
 - System for Timely, Accurate and Reliable Diagnostics
 - Accredited as of September 1, 2016 (4th in nation)
 - University of Florida, 2014
 - Cornell University, 2014
 - Nevada Department of Ag, 2015
 - **NMSU, 2016**
 - Texas A&M, 2017
 - Iowa State University, 2019
 - University of Puerto Rico, 2020



NMSU Plant Diagnostic Clinic

- Team effort

- Personnel:

- Director/ Weed specialist (Dr. Leslie Beck)
- Diagnostician (Phillip Lujan)
- Assistance from all Extension Specialists
 - Entomologists
 - Weed scientists
 - Horticulturists
 - Nematologists



NMSU Plant Diagnostic Clinic

- Services provided under our accreditation scope:
 - **Integrated** plant diagnostic clinic
 - Biotic issues/diseases
 - Abiotic issues
 - Arthropods
 - Plant and weed identification
 - Permitted to receive unknowns (diseases/abiotic/nematodes/insects) from within the contiguous 48 states



NMSU Plant Diagnostic Clinic

- Services outside our accreditation scope and **unable to provide**:
 - Anything human disease related
 - Inside home problems (molds)
 - Toxicology/animal parasites (vet issues)
 - Herbicide concentrations
 - Plant nutritional analysis / soil tests
 - Seed testing for certification



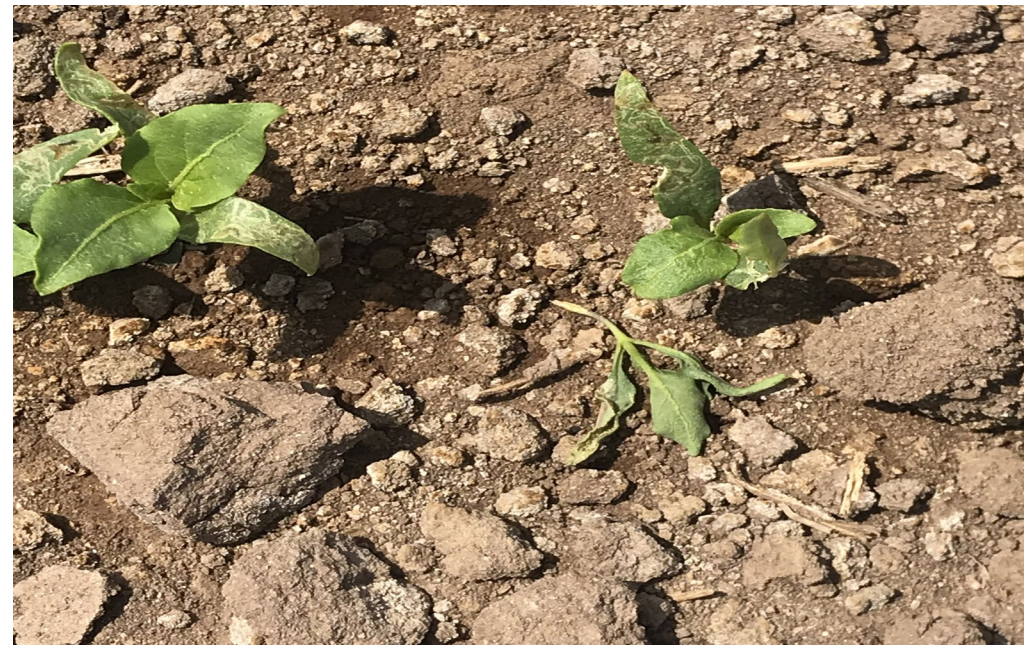
2021 Disease Observations



- NM “Big 4”
 - Seedling stage – damping off
 - *Fusarium sp.*
 - *Rhizoctonia solani*
 - Mature stage – wilt and root rot
 - *Verticillium dahliae*
 - *Phytophthora capsici*
- Powdery mildew
- Anthracnose
- Tomato spotted wilt virus
- Beet curly top virus
- Alfalfa mosaic virus

Fusarium/Rhizoctonia

- Soilborne fungal seed/seedling diseases
 - Symptom: “damping off” – occurs when seeds or seedlings are attacked by these pathogens
 - Seeds: fail to germinate
 - Seedlings:
 - A) Roots rot causing wilt and death
 - B) Pathogen attacks stem at the ground line causing collapse
- Direct seeded chile more susceptible than transplants
- Results in poor stand development



Fusarium/Rhizoctonia

- Conducive environment for infection:
 - Cold, wet periods after spring planting
 - Also delays seedling growth = stage more susceptible to pathogen attack
 - Excessive irrigation prior to emergence = > disease severity
 - Problem in raising transplants in greenhouse
 - High humidity + frequent overhead watering
 - Using sterile soil or potting mix is recommended
- Management: plant high quality seed or transplants, avoid fields and seed beds that are poorly drained



Verticillium dahliae



- Verticillium wilt
 - Soilborne fungus
 - Occurs worldwide on a diverse group of plants
 - Hosts include: chile, cotton, alfalfa, melons and several weed species
 - Symptoms can be highly variable
 - Susceptibility of the host
 - Aggressiveness of the pathogen
 - Environmental conditions
 - Early symptoms:
 - Chlorosis of lower leaves / plant stunting
 - Mature symptoms:
 - Excessive yellowing / leaf shedding
 - Poor stand

Verticillium dahliae

- Conditions for disease:
 - Microsclerotia in soil and crop debris
 - Specialized survival structures
 - Tolerate extreme environmental conditions or in absence of a host
 - Germinates in presence of moisture or root exudates of susceptible plants
 - Fungus penetrates roots and moves through xylem
 - Leading to above-ground symptoms
- Management: no great control measures known; if pathogen is present, 3-4 year crop rotation and plant barely or small grains to reduce population of microsclerotia in soil



Phytophthora capsici

- Phytophthora crown and root rot, “chile wilt”, Phytophthora blight
- Soilborne fungal-like organism
- Survives in crop debris and soil as oospores
- Moves and can cause infection via motile zoospores
- Symptoms:
 - Severe wilting
 - Plant collapse after a few days, turning straw colored
 - Defoliated plants
 - Root/crown rot
 - Fruit rot



Phytophthora capsici

- Conditions for disease:
 - Excessively wet soil
 - Over-irrigation, heavy rains or both
 - Heavy soil / low spots
 - Water tends to sit and collect for long periods of time
 - Shading
 - Plants grown next to tall trees or buildings, more susceptible
 - Higher humidity and slower drying
- Management: avoid poorly drained, heavy soils if possible. Reduce the length of time soil remains saturated. Field leveling and planting in raised beds



Powdery mildew



- Common fungal disease on many types of crops
 - Chile, cotton, onion, tomatoes and weeds (sowthistle and groundcherry)
 - Disease fairly uncommon in NM chile
 - When conditions are favorable, chile has been attacked
- Symptoms/signs:
 - White, powdery fungal growth on lower leaf surface
 - Upper leaf surface may show yellow/brownish discoloration
 - Edges of infected leaves roll upward
 - Infected leaves will drop prematurely
 - Expose fruit to sun potentially causing sunscald

Powdery mildew

- Conditions for disease:
 - Disease favored by warm temperatures (65-95° F)
 - High humidity = > germination of spores
 - Reproduces rapidly under favorable conditions
 - Moisture and humidity
 - Wind can spread spores causing secondary infection
 - Predominately attacks leaves, occasionally attacks fruit
 - Most severe on older leaves just prior to fruit set
 - Happened in 2021, fruit set, no need for management
- Management: sanitation practices (removing infected crops and weed control), if early in season, fungicides available.



Anthracnose (ripe rot)



- *Collectotrichum* spp.
 - Occurs worldwide wherever peppers are grown
 - Rare in NM, predominately in fields with overhead irrigation
 - Fungus persists in infected seed, crop debris and alternate hosts
 - Occurs during periods of excess irrigation or rain on immature pods
 - Symptoms not expressed until the pod becomes mature and goes from green to red

Anthracnose (ripe rot)

- Symptoms:
 - First appear as small, water-soaked lesions that rapidly expand
 - Fully expanded lesions are sunken
 - Range in color from dark red to tan to black
 - As infection progresses, brown colored spores appear scattered or in rings within the lesions
 - Infection takes place in field (immature fruit), however post harvest symptom development is also common
- Management: use of clean seed and crop rotation are two most important control practices; fungicides available



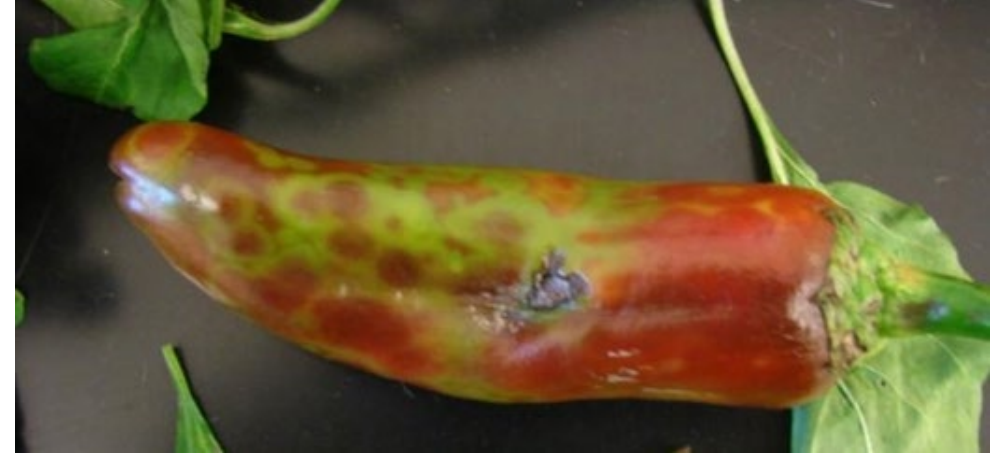
Tomato Spotted Wilt Virus (TSWV)

- Has been found in most chile growing areas in NM
- Can infected a diverse group of plant species
 - Chile, tomatoes, peanuts, lettuce and many ornamentals
- Transmitted by thrips
- Overwinters in perennial weeds (bindweed and curly dock)
- If unchecked, has the potential for causing significant crop losses
- Disease affects late-maturing pods, reducing yield of processing chile



Tomato Spotted Wilt Virus (TSWV)

- Symptoms: numerous and varied, cultivar
 - Fruit
 - Disease most commonly recognized by fruit symptoms
 - Both green and red fruit can be infected
 - Green pods
 - Small, off-colored spots
 - Red pods
 - Patches of yellow that never turn red
 - Chlorotic and necrotic spotting
 - Concentric ring patterns / distortion
 - Foliage
 - Mosaic
 - Chlorotic ring spots
 - Deformation
 - Shoot terminals die and leaves fall off
- Management: difficult, incidence and severity may be reduced by early removal of infected plants and controlling weeds



Beet Curly Top Virus

- Transmitted by beet leafhopper (*Circulifer tenellus*)
 - Overwinters on winter annuals (mustards)
- Continues to be successful because of many strains
- Infects a wide range of perennial and annual plants
- Symptoms:
 - Infected seedlings
 - Yellowing, curling and twisting of foliage
 - Infection often results in death
 - Mature plants
 - Stunting
 - Vein clearing, curling and twisting
 - Leathery and stiff foliage
 - Produce little to no fruit
- Management: difficult; plant in shady location (home grower) or cages



Alfalfa Mosaic Virus

- Aphid-transmitted virus
- Wide host range
 - Chile, alfalfa, tomatoes, lettuce and potatoes
- Primary source for transmission to chile is alfalfa

- Symptoms:
 - Mild stunting
 - Whitish, blotchy leaves
 - Fruit may be distorted

- Management: difficult; crop rotation avoiding tomatoes, lettuce or cucurbits



Something to look out for...

- Tomato brown rugose fruit virus (ToBRFV)
 - ToBRFV is a highly virulent, very aggressive virus
 - Can cause severe infection on tomatoes and peppers
- First appeared in Israel in 2014; shown up in greenhouse outbreaks in 2018 and 2019 in AZ and CA but eradicated.
 - Present in Mexico and Netherlands (exports tomato and pepper to US)
- Can spread quickly and easily by mechanical transmission
 - Moved very easily from plant to plant by workers or even from root to root contact.

USDA FAQ's and resources about coronavirus (COVID-19). [LEARN MORE](#)

Tomato Brown Rugose Fruit Virus



(Figures 1 and 2: Luria, et al., 2017 <https://doi.org/10.1371/journal.pone.0170429.g001>); Figure 3: Alkowni, et al., 2019 <https://www.researchgate.net/publication/330722102>)

On November 15, 2019, APHIS issued a Federal Order imposing restrictions on imports of tomato and pepper seed lots, transplants, and fruit from all countries where tomato brown rugose fruit virus exists. These actions went into effect Friday, November 22.

<https://www.aphis.usda.gov/achis/about-us/animal-plant-health/import-and-export/federal-import-orders/2019/tomato-brown-rugose-fruit-virus>

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USDA APHIS | Tomato Brown Rugose Fruit Virus

On June 3, 2020, APHIS amended the import requirements for tomato and pepper fruit for consumption by adding restrictions for tomatoes and peppers to additional countries. Also the amendment clarifies that obscured tomato and pepper seed remain eligible for importation into the United States under the obscured seed program. The Federal Order effective date is Friday, June 5, 2020. All other requirements in the November 15, 2019 (DA-2019-28) version of the Federal Order are unchanged.

Stakeholder Announcement

[November 15, 2019](#)

Federal Import Order

[November 15, 2019](#) | [June 3, 2020](#)

[Frequently Asked Questions](#)

[Industry Certification Information](#)

[Inspection Guidelines](#)

Domestic Survey and Response Guidance

[ToBRFV Survey and Response Plan](#)

Tomato brown rugose fruit virus (ToBRFV)

- Symptoms: leaf distortion, shoestring and rough, wrinkled surface, browning of veins. Affected fruit may be aborted or small with blotching or brown spots
- Management: Sanitation, certified seed and avoidance



Submitting a sample to the PDC

- “Dead plants tell no tales”
 - The accuracy of a disease diagnosis, insect or weed identification is only as good as the sample and information provided
 - Sample must be representative of the symptoms and severity of the problem
 - Samples must contain the right material
 - Samples must be fresh and in good condition
 - Rapid delivery to diagnostic clinic may be critical



Tomato sample



Onion sample

Sampling

- Collect a representative sample
 - Material showing symptoms which you, the grower, are concerned about
 - Send several samples showing the symptom of concern
 - Suspect root issue, dig out plants (DO NOT PULL), shake excess soil but DO NOT WASH SOIL OFF



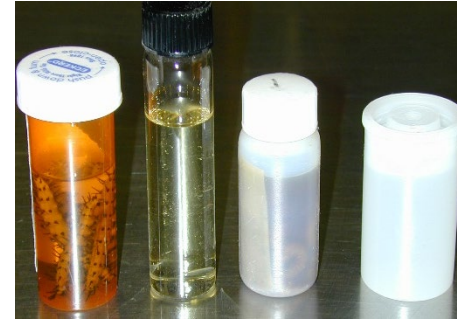
Plant sampling and shipping

- If you suspect Verticillium/Fusarium/Phytophthora, select plants exhibiting symptoms of chlorosis or wilt
- Select plants expressing a range of symptoms
- Do not collect already dead plants, collect plants beginning to show symptoms
- Extension pub: H158 - How to Collect and Send Plant Specimens for Disease Diagnosis
 - https://aces.nmsu.edu/pubs/_h/H158/welcome.html



Submitting an insect sample

- Most insects can be preserved in a vial with 70% isopropyl or ethyl alcohol
- Hard bodied insects can be put in a ziplock and placed in a freezer
- Scale insects, mealybugs or other small arthropods may be submitted wrapped in paper towels and placed in plastic bags

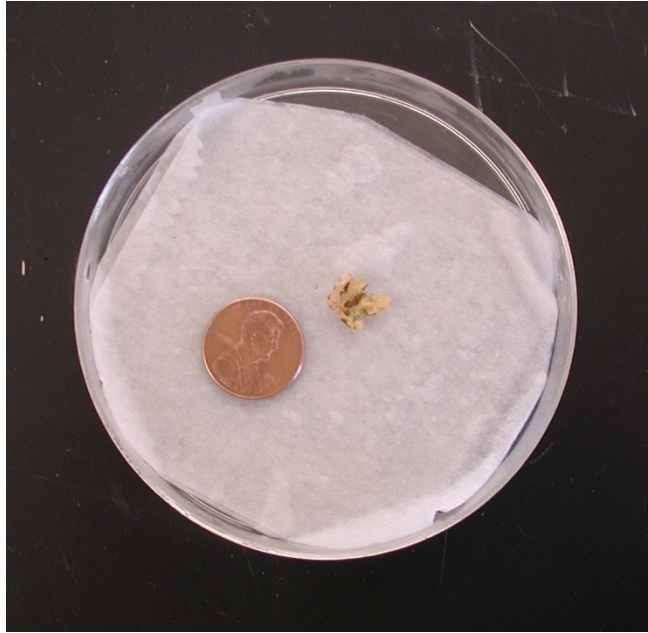


Submitting a weed/plant sample for identification

- If at all possible, include all parts of the plant/weed:
 - Stems
 - Roots
 - Leaves (attached to stem)
 - Flowers
 - Fruits
 - Seeds
- If present, collect plants/weeds at various growth stages (seedlings to mature plants)



Not so great samples sent in to PDC



Questions? Want to submit a sample?

- Contact: Phillip Lujan
- Phone:
 - 575-646-1822 office
 - 575-646-1965 lab
- Email: pl11@nmsu.edu (preferred method)
- Website: plantclinic.nmsu.edu
- Office: Skeen Hall, NMSU N258
- Updated Chile Pepper Disease Circular 549:
 - https://aces.nmsu.edu/pubs/_circulars/CR549/welcome.html

