Yavapai County
Master Gardener Association

Molds, Mildew & Fungi

January 2023

THE UNIVERSITY OF ARIZONA

The University of Arizona
Master Gardener Association
Yavapai County Cooperative Extension

Prescott Office: 840 Rodeo Drive, Bldg C
Prescott, AZ 86305
928-445-6590 x222
prescottmg@gmail.com

Verde Valley: 2830 N Commonwealth Drive, Ste 103
Camp Verde, AZ 86322
928-554-8999
verdevalleymg@gmail.com

Master Gardener Web: extension.arizona.edu/yavapai
Speakers' Bureau Email: ycmgspeakersbureau@gmail.com
Facebook: yavapaicountymastergardeners

What's the Difference?

Fungi – spore producing organisms feeding on organic matter including molds, yeast, mushrooms and toadstools.

Mold – includes all species of microscopic fungi that grow in multicellular filaments called hyphae (hi-fee) and is found on any organic matter with moisture issues.

Mildew – refers to certain kinds of mold or fungus. The term is used to refer to mold with a flat growth habit and in areas with high moisture levels.

Fungi Facts

- Fungi are not plants and are in their own separate Kingdom
- The part of the fungus we notice is the “fruit” or the reproductive structure of the organism
- The living body of the fungus is the mycelium made of a web of tiny filaments called hyphae and usually in the soil
- The webs are unseen until they develop mushrooms, truffles and other fruiting bodies
- There are about 100,000 species of fungi known, but it is estimated there may be 1.5M worldwide

Fungi Facts con't

- Most Fungi build their cell walls out of Chitin (ki-tin) which is the same as the hard outer shell of insects
- Fungi do not have stomachs but absorb nutrients from organic materials and have evolved to feed off many different organic food
- Some fungi are pathogenic such as athlete's foot, Valley Fever & ringworm in humans or animals
- Fungal products are used in everyday products such as yeasts, drugs and general food products including flavorings, vitamins and enzymes for stain removal

Fungi Facts con't

- Fungi in the garden can be a good thing
- Mycorrhizae is a beneficial fungi that attach to the root systems and breaks down nutrients in the soil making it easier for the plants to absorb the nutrients
- Mycorrhizae (my-kuh-ri-zee) will thrive by adding compost, avoiding chemical fungicides and NOT tilling the soil which can damage the network of hyphae
- Planting cover crops in the fall also helps maintain the hyphae network year round

Mushrooms

Photos: from Pixabay

Mushrooms

- Mushrooms do minimal damage to the soil, but many are poisonous to animals and humans
- Pluck mushrooms early before the spores disperse to prevent spreading to other areas
- Mushrooms grow from underground mycelia making them hard to permanently remove

Stinkhorns

- Produce a fruiting body covered with a stinky and sticky substance with a bad order
- Found in lawns, flowerbeds & on dead trees
- Active during cool wet periods in late summer and fall
- Are not harmful to plants, but do not eat stinkhorn eggs
- Control by picking and disposing

Photo: University of Minnesota Extension

Bird's Nest Fungi

- Bird's nest fungi are saphrophytes, a group of organisms named for their resemblance to miniature bird's nests
- Only ¼ in tall, they grow on decaying organic matter such as manure and do not harm plants
- Commonly light brown, gray or yellow

Fruiting bodies of Crucibulum laeve found on decaying wood. University of Wisconsin Extension -(Photo courtesy of Mark Steinmetz)

Bird's Nest Fungi

- Bird's nest fungi are saphrophytes, a group of organisms named for their resemblance to miniature bird's nests
- Tiny egg-like capsules (peridioles) are attached to the nest with a sticky coiled cord
- When the peridioles is forcibly ejected over 3 ft, the cord sticks to and wraps around what it land on (even patio furniture and walls)
- Falling water drops can also force out eggs

Shotgun or Artillary Fungi

Shotgun fungi in the same class as Bird's nest

- These ballistic fungi, has its unique method of spore dispersal
- It is not harmful to humans or pets, and does not kill garden plants

Photo: University of Minnesota Extension - Shotgun fungi (Pilobolus crystallinus)

Shotgun Fungi

- Grow mostly on old horse manure
- Clear glasslike fruiting body with a black shiny peridiole on top of the bulb
- Bends toward the light to ensure a clear path to travel – bending stops when the peridiole is pointing directly at the light source
- The swollen bulb swells with water until the pressure is 5 times that outside causing it to rupture and send the peridioles flying

Sphere Thrower (Cannonball) Fungi

- Similar to Bird's Nest it grows on rotting wood and develops small round fruiting eggs

• Fruiting bodies mature, the outer layer of the ball peels back to form a cup with a single round peridiole inside.

•Pressure builds causing the inner cup to explosively turn inside out.

•The force of the inversion launches the peridiole, which can travel more than five yards

Photo: University of Minnesota Extension - Cannonball fungi (Sphaerobolus)

Gray Mold

Infected Geranium leaf – University of Minnesota Extension

Mold starts as small as brown to gray circular spots

Gray mold (*Botrytis cinerea*) on harvested strawberries. Edward Sikora, Auburn University

Gray Molds

- Gray Mold is one of the more deadly garden varieties, also known as botrytis blight
- Requires moisture to infect plants so prolonged periods of wet weather can be deadly for infected plants
- Avoid overhead watering – this mold can spread by water splashing and wind
- Check new or inner petals of a flower for browning which may indicate gray mold
- An ounce of prevention – deadhead dying flowers and remove infected plant material

Gray Molds

- Can infect fruits some vegetables flowers and shrubs
- Flowers with thick succulent petals such as begonias, peonies & geraniums are most susceptible
- The fruit from trees, all berries, tomatoes & beans can be infected especially after being harvested and moved to cool storage areas
- Check new or inner petals of a flower for browning which may indicate gray mold

White Mold

White mold sclerotinia in a zinnia stem– University of Minnesota Extension. Photo: Michelle Grabowski

White mold on a carrot; University of Minnesota Extension

White Mold

- White Mold causes stem rot, wilt and death of many common flowers
- Hard structures, called sclerotia (black in color) allow the fungus to survive for up to 5 years
- Once white mold is introduced to the garden, it is likely to reoccur each year
- Infected parts of stem turn tan and are dry and brittle, rest of stem will remain green
- Fluffy, white fungal growth can be seen on stems and leaves when humidity is high

Plants Susceptible to White Mold

- Annual Flowering Plants:
  - Marigold, Nicotiana, Salvia, Sunflower, Petunia and Zinnia
- Perennial Plants:
  - Chrysanthemum, Columbine, Delphinium, Peony and common garden weeds
- Garden Vegetables:
  - Beans, Carrot, Squash and Tomato
- If possible, plant disease resistant varieties

Slime Mold

Is not parasitic and does not cause plant disease

Courtesy of University of Maryland Extension

Slime Mold

- Slime molds are present in almost all soils
- Although classified as a fungi, slime molds are aggregations called plasmodia – moves out of soil to other surfaces
- Common on decaying logs, fallen leaves, thatch, mulch and strawberry leaves
- During cool wet weather, spores germinate and produce single-celled amoeba like spores
- Spores feed on micro-organisms and organic matter until something causes them to join
- Spores can survive winter in thatch layers & soil
- Usually disappears during hot dry weather

How to Keep Mold out of the Garden

- Kill existing mold before planting your garden (sterilize soil by heat or chemicals)
- Remove soil in the areas where mold existed
- Plant in sunny, well drained soil
- Do not overcrowd plants
- Do not over water

How to Keep Mold out of the Garden

- Check plants often and treat before mold spreads
- Remove affected leaves, plants and weeds as they can spread spores to nearby plants
- Do not place infected vegetation in your compost pile

Powdery Mildew

Black, round fungal resting structures of powdery mildew on a phlox stem

Low level of powdery mildew on zinnia will not reduce flowering.

Photos: M Grabowski Courtesy of University of Minnesota Extension Photo: M Grabowski

Powdery Mildew

- A fungal disease that can affect almost every type of plant including shrubs and fruit trees
- There are more than 70,000 known species
- Consists of patches of whitish-gray thinly layered powder on vegetation
- Causes leaves to turn yellow and die prematurely
- Tiny, round, orange to black balls may form within white fungal mats often at the end of the growing season
- Is most severe on plants in shaded areas with poor air movement

Powdery Mildew Facts

- Usually starts on the plant's lower leaves and will spread over the entire plant if not treated
- Interrupts photosynthesis if severe causing leaves to turn yellow and die
- Stressed plants may not flower and produce underdeveloped or no fruit
- Prefers temperatures 50-65 degrees (F) but warm dry days allow spores to spread
- Unlike most fungi, it does not require water and can thrive in warm, dry climates and survives in the soil during winter

Powdery Mildew Facts

- Spores are easily carried by the wind up to 100 miles away
- Once a spore lands on a host it quickly germinates to start a new infection
- Mildew forms a mat of fungal growth on the surface of the plant
- Specialized fungal structures penetrate the plant tissue to take up nutrients

8 Organic Treatment Options

- **Potassium Bicarbonate** –kills spores on contact and is a preventative treatment as it raises the PH level over 8.3 which is not ideal for fungal growth. (3 Tbsp PB, 3 Tbsp vegetable oil, ½ tsp dish soap)
- **Milk** – Studies show that when milk interacts with the sun it produces free radicals that are toxic to the fungus. (Spray bi-weekly 40% milk to 60% water or 1oz powdered milk & 2 liters of water)
- **Apple Cider Vinegar** – 4 Tbsp of vinegar with 1 gallon of water Apply every 3 days as needed (caution - too much acid can burn plant leaves)

Organic Treatment Options con't

- **Neem Oil** will kill powdery mildew in 24 hours by disrupting the plant's metabolism, stopping spore production. 3 Tbsp oil to 1 gallon of water. Spray every 7-14 days, avoid spraying buds & flowers
- **Baking Soda** has pH of 9 which kills the fungus. Mix 1 Tbsp of soda, ½ tsp. liquid soap with 1 gal of water – reapply weekly or after heavy rain. Do not spray during daylight hours to avoid sun burn
- **Sulfur**– prevents & controls mildew. Can be purchased as dust or liquid – follow directions

Organic Treatment Options con't

- **Garlic Oil** – has a high sulfur content which is an anti-fungicide. 6 cloves of crushed garlic, 1 oz of neem or organic oil & 1 oz of rubbing alcohol. Let set for 2 days, resoak garlic for one day in 1 cup of water. Strain out garlic & combine both mixtures with 1 gal of water – spray only on leaves
- **Copper Fungicides** – OTC are effective but to much can be detrimental to plants and the soil
- **Fungicides** should only be used to protect high-value plants with a history of disease and will not cure existing powdery mildew infections

Plants Susceptible to Mildew

- Powdery mildew affects over 10,000 plants
- Annual Flowering Plants:
  - Marigold, Nicotiana, Salvia, Sunflower, Petunia and Zinnia
- Perennial Plants:
  - Chrysanthemum, Lilacs, Roses, Peony and common garden weeds
- Lettuce, Parsley, Peppers, Tomatoes and Zucchinis
- If possible, plant disease resistant varieties

Prevention & Treatment

- Follow good sanitation practices – clean tools after use and dispose of dead flowers and infected plants
- Water the soil and not the plants
- Provide good air circulation- overcrowding plants will hold in moisture and not allow adequate sunlight
- Follow best gardening practices (fertilization, irrigation and pruning) to maintain healthy plants
- Pretreat or sterilize contaminated soil before planting

Prevention & Treatment con't

- Chemical Controls – last resort
- Can apply fungicides during periods of high humidity and cool temperatures
- Always check the label to determine it will control gray mold and how and when to apply
- Recommend to test on a few plants before treating all infected plants
- Don't spray vinegar or baking soda during the day as it can cause sunburn to plant leaves

Questions?

Thank You!

For more information about our programs, visit our website at

extension.arizona.edu/yavapai

The University of Arizona
is an equal opportunity provider.

Learn more at:
https://extension.arizona.edu/legal-disclaimer

Cooperative Extension
Yavapai County

THE UNIVERSITY OF ARIZONA