War of the Roses: A Case Study in Plant Pathology

by
Melissa B. Riley
Department of Plant Pathology and Physiology
Clemson University

Jason headed home with a pile of dirty clothes for his mother to wash. The previous week had been hectic, with an exam in entomology, a homework assignment in plant pathology, and an exam just today in plant physiology. All he wanted to do over the weekend was relax. As he pulled into the driveway, he wondered what was for supper.

"Mom?" yelled Jason as he opened the front door. "Where are you?"

"Out here," came a faint response from the back yard.

As Jason walked out to the back deck, his mother, Mrs. Cook, continued: "Something is wrong with my rose bush next to the deck and I need to know what to do about it."

Symptoms expressed in Mrs. Cook's rosesJason bent over the rosebush his mother was pointing to. "Look at this," she complained. "They looked beautiful just a couple of months ago and now, just look. I have lots of these black spots on the leaves. After the leaves get these black spots, the spots get larger, and then leaves turn yellow and eventually start to fall off. If this continues, it won't be long before there won't be any leaves left."

Jason tried to remember if they had discussed roses and their diseases in his plant pathology class.

Mrs. Cook continued on her tirade. "You're taking a course on plant diseases this semester, aren't you? Haven't you learned anything that you can use?"

"Mom, I'm not interested in diseases of ornamental plants. I'm getting a degree in turfgrass management. I'm interested in diseases that occur on grasses and lawns."

"Don't golf courses have flowers around them that you'll have to maintain?" asked Mrs. Cook.

"Yeah, they do have flowers and other ornamental plants, but most golf courses have someone hired to maintain the ornamentals around the golf course. I'm not planning on working with that part of the industry."

"But don't you think you ought to know something about other plants even if it's just to keep the plants around your mother's house healthy?" complained Mrs. Cook as she walked across the yard. "Look at this rose bush. It looks fine. I haven't treated this plant any differently from the other one. The two plants got the same amount of fertilizer and water."

Jason sighed and said, "OK, Mom. I'll try to find out what is wrong with your roses and what you can do to control the problem. I can contact someone at State University when I get back on Monday, or I'll look up some information for you."

Jason remembered that there was a Plant Problem Clinic back at State University and that he could send a sample there.

On Monday after Jason returned to school he went by the Plant Problem Clinic and got the form he needed to complete to submit a sample of his mother's roses to the clinic. He hoped that he could get a quick answer to his mom's problem. As he looked at the form he was overwhelmed by the amount of information it asked for and he started to wonder if the problem with his mother's roses was really worth the hassle.

Figure 1. Symptoms expressed on Mrs. Cook's roses. Early symptoms on left and later symptoms on right.

Questions

1. What is meant by symptoms and signs of plant diseases? What do these terms refer to and why are they important?
2. Describe the symptoms/signs of the rose plant provided in lab that was seen by Jason in Mrs. Cook's yard. How can the microscopic observations be important? (Samples should be observed utilizing compound and dissecting microscopes. Using the directions included in this case study, students should make tissue mounts to look for the presence of spores on the leaf surface.)
3. What are some questions that Jason should ask his mother concerning the care and culture of her roses? Why are these questions important?
4. Try to answer the questions on the plant problem clinic form. Why are these questions important?
5. Is the problem found on the rose a disease, insect, or physiological/cultural problem? What is the basis for your answer? Are you positive? Why or why not?
6. Where would you find information on the diseases associated with roses, both on the Internet and in printed resources? Give three sources of information, at least one from Internet sources and at least one from printed resources.
7. Based on the information that you have obtained, what is possibly affecting Mrs. Cook's roses? Is this the only possibility? Why or why not?
8. What are the possible reasons why the problem is not occurring on the other rosebush in the yard?
9. If you were Jason, what kind of recommendations would you make to your mother? What are the advantages and disadvantages of the different measures? Would what you recommend be different if you were talking to a commercial grower of roses? Why or why not? What would you do if your mother does not want to use any chemical treatment measures?
10. What are the differences between diagnosing a plant disease and a human disease? Is it more or less difficult to diagnose a plant disease?

PLANT PROBLEM CLINIC
STATE UNIVERSITY
Anywhere, USA

Laboratory ID Number
_____

Name _____
Address _____
City _____
State _____ **ZIP Code** _____
Phone _____ **FAX** _____
Completed by: _____

County _____
Date Collected _____
Date Submitted _____
Grower type ___ Residential ___ Commercial

Plant Problem Diagnosis

1. **Name of plant** _____ **Cultivar/Variety** _____
2. **Soil for nematode assay enclosed** ___ Yes ___ No
3. **Soil for pH and nutrient analysis enclosed** ___ Yes ___ No
4. **Tissue specifically for tissue nutrient analysis enclosed** ___ Yes ___ No
5. **Planting date or age of plant** _____
6. **Plant height** _____
7. **Acreage or Number of Plants** _____
8. **Previous crop** _____

Location of planting
__ home grounds
__ garden
__ greenhouse
__ nursery
__ field
__ orchard
__ indoors
__ other

Plant Part affected
__ roots
__ stems
__ leaves/needles
__ twigs/branches
__ trunk
__ buds
__ fruit
__ flowers
__ pods
__ seeds
__ entire plant

Symptoms
__ spot
__ rot
__ blight
__ wilt
__ dieback
__ abnormal growth
__ canker
__ stunting
__ galls/swellings
__ burn/scorch
__ yellowing
__ defoliation
__ mosaic
__ other

Degree of injury
__ slight
__ moderate
__ severe

Distribution of problem
__ single plant
__ scattered plants
__ localized area
__ large area
__ every plant

Development of problem
__ sudden
__ gradual

Soil Texture
__ artificial mix
__ clay
__ sand
__ loam

Rainfall
__ below normal
__ normal
__ above normal

Irrigation (watering)
__ yes
__ no

Drainage
__ poor
__ fair
__ good
__ extensive

Lighting
__ full shade
__ morning shade
__ afternoon shade
__ full sun

Chemical applied to this crop

Fertilizer: What _____ When _____ Rate _____
Fungicide: What _____ When _____ Rate _____
Herbicide: What _____ When _____ Rate _____
Insecticide: What _____ When _____ Rate _____
Nematicide: What _____ When _____ Rate _____
Other: What _____ When _____ Rate _____

Suspected Diagnosis_____
Additional Comments_____

SAMPLING GUIDELINES are listed below. If you have questions, please consult with your local county Extension agent. Attach additional information as needed.

Plant Problem Sample

Select as much recently affected plant tissue as possible but if there appears to be a progression of symptoms include examples of this progression. Material that has been dead for some time is often useless for diagnosis. Do not wash samples since this may remove pathogen structures and encourage growth of secondary organisms. If possible, send photographs of the diseased plant(s). Submission of healthy samples for comparison is encouraged. Plastic bags are ideal for use in mailing most plant samples, as they prevent drying. Never add moisture, such as wet paper towels, as this encourages growth of secondary microorganisms and may lead to sample decay and incorrect diagnosis. Keep samples cool but not frozen before mailing. Use mailing containers that prevent crushing of samples.

It is important to include date of sample collection and date mailed. This information, along with a complete description of the problem, is needed so that damage or contamination of the sample during transit will not be confused with the real problem.

LEAF SPOTS: Collect at least 6-12 leaves representing all stages of infection or progression of symptoms. For plants with small leaves, cut off a branch with leaves intact.

FRUITS OR FLESHY ORGANS: Wipe off excess moisture and wrap fruits individually in dry paper towels or newspaper and place in a plastic bag. Avoid packing fruit showing advanced stages of rot: select early stages of infection or damage.

STEM LESIONS, DIEBACKS, CANKERS, AND GALLS: Select branches with active lesions or young galls. Cut branch or twigs to include the margin between the healthy and affected area. Dead branches and twigs are undesirable for diagnosis.

TURFGRASS SAMPLES: Cut out blocks of turfgrass (6 x 6 inches) at the margin of the affected and healthy areas in the lawn. Submit soil from healthy and infected areas in separate plastic bags for nematode assay and in soil boxes for pH and fertility analysis.

VIRUS SYMPTOMS: Ring spots, mosaic patterns, and distorted new growth are common symptoms of diseases caused by viruses. The whole plant should be submitted when practical. Samples should be sent by overnight delivery for virus assays.

PLANTS EXHIBITING WILTING, YELLOWING AND GENERAL DECLINE: Carefully dig up and submit entire plant if possible. Place soil and roots in one plastic bag, then place another bag over the top of the plant. In the case of large trees and shrubs, submit a branch or part of the plant showing typical symptoms in a plastic bag. Various sized roots, specifically fine fibrous ones, should be submitted with soil in a plastic bag for fungal isolations. Roots showing healthy and damaged areas are preferred. Severely rotted roots alone may be overcome with secondary invaders, which can mask the primary cause of the problem. Submit container-grown plants with a plastic bag over the top. Submit one quart of soil in a plastic bag for nematode assay. A full soil box full is needed to test for soluble salts, nutrient imbalances, and unfavorable pH values. If a soiless medium is involved, one quart of this medium is required.

Guidelines for Mounting Specimens Including Spores

Reference: McCain, J.W. 1988. Use and care of the light microscope. In: *Laboratory Exercises in Plant Pathology: An Instructional Kit*. A.B.A.M. Baudoin, ed. APS Press: St. Paul, Minnesota. pp.1:8-1:12.

Mounting of specimens involves transferring them to microscope slides and preparing them for examination. Begin with clean slides and cover slips. Lens paper or lens paper plus water will suffice to clean most new slides, but it is more effective to dip slides in 70-95% ethanol and dry them with clean Kim-wipes.

1. The specimen may be mounted in a drop of water. Sterile or distilled water is a good mounting liquid but the mounts dry out quickly.
2. Mounting in a stain such as cotton blue can also be used to color pale specimens.

Mounting Procedure

Put a drop of mounting solution on the slide and place the specimen in the drop. Lower a cover slip onto the slide, being careful to avoid pushing the specimen to one side or out from under the cover slip. Avoid using too much mounting solution. Air bubbles can distort images under the microscope. It is sometimes difficult to recognize air bubbles. Adding the cover slip carefully will keep the number of bubbles to a minimum as would using specimens that are not too thick. Sometimes gentle pressure with a dissecting needle will push the bubbles out from under the cover slip. However, surface features of certain specimens, such as spines on a fungal spore, may actually be easier to see when they are against or in an air bubble. Also, if you focus on the edge of an air bubble, the specimen should almost be in focus, too, needing only a partial turn of the fine-focus knob of the microscope.

Scrape Mounts

Small, loose items, such as fungal spores, may simply be scraped from the surface of a leaf or other plant part or from the surface of an agar culture with a scalpel. Dry spores may stick to the tool more readily if you dip the tool into the drop of mounting liquid or stain that should be waiting on a microscope slide. Be careful not to disrupt the structure any more than necessary--gently tease spores off of the leaf surface or culture plate.

Cellophane Tape Method

Cellophane tape can be used as another way to transfer samples to a microscope slide. It has the advantage that structures will more or less retain their original position relative to each other; for instance, chains of spores will remain chains.

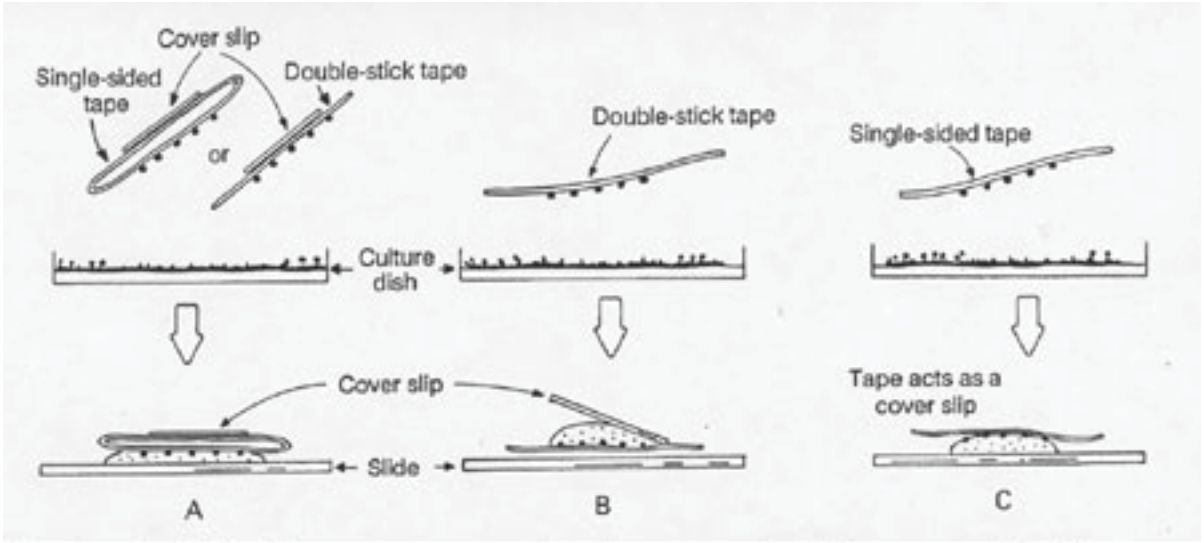

Figure 1 - Cellophane tape mounts for observing fungal spores and hyphae.

Variations

1. Make a loop of a piece of tape or use a piece of double-stick tape (adhesive on both sides). Attach a cover glass to one side of the tape. Trim off excess tape if necessary. Touch the specimen or culture plate with the exposed sticky side of the tape so that spores or other objects become attached to the tape. Lift the tape with cover glass from the specimen or culture, and lower onto a drop of mounting liquid on a slide (Figure 1A).
2. Press a length of double-stick tape gently against the culture or spore-bearing plant material. Then attach it to a microscope slide with the spore-bearing surface up. Add a drop of mounting liquid and a cover slip (Figure 1B).
3. Press the sticky side of single sided cellophane tape gently onto the specimen and then mount the tape with the adhering spores and hyphae down in a drop of water or stain on a slide such that the tape acts as a cover slip (Figure 1C).