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DIAGNOSTIC KEYS FOR IDENTIFICATION OF DISEASES ON APPLE, PEACH, AND CHERRY TREES IN THE NORTHEASTERN UNITED STATES

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The diagnostic keys for apple, cherry, and peach diseases were developed to aid field personnel in the identification of diseases that are common to the Northeastern region of the United States. The keys are arranged to guide a user through a series of logically arranged statements describing symptoms and signs of fruit tree disorders. By selecting from a series of numbered statements, those which most closely describe observations made in the field, the user should be able to narrow the possibilities to only one or a couple of probable diseases.

The keys are also available for anyone with access to SCAMP (System for Computer-Aided Management of Pests), a computerized extension communications and information delivery system developed at the New York State Agricultural Experiment Station. SCAMP users wanting to use the diagnostic keys should log onto the SCAMP system and then specify the TDISEASE program in LIBRARY.

Many problems will not be diagnosed easily because some insect, rodent, bird, hail, and other mechanical damage, nutritional deficiencies, abiotic factors, herbicide injury, and other causes can often be mistaken for or appear concurrent with disease symptoms and signs. The more information that can be obtained, the greater the chance of arriving at the proper diagnosis.

The following points should be considered when making a disease diagnosis.

1. Disease symptoms may vary slightly from season to season and on their time of appearance, often depending on environmental conditions.
2. It is essential to obtain fresh disease samples. Secondary organisms will often follow the prim-

ary pathogen and make diagnosis difficult or impossible.

3. The observer should record the varieties and rootstocks that are affected. Susceptibility of apple varieties and rootstocks to some diseases will vary greatly and may give a valuable clue to diagnosis.
4. The distribution of symptoms within an orchard and in individual trees will often aid in determining if the disorder is caused by a pathogen and how it spreads in the orchard.
5. Observe the areas surrounding the orchard for alternate hosts, abandoned orchards, and other sites of potential disease reservoirs. Observe the orchard configuration, contour, and soil type(s).
6. Complete records containing timings and rates of all pesticides, growth regulators, and fertilizers may be helpful in determining the problem.
7. Records of previous year's weather patterns, such as excessive rains, drought or extremely cold winter periods, along with grower cultural practices in the orchard may help in diagnosis.
8. A history of previous orchard problems should be obtained if possible.

The Extension Plant Pathologist should be contacted if there are any further questions concerning diagnosis or control of these diseases.

To use the key, select a statement from the first set of statements which most closely describes your field observations. Continue to the next numbered statement that is specified by the line you've chosen. Continue through the key in this manner until a numbered statement suggests a particular diagnosis.

KEY TO APPLE DISEASE IDENTIFICATION

- 1 a. General growth and vigor of the tree is reduced. Trees stunted or weakened. Foliage wilted or off-color with early reddening and defoliation in the fall. No other obvious symptoms on tree. (2)
- 1b. Obvious leaf, blossom, or fruit infections, cankers, galls or leaf variegation patterns. (7)
- 2a. Roots showing no obvious decay. (3) 2b. Roots, crown, and/or lower trunk showing obvious decay. (4)
- 3a. Fibrous roots lacking or showing witches broom. Most common on light-textured soils. NEMATODE DAMAGE (*Pratylenchus penetrans*)
- 3b. Distinct black sunken line at union apparent below bark. Trees may subsequently break at union. APPLE UNION NECROSIS (Tomato Ring-spot virus)
- 3c. Bark missing at or below the soil line. Gnawing marks sometimes visible in wood. Callus formed in bark at margin of bare wood. RODENT DAMAGE
- 4a. Bark at crown and roots easily sloughs off exposing dense white fungus growth with fan shaped distribution at cambium. Black shoestring-like strands (rhizomorphs) may be obvious on surface of bark and yellow-brown mushrooms may appear at base of tree in late summer or early fall. ARMILLARIA ROOT ROT (*Armillaria mellea*)
- 4b. Decay present in root, crown and/or lower trunk area. Advancing margin of infection sometimes orange in color or slimy in appearance. Often a definite margin of infection. (5)
- 5a. *Phytophthora* isolated from decay. CROWN ROT (*Phytophthora cactorum* and other *Phytophthora* spp.)
- 5b. Wood slimy in appearance. Margin of decay may or may not be distinct. Decay may be restricted to interstem or rootstock only. *Erwinia amylovora* isolated from decay margins. FIRE BLIGHT (*Erwinia amylovora*)
- 5c. *Phytophthora* or *Erwinia* not recovered. (6)
- 6a. Funneled air space around base of tree where water collected and froze in contact with tree crown. WINTER FREEZE INJURY
- 6b. Roots in waterlogged soils appear blue to gray when cut into. ROOTS KILLED BY ASPHYXIATION
- 7a. Leaf spots, ooze, or obvious fungus fruiting bodies or growths on leaves, fruits, shoots, or wood. (8)
- 7b. Leaves showing distinct chlorotic or necrotic patterns on single branches or entire trees and locally or widely spread throughout orchard. Check for virus, nutritional disorder, pesticide injury or necrotic leaf blotch on Golden Delicious.
- 8a. Milky droplets of ooze exuded on the surface of cankers, infected blossoms, fruits or shoots during moist conditions. Infected tissues become scorched in appearance. FIRE BLIGHT (*Erwinia amylovora*)
- 8b. Small to large warty appearing growths at crown or in roots. CROWN GALL (*Agrobacterium tumefaciens*)
- 8c. Infections occurring on leaves or fruits. (9)
- 8d. Cankers on wood 1 year old and older. (18)
- 9a Infections on leaves (may also be on fruits). (13) 9b. Infections on fruit only. (10)
- 10a. Infection initiating almost entirely at calyx end of fruit. (12) 10b. Infection not restricted to calyx end. (11)
- 11a. Lesions 1-5 mm diam., purplish black in color associated with stomata, primarily on Mutsu variety. BLISTER SPOT (*Pseudomonas syringae* pv. *V. papulans*)
- 11 b. Black, blotchy, sooty fungus growth on surface of fruit, most apparent near harvest. SOOTY BLOTCH (*Gloeodes pomigena*)
- 11c. Superficial fungus growth, showing black speckled pattern on fruit, most apparent near harvest. FLY SPECK (*Microthyriella rubi*)
- 12a. Infection may be restricted to calyx or may be actively rotting entire fruit. BLOSSOM END ROT (*Sclerotinia sclerotiorum*, *Phylospora obtusa*, *Botrytis cinerea*)
- 12b. Infection initiating at open calyx and then extending inward to cause a black fungus core rot. Fruits ripen early and decay only obvious when fruit are cut in half. Important on varieties with open calyx such as Delicious and its Red Sports. MOLDY CORE (*Alternaria alternata*)
- 12c. No foliar lesions, usually fruit lesions which rarely sporulate, are dark green on the surface with necrotic tissues extending to the core. Particular problem on Delicious. QUINCE RUST (*Gymnosporangium clavipes*)
- 13a. Yellow to orangish lesions apparent on leaves and sometimes on fruit. Red cedar, the alternate host, may be observed near the orchard. (14)
- 13b. Leaf or fruit lesions not orange in color. (16)

14a. May infect fruit and leaves. Most common apple rust. CEDAR APPLE RUST (*Gymnosporangium juniperi-virginianae*)

14b. Lesions only on leaves. (15)

15a. Found on McIntosh. Also attacks Hawthorn. HAWTHORN RUST (*Gymnosporangium gibbosum*) 15b. May develop on other varieties.

CEDAR APPLE

RUST (*G. juniperi- virginianae*)

16a. White powdery fungus growth on leaves and sometimes blossoms causing distorted terminal growth. May cause net-like pattern of russetting on fruit. POWDERY MILDEW (*Podosphaera leucotricha*)

16b. Foliage associated with a major branch or occasionally entire tree becomes silvery in appearance. SILVER LEAF (*Stereum purpureum*)

16c. Lesion on leaves and on fruit. Lesion olive to black in color, maybe necrotic. (17)

17a. Leaf and early fruit lesions olive to black and velvety in appearance. Maturing fruit misshapen and warty in appearance. APPLE SCAB (*Venturia inaequalis*)

17b. Leaf lesions frog-eyed in appearance, necrotic and may contain small black spherical structures (pycnidia). Fruit infections with extensive soft decay and rows of pycnidia sometimes apparent. BLACK ROT (*Phyalospora obtusa*)

18a. Milky ooze coming from cankers on bark in early spring. Beneath bark, wood is slimy in appearance. Cankers may have smooth or rough margins. FIRE BLIGHT (*Erwinia amylovora*)

18b. Black pycnidia on canker surface. Canker infection apparently initiated at large pruning cut or winter-injured site. BLACK ROT (*Phyalospora obtusa*)

18c. Wilting and death of new shoots in mid-summer. Pink to orange fungus sporulation apparent near previous seasons fruit scar or on older wood. Common on Rome Beauty, Twenty Ounce, and Ben Davis varieties. NECTRIA TWIG BLIGHT (*Nectria cinnabarina*)

18d. Cankers on wood in weak orchards. Several wood rot fungi may invade weakened tissues. WINTER INJURY

color with early reddening and defoliation in the fall. No other obvious symptoms on tree. (10) 1 b.

Obvious leaf, blossom or fruit infections or distortions, cankers, galls, or leaf variegation patterns. (2)

2a. Small to large warty appearing growths at crown or root area. CROWN GALL (*Agrobacterium tumefaciens*)

2b. Small green, corky, elongated outgrowths (knots) on limbs. Knots turning black and woody after one season. Common on plum, occasionally found on sweet cherry, rarely on tart cherry. BLACK KNOT (*Apiosporina morbosa* = *Dibotryon morbosum*)

2c. No knots, tumors or galls. (3)

3a. Distinct lesions or distortions of leaves. (6)

3b. Distinct lesions or blemishes on fruits. (5)

3c. Fruits pointed, small, pale. (15)

3d. Blossom blight. (4)

3e. Cankers on twigs or branches only. (9)

4a. Gummy appearance of blighted blossoms. Powdery-gray masses of spores develop on diseased areas during warm wet conditions. Infection may continue to spread into twigs causing gummosis. BROWN ROT (*Monilinia fructicola*)

4b. Blossoms browned and withered during cool wet weather. Brown lesions turn fuzzy gray from fungal sporulation. Disease not spread into twigs. BOTRYTIS (*Botrytis cinerea*)

4c. Ooze present on infected blossoms, then they wither, dry, and turn dark brown. Infection may extend 1 or 2 inches into spur. Nofungal sporulation or water-soaking on infected tissues is apparent. Freezing injury to blossoms favors infection. BLOSSOM BLAST (*Pseudomonas syringae*)

5a. Soft brown spots on maturing fruits that expand rapidly and produce tan powdery masses of spores. BROWN ROT (*Monilinia fructicola*) or BOTRYTIS (*Botrytis cinerea*)

5b. Velvety dark green to black, sunken lesions on mature fruit. Lesions associated with over-ripe or damaged fruit. ALTERNARIA FRUIT ROT (*Alternaria alternata*)

5c. Sour cherries, primarily Montmorency or Morello, with corky, brown-discolored pits or rings in the epidermis and extending into the flesh of the fruit. Fruit off-flavor. GREEN RING MOTTLE (Green Ring Mottle Virus)

5d. Deep black depressions on fruit associated with cankering of twigs or branches and tattered appearance of leaves. (8)

KEY TO CHERRY DISEASE IDENTIFICATION

1 a. General growth and vigor of the tree is reduced. Trees stunted or weakened. Foliage wilted or off-

- 6a. Distinct chlorotic or necrotic spots, rings or lines, shot-holing or tattering of leaves. (8)
- 6b. Leaves cupped, distorted, narrowed, yellowed or green mottled followed by defoliation. (7)
- 6c. Small purple spots on upper leaf surface becoming dark red to brown. Pink to white spore masses developing from spots on underside of leaf during rainy weather. Infected leaves turning yellow and dropping. Spots found on fruit stems in heavy infections. CHERRY LEAF SPOT (*Coccomyces hiemalis* = *Blumeria jaapii*)
- 6d. Leaves curled, slender, distorted, pale green, covered with white, powdery fungus growth. Affected terminals stunted, distorted. More common on sour cherry. POWDERY MILDEW (*Podosphaera clandestina*)
- 7a. Leaves in interior, shaded canopy of Montmorency turn yellow and green mottled, then drop. Margins of Montmorency or Morello leaves showing "constricting chlorosis" caused by restricted expansion of leaves along chlorotic veins. May be associated with necrotic areas on fruit. GREEN RING MOTTLE (Green Ring Mottle Virus)
- 7b. Leaves cupping upward, turning yellow, red, then dropping from localized areas of the canopy. Associated with thick spongy bark at crown area. PRUNUS STEM PITTING (Tomato Ring Spot Virus)
- 7c. Older leaves showing irregular green to yellow mottling or interveinal chlorosis then dropping 3-4 weeks after petal fall. Successive waves of mottling and dropping as temperatures fluctuate. Older trees showing willowy type of growth from reduction of fruit spurs. Fruit sparse but large. SOUR CHERRY YELLOWS (Prune Dwarf Virus and Necrotic Ring Spot Virus)
- 8a. Individual branches or entire tree showing delayed foliation, stunted wavy leaves, and shortened blossom pedicels in spring. Leaves develop chlorotic spots, lines, or rings as they emerge. In severe cases, chlorotic areas become necrotic and fall out, leaving the leaves "shot-holed" or tattered. NECROTIC RING SPOT (Prunus Ring Spot Virus)
- 8b. Small, purple lesions surrounded by a green halo on leaves in spring. Lesions become necrotic and fall out giving leaves a tattered appearance. Symptoms associated with deep black depressions on fruit and cankering of twigs and branches. Occasionally a bare-branched or "leggy" condition resulting from buds and spurs killed by cankers. Primarily sweet cherry, occasionally sour cherry. BACTERIAL CANKER (*Pseudomonas syringae* and *P. morsprunorum*)
- 9a. Perennial, elongated cankers surrounded by large, black, swollen rings of callus gumming. Canker associated with wounds, pruning stubs, shaded-out twigs or leaf scars. On sweet cherry. CYTOSPORA/VALSA CANKER (*Cytospora cincta* or *C. leucostoma*)
- 9b. Cankers on wood in weak orchards. Several wood rot fungi may invade weakened tissues. WINTER INJURY
- 9c. Cankers originating from blighted blossoms that remained attached. (4)
- 9d. Twig cankers on sweet cherry associated with distinct tattered appearance of leaves. (8)
- 10a. Decay is evident at the root/crown area. (11)
- 10b. Decay is not evident at the root/crown area. (12)
- 11a. Wood darkened and covered by living bark at its edges. Bark easily sloughs off crown area or southwest side of trunk. Larger roots may also be dead. WINTER INJURY
- 11b. Wood at canker is orange to brown in color, water-soaked and slimy. Canker, delimited by a definite margin of infection, sometimes extending into trunk or root area. Phytophthora isolated from margin of decay. PHYTOPHTHORA CROWN ROT (*Phytophthora* spp.)
- 11c. Bark at crown and roots easily sloughs off exposing dense white fungus growth with fan-shaped distribution at cambium. Black shoestring-like strands (rhizomorphs) may be obvious on surface of bark and yellow-brown mushrooms may appear at base of tree in late summer or early fall. ARMILLARIA ROOT ROT (*Armillaria mellea*)
- 12a. Fibrous roots lacking or showing witches broom. Most common on light-textured soils. NEMATODE DAMAGE (*Pratylenchus penetrans*)
- 12b. Tumor or gall located on root or crown area. (2)
- 12c. Roots appear normal. (13)
- 13a. Bark easily sloughs off at crown area. (11)
- 13b. Bark missing at or below the soil line. Gnawing marks sometimes visible in wood. Callus formed in bark at margin of bare wood. RODENT DAMAGE
- 13c. Bark abnormally thick and spongy, wood underneath has severely pitted, indented texture. Leaves may have upward cupping, turning reddish purple, then dropping. PRUNUS STEM PITTING (Tomato Ring Spot Virus)
- 13d. Bark normal at crown area. (14)
- 14a. Leaves wilted or browned on one or several scaffolds (flagging). Rest of tree appears healthy. Dark streaks in sapwood of 2-3 year or older wood. Symptoms enhanced by water stress in

mid-summer. VERTICILLIUM WILT (*Verticillium albo-atrum*)

- 14b. Flagging is not evident. Other above ground symptoms. (15)
- 15a. Trees have a "bare-branched" or willowy appearance from lack of lateral spurs. (6)
- 15b. Leaves on affected branches turn rusty red colored in late summer. Localized areas or the entire canopy defoliates leaving foliage only at the tips. Choke cherry, the alternate host, may be observed near the orchard. Cherries small, flattened, pointed, and pale-colored. Affected berries confined to a few branches but mixed with some normal fruits. X-DISEASE

KEY TO PEACH DISEASE IDENTIFICATION

- 1a. General growth and vigor of the tree is reduced. Trees stunted or weakened. Foliage wilted or off-color with early reddening and defoliation in the fall. No other obvious symptoms on tree. (2)
- 1b. Obvious leaf, blossom, or fruit infections, cankers, galls or leaf variegation patterns. (7)
- 2a. Decay is evident at the root/crown area. (3) 2b. Decay is not evident at the root/crown area. (4)
- 3a. Wood darkened and covered by living bark at its edges. Bark easily sloughs off crown area or Southeast side of trunk. Larger roots may also be dead. WINTER INJURY
- 3b. Wood at canker is orange to brown in color, water-soaked and slimy. Canker, delimited by a definite margin of infection, sometimes extending into trunk or root area. Phytophthora isolated from margin of decay. PHYTOPHTHORA CROWN ROT (*Phytophthora* spp.)
- 3c. Bark at crown and roots easily sloughs off exposing dense white fungus growth with fan shaped distribution at cambium. Black shoestring-like strands (rhizomorphs) may be obvious on surface of bark and yellow-brown mushrooms may appear at base of tree in late summer or early fall. ARMILLARIA ROOT ROT (*Armillaria mellea*)
- 4a. Fibrous roots lacking or showing witches broom. Most common on light-textured soils. NEMATODE DAMAGE (*Pratylenchus penetrans*)
- 4b. Roots appear normal. (5)
- 5a. Bark easily sloughs off at crown area. (3) 5b. Bark missing at or below the soil line. Gnawing marks sometimes visible in wood. Callus formed in bark at margin of bare wood. RODENT DAMAGE
- 5c. Bark normal at crown area. (6)
- 5d. Bark abnormally thick and spongy, wood underneath has severely pitted, grooved, and indented texture. Leaves may have upward cupping, turning reddish purple, then dropping. PRUNUS STEM PITTING (Tomato Ring Spot Virus)
- 6a. Leaves wilted or browned on one or several scaffolds (flagging). Rest of tree appears healthy. Dark streaks in sapwood of 2-3 year and older wood. Symptoms enhanced by water stress in mid-summer. VERTICILLIUM WILT (*Verticillium albo-atrum*)
- 6b. Flagging is not evident. Other above ground symptoms. (7)
- 7a. Distinct lesions or distortions of leaves. (8) 7b. Distinct lesions or blemishes on fruits. (11) 7c. Distinct lesions on leaves and fruits accompanied by twig cankers. (10) 7d. Cankers on twigs or branches only. (13) 7e. Blossom blight. (12)
- 7f. Small to large warty appearing growths at crown or in roots. CROWN GALL. (*Agrobacterium tumefaciens*)
- 8a. Distinct lesions or shot-holes visible on the leaves. (10) 8b. Leaves are cupped, swollen, distorted or in some way abnormally shaped. (9)
- 9a. Leaves swollen and distorted along midrib early in the season, later turning red to purple, browning, and dropping from tree. Upper leaf surface becoming powdery-gray from fungal sporulation. PEACH LEAF CURL (*Taphrina deformans*)
- 9b. Leaves curled inward after several months. Water-soaked spots turn red, necrotic and drop out giving leaves a tattered appearance. Localized areas or the entire canopy defoliates leaving foliage only at the tips. Choke cherry, the alternate host, may be seen near the orchard. X-DISEASE
- 9c. Leaves cupping upward, turning yellow, red, then dropping from localized areas of the canopy. PRUNUS STEM PITTING (Tomato Ring Spot Virus)
- 10a. Small, purple lesions surrounded by a green halo on leaves in the spring. Lesions become necrotic and fall out giving leaves a tattered appearance. Symptoms associated with deep, black depressions on fruit and cankering of twigs and branches. Occasionally a bare-branched or "leggy" condition resulting from buds and spurs killed by cankers. BACTERIAL CANKER (*Pseudomonas syringae* and *P. mors-prunorum*)

- 10b. Small, brown or black angular lesions surrounded by a light-green halo. Lesions most apparent at leaf tips. Later the lesions drop out (shot-holing). Small circular, darkened, water-soaked lesions sometimes on twigs. Small circular lesions coalescing into cracks on developing fruit. The varieties Sunhigh, Afterglow, N.Y. 2602, N.Y. 2604, and N.Y. 1466, Collins, Merrill 49'er, Red Globe, and Washington are very susceptible. BACTERIAL SPOT (*Xanthomonas pruni*)
- 10c. Leaves develop chlorotic spots, lines, and rings as they emerge. In severe cases chlorotic areas become necrotic and fall out, leaving the leaves "shot-holed" or tattered. NECROTIC RING SPOT.
- 11a. White powdery areas on young fruit. Hard, leathery dark lesions on older fruits. POWDERY MILDEW (*Sphaerotheca pannosa* or *Podosphaera oxyacanthae*)
- 11b. Small, circular green spots sometimes concentrated around stem-end of fruit. PEACH SCAB (*Cladosporium carpophilum*)
- 11 c. Soft brown spots on maturing fruits that expand rapidly and produce tan powdery masses of spores. BROWN ROT (*Monilinia fructicola*) or BOTRYTIS (*Botrytis cinerea*)
- 12a. Gummy appearance of blighted blossoms. Powdery-gray mass of spores develop on diseased areas during warm wet conditions. Infection may continue to spread into twigs causing gummosis. BROWN ROT (*Monilinia fructicola*)
- 12b. Blossoms browned and withered during cool, wet weather. Brown lesions turn fuzzy gray from fungal sporulation. Disease not spread into twigs. BOTRYTIS (*Botrytis cinerea*)
- 12c. Blossoms wither, dry, and turn dark brown. Infection may extend 1 or 2 inches into spur. No fungal sporulation or water-soaking on infected tissues is apparent. Freezing injury to blossoms favors infection. BLOSSOM BLAST (*Pseudomonas syringae*)
- 13a. Perennial, elongated cankers surrounded by large, black, swollen rings of callus gumming. Canker associated with wounds, pruning stubs, peach tree borer, shaded-out twigs, or leaf scars. CYTOSPORA/VALSA CANKER (*Cytospora cincta* and *C. leucostoma*)
- 13b. Small, dark, oval cankers at buds or leaf scars of current season's twigs. Condition persists for only one year with symptoms most common in fall and spring. More frequent in warm regions. FUSICOCCUM CANKER (*Fusicoccum amygdali*)
- 13c. Canker originating from blighted blossom. (12)
-