Disease and Insect Pests of Celery
Michigan State University
Cooperative Extension Service
M.L. Lacy, Department of Botany and Plant Pathology
E.J. Grafius, Department of Entomology
July 1980
8 pages

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Extension Bulletin E-1427, July 1980, FILE 27.34, $1.50
COOPERATIVE EXTENSION SERVICE • MICHIGAN STATE UNIVERSITY

M. L. Lacy
Department of Botany & Plant Pathology
E. J. Grafius
Department of Entomology

Disease and insect pests of celery cause significant losses to Michigan celery producers each year. Correct identification of the disease or insect is the first step toward control. Photos of the major disease and insect pests in Michigan are given here to aid in identification. For control recommendations, see Extension Bulletin E-312, "Insect, Disease and Nematode Control on Commercial Vegetables," $1.10.

Septoria Leaf Blight (Late Blight)

Septoria leaf blight (late blight) is the most destructive disease of celery in Michigan. The causal fungus (*Septoria apiicola*) forms yellow to brown, irregularly-shaped lesions on the leaves and petioles (Fig. 1). Embedded in these lesions are the small, dark flask-shaped structures called pycnidia which contain the long multicellular spores. When the pycnidia are mature, water on leaves or petioles will cause the spores to be expelled from the pycnidia. The spores are then spread by splashing rain, or carried by implements or people passing through the field. This disease is favored by cool, wet weather. Spores carried on seeds do not survive more than two years.

Control: Use three-year-old seed or seed that has been hot water-treated; use sanitation in the greenhouse; stay out of fields or seed beds when the foliage is wet; apply fungicide sprays as recommended in Ext. Bull. E-312.

Cercospora Leaf Blight (Early Blight)

Cercospora leaf blight (early blight) occurs at times on Michigan celery, usually during midsummer weather with bright warm days followed by heavy dews at night. The fungus causes circular yellow to tan spots on leaves which enlarge to 1 cm or more in diameter (Fig. 2), and may cause elongate lesions on the petioles

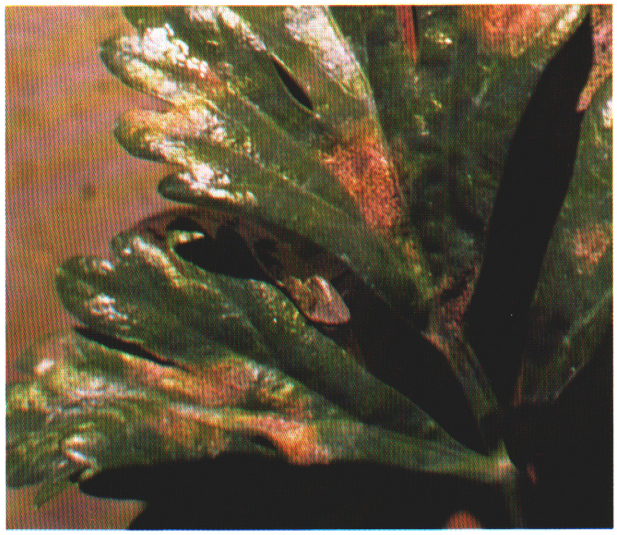


Fig. 1. Septoria leaf blight (late blight).

Fig. 2. Cercospora (early) blight.

in severe cases. Lesion surfaces assume a grey cast after humid periods when spores are being produced. The microscopic spores are produced on the lesion surfaces and are carried by wind currents for long distances. Spores can infect the leaf in 2 to 4 hours when temperatures are warm (80 to 82°F) and leaves are wet.

Control: Use clean seed and sanitary practices in the greenhouse for seedling production; apply fungicidal sprays as recommended in Ext. Bull. E-312.

Bacterial Blight

Bacterial blight *(Pseudomonas apii)* occurs in irregular, circular, rusty-red spots on the leaves, which may reach 5 mm in diameter (Fig. 3). Young lesions may have a yellow halo. This disease rarely gets severe enough to cause defoliation and seldom affects the petioles. The causal bacterium overwinters in diseased leaves or on seeds for a period of one year. Ten hours of continuous leaf wetness and moderate temperatures are required for infection to occur. The disease is spread by splashing rain and on machinery and clothing when leaves are wet.

Control: Rotate celery with another crop for at least one year; plant clean seed; stay out of fields when foliage is wet; sprays of fixed copper compounds (Ext. Bull. E-312) may help retard spread but will not provide complete control.

Sclerotinia Rot (Pink Rot)

Sclerotinia rot (pink rot) is a fungal disease that often attacks the celery stalk, usually near ground level. The disease is characterized by a white cottony mass of fungal mycelium, and a definite pink color in rotted tissue (Fig. 4). Black resting bodies (sclerotia), about 5 mm in diameter, may be found on rotted tissue; these sclerotia enable the fungus to survive in soil for years. The disease is favored by cool, wet weather. The fungus can also cause damping-off of seedlings in the seed bed. Human contact with rotted tissue by bare skin followed by exposure to the sun can cause severe blistering of skin on celery harvesters or packers.

Control: Fungicidal sprays (Ext. Bull. E-312) directed at the base of the plants; regular rotation with onions, mint, or other crops not susceptible to *Sclerotinia*.

Damping Off and Crater Rot

Rhizoctonia solani, a common soilborne fungus, may cause damping-off of young plants in the seedbed (Fig. 5), and may also cause the formation of brown, oval,

Fig. 3. Bacterial blight.

Fig. 4. Sclerotinia (pink) rot.

Fig. 5. Rhizoctonia damping off.

Fig. 6. Rhizotonia crater rot.

Fig. 7. Fusarium yellows, foliar symptoms.

Fig. 8. Fusarium yellows, internal discoloration.

sharply delineated tan to brown lesions on the exterior of the petioles, particularly the outer petioles (Fig. 6). This fungus is naturally present in all soils and can survive indefinitely on nonliving plant material. Its attack on celery is favored by warm, wet conditions. The fungus may also cause a damping-off or blight of seedlings in the field or greenhouse.

Control: In seedbeds, plant in sterilized soil and/or apply a fungicide drench. In the field, avoid throwing soil up around the plant crowns, and apply fungicide sprays directed at the base of the plant (Ext. Bull. E-312).

Fusarium Yellows

Fusarium yellows is caused by the soil-borne fungus *Fusarium oxysporum* f. sp. *apii*. The fungus causes yellowing and stunting (Fig. 7), and vascular discoloration inside the crown and petiole (Fig. 8). Plants may eventually collapse and die. The fungus forms spores which can survive in soil for many years. The longer susceptible celery is grown, the more the fungus builds up and the more serious the disease becomes. The green celery variety, Tall Utah 52-70, and selections from it, have been highly resistant to Fusarium yellows for many years until the recent reappearance of the disease in California and Florida on previously resistant varieties. If the disease reappears in Michigan, new sources of resistance will have to be found.

Control: Continue to grow resistant varieties; if celery transplants are imported, make sure they are from a *Fusarium*-free source.

Cucumber Mosaic (Southern Celery Mosaic)

This disease is caused by a virus which was originally described on cucumber; however, it can cause disease symptoms on a wide range of crop plants. In addition to celery and its relatives (carrot, parsley, celeriac, parsnip, etc.) it can be found on cucurbits (cucumber, canteloupe, squash, watermelon), tomato, pepper, eggplant, onion, corn, and numerous other plants, including ornamental and weed species.

The virus is often spread early in the season from chrysanthemum, gladiolus, larkspur, morning glory, periwinkle, tulip, or other ornamentals, or from weeds, such as wild cucumber, horse nettle, milkweed, catnip, ground cherry, and others. The virus is spread both mechanically (by implements or people) and by aphids. The golden celery varieties exhibit prominent vein-yellowing, mottling, and leaf puckering symptoms (Fig. 9), whereas the green varieties usually show only slight to severe brown streaks in the outer petioles (Fig. 10). Green varieties are more difficult to infect than golden varieties.

Fig. 9. Cucumber mosaic virus in golden celery.

Control: Try to eliminate perennial ornamental or weed hosts that can harbor cucumber mosaic within 100 yards of celery fields. Practice good aphid control (Ext. Bull. E-312) and grow green varieties where the virus is a problem.

Common (Western) Celery Mosaic

This disease is rarely found in Michigan. The first symptom is clearing of veins in the leaflets (veins take on a transluscent appearance and appear white). Later the petioles of the center leaves become shortened and tend to lie more horizontally than the older petioles (Fig. 11). The entire plant becomes stunted and the leaves crinkled and malformed. This virus infects only celery and closely related plants such as celeriac, carrot, dill, chervil, caraway, coriander, and parsley. The virus is spread by many species of aphids.

Control: Green celery varieties are less susceptible than golden varieties. Try to keep related perennial weeds such as Queen Anne's Lace away from celery fields. Keep aphids under control.

Aster Yellows

Aster yellows is caused by a mycoplasma organism, and is spread by leafhoppers, primarily the aster leafhopper (Fig. 12). The symptoms are yellowing of leaves, and twisting malformation of new growth in the

Fig. 10. Cucumber mosaic virus in green celery.

Fig. 11. Western celery mosaic.

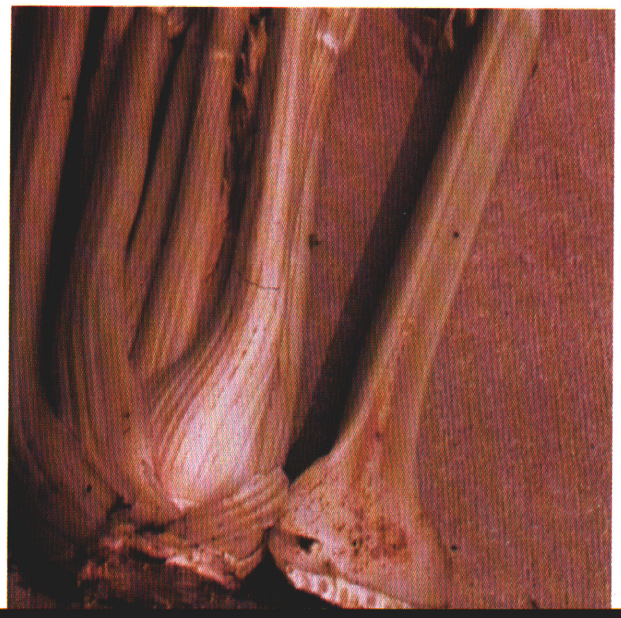
~~*Fig. 12. Aster yellows disease.*~~

Fig. 12. Aster (six-spotted) leafhopper.

~~Fig. 13. Aster (six-spotted) leafhopper.~~
Fig. 13. Aster yellows disease.

Fig. 14. Celery blackheart (physiological disease).

Fig. 15. Celery cracked stem (boron deficiency).



center of the stalk (Fig. 13). This disease can cause up to a 30% loss, so leafhopper populations should be monitored and control programs instituted when leafhoppers appear. Leafhoppers commonly are carried in on storm fronts coming from the southwest in late spring or early summer. Do not wait to control leafhoppers until symptoms appear because no symptoms will be evident until 30 days or more after the mycoplasma is injected by the the leafhopper. The mycoplasma overwinters on perennial weeds such as wild carrot, plantain, dandelion, chicory, perennial sowthistle, or wild aster. Wild lettuce near field borders is sometimes heavily infected by aster yellows, and the mycoplasma can be spread into nearby celery fields by leafhoppers.

Control: Begin spray programs when leafhoppers first appear (usually mid-to-late May). Up-to-date local pest activity is reported in county newsletters and code-a-phone bulletins at your County Extension Office. Control weed hosts of the disease around fields.

Black Heart

Black heart is a physiological disease which occurs when celery plants growing rapidly in heavily fertilized wet soils are exposed to a series of hot, cloudy, humid days. Young shoots in the heart of the plant turn black and die (Fig. 14).

Control: Spray applications of calcium chloride (5 to 10 pounds per acre) help prevent this disorder. Use high calcium lime when fields are limed; don't over-fertilize.

Cracked Stem (Boron Deficiency)

This disorder, commonly called cracked stem, usually appears as longitudinal tan streaks between the ribs on the petiole (Fig. 15). Transverse cracks along these streaks may or may not occur. Root growth may be inhibited.

Control: Apply borax to the soil according to Soil Testing Laboratory recommendations (usually not more than 10 pounds per acre).

Aphids

Aphids, particularly the green peach aphid, are common and serious pests of celery (Fig. 16). The aphids suck plant juices from stalks and the undersides of leaves, particularly on the new growth (Fig. 17). They reproduce very rapidly and high numbers will cause distorted plant growth, stunting of the plants, and contamination of the product. Virus diseases may also be

Fig. 16. Close-up of aphid on celery.

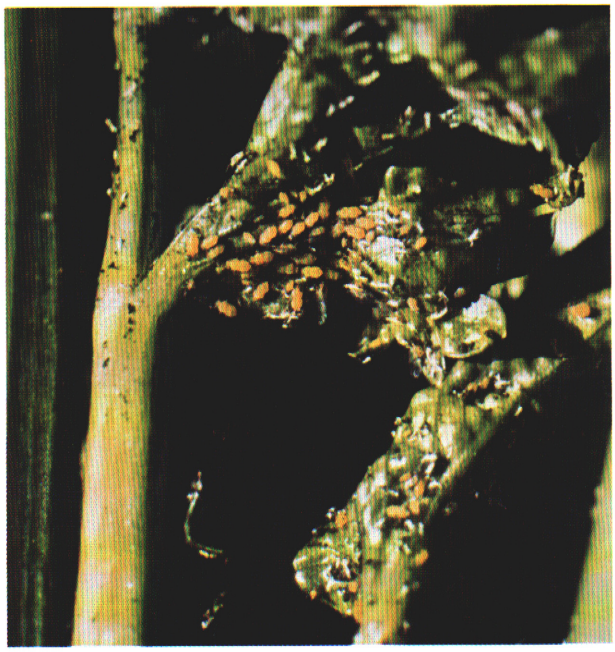


Fig. 17. Aphids feeding on celery.

Fig. 18. Variegated cutworm larva and feeding damage.

transmitted by aphids.

Green peach aphids overwinter as eggs on peach, plum and possibly chokecherry and other small stone fruit trees. In the early spring, the eggs hatch into nymphs which all develop into females. Around the first week in June, the winged forms begin to migrate to over 250 host plants, including celery, carrots, and lettuce. The succeeding generations are all females and have the capacity to give birth to 80-100 young. There may be 12 to 15 generations per year. Only the final generation has males. They mate with the females, which in turn lay the overwintering eggs.

Although aphids have very high reproductive rates, they are also vulnerable to predators and parasites. Some of the most common natural enemies of aphids are: lady beetle adults and larvae (several different species), lacewing larvae (also known as aphid lions), larvae of the bee flies, and a number of tiny parasitic wasps.

Control: Apply foliar insecticides as needed for control. To minimize the impact on natural enemies, avoid excessive sprays and use aphid-specific materials if possible. Recommended materials and rates are listed in Ext. Bull. E-312.

Variegated Cutworm

Variegated cutworms are capable of causing severe damage to celery. Larvae feed primarily on the inside of the stalks, near the heart of the plant (Fig. 18). Damage to the stalks may make the product unmarketable and larvae may be present as a contaminant.

Larvae are highly variable in color but have a distinctive series of yellow/orange dots down the back. Like the other cutworms, they curl into a tight ball when disturbed. The adult is a greyish/brown moth (Fig. 19).

Variegated cutworms are found on a wide variety of hosts and overwinter as larvae or pupae in the soil. Some adults may also migrate into Michigan. Details on spring and early summer biology are still largely unknown. However, the primary damage to celery comes during July (earlier and/or later depending on the season). Eggs are laid on the celery foliage. Young larvae may feed more on the foliage than do more mature larvae. However, both young and old larvae are difficult to detect. By carefully monitoring adult flight activity using black light traps and/or sex attractant traps, growers and scouts can be alert to the precise time to look closely for egg masses and young larvae on the foliage and treat, if necessary. Adult catches may also give some indication of the potential for damage. Once larvae are inside the celery heart, damage goes on, largely unnoticed, until harvest. Control measures at this stage are generally ineffective, since the larvae

are protected from sprays and, even if killed, would remain as a contaminant.

Control: Apply foliar insecticides on a regular basis when adults are active (July and early August), to control young larvae while they are still susceptible to insecticides and before serious damage has occurred. Watch local newsletters or code-a-phones for information on the critical times to treat. See Ext. Bull. E-312 for recommended materials.

Celery and Cabbage Loopers

Celery loopers may be present in the fields beginning in May, while cabbage looper adults migrate into Michigan in mid-July or later. Celery loopers may have 4 to 5 generations per year in Michigan and cabbage loopers may have 2 or 3.

Celery and cabbage loopers cause foliar damage to celery. However, since these larvae do not directly damage the stalks and don't often cause serious contamination problems, loopers are not as critical a concern as many of the other pests.

Celery and cabbage loopers are very similar in appearance (green with white stripes) (Fig. 20). Loopers lack legs on the middle segments of their bodies, having only 3 pairs of jointed "true" legs near the head and 3 pairs of "false" legs at the back.

Control: Apply foliar insecticides for control if damage is observed and larvae are present in significant numbers (e.g. an average of more than 1 larva per 10 plants). Control of mature larvae is more difficult and will not prevent much damage, so monitor your fields and treat, if necessary, when larvae are small. See Ext. Bull. E-312 for recommendations.

Carrot Weevil

Carrot weevils can also cause severe damage to celery plants. Larvae feed on and inside the roots (Fig. 21) and may kill plants, stunt growth, or provide avenues for secondary infection (Fig. 22).

Adults of the carrot weevil are small (5/16 inch) dark brown (black when wet) with a faint white band around the mid-region of the hind leg (Fig. 23). Larvae are legless, cream-white with brown to orangish heads (Fig. 24). Pupae are cream-white with externally developing wings.

Adults overwinter in field margins and ditchbanks. They resume activity in mid-April to late May, when temperatures rise to approximately 60°F, and begin feeding and egg-laying. Adults feed and larvae develop on a number of weed species (dock, plantain, dill, wild carrot, etc.), as well as on carrots, parsley, and celery.

Fig. 19. Variegated cutworm adult moth.

Fig. 20. Cabbage looper larva.

Fig. 21. Celery plants dying due to carrot weevil.

Fig. 22. Carrot weevil larvae and damage to base of celery plant.

Fig. 23. Carrot weevil adults.

The adults feed and lay eggs on the petioles of the celery plant. Larvae usually hatch within a week and bore down to the roots. They spend 2 to 4 weeks feeding and maturing before leaving to pupate in the surrounding soil. Adults emerge from these pupae as early as mid-June and begin laying eggs in 10 days to 2 weeks. Since a female may continue to lay eggs for several months, all stages of development (eggs, larvae, pupae, and adults) may be present at any time. In late summer or early fall, in response to shorter days, females cease laying eggs and the adults of both sexes migrate to suitable overwintering sites.

Control: Techniques for monitoring adult activity and principles of control are outlined in Ext. Bull. E-890, Detection and Control of Carrot Weevil on Carrots and Celery. In general, apply treatment if significant numbers of adults are caught or as soon as damage is observed. Treatment of only the outside rows may be adequate, depending on the source of the problem (adults don't fly). See Ext. Bull. E-312 for recommended materials. Rotation to non-host crops (e.g. onions, potatoes, lettuce) in problem fields is highly recommended. Special attention should be paid to control in greenhouses and seedbeds to avoid transplanting the insects out into the field.

Fig. 24. Carrot weevil larvae.

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