21 Jerusalem artichoke

BACTERIAL DISEASES

▶ 21.1 Apical chlorosis *Figs. 21.1a,b*

Pseudomonas syringae pv. *tagetis* (Hellmers) Young, Dye & Wilkie
(syn. *Pseudomonas tagetis* Hellmers)

Apical chlorosis has been a severe problem in Jerusalem artichoke in parts of the United States. In Canada, it has been reported from Quebec, Ontario and Manitoba. The disease can reduce plant stands by as much as 50%. Sunflower (*Helianthus annuus* L.), marigold (*Tagetes* spp.) and zinnia are other hosts for the pathogen.

Symptoms Newly emerged shoots exhibit a yellowing of the growing tips (apical chlorosis) which can spread downward over most of the shoot *(21.1a).* Affected leaves are yellow to white and, in time, turn brown. Diseased shoots are stunted and usually fail to survive *(21.1b).* Other foliar symptoms include brown leaf spots, varying from 1 to 2 mm in diameter, surrounded by a faint yellow halo, or large, yellow-green spots with small patches of gray-colored tissue in the center. Droplets of bacteria may ooze from these spots.

Causal agent *Pseudomonas syringae* pv. *tagetis* is a Gram-negative, oxidase-negative, arginine dihydrolase-negative, aerobic rod. Two strains of the bacterium have been reported, based on differences in symptoms that develop on spray-inoculated Jerusalem artichoke. "CN" strains produce chlorosis and necrotic spots on the host, while "N" strains cause only small, 1 to 3 mm, necrotic spots.

The pathogen may be isolated from necrotic foliage or from infested tubers by surface sterilizing the tissues in sodium hypochlorite, transferring treated pieces to sterile distilled water to allow the bacteria to ooze out, then streaking the water onto either nutrient agar or King's B medium. On these media, the pathogen produces colonies with slightly irregular margins. Flat colonies with highly irregular margins may be produced by some isolates upon repeated subculturing. The pathogen produces a fluorescent diffusate when grown on King's B medium.

Pathogenicity testing may be done by spraying the isolated bacteria, at a concentration of 5×10^6 cells/mL, onto the foliage of test plants, followed by an additional misting of the foliage for two days. Symptoms of foliar chlorosis and/or necrosis develop on Jerusalem artichoke, sunflower and marigold within two weeks.

Disease cycle The pathogen is tuber-borne in Jerusalem artichoke. The shoots that emerge from infested tubers usually become diseased. When necrotic tissue becomes wet, the bacterial cells are liberated and, under favorable conditions for infection, they promote secondary spread of the disease in the field. Apical chlorosis is less severe when infection occurs in older plants and they may eventually outgrow it. The disease also occurs in ragweed *(Ambrosia artemisiifolia* L.). Infection of ragweed and other weedy hosts within the family Asteraceae may provide natural reservoirs of inoculum. In sunflower, *P. syringae* pv. *tagetis* is seed-borne, but it is not known if this type of transmission occurs in Jerusalem artichoke.

Management

Cultural practices — Seed stock tubers should be obtained only from fields free from apical chlorosis. It is important to check such fields for the disease before flowering because the symptoms may become less conspicuous as the plants mature.

Selected references

Gulya, T.J., R. Urs and E.E. Banttari. 1982. Apical chlorosis of sunflower caused by *Pseudomonas syringae* pv. *tagetis. Plant Dis.* 66:598-600.
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Shane, W.W., and J.S. Baumer. 1984. Apical chlorosis and leaf spot of Jerusalem artichoke incited by *Pseudomonas syringae* pv. *tagetis. Plant Dis.* 68:257-260.
Styer, D.J., and R.D. Durbin. 1982. Common ragweed: a new host of *Pseudomonas syringae* pv. *tagetis. Plant Dis.* 66:71.

(Original by R.A. Brammall)

FUNGAL DISEASES

▶ 21.2 Downy mildew *Fig. 21.2*

Plasmopara halstedii (Farl.) Berl. & De Toni in Sacc.

This disease *(21.2)* is a minor problem in Jerusalem artichoke; it has been noted by W.E. Sackston (unpublished) in the field in Manitoba and in a disease nursery at Sainte- Anne-de-Bellevue, Quebec, that was infested with soil from a sunflower field at La Pocatière, Quebec. *Plasmopara halstedii* is a soil-borne fungus that also affects other members of the Asteraceae, including sunflower.

(Original by W.L. Seaman and W.E. Sackston)

▶ 21.3 Powdery mildew *Fig. 21.3*

Erysiphe cichoracearum DC.:Mérat

Powdery mildew affects the mature foliage of Jerusalem artichoke. The economic consequences of the disease are unknown; heavy infestations likely cause a reduction in yield and plant vigor. The disease has been reported from Quebec, Ontario and Manitoba. *Erysiphe cichoracearum* is capable of infecting a variety of cultivated and wild Asteraceae, as well as lettuce, cucurbits and several herbs and spices.

Symptoms Powdery mildew appears as a powdery white growth on the surface of the stems and leaves *(21.3).* This growth consists of the spores and mycelium of the causal fungus. Initially, the mildew lesions are discrete, but later enlarge, merge and may cover much of the foliage. Affected tissues turn yellow and eventually die.

Causal agent (see Lettuce, powdery mildew, 11.12)

Disease cycle The pathogen is an obligate parasite. Conidia, which are formed on the infected tissue, are dispersed by wind to cause new infections throughout the season. With the approach of autumn, the fungus produces cleistothecia on the older mycelium, generally on the upper surface of infected leaves. In spring, the cleistothecia split open when wetted and the ascospores are forcibly discharged. Those that land on leaves and stems of Jerusalem artichoke and other hosts may germinate and infect these plants.

Management

Cultural practices — Mildew-susceptible weeds should be controlled in the vicinity of Jerusalem artichoke plantings. Destruction of residues from infected crops may help to reduce the amount of disease the following year.

Resistant cultivars — Certain cultivars of Jerusalem artichoke differ in susceptibility to powdery mildew. Late- maturing cultivars may be less severely affected than early ones.

Selected references

Kapoor, J.N. 1967. *Erysiphe cichoracearum.* CMI Descriptions of Pathogenic Fungi and Bacteria, No. 152. Commonw. Mycol. Inst., Kew, Surrey, England. 2 pp.

Laberge, C., and W.E. Sackston. 1987. Adaptability and diseases of Jerusalem artichoke (*Helianthus tuberosus)* in Quebec. *Can. J. Plant Sei.* 67:349-352.

Lorenzini, G., and E. Triolo. 1980. Sunflower and Jerusalem artichoke, new hosts of *Erysiphe cichoracearum* DC. in Italy. *Informatore Fitopatologico* 30:9-11.

McCarter, S.M., and S.J. Kays. 1984. Diseases limiting production of Jerusalem artichokes in Georgia. *Plant Dis.* 68:299-302.

(Original by R.A. Brammall)

▶ 21.4 Rust *Fig. 21.4*

Puccinia helianthi Schwein.

Rust has been a serious disease of Jerusalem artichoke in the southeastern United States. In Canada, it is a minor problem on Jerusalem artichoke in Ontario and Quebec; however, *Puccinia helianthi* is a serious pathogen of cultivated sunflower *(Helianthus annuus* L.) in Manitoba. Rust also affects other *Helianthus* spp. and occurs throughout the range of these species. Rust is one of the most important diseases affecting cultivated *Helianthus* spp. throughout the world.

Symptoms The first symptom of rust usually noted is the production of uredinial pustules on the foliage and, occasionally, on the stem. Reddish-brown urediniospores form within the uredinia during mid- to late summer. Young foliage may be affected and fail to grow because of heavy infections. The uredinia are most frequently found on the undersurface of the leaves. At the end of the growing season, the uredinia turn black as teliospores are produced *(21.4).*

Causal agent *Puccinia helianthi* uredia are mostly hypophyllous, irregularly scattered, cinnamon, and 0.5 to 1.0 µm in diameter. Urediniospores are ellipsoidal, obovoidal or cylindrical, 25 to 32 by 19 to 25 µm, very finely echinulate, and reddish brown. The

telia resemble the uredinia, but are darker colored. The teliospores are cylindrical to clavate, slightly constricted at the septum, 40 to 60 by 18 to 30 µm, and reddish to chestnut brown.

Disease cycle *Puccinia helianthi* is a macrocyclic, autoe- cious rust. Teliospores are formed and overwinter on host residues. They germinate in the spring to produce sporidia, which can infect the young plants. Sporidial fusions result in the production of pycnia and aecia (see Asparagus, rust, 4.6). These spore stages are often inconspicuous. Infection by the aeciospores results in the production of urediniospores in the uredinia. The urediniospores are dispersed during the summer to cause new infections. In autumn, the uredinia cease to be formed and overwintering teliospores are produced. Volunteer Jerusalem artichoke plants and wild sunflowers may serve as the initial source of infection during the growing season.

Management

Cultural practices — Destruction of infested crop residues will reduce the amount of overwintering inoculum. Crop rotation or the selection of new sites for each successive planting may also help to limit disease development.

Resistant cultivars — No rust-resistant cultivars of Jerusalem artichoke have been developed, but resistance genes for specific races of *P. helianthi* have been identified in this crop.

Selected references

Laundon, G.F., and J.M. Waterston. 1965. *Puccinia helianthi.* CMI Descriptions of Pathogenic Fungi and Bacteria, No. 55. Commonw. Mycol. Inst., Kew, Surrey, England. 2 pp.

Putt, E.D., and W.E. Sackston. 1957. Studies on sunflower rust. I. Some sources of rust resistance. *Can. J. Plant Sci.* 37:43-54.

Zimmer, D.E., and D. Rehder. 1976. Rust resistance of wild *Helianthus* species of the north central United States. *Phytopathology* 66:208-211.

(Original by R.A. Brammall)

▶ 21.5 Sclerotinia wilt, stalk and tuber rot *Figs. 21.5a, b*

Sclerotinia sclerotiorum (Lib.) de Bary
(syn. *Whetzelinia sclerotiorum* (Lib.) Korf & Dumont)

Sclerotinia wilt and stalk and tuber rot have been reported on Jerusalem artichoke in Quebec, Ontario, Manitoba and British Columbia. The pathogen causes similar diseases on cultivated sunflower (*Helianthus annuus* L.). *Sclerotinia sclerotiorum* has a wide host range, which includes many vegetable crops and broadleaved weeds. The ubiquitous nature of the pathogen means that wilt and stalk and tuber rot will likely occur, to some extent, wherever Jerusalem artichoke is grown.

Symptoms *Sclerotinia* infection produces basal cankers, root rot, tuber rot, and wilt symptoms *(21.5a).* The root system and tubers may be destroyed by the disease. Rotting may extend up the stem above the soil line *(21.5b).* Dense white mycelium and black sclerotia often form upon and within the affected tissues (see Carrot, sclerotinia rot).

Causal agent (see Carrot, sclerotinia rot, 6.15)

Disease cycle The pathogen persists in soil as sclerotia (see Carrot, sclerotinia rot). Wilt and root and basal stem rot of sunflower are caused by penetration of the roots and stems by hyphae from germinating sclerotia. Head rot can be caused by air-borne ascospores released from apothecia produced by sclerotia in the soil. The infection process in Jerusalem artichoke is probably similar to that in sunflower, but this remains to be determined.

Management

Cultural practices — Growers should select fields that do not have a history of sclerotinia diseases. Tubers used for planting should be free of the pathogen. Cereals, corn or grasses should be used in crop rotations and at least four years should be allowed between successive crops of Jerusalem artichoke and other susceptible species. Volunteer Jerusalem artichoke plants and susceptible weeds should be controlled in these rotational crops.

Selected references

Huang, H.C., and J. Dueck. 1980. Wilt of sunflower from infection by mycelial-germinating sclerotia of *Sclerotinia sclerotiorum. Can. J. Plant Pathol.* 2:47-52.

Mordue, J.E.M., and P. Holliday. 1976. *Sclerotinia sclerotiorum.* CMI Descriptions of Pathogenic Fungi and Bacteria, No. 513. Commonw. Mycol. Inst., Kew, Surrey, England. 2 pp.

(Original by R.A. Brammall)

INSECT PESTS

▶ 21.6 Stem borers *Fig. 21.6*

In western Quebec some years ago, W.E. Sackston found a stem borer identified as the sunflower maggot *Strauzia longipennis* (Wiedemann) (see Additional references, Westdal and Barrett 1960), which burrows in the stem, overwinters in the crown as a

pupa, and occurs in Canada from Manitoba east; and A.J. Kolach found a stem borer in Manitoba that tentatively was assigned to *Eucosma* sp.

ADDITIONAL REFERENCES

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Shoemaker, D.N. 1927. The Jerusalem artichoke as a crop plant. *U.S. Dep. Agric. Tech. Bull.* 33. 32 pp.

Westdal, P.H., and C.F. Barrett. 1960. Life-history and habits of the sunflower maggot, *Strauzia longipennis* (Wied.) (Diptera: Trypetidae), in Manitoba. *Can. Entomol.* 92:481-488.