Figures *27.1* to *27.2; 27.2T1*
Bacterial diseases
27.1 Bacterial soft rot of alfalfa sprouts
27.2 Bacterial soft rot of bean sprouts, physiological collapse

BACTERIAL DISEASES

▶ 27.1 Bacterial soft rot of alfalfa sprouts *Figs. 27.1a,b*

Erwinia chrysanthemi Burkholder, McFadden & Dimock

Soft rot usually occurs in seed germination trays. It can be particularly severe when temperatures exceed 28°C. The pathogen is capable of attacking a variety of horticultural plants.

Symptoms The first symptom is a yellowish, translucent appearance of the alfalfa root *(27.1b)*, which soon stops growing. A smelly rot develops, which can spread rapidly and destroy whole trays of seedlings *(27.1a).*

Causal agent *Erwinia chrysanthemi* is a Gram-negative, non-spore-forming rod, 0.5 to 0.7 by 1 to 2.5 µm, with a physiology characteristic of the genus, except that it shows some growth in 5% sodium chloride. It liquefies gelatin and rots potato tuber tissue. On King's B medium, colonies are light-colored, translucent, round, and slightly umbonate with undulate margins and a strong odor of banana. On Miller-Schroth medium, colonies have a fried-egg appearance, being orange in the center and lighter toward the margin. The colonies and surrounding medium turn orange within one to three days, then green after four days.

Erwinia carotovora subsp. *carotovora,* another species causing soft rot of vegetables, apparently has not been reported on alfalfa sprouts, but it too may cause bacterial soft rot.

Erwinia chrysanthemi can be distinguished from *E. carotovora* subsp. *carotovora* by the fried-egg-type colonies on potato dextrose agar and Miller-Schroth medium, by the blue pigment when produced, by its failure to produce acid from lactose, maltose, trehalose or p-methyl glucoside in seven days, failure to grow in 5% sodium chloride, positive indole, lecithinase and phosphatase, and sensitivity to erythromycin.

Disease cycle The bacterium is probably introduced in water, because it does not survive on dry seeds longer than two weeks. The disease is very contagious and develops rapidly between 16 and 34°C.

Management

Cultural practices — Scrupulous hygiene is important to eliminate or reduce inoculum in water and air-borne dust. Temperatures of 21°C or less, although slowing germination, can reduce disease progression.

Chemical control — Before germination, seeds may be soaked in 0.5% calcium hypochlorite solution for two hours to disinfest them. Sodium hypochlorite and hydrogen peroxide solutions are less effective. As with bacterial soft rot of mung bean sprouts (see bacterial soft rot of bean sprouts, this chapter), calcium chloride or calcium nitrate added to the germination water at about 0.005 molar (0.5 to 0.6 g/L) is an effective control measure.

Selected references
Bradbury, J.F. 1977. *Erwinia chrysanthemi.* CMI Descriptions of Pathogenic Fungi and Bacteria, No. 553. Commonw. Mycol. Inst., Kew, Surrey, England. 3 pp.
King, E.O., A.H. Wood and D.E. Raney. 1954. Two simple media for the demonstration of pyocyanin and fluorescin. *J. Lab. Clin. Med.* 44:301-307.
Miller, T.D., and M.N. Schroth. 1972. Monitoring the epiphytic population of *Erwinia amylovora* on peas with a selective medium. *Phytopathology* 62:1175-1182.
Pierce, L., and A.H. McCain. 1987. Alfalfa sprout rot caused by *Erwinia chrysanthemi. Plant Dis.* 71:786-788.

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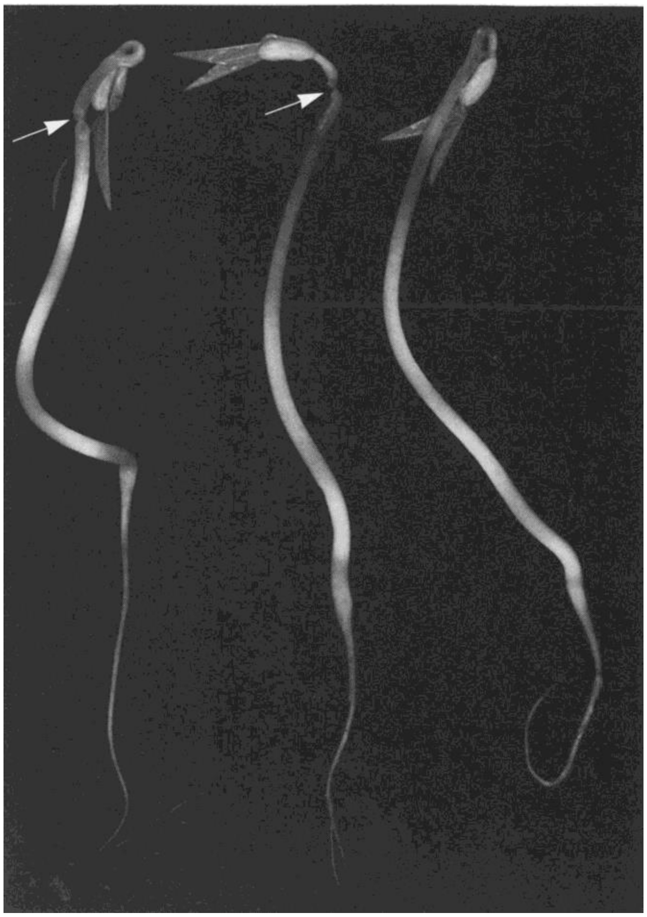

27.2T1 Bacterial soft rot of bean sprouts; water-soaked constriction (arrow) of the hypocotyl at the crook just below cotyledons is associated with calcium deficiency; the tissue becomes necrotic and is invaded by soft-rot bacteria.

▶ 27.2 Bacterial soft rot of bean sprouts, physiological collapse *Figs. 27.2; 27.2T1*

Erwinia carotovora subsp. *carotovora* (Jones) Bergey *et al.*
Erwinia chrysanthemi Burkholder, McFadden & Dimock

Physiological collapse can occur when there is inadequate calcium in the water used to germinate seeds. Affected seedlings are susceptible to bacterial soft rot. The bacteria that cause soft rot usually belong to the genus *Erwinia*, either *E. carotovora* subsp. *carotovora* or *E. chrysanthemi.* Both species are ubiquitous and may readily contaminate unhygienic sprout production systems.

Symptoms A water-soaked lesion appears just below the cotyledonary hook (27.2) and the hypocotyl becomes constricted (*27.2T1*). Bacteria invade the damaged tissue and cause a smelly soft rot that very quickly spreads through the bean sprouts.

Causal agent The initial damage is usually from a lack of calcium in the cell walls of the bean sprouts. Calcium links parallel pectin chains, which provide structural strength in the cell wall. It also renders pectin more resistant to microbial degradation. (For descriptions of *Erwinia chrysanthemi* and *E. carotovora* subsp. *carotovora*, see bacterial soft rot of alfalfa sprouts, 27.1, and Potato, bacterial soft rot, 16.2.)

Disease cycle (see bacterial soft rot of alfalfa sprouts, 27.1; and Potato, bacterial soft rot, 16.2)

Management

Cultural practices — Calcium can be added to the germination water as calcium chloride or calcium nitrate, creating about a 0.005 molar (0.5 to 0.6 g/L) solution. Because the invading bacteria may be waterborne, care should be taken to avoid contamination of the water supply by soil or plant residue. Creek and well water should never be used without prior filtration and sterilization. Growers should maintain hygienic conditions in the production system. An essential part of this strategy is the surface sterilization of seed in 0.5% calcium hypochlorite solution for two hours immediately before germination.

Selected references

Liptay, A., and P. Vandierendonck. 1987. Calcium retards physiological collapse and subsequent microbial degradation of mung bean (*Vigna radiata* (L.) Wilczek) sprouts. *Can. J. Plant Sci.* 67:537-548.

(Original by W.R. Jarvis)