SCORCH DISEASE OF RHIZOMATOUS IRIS

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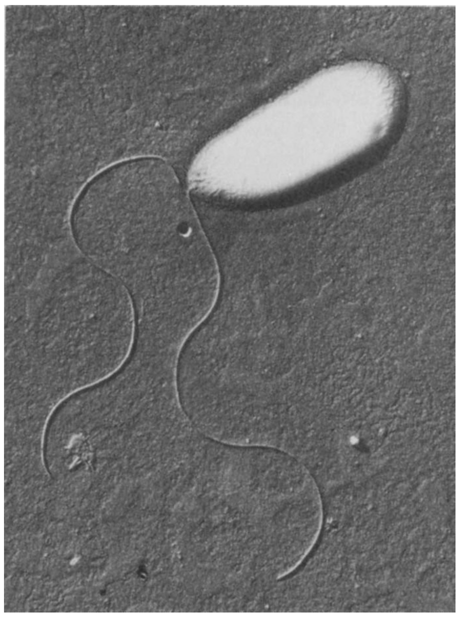
WHILE WORKING on scale tip rot of lilies, it was discovered that the same bacterium, *Pseudomonas*, might also be the cause of scorch disease of rhizomatous iris. Bacteria isolated from scorch-diseased iris that looked like the lily *Pseudomonas* were inoculated to bulb scales of Easter lily with positive results and the original bacterium was reisolated from the lily scales.

Scorch disease of iris occurs only occasionally in California and is not of much economic importance at this time. The disease depends for full development on a balance between the pathogen causing it, the climate, the growth of the host plant, and other conditions not yet fully understood. Symptoms of the scorch disease include a gradual dying back of the plants starting at the leaf tips, with dead leaf tissues turning brown or reddish brown and eventually dying back to the rhizome. The roots also start to rot or become digested, advancing to stop only at the rhizome itself. Plants surviving the initial attack may persist but seldom regain full vigor.

The pathogenic bacterium from iris is a member of the "fluorescens" group of the genus *Pseudomonas:* the bacteriologists who have examined the cultures have not given it a specific name. It also appears that the *Pseudomonas* isolates causing diseases in lily and iris are closely related to, or the same as, two named species causing soft rot disease in onion.

Seen under the electron microscope the lily and iris *Pseudomonas* is a rod-shaped cell with two whip-like flagella (see photo). When it is young and vigorous, it uses its flagella to swim actively in liquid media or water, and no doubt this helps it to infect iris plants from films of soil water around the roots. *Pseudomonas* has difficulty infecting unwounded tissues; under experimental conditions it generally gets in through wounds. Inoculation methods used always involved the wounding of tissues in the presence of a bacterial suspension.

A single bacterium of Pseudomonas sp., the cause of scorch disease of rhizomatous iris, photographed under the electron microscope. The bacterial cell is slightly shorter than average, but the two flagella arising from one end are characteristic. Photomicrograph by Dr. Paul Desjardins.

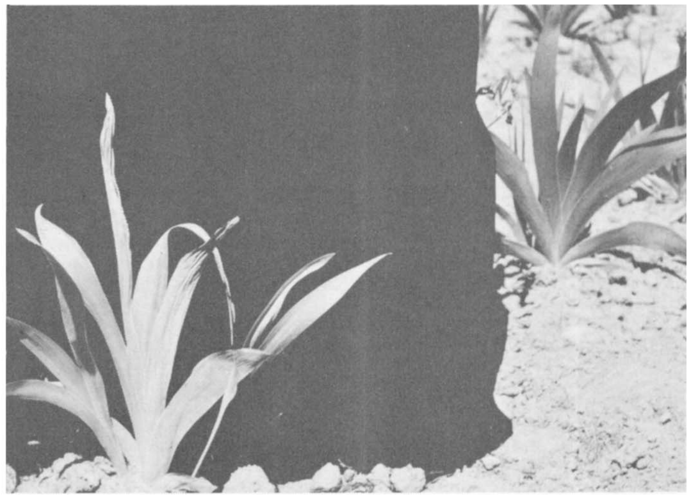


Most pathogenicity tests were done during two periods around 1961–62 and 1965–66. Both times, plants used for inoculation were from the same seedling stock. During the earlier period, clear evidence of pathogenicity was obtained but symptoms were not so severe as typical field "scorch"; during the later period scorch symptoms were reproduced. In between the two series of trials the whole stock of test plants became infested with a strain of the fungus, *Rhizoctonia,* which entered the iris roots and grew between the cells, apparently doing the plants no harm. It behaved somewhat like the mycorrhizal fungus that is essential to the growth of orchids. *Rhizoctonia* has been demonstrable on the roots of most rhizomatous iris plants from California that have been examined. It has not been directly associated with symptoms of disease, but the question arises, does it help *Pseudomonas* to enter the roots of iris plants and cause "scorch"? The question remains unanswered.

Disease cycle

The acute phase of scorch disease occurs most often in plants grown where a warm spring follows a cold winter. In southern California, it is a rare disease. The contrast led to an examination of the growth cycle of rhizomatous iris plants in New York State and southern California. Cold winters bring the growth cycle of rhizomatous iris into phase, roots are produced, then foliage; and when the blooms are developing and expanding, other growth almost stops. It is at this time that the disease attacks. Judging by our experience with lilies, the *Pseudomonas* attacks in moist soil at temperatures around 60° but not much above 70°F. It can destroy the root system in a short time; and replacement of roots is difficult because the production of foliage and flowers draws away the plant's reserves of food stuffs. In New York the incidence of the disease is generally reduced during the hottest months. It may rise again in autumn, but seldom to so high a level as in spring.

Two-year rhizomatous iris plants infected with scorch disease and dying, on either side of a healthy plant.

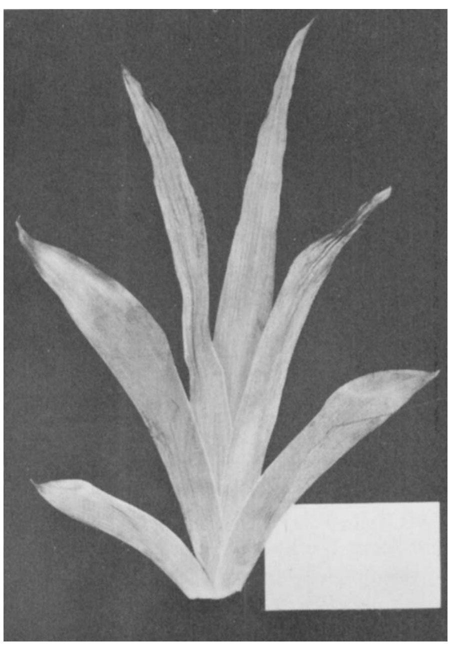


A young rhizomatous iris plant in the field showing scorch disease photographed against a black background. Healthy non-infected plant is seen behind it, to right.

In a climate where a mild winter root growth occurs throughout the year, the production of leaves and flowers is not forced to a climax in so short a period, and plants have a better chance of making good the loss of roots rotted away by *Pseudomonas*. However, in southern California the balance can be upset, and the acute phase of the disease sometimes appears.

The iris *Pseudomonas* is carried in or on rhizomes or roots of infected plants. The chances are it spreads after harvest from infected to healthy rhizomes by contact during handling and trimming, and through infested soil and plant debris accumulating on work benches and on floors. There is evidence of some spread

Scorch disease of rhizomatous iris (early symptoms) showing the central leaves of a fan withering from the tip. There is no definite margin between the dying tissue at the tip and the green leaf base.



between adjacent plants in the field—whether by soil-water, splash, or root contact is unknown.

Knowing there is some spread through the soil, it must be assumed that plants next in the row to diseased plants are also diseased. Unless diseased plants are indispensable, or there are too many, or they are too large to handle easily, they should be dug, placed in a container, carried from the planting, and destroyed. If they must be left, healthy plants should be taken out first, diseased and adjacent plants later. All operations should be on an assembly line principle, never allowing clean healthy stock to go back along the line to make contact with trimmings, soil, or debris from other plants. As much soil as possible should be shaken off the roots in the field; and at the other end the sorting, packing and storage space should be separated as clearly as possible from the area where dividing, cleaning and trimming are done.

One of the best and most generally available materials for treating the recently cleaned and trimmed rhizomes is sodium or calcium hypochlorite, in the form of household bleach—diluted before use to ½ per cent of the active material. The same solution may be used for washing benches, floors, plastic sheeting, wooden flats, etc. However, knives or other metal objects must be washed in clean water after dipping to prevent corrosion. Plant material does not need to be rinsed after dipping. The dip rapidly loses strength and should be regularly renewed.

Treatment of rhizomes with an antibiotic is a possibility. The one generally available is streptomycin, marketed under several different names. As a dip for rhizomes, 200 ppm of the active substance is as high as one can usually go without some yellowing and stunting of the plants. Although some *Pseudomonas* species causing plant diseases are fairly resistant to heat and to formaldehyde, one species, causing bacterial scab of gladiolus, is known to be sensitive to 200 ppm of streptomycin, used as a presoak for bulblets before hot water treatment. There are other indications that streptomycin might work at least as a preventive of surface contamination.

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Scorch disease of rhizomatous iris showing the withering of leaves advancing towards the base.