Diseases Caused by Bacteria

Bacterial Leaf Spot

Bacterial leaf spot of peanut, caused by an unidentified species of *Pseudomonas*, has been observed in India, Vietnam, and Zimbabwe.

Symptoms

Lesions, which are small, circular to irregular, and light brown, frequently occur on the lower leaves of young plants. At early stages of disease development, the lesions are water soaked and prominent on upper surfaces of leaflets. On the lower surfaces of the leaflets, lesions become visible only after the spots on the upper surfaces are well developed. The lesions enlarge, become irregular, and may develop chlorotic halos. When lesions are fully developed, their centers are light brown with dark brown margins (Plate 78). Under favorable conditions for disease development, the lesions coalesce, and the leaflets become chlorotic and shed prematurely.

Bacterial colonies grown on D4 medium are pale white, circular, raised, and 1–2 mm in diameter. The bacterium (0.5–0.8 × 1.0–1.3 µm) is gram negative, nonfluorescent on King's medium, and rod shaped and has one or two polar flagella.

Selected References

Kado, C. I., and Heskett, 1970. Selective media for isolation of *Agrobacterium, Corynebacterium, Erwinia, Pseudomonas*, and *Xanthomonas*. Phytopathology 60:969-976.

Raghava Reddy, J., McDonald, D., and Joshi, N. C. 1989. Bacterial diseases of ICRISAT legume crops and methods in plant bacteriology. Pages 37-55 in: Rep. Int. Legumes Pathol. Training Course, 8th. Int. Crops Res. Inst. Semi-Arid Trop. Legumes Pathol. Progr. Rep. 10.

Subrahmanyam, P., Wongkaew, S., Reddy, D. V. R., Demski, J. W., McDonald, D., Sharma, S. B., and Smith, D. H. 1992. Field diagnosis of groundnut diseases. Int. Crops Res. Inst. Semi-Arid Trop. Bull. 36.

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Bacterial Wilt

Bacterial wilt of peanut, caused by *Pseudomonas solanacearum*, was first reported in Indonesia in 1905 and since then has been reported in many regions throughout the world. The first report of the disease in the United States was in 1915 from Granville County, North Carolina, which had previously experienced a high incidence of bacterial wilt of tobacco. Bacterial wilt of peanut was responsible for heavy losses in Georgia in 1913 but is now of minor importance in the United States. By contrast, the disease is a major constraint to peanut production in several Asian and African countries, notably China, Indonesia, Malaysia, Uganda, and Vietnam.

In Indonesia, bacterial wilt of peanut is most severe in western Java, southern Sulawesi, and southern Sumatra and is also important in central and eastern Java, Bali, and North Sulawesi. In China, the disease is most severe in 16 southern and central provinces, where it is estimated that more than 200,000 ha of peanut fields are infested with the wilt pathogen. The annual incidence of the disease is estimated to be 4–8% on resistant cultivars and 10–30% on susceptible ones in some regions, and the annual loss in pod yield caused by the disease is estimated to be approximately 36,000 t. The disease is widespread in the major peanut-growing areas of both northern and southern Vietnam and is most severe in dryland cropping systems, especially on sandy upland or riverbank soils. Peanut is probably less susceptible to bacterial wilt than solanaceous hosts such as tomato, potato, tobacco, and eggplant, except where peanut is intensely cropped under environmental conditions conducive to the disease and highly virulent strains of *P. solanacearum* occur. Bacterial wilt is regarded as a potential threat to peanut production in several warm, humid areas of the world as production expands into new areas or cultural practices change.

Symptoms

Infection of young plants can result in the sudden wilting of stems and foliage, although leaves on dead plants remain green (Plate 79). Wilt symptoms can be observed 2–3 weeks after sowing. The first sign of the disease is a slight drooping or curling of one or more leaves. In mature plants or in cultivars that are not highly susceptible, a gradual decline causes the foliage to turn yellow. Wilt and death of single branches (Plate 80) or of the entire plant (Plate 81) may follow. Alternatively, the plant may show signs of recovery. The root systems of infected plants display numerous discolored and dead roots. Dying branches often curl to form a "shepherd's crook." Diagnostic characteristics for this disease are a dark discoloration in the xylem and pith (Plate 82) and a milky white ooze composed of masses of bacteria that exudes from cut ends of stems placed in water.

Causal Organism

P. solanacearum (Smith) Smith (syns. *Burkholderia solanacearum* (Yabuuchi et al.) and *Ralstonia solanacearum* (Yabuuchi et al.)) is an aerobic, gram-negative, rod-shaped bacterium that does not form spores and accumulates poly-β-hydroxybutyrate as a carbon reserve. Although the bacterium does not produce fluorescent pigments, it can produce a brown, diffusible pigment on agar media containing tyrosine. The organism does not grow at 41°C, and it cannot utilize arginine and betaine as sole carbon sources. The bacterium is unable to hydrolyze starch, and gelatin is liquefied weakly or not at all. There is variation in nitrate metabolism. Asian isolates from peanut produce gas from nitrate, whereas those from the Americas reduce nitrate to nitrite but without gas production. The optimum temperature for growth is 30–35°C.

P. solanacearum is heterogeneous in phenotypic properties, such as ability to utilize specific carbon sources, and has been classified into five biovars on the basis of differences in oxidation of particular hexose alcohols and disaccharides. Biovars 1, 3, and 4 have been reported as pathogens of peanut. In the United States, the disease is caused by biovar 1, whereas in those Asian and African countries for which there is published information, it is caused by biovar 3 or 4. On the basis of hosts of origin and host range, isolates of *P. solanacearum* have been tentatively divided into five races. The isolates from peanut are identified as race 1.

The classification of strains of *P. solanacearum* has been greatly advanced by DNA analysis. Restriction fragment length polymorphism (RFLP) analysis has been used to differentiate *P. solanacearum* into RFLP groups by using nine probes to regions of the chromosomal DNA associated with virulence and the hypersensitive response. Similarity coefficients for all