Bacterial Wilt

Causal organism

Ralstonia solanacearum (Yabuuchi *et al*. 1995) Smith
Synonyms: *Bacillus solanacearum* (Smith), *Pseudomonas solanacearum* (Smith) Smith, *Burkholderia solanacearum* (Smith) Yabuuchi *et al*.

Host range

Eucalypt-infecting strains are all Race 1 (the race with a broadest host range) and either biovar 1 (in South America) or biovar 3 (Asia and Australia) (Gillings and Fahy 1993). These biovars also attack a wide range of hosts including many woody species, e.g. casuarina, olive, teak, neem, cassava and cashew (Hayward 1993). Eucalypt hosts recorded so far include *E. camaldulensis*, *C. citriodora*, *E. grandis*, *E. 'leizhou'*, *E. pellita*, *E. propinqua*, *E. saligna*, *E. urophylla* and *E. grandis* (Ciesla *et al*. 1996).

Distribution

Bacterial wilt is widespread throughout tropical, subtropical and warm temperate regions of the world (Smith *et al*. 1992). On *Eucalyptus*, recorded in Brazil (Dianese *et al*. 1990), China (Wu and Liang 1988), Indonesia (Machmud 1985), Taiwan (Wang 1992), Thailand (Pongpanich 2000), Vietnam (Thu *et al*. 2000), South Africa (Coutinho *et al*. 2000), Uganda (Roux *et al*. 2000) and Australia (Akiew and Trevorrow 1994).

Symptoms

These pathogens are soil-borne, and disease symptoms develop shortly after planting (Figs 84, 85). Affected trees are often scattered through the stand and show wilting, leaf drop, stem death and reduced growth rate (Fig. 85). Vascular discoloration commonly occurs, roots die and basal cankers may be found on affected trees (Figs 86, 87). Symptomatic trees usually wilt and die. Stem sections, cut through discoloured vascular tissue (Fig. 87) exude bacterial masses if incubated moist in plastic bags for 24 hours or suspended in water (Fig. 88). Selective media, serological and molecular methods including DNA analyses are routinely used to detect and type bacterial isolates (Seal and Elphinstone 1994).

Pathology

There is a large body of physiological, biochemical and ecological information indicating that *R. solanacearum* is a complex and heterogeneous species, causing disease on an extremely wide range of crops. A full description, based on standard morphological and biochemical characteristics, is given in Saddler (1994) and a summary of the subspecific classification system is described in Hayward (1991) and Gillings and Fahy (1993). The latter authors also describe rapid DNA-based methods for detecting the bacteria and identifying isolates to subspecific levels. The biology and epidemiology of *R. solanacearum* are discussed by Hayward (1991).

Bacteria occur in soil but the relationship between the epidemiology of disease on other hosts and the disease on *Eucalyptus* is not known. On other hosts, spread can be by movement of cuttings, storage organs and seed. There is also some evidence for insect vectors. Local splash-dispersal within plantations from cankers on infected eucalypt stems seems likely. Sequences and lengths of crop rotations may also be a factor in the incidence of bacterial wilt in *Eucalyptus*. For example, experience in Vietnam and eastern Thailand suggested that wilt of clonal plantings of *E. camaldulensis* occurred more commonly when eucalypts were planted in fields formerly growing cassava.

Impacts

In severely affected plantations of *E. urophylla* in northern Vietnam, tree mortality was as high as 30% one year after planting. In a plantation of 13-month-old *E. pellita* examined in northern Queensland by the authors in 1996, significant numbers of one-year-old trees suffered bacterial wilt. Eighteen months later, no newly diseased trees were found and some recovery of trees was evident through healing of basal cankers. In older trees, such cankers may be invaded by secondary pathogens causing stem and butt rot with increased incidence of wind-throw.

Control and management

Bacterial wilt can originate from infected nursery stock, although for *Eucalyptus*, *R. solanacearum* is rarely reported as a nursery problem. Different *Eucalyptus* species undoubtedly vary in their susceptibility to disease, with *E. pellita* and *E. urophylla* often being susceptible. Variation in resistance to bacterial wilt has been identified for a range of eucalypt species in Brazil (Dianese and Dristig 1993). Clonal variation in susceptibility also occurs, with evidence from South Africa that the disease is restricted to some inter-specific hybrid clones. The circumstantial evidence for enhanced disease incidence following cassava is of interest, and other crop sequences may influence pathogen populations. No control practices for bacterial wilt of eucalypts have been evaluated, nor can any be recommended. For example, culling of diseased trees would not be effective as the pathogen would remain in infected roots and infested soil.

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