Pineapple disease

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Cause

Ceratocystis paradoxa (Dade) C. Moreau, ascomycete fungus; anamorph = *Thielaviopsis paradoxa* (de Seynes) F.X.R. von Höhnel.

Geographical distribution

Antigua, Argentina, Australia, Barbados, Belize, Brazil, Burkina Faso, China, Colombia, Congo, Costa Rica, Côte d'Ivoire, Cuba, Democratic Republic of the Congo, Dominican Republic, Egypt, Fiji, Ghana, Guadeloupe, Guyana, Haiti, Hawaii, India, Indonesia, Iran, Jamaica, Japan, Madagascar, Madeira, Malawi, Malaysia, Mauritius, Mexico, Mozambique, Nicaragua, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Puerto Rico, Réunion, St Kitts and Nevis, St Lucia, Senegal, South Africa, Sri Lanka, Swaziland, Tahiti, Taiwan, Thailand, Trinidad and Tobago, Uganda, Uruguay, USA, Venezuela, Vietnam, Zimbabwe; and probably in almost all countries where sugarcane is grown.

Symptoms

Pineapple disease is primarily a disease that causes rotting of sugarcane seed pieces or setts. Poor germination and/or wilting of the young sugarcane shoots at emergence in the field may indicate the presence of the disease. When the setts are cut longitudinally at an early stage of the disease, the internodal tissues are red in colour. The cuttings may smell like very ripe pineapple, a characteristic feature that gives the disease its name. At a later stage, the centre of the cutting breaks down and turns black because of the dust-like chlamydospores which are distributed between the vascular bundles (Figures 1 and 2). Pineapple disease may also occur in stalks of growing sugarcane if they have been physically damaged by rats, borers, mechanical means or generally debilitated by insect attacks or drought (Wismer, 1961; Wismer and Bailey, 1989).

Diagnosis

A close observation of the internal symptoms in sugarcane setts split longitudinally generally helps to diagnose pineapple disease, and to discard other sett rot inducing diseases (Fusarium sett rot, red rot, black rot). Special care should be taken not to mistake pineapple disease for black rot of sugarcane, caused by *Ceratocystis adiposa*, although the latter is rather uncommon (see the chapter 'Minor fungal diseases'). Confirmatory diagnosis is provided by the microscopic examination of the spores (conidia and chlamydospores, also called microspores and macrospores respectively) of the imperfect stage of the fungus (WISMER and BAILEY, 1989). Conidia are cylindrical to somewhat oval, hyaline to mid-brown, measure 6–24 (mean 13 µm) × 2–5.5 µm, and emerge in chains from the open end of the conidiophores. Chlamydospores are obovate to oval, thick-walled, brown, measure 10–25 × 7.5–20 µm, and are also usually produced in chains. Additional information on the pathogen can be found in MORGAN-JONES (1967), SIVANESAN and WALLER (1986), WISMER (1961) and WISMER and BAILEY (1989).

Strains of the pathogen

There is little information available on variation of the pathogen. BYTHER and STEINER (1974, cited by WISMER and BAILEY, 1989) found little difference in virulence among isolates collected from sugarcane in Hawaii. When sugarcane setts were inoculated with an isolate of *C. paradoxa* from pineapple and with an isolate from sugarcane, the isolate from sugarcane was less pathogenic (LIU and MARCANO, 1973, cited by WISMER and BAILEY, 1989). SASTRY *et al.* (1989) showed that three isolates of *C. paradoxa* from arecanut, coconut and sugarcane, respectively, were cross-pathogenic. However, they distinguished two groups on the basis of the proportion of macrospores to microspores produced *in vitro* and the symptoms on the three hosts; one group comprised the arecanut and coconut isolates, and the other group was formed by the sugarcane isolate.

Transmission

Pineapple disease is mainly soil-borne: the conidia and chlamydospores of the fungus survive in the upper layer of the soil and ensure the contamination of cuttings. The period of survival of the pathogen in soil may exceed 15 months in sugarcane residues (MIRALLES VIRELLES and HERRERA ISLA, 1994). Physically damaged stalks of standing cane or stalks debilitated by drought can occasionally be infected by wind-blown spores (WISMER, 1961).

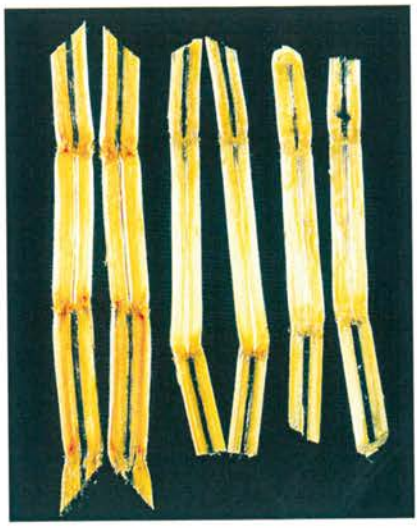

Figure 1. Black-coloured internodal tissues of setts (ISSCT).

Figure 2. Red and black discoloration of internodal tissues of setts (ISSCT).

Host range

Ceratocystis paradoxa can infect a variety of plants including arecanut, banana, cocoa, coconut, maize, oil palm, *Phoenix canariensis* and pineapple (MORGAN-JONES, 1967; WISMER, 1961).

Epidemiology

Factors which slow down germination of cuttings favour infection by the pathogen, such as cool temperatures, excessive soil moisture, drought or an inability of buds to germinate readily. Hot water treatments render the cuttings more susceptible to pineapple disease if they are not associated with a fungicide treatment (WISMER, 1961).

Economic importance

Pineapple disease can cause considerable damage at emergence of sugarcane if the conditions are favourable to disease development and if no appropriate control measures are taken. In such cases, cane growers may have to partially or completely re-plant the diseased fields (WISMER and BAILEY, 1989).

Control

Although potentially highly destructive, pineapple disease can be efficiently avoided or controlled if a range of precautions or control measures are taken. A general recommendation is to use healthy setts of an appropriate physiological age to ensure rapid germination, setts with at least three nodes to increase the likelihood that the buds towards the centre will germinate before the fungus invades all the tissues, and crop management practices that promote germination and rooting (drainage, irrigation, etc.) (WISMER and BAILEY, 1989).

Fungicide treatments at planting may be necessary, particularly after hot water treatment. The organomercury compounds are no longer recommended, and are no longer allowed in several countries, because of their toxicity and the environmental risks. Benzimidazoles like benomyl, or triazoles like propiconazole, can be used as fungicide sprays in the furrow at planting or, even better, as a fungicide bath for the setts before planting (WISMER and BAILEY, 1989). RAID *et al.* (1991) felt that the treatment of sugarcane setts with a fungicide may enable Florida sugarcane growers to reduce planting density while maintaining stalk population and yield of the susceptible cultivar CP74-2005.

A method aimed at the physical protection of setts from the pathogen was recently proposed by CROFT (1998): he demonstrated that polyethylene coating of short, hot water treated setts significantly improved the control of pineapple disease, especially when the setts are also treated with a fungicide.

Some promising experimental results were obtained when different species of *Trichoderma* and two species of *Gliocladium* were used as biological control agents for sugarcane pineapple disease (GUEVARRA, 1990; SAMPANG, 1991). The efficiency of these fungi on a larger scale has, however, yet to be proven.

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