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First report of corm rot disease caused by *Sclerotium rolfsii* in banana

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Abstract. A corm rot disease was observed for the first time in banana. The disease was found to occur in the majority of commercial cultivars grown in different banana-growing states of India. The incidence of the disease was up to 50% and found to occur at an altitude up to 3000 m asl. The pathogen was identified as *Sclerotium rolfsii* based on morphological characters and rDNA internal transcribed spacer sequence data.

Bananas (*Musa* spp.) are the world's fourth most important global food crop grown in more than 120 countries (Molina and Valmayor 1999) and are the staple food for more than 400 million people (Swennen *et al.* 1995). India is the world's largest banana producer and 26 million tonnes are produced annually from 709 000 ha. However, various pests and disease problems, particularly Fusarium wilt, cause significant losses (Ploetz 2005).

During a disease survey in different banana-growing regions of India in March 2005, a new wilt-like disease was observed in cv. Rasthali (Silk-AAB) in the Tirukattupalli area of Thanjavur district in Tamil Nadu, India. The important symptoms observed were yellowing of leaves from base to apex, extensive pseudostem sheath rot with profuse mycelial growth on the pseudostem (Fig. 1*A*, *B*). The colour of the rotted portion was yellowish-red to reddish-brown (Fig. 1*B*, *C*), with numerous brown sclerotia present. Splitting of the basal portion or the pseudostem sheath was observed, and the bottom leaves had desiccated. The infected plant emanated a mushroom odour. The inner tissues of the corm were spongy and colonised extensively with white mycelium (Fig. 2*A*). At higher altitudes of 2000–3000 m asl, the cortical portion of the corm was completely converted into a mass of fibre (like coconut fibre) with profuse growth of fungal mycelium (Fig. 2*B*). In some plants, the infection extended up to half of the medulla region. The emerging peeper was necrotic and colonised extensively with white mycelium. In some cases the mycelial growth was seen on the growing tip of the young bud and resulted in reddish brown necrosis. The symptoms were observed in all stages of plant growth.

Samples of the diseased plant parts were collected and brought to the laboratory and cultured on potato dextrose agar (PDA). White mycelial growth was observed within a week. Subsequently, small round dark-brown sclerotia developed in

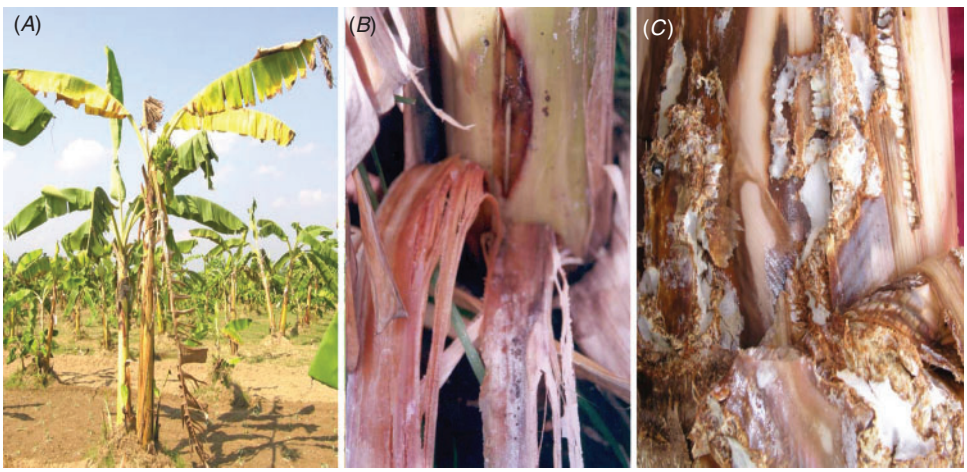

Fig. 1. External symptoms due to corm rot disease. (*A*) Affected plants with yellowing of leaves in cv. Malbhog (Silk-AAB) in Tripura. (*B*, *C*) Reddening of leaf sheath due to rotting caused by the disease with white mycelial growth over the leaf sheath.

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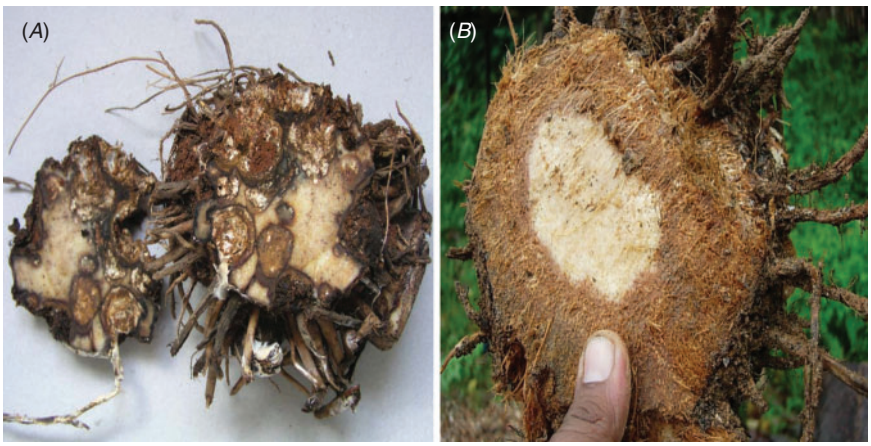

Fig. 2. Symptoms of corm rot disease in the corm. (*A*) Rotting of corm, in patches filled with mycelial growth of the fungus. (*B*) The infection of the fungus leads to conversion of corm tissues into fibrous material with mycelial growth.

the culture. The fungus was grown for 15 days in banana pseudostem pieces which had been shade-dried to 60% moisture and autoclaved, to provide inoculum for pathogenicity tests. Three-month old tissue-cultured banana plants of cv. Rasthali were potted in sterile standard potting mixture (Thangavelu and Jayanthi 2009). Two to three colonised pseudostem pieces were applied 5 cm below the soil surface around each plant and covered with the same top soil. All the 10 plants inoculated expressed similar symptoms to those observed in the field (Fig. 3*A*, *B*) and all inoculated plants died within 15 days. The control plants maintained without inoculation did not show any symptoms. The same fungus was re-isolated from the infected plants and confirmed by cultural and morphological characters. The placement of single sclerotia in the pseudostem sheath of tissue-cultured plants wounded with pinpricks also caused rotting of tissues in 3 days.

Microscopic examination of the fungus revealed that in the profuse growth of the compact, septate, hyaline mycelium, there were protuberances that later developed into sclerotia. The number of sclerotia produced in culture on PDA (Fig. 4) ranged from 47 to 199 per 9-cm plate, and the sclerotial diameter ranged from 0.8 to 1.0 mm. Clamp connections were

Fig. 3. Pathogenicity studies of *Sclerotium rolfsii* under pot culture conditions in cv. Rasthali (Silk-AAB) (*A*) pseudostem rotting (right) and splitting of leaf sheath at the base of the pseudostem (left). (*B*) Death of the entire plant with profuse growth of the fungus over the corm (right) and splitting of leaf sheath longitudinally at the base of the pseudostem.

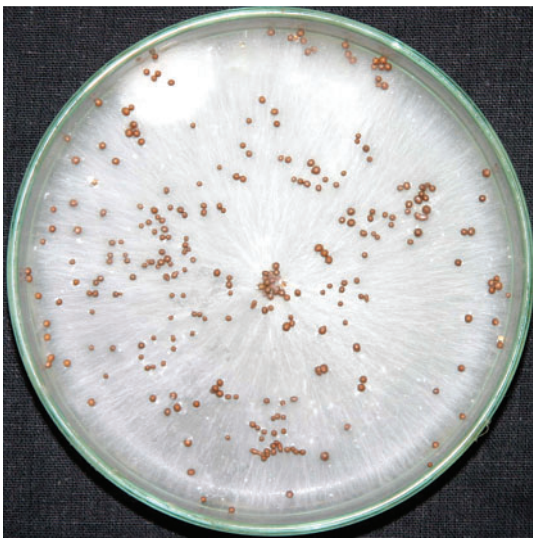

Fig. 4. Colony of *Sclerotium rolfsii* with brown sclerotia, after 7 days growth on potato dextrose agar.

also observed on the hyphae. These morphological characters are very similar to those of *Sclerotium rolfsii* (Sarma *et al*. 2002). From the purified cultures, the rDNA internal transcribed spacer region (ITS) was amplified and sequenced using primers ITS1 and ITS4 (White *et al*. 1990). The nucleotide Basic Local Alignment Search Tool (BLAST) performed on the National Center for Biotechnology Information (NCBI) website (http://blast.ncbi.nlm.nih.gov/) indicated that the sequence is 100% homologous to *Athelia rolfsii* isolated from the southern blight plants of *Zamioculcas zamiifolia* in China (GQ121442). The sequence was deposited in GenBank as accession number GQ 215695. The culture has been deposited in the Microbial Type Culture Collection (MTCC), Institute of Microbial Technology (IMTECH), Chandigarh, India.

During a subsequent survey conducted in different parts of banana-growing states of India in 2005, the disease was observed in many commercial varieties such as Rasthali (Silk-AAB), Virupakshi (Hill banana-AAB) and Karpuravalli (Pisang Awak-ABB) in Tamil Nadu, Amritapani and Mortamon (an ecotype of Rasthali) in Andhra Pradesh, Neypoovan (AB) in Karnataka, Chinali (AAB), Matti (AB), Boothibale (Monthan-ABB), Kijinan (AB) in Kerala, Athiakol (BB) in Assam, Malbhog (Silk-AAB) in Meghalaya and Sabri (Silk-AAB) in Tripura. In most of the areas surveyed, the disease was observed in only few plants but in two areas, west Godavari district of Andhra Pradesh and A. Pudupatti village of Madurai district in Tamil Nadu, the disease incidence was more than 50% in cv. Rasthali (AAB). Thus the disease is widespread in India (Fig. 5).

A root and corm rot of banana, caused by *Sclerotium* sp., was reported in Enset at Areka Experimental Station in Welayita, Ethiopia where it caused disease in young seedlings and transplants (Tessera and Quimio 1994). Mohan and Lakshmanan (1989) reported pseudostem rot disease caused by *Corticium rolfsii* in 3–5-month-old banana plants in Tamil Nadu, India but they did not observe any corm rot disease due to this pathogen. Moreover, the symptoms on the pseudostem described are not exactly similar to the symptoms described in this report. Besides, in

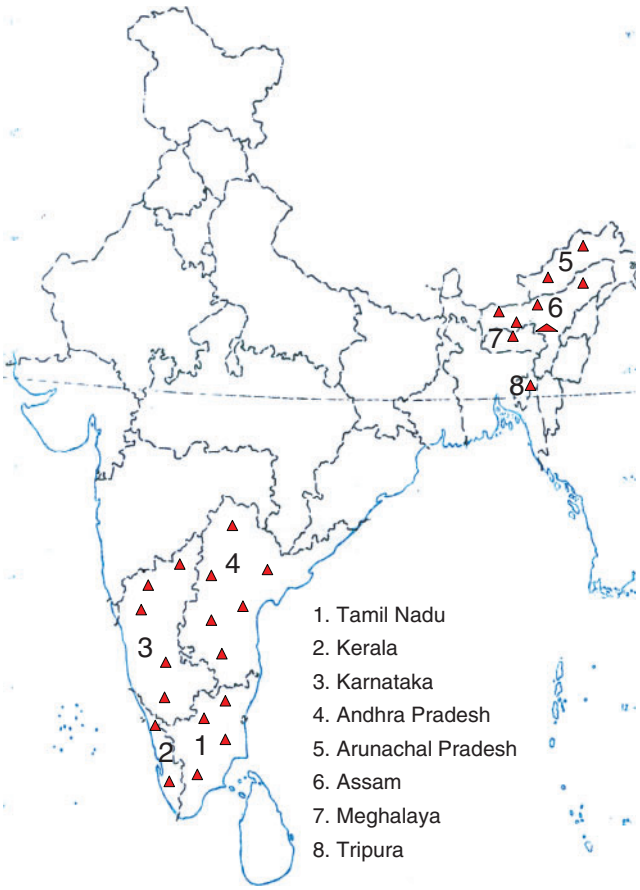

Fig. 5. The states in India where corm rot caused by *Sclerotium rolfsii* has been recorded.

all cases, the corm rot disease reported here was observed only in older plants, at least 7 months after planting and not in the young plants as stated by Mohan and Lakshmanan (1989). The disease described in this paper was initially suspected to be Marasmiellus pseudostem and root rot disease (Stover 1972) as the symptoms of the two diseases in the pseudostem are very similar. However, our studies have led to the identification of the pathogen as *Sclerotium rolfsii*, the first report of this pathogen causing corm rot disease in banana.

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