

Management of Pokkah Disease: Current Status and Future Directions

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Abstract:

Fusarium proliferatum, the source of Pokkah boeng disease, is a serious danger to the world's sugarcane crop, especially in tropical and subtropical areas like China and India. Due to decreased production and juice quality, this fungal disease causes varying incidence rates in different kinds of sugarcane, which results in significant financial losses. Warm, humid weather during the early monsoon season promotes the growth of disease-causing microorganisms and their spread through the air and through diseased cane cuttings. Fungicide treatments like carbendazim and tebuconazole, along with biocontrol agents like *Trichoderma* spp. that have shown effective in lessening the severity of the illness, are effective management techniques. In order to mitigate the effects of Pokkah boeng disease and maintain sugarcane output, integrated disease management measures that include chemical and biological interventions are essential. Research is still being done to improve these methods of protecting sugarcane crops from this enduring fungal menace.

Introduction:

Globally important sugarcane (*Saccharum officinarum* L.), a member of the Poaceae family, is grown in tropical and subtropical climates all over the world. Its diversity core is in New Guinea, where it originated, and its extensive cultivation extends to India and beyond. It is a product of the Indo-Burma-China border. Sugarcane is a very profitable crop in India and is essential to the country's agricultural and sugar industries, which both make large economic contributions. White sugar, jaggery (gur), and byproducts like bagasse and molasses are among the goods made from sugarcane. With over 700 sugar plants contributing to an annual turnover of around Rs. 80,000 crore, India is both the world's largest consumer and second-largest producer of sugar (NITI Aayog, 2023). Via excise taxes and farmer payments, sugarcane farming contributes significantly to India's GDP and directly and indirectly supports millions of livelihoods. Numerous infections, such as *Fusarium proliferatum*, the cause of Pokkah boeng

disease, cause the sugarcane crop to incur considerable losses of 10–25%. Walker and went initially discovered this fungus airborne illness in Java in 1896 as a mild infection (Vishwakarma et al., 2013). The taxonomic classification of *Fusarium proliferatum* is as follows: Order Hypocreales, Division Ascomycota, Class Sordariomycetes, Kingdom Fungi, Family Nectriaceae, Genus *Fusarium*, Species *proliferatum*. The Pokkah boeng sickness was first identified in 1896 by Walker and Went, and its name comes from the Javanese word meaning "malformed top" (Martin, 1989). In Maharashtra in 1983–1984, the cultivars Co 7219 and Co 671 were affected by the first recorded case of Pokkah boeng disease in India (Patil and Hapse, 1987). According to Patil et al. (2007), Pokkah boeng disease was found in most commercial sugarcane varieties in Assam, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Bihar, and Haryana at trace to moderate levels, with the maximum severity seen in Maharashtra and Uttar Pradesh.

Symptoms:

The disease symptom progression can be categorized into four stages: chlorotic phase I, chlorotic phase II, acute or top rot phase, and knife cut phase. Knife cut symptoms have been observed in varieties CoS 767, CoC 671, CoC 8014, Co 1158, CoS 8315, and CoS. Infection results in crumpled, twisted, and shortened leaves, often accompanied by malformation or distortion, leading to reduced yield and juice quality. The most severe stage, top rot, involves the death of the growth point and the entire top of the plant, particularly affecting sugarcane crops aged three to seven months (Raid and Lentini (1991) observed ladder-like or abnormal growth in the internodal zone of sugarcane, attributing it to the splitting of diseased cells unable to integrate with healthy tissue.

Pathogen:

According to Booth's classification in 1971, *Fusarium moniliforme* var. *subglutinans* produces two different kinds of conidia: Macroconidia, which measure 20–24 x 3.5–4 micrometers and are delicate with thin walls and frequently have sharply curved apical cells, and Microconidia, which are fusiform to clavate and measure 5–12 x 1.5–2.5 micrometers with sporadic single septa. The size of the macro and micro conidia of *Fusarium proliferatum* varied from 12.4 to 46.8 x 2.4–6.8 micrometers, but they were always spindle-shaped, hyaline, and septate. *Fusarium moniliforme* var. *subglutinans* whitish mycelium that first turns quite black. Microconidia were primarily singularly septate or sporadically non-septate, whereas conidia

varied in length from 7.2-20.3 micrometers, were usually sickle-shaped, and had one or two septa.

Mode of Transmission:

Pokkah boeng disease is present anywhere that sugarcane is farmed. Pupae and adults of sugarcane stem borers, wind-blown rain, and contaminated cane cuttings are all ways that the infection spreads. The most common way that infection spreads is by the partially unfolded leaf spindle, which water takes to the base of the spindle where the germs infect the interior tissues. The disease thrives in warm, humid environments, particularly in the early monsoon season when crop growth is at its fastest. Cloudy skies and summer rains also encourage the growth of diseases, with crops that are three to seven months old being most vulnerable. The illness can be spread by infected individuals and is mostly transmitted by airborne spores. Environmental factors such as windy, wet, or dry days affect the dissemination tactics of spores. When leaves open due to heat or dryness, airborne conidia can fall and are carried by raindrops to susceptible areas of the spindles, where they can germinate and infect newly sprouting leaves. After that, the mycelium spreads to vascular bundles, resulting in lesions and growth abnormalities. The fungus can also be spread by sugarcane stem borers, which exhibit symptoms akin to those of Pokkah boeng disease. Another way the fungus spreads is through infected seeds. In plant waste, fungal survival is enhanced by cool, dry circumstances. The infection is also dispersed by air currents that carry airborne spores. Deacon (2006) reported two ways of fungal dispersal: first, spore chains produced by fungi on leaf surfaces that are removed by wind or drying motions, and second, spore chains distributed by fungus dispersed by rain splashes employing "puff" and "tap" mechanisms.

Management:

- Better qualities, both numeric and qualitative, in sugarcane treated with FYM (10 t ha⁻¹) and press mud (25 t ha⁻¹).
- arbandazim works well to combat Pokkah boeng disease, especially in the stage of top rot. The most successful fungicide for cane yield (95.56 t ha⁻¹) was carbendazim, which was followed in order of decreasing efficacy in disease control by tebuconazole (91.11 t ha⁻¹) and carbendazim + mancozeb (88.15 t ha⁻¹).
- When compared to healthy plants, sick sugarcane has a lower soluble solids content and a heavier stalk.

- Trichoderma species and *C. globosum* as agents of biocontrol for diseases in the air. According to Harman (2011), Trichoderma species are recognized for their ability to stimulate plant growth, solubilize nutrients, and foster stress tolerance.
- Recovering sugarcane growth with copper oxychloride spray in September; • Higher brix % in sugarcane treated with Trichoderma harzianum Th14 compared to untreated controls. Tebuconazole and carbendazim have been found to be useful in managing Pokkah boeng illness, especially when used in combination with sett therapy and spray treatments.
- Both qualitative (brix%, sucrose%, purity%) and quantitative (germination count, seedling mortality, cane height, girth, weight, yield, and number of millable canes) characteristics were noted. Carbendazim 50 WP @ 0.5 gm L⁻¹ + Urea @ 0.5 gm L⁻¹ + ZnSO₄ @ 0.5 gm L⁻¹ + FeSO₄ @ 0.5 gm L⁻¹ + Fipronil (5 SC) @ 0.5 ml L⁻¹ was the most effective treatment across all sett types.
- Thiophenate Methyl 70 WP @ 1 gm L⁻¹, Carbendazim 50 WP @ 1 gm L⁻¹, Azoxystrobin 23% SC @ 1 ml L⁻¹, and Propiconazole 25 EC @ 1 ml L⁻¹ were the next most effective treatments. With 2 grams L⁻¹, Saaf was the least effective. Trichoderma asperellum @ 10 gm L⁻¹ was less effective than Trichoderma harzianum @ 10 gm L⁻¹ among the bioagents.

Conclusion:

Fusarium proliferatum, the source of Pokkah boeng disease, is a serious danger to sugarcane production worldwide, especially in tropical and subtropical areas like China and India. Due to decreased sugarcane juice output and quality, the disease has substantial economic ramifications and varies in incidence rates between sugarcane cultivars. Airborne spores and infected cane cuttings are the main routes of disease transmission. Environmental variables that promote the development of the illness include warm, humid weather during the early monsoon season. Fungicide therapies such as carbendazim and tebuconazole, together with biocontrol agents like Trichoderma spp. that have demonstrated encouraging outcomes in mitigating disease severity, are effective techniques for management.

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