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South American Bud rot: A biosecurity threat to South East Asian oil palm

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ABSTRACT

Diseases affecting oil palm with significant economic impact have been confined according to the region where the crop is established. Yield losses reported by these diseases are higher than the losses caused by other pests in the crop. Oil palm planted in South East Asia is currently devastated by the deadly white rot fungus, *Ganoderma* spp. while in Africa, *Fusarium oxysporum* spp. causes the catastrophic Vascular wilt. But among these, Bud rot affecting the South American industry is deemed the worst due to the speed of the spread and its economic impact. Initial reports associated abiotic factors to the outbreak but after extensive studies, researchers from Colombia proved that a biotic agent is responsible for the disease. *Phytophthora palmivora* was identified as the causal agent although the finding is still being challenged. The pathogen however, has a cosmopolitan distribution recording significant disease damages in some of the commodity crops in Malaysia; cocoa, durian, jackfruit, papaya and black pepper. A biosecurity alert immediately ensued in Malaysia resulting in various activities to reduce the potential threat presented by the pathogen. Although phylogenetic analysis of the local *P. palmivora* isolates showed the isolates are closely related to the Colombian isolates based on ITS region with preliminary pathogenicity assays with the local isolates on oil palm resulting in negative infection. This paper reviews the disease, potential risk involved to the multibillion-dollar industry and outlines mitigating measures that took place to avoid accidental introduction into the country.

Contents

1. Introduction

The social and economic growth seen in Malaysia for the past 40 years is hugely contributed by the exotic introduction back in 1917

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into Tennamaran Estate, the *oil palm*. The plant, *Elaeis guineensis* Jacq. is believed to have originated from Africa. Malaysia together with Indonesia are the largest producers (>80%) of palm oil in the world with Malaysia alone contributing 39% and with an export revenue earnings from 46 oil palm products of more than USD15 billion in 2016 (Alam et al., 2015; Overview MPOB, 2016; Pittman et al., 2013). Ironically, oil palm is only planted in 5.1% from the global area planted with oil crops, but provides more than 36% of the world consumption (Mesa, 2014 as cited in Torres et al., 2016). The crop is also largely planted in Latin American countries such as Colombia, Ecuador, Suriname, Brazil, Costa Rica and Panama (Rocha et al., 2005). The crop has considerable importance in the South and Central America where there is a high market for the oil along with the demand of increasing populations together with the need to replace the imported oils (Van de Lande, 1993). Colombia is currently the largest producer of palm oil in South America with an area of planting of close to 450 000 ha (FEDEPALMA, 2011). Despite oil palm's huge prospect in agriculture, it has a significant downside to its cultivation. The crop is susceptible to a number of diseases that vary according to region it is commercially planted.

Basal stem rot caused by *Ganoderma boninense* (Sundram et al., 2015) is a disease that is prevalent in South East Asia followed by the economically important *Fusarium* Vascular Wilt in Africa (Rusli et al., 2015). Red ring and Bud rot (also referred as Spear rot) are the other two important phytosanitary problems in the Tropical America. Spear rot and Bud rot are often interchangeably used in the description of the disease due to the overlapping symptoms, which complicates the precision in distinguishing the diseases. This review however, we will be confining our discussion to Bud rot. The expansion of oil palm industry in South America is largely halted due to the crop's susceptibility to this indigenous disease despite having large potential area for plantings. The prevalence of the disease is so widespread that it significantly affects the yield production which in return has deterred Latin American planters to extensively plant oil palm. A recent report by Torres et al. (2010) identified *Phytophthora palmivora* as the causal agent for this disease that caused an immediate biosecurity alarm in oil palm countries in the Tropics especially Malaysia. *P. palmivora* is a local indigenous pathogen that poses serious economic losses to local Malaysian commodities; durian, cocoa and jack fruit. The pathogen has been reported to attack more than 170 species of plants of tropics and subtropics affecting a wide range of monocots and dicots (Drenth and Guest, 2013; Erwin and Ribeiro, 1996). In this paper, we will discuss briefly on the disease, it's prevalence and control in South American countries, potential threat of the introduction to other regions, assessment of susceptibility of local oil palm materials and biosecurity role in the prevention of the disease.

2. The disease

The first report of Bud rot was reported in a 4 year old oil palm plantation in Suriname in 1920 (Malaguti, 1953) followed by another incidence in Panama reported by Reinking in 1927 (Richardson, 1995; Benítez and García, 2014). The epidemic reports continued in several other South American countries reporting the devastation caused by the disease in Colombia, Ecuador, Peru and Brazil (de Franqueville, 2003; De Rojas and Ruíz, 1972; Malaguti, 1953). The disease is synonym to a few other names such as *Pudricion del cogollo* (Spanish) or abbreviated to PC, Heart rot, Bud rot complex, Spear rot, Amarelecimento fatal (AF), Fatal/lethal yellowing possibly according to the native language where it was first described, stages of infection and in the absence of a clear causal agent (Torres et al., 2016; Van de Lande, 1993). Some authors still refer Bud rot as a disorder and not a disease (Albertazzi et al., 2005; Chinchilla, 2008) since the epidemics were associated to environmental factors such as wet weather, continuous precipitation, agronomic practices and poor irrigation. The disease is characterized by a few classic sequence of observations. A typical observation of a palm affected by this disease is the first onset of spear leaf rotting accompanied/followed by chlorosis of younger fronds (de Franqueville, 2003; Turner and Gillbanks, 2003). Fig. 1 shows the typical spear leaf rotting and infection initiates at the heart of palm slightly above the meristematic zone. The decay moves slowly to the central core of the undifferentiated leaves which hinders the growth of new leaves which in turn restricts the development normal healthy leaves (Navia et al., 2014). The disease will then lead to a collapse of new spears if left unchecked which is also a distinct symptom after an infection has occurred (Fig. 2). Attempts of recovery by the severely affected palms are sometimes seen through the development of little leaf. Upon closer inspection of the crown area, the palm severity ranges from severe rotting of soft tissues to non-fatal recovery of the spear leaves creating a crater. Under favourable conditions, particularly continued rainy conditions, reported to further assist the rotting of the heart and destroy the bud (Martínez, 2011). The disease spreads through contact between infected (a composite of secondary infections) and

Fig. 1. Symptoms observed in oil palms affected by Bud rot. Picture taken in a local plantation in Colombia. Typical spear leaf drying and rotting in an advanced stage of disease infection.

Fig. 2. Total collapse of new spear leaves in an advanced stage of Bud rot infection. The palm may or may not recover from the infection referred as remission.