

# Cacao (*Theobroma cacao*) diseases: threats to the Philippine cocoa industry

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## ABSTRACT

Cacao (*Theobroma cacao*) is considered one of the most important crops grown in the Philippines that could provide a potential source of income among large and small-scale farmers. The crop has an increasing global demand, which has tripled since 1970. However, production constraint due to diseases is one of the major challenges facing the industry nowadays. The major diseases of cacao in the country are cacao pod rot caused by *Phytophthora palmivora* and the vascular streak dieback caused by *Ceratobasidium theobromae* (syn: *Oncobasidium theobromae*, *Thanatephorus theobromae*).

Keywords: *Phytophthora palmivora*, *Ceratobasidium theobromae*, Vascular streak die-back, Cacao pod rot

## Cacao pod rot (*Phytophthora palmivora*)

The cacao pod rot caused by *P. palmivora* Butler. Butler was first reported on the island of Luzon, the Philippines, by Reinking (1918), causing severe losses. The pathogen infects the pod at any stage of the plant's development. Symptom begins as a minute black spot on the infected part then gradually enlarges until the pod becomes blackened. In extreme damp weather, which is favorable to pathogen development, a mass of mycelium with conidia can be produced on the surface of the diseased pod (Figure 1). Diseased pods can fall or remain on the tree, drying up and becoming mummified. The pathogen can also infect flowers and can cause stem canker on young twigs, older branches, and the trunks of trees. The infection can spread from diseased pods towards the tree branches or trunk (Reinking 1922). The disease may incur pod losses of up to 20 to 30% annually. In comparison, other plantations have lost up to 90% of their pods in highly moist humid conditions, while canker disease could kill up to 10% of all trees annually (Acebo-Guerrero 2012).

## Vascular streak die-back (*Ceratobasidium theobromae*)

The vascular streak dieback (VSD) caused by *C. theobromae* Talbot and Keane was previously observed in 1982 in Zamboanga del Sur, Philippines (Bourke, 1992) and has been consistently present in cacao orchards in Mindanao. This disease is common in most cacao-growing areas in South and Southeast Asia, and Melanesia. It can cause an estimated yield loss of 30,000 tonnes, causing branch dieback with infections capable of killing the seedlings and mature trees of

susceptible cacao varieties (McMahon and Purwantara 2016; Guest and Keane 2018). The disease was named vascular-streak dieback (VSD) after the characteristic brown streaking in the xylem of infected shoots visible after scraping off the dry surface of the leaf scars left by the abscission of infected leaves (Guest and Keane 2018). Symptoms of the disease include yellowing of leaves characterized by interveinal chlorosis, roughened bark on infected branches, vascular streaking or brown stain in the wood when splitting open, and black vascular traces in leaf scar (Figure 2).

In addition to this, VSD-like symptoms of cacao caused by *Lasiodiplodia theobromae* was also recently reported in the Davao Region, Philippines (Alvandia and Gallema, 2017). VSD-like symptoms were observed on seedlings and mature cacao trees at the nursery and budwood gardens in Davao City. The disease resembles the symptoms caused by VSD pathogen. So far, the possibility of a disease complex involving *Ceratobasidium theobromae* and *Lasiodiplodia theobromae* in cacao has not been studied.

## Other diseases of cacao

Other diseases of cacao reported in the Philippines listed by Tangonan (1999) includes the root rot diseases (caused by *Armillaria* sp., *Fomes* sp., *Ganoderma* sp., *Rhizoctonia solani*, *Rosellinia* sp.), pod/charcoal rot (*Botryodiplodia theobromae*, *Monilia* sp., *Penicillium* sp., *Rhizopus* sp.), brown bark (*Calonectria rigidiuscula*), cherelle wilt (*Colletotrichum gloeosporioides*), pink disease (*Corticium salmonicolor*), brown pod rot/dieback (*Diplodia theobromae*), black rot/leaf blight (*Fusarium* sp.), dieback (*Gloeosporium* sp.), brown bark



Figure 1. Cacao pod rot caused by *P. palmivora* shows large brown lesion on infected part with a mass of mycelium on the surface of the diseased pod.

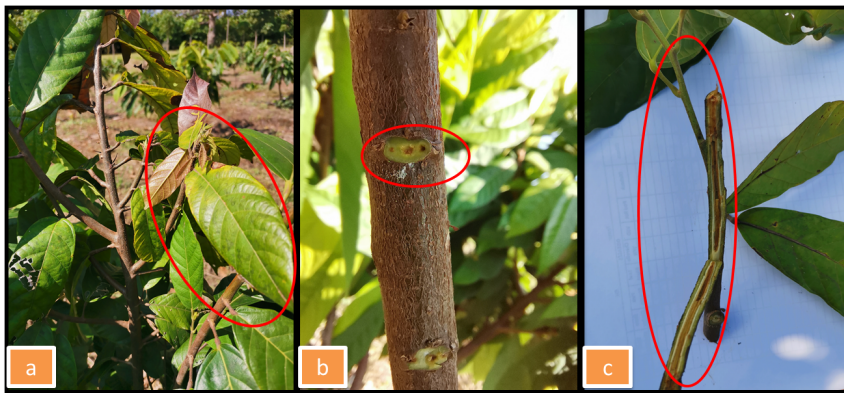


Figure 2. Vascular Streak Die-Back (VSD) in cacao caused by *C. theobromae* showing typical symptoms such as interveinal chlorosis of leaves, leaf fall/defoliation beginning on the second or third flush behind the stem apex (a), black vascular traces in leaf scar (b), and brown stain when split open or vascular streaking (c).

rot (*Hypomyces haematococcus*), dry sooty rot/storage rot (*Lasiodiplodia theobromae*), witches broom (*Marasmius perniciosus*), pod blotch (*Nectaria bainii*), canker (*Nectaria theobromae*), thread blight (*Pellicularia koleroga*, *Rhizoctonia solani*), and the gray leaf spot (*Pestalotia palmarum*).

### General Cacao Disease Management

Combined management strategies such as sanitation, proper pruning, good irrigation and drainage, and eradication or removal of an infected plant part should be performed. Nutrient management, use of biological-based control strategies, and the judicious use of pesticides should also be implemented, with the aid of consistent disease surveillance, to combat these threats in the cacao industry.

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