Agroland : The Agriculture Science Journal, 2019 June 6 (1) 57 - 62 **ISSN : 2407 – 7585**
E-ISSN : 2407 – 7593

CURRENT STATUS ON CACAO DISEASE INCIDENCE IN CENTRAL SULAWESI

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ABSTRACT

Central Sulawesi is the largest cocoa bean producer in Indonesia. However, cocoa production constrained by important diseases. Currently, data about cocoa beandamage due to pathogen infection have not been updated. This study observed the incidence of major diseases in cacao plantations, included pod rot, canker, and vascular-streak dieback (VSD). The study located at the largest cacao plantation in Palolo, Central Sulawesi. The observation pronounced that the cacao trees in the study sites were infected by the pathogens of pod rot, canker, and VSD with different incidence levels. VSD was a disease with the highest incidence and distribution in the cacao plantations. Besides, this study also described the symptom of the disease.

Keywords: Canker, Pod rot, Vascular-streak dieback.

INTRODUCTION

Sigi Regency is one of the most extensive cacao plantations in Central Sulawesi. Palolo Subdistrict in Sigi Regency is the largest cocoa planting area of 10,852 ha with a production of 9,232 tons compared to other districts (Central Bureau of Statistics, 2018). A critical challenge in increasing cocoa production is the presence of plant disease. The presence of the pathogen in the cacao plantation ecosystem has a vital role as a cause of decreased production by causing the disruption of the physiology of the cacao tree, damaging the plant parts, or damaging the fruit and causing crop dead(Agrios, 2005; Lucas, 2009). This study focuses on the existence of themaincacao diseases and the intensity of their attacks in SigiRegency. Notably, there have been no recent updated reports about this matter.

Common diseases that attack cocoa in Indonesia are black pod, stem canker, and vascular-streak dieback (VSD) disease(Arfani et al., 2013; Ploetz, 2016; Rosmana, 2006). The Black pod and stem canker caused by *Phytopthora* spp. The causal agent of VSD is *Ceratobasidium theobromae*, which was previously called *Oncobasidium theobromae* (McMahon and Purwantara, 2016). Cacao disease plays an essential role as a determinant of the decreased the number and the quality of cocoa beans

Phytophthora spp. is a common pathogen in cultivated plants. Loss of harvest due to *Phytophthora* spp. is around 20-30% of the total world cocoa yield (Adeniyi, 2019; Guest, 2007). VSD assumed to be the primary disease of cacao tree in Southeast Asia. In Asia, the disease killed the cacao seedlings massively and caused various damage (Guest and Keane, 2007).

It has been reported that several cacao plantations in Indonesia have been attacked by *Phytophthora* spp. and *C. theobromae.* Black pod disease has been a long story in cacao plantation of Central Sulawesi. Various cacao variety has been tested to evaluate the resistance to the *Phytophthora* spp. A six cacao varieties that commonly planted in Central Sulawesi has been tested by Aminullah, et al. (2018).

Among the cocoa tested, CRD 60 was the susceptible one compared to others. In Sulawesi island, VSD was reported initially in 2002 in Polmas and Pinrang, South Sulawesi (Rosmana, 2006). VSD has been reported in West Sumatra that causing 58.82 to 100% disease incidence (Trisno et al., 2016). In Central Sulawesi, the previous investigation stated that the pathogen of VSD able to attacked cacao varieties, however, cacao planted in Sidondo District more susceptible compared to other (Febrianto et al., 2016).

Although some cacao planted showed the resistant ability against cacao disease, the pathogens seem like suitable with the tropical environment in Sigi plantations. Suitability of the pathogen in the cacao ecosystems. Environmental factors include shade in plantation, rainfall, humidity, and the presence of disease vector can be a possible condition for disease development. Here, we recorded the current status of the cacao disease incidence in Sigi, Central Sulawesi. The data, therefore, could be used by the stakeholders in managing the disease for enhancing cocoa production in Central Sulawesi.

MATERIALS AND METHODS

The study was conducted in January-June 2019, located in Ampera, Berdikari, Bahagia, Ue Rani, and Sejahtera Villages, and Bahagia villages. The villages were chosen as the largest cacao plantation area compared to other villages in the Palolo District, Sigi Regency, Central Sulawesi Province. The survey carried out to obtain data on the disease incidence in farmers' plantations. In each village, three plantations were chosen as observation plots. The observations included symptoms of the disease, includedpod rot, stem canker, and VSD. Each symptom was documented in the form of photograph and description. In order to calculate incidence (DI) of the disease,the number of infected cacao trees was calculated and compared with the number of uninfected cacao trees (DI% = number of infected cacao trees / number of total cacao tree observed × 100).

RESULTS AND DISCUSSION

Five areas that were determined as research locations showed the condition of cocoa plantations infected with fruit rot, stem canker, and VSD in a different incidence. The observations pronounced the condition of plantations were not appropriately sanitized. Leaf litter piled on the soil surface. Rare pruning on cocoa trees can be seen from the lush cover and shade. The survey results presented as follows.

Pod Rot Disease. The symptoms of pod rot were commonly wet brown spots on the fruit surface and in some cases followed by stem canker (Figure 1). The incidence of fruit rot shows an attack rate of more than 50%, except in the village of Ampera (Figure1). Generally, brown to black spots located at the base port of the fruit, especially at the pods that were hanging in below part of cacao tree which was adjacent to the soil. The brown spot subsequently spread on the pod surface. Once the spot covered entire pod surface, the infection may continue to the beans. The pathogen attacked both young and old pods. However, farmers can still harvest cocoa beans before more damage occurs. Occasionally, infected pods also white mycelium fungus presence on infected tree. The pathogen can penetrate the wax layer before cuticle of the cocoa pod through the epidermis (Vanegtern et al., 2018).

Figure 1. Pod rot disease (down arrow) followed by stem canker (up arrow).

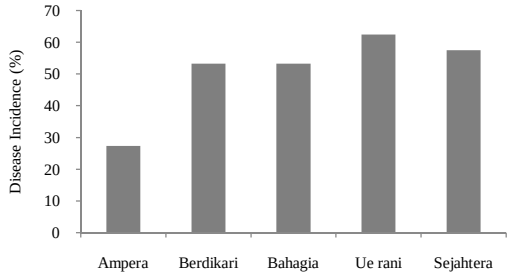

Figure 2. Pod rot disease incidence extensive cocoa plantations in Central Sulawesi

Figure 3. Canker disease symptom

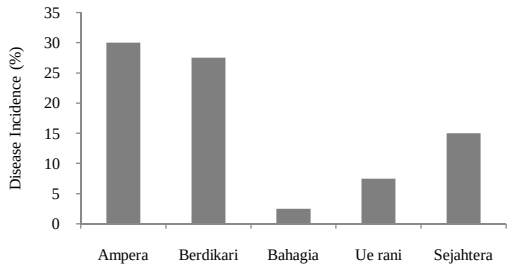

Figure 4. Canker disease incidence extensive cocoa plantations in Central Sulawesi

The pathogen that causes cacao pod rot is *Phytopthora* spp. Some species that have been reported can infect cacao were *P. palmivora*, *P. citropthora*, *P. megakarya*, and *tropicalis* (Surujdeo-Maharaj et al. 2016). Of the diverse Phytopthora species, *P. palmivora* was the broadest distribution in infecting cacao tree in tropical plantations (Brasier and Griffin, 1979). The incidence and severity of fruit rot disease show varying degrees of attack in each region. Environmental conditions are triggers affecting the disease spread. In a high rainfall, moisture potentially increases and affect the favorable situation for fungal sporulation (Vanegtern et al., 2018). *P. palmivora*is a great destroyer. This pathogen favored moisture condition in soil and cacao tree. The ability to reproduce asexually with coenocytic mycelium will address it as the soil-borne pathogen in a favorable condition (Surujdeo-Maharaj et al., 2016). Mainly when the sanitation of the plantation is not well maintained.

Cankers. Infected cacao tree by Phytophthora may continue to be a canker. In this study, we found mostly stem damage due to the attack of Phytophthora. Cacao canker is a condition when the stem or branch bark damaged after Phytophthora infection (Firman and Vernon, 1970).Stem infected by canker, initially, will show a necrotic bark. The beginning point can be from the wound or pruned branches. In part of cacao stem, cankers only appeared in the bark while the cambium did not necrose. However, in a long period, cankers extended to the inner part of the stem (Figure 3) Although it was causing damage less than 30% (Figure 4) loss of yield due to canker was detrimental.

Bark canker recorded firstly in a single Criollo in 1961 in Eastern Caroline island. It took only a year later, thousands of cacao infected by the disease (Zaiger and Zentmyer, 1965). In a cacao plantation, trunk and branch cankers normally presence when the plant has pod rot disease. Both pod rot and canker caused by Phythopthora. The disease incidence highly influenced by the humidity. Once the high rainfall followed by the high humidity, the pathogen will have favorable environment to spread. Area with annual rainfall about 4,000 mm at 400-600 masl, for instance in Wes Java, has been reported suffered with pod rot and canker (Purwantara , 1990).

Vascular-Streak Dieback. Among the cacao disease observed in this study, VSD suffered most of the plantation di Palolo. There was no report when was the disease started to spread in Central Sulawesi. The easy way to find the disease symptom was

the yellow leaves followed by necrotic and finally fall. By cut off the petiole, we found a specific symptom as three necrotic spots (Figure5). When the branches sliced sideways, necrotic lines were seen on the xylem tissue till the end of the petiole. We also found the leaves suffered from the symptoms less of calcium. Our observation recorded the incidence of this disease reach 100 % in the study sites (Figure 6), except in Berdikari.

Figure 5. Vascular-streak dieback disease symptom in leaves (a) and petiole (b).

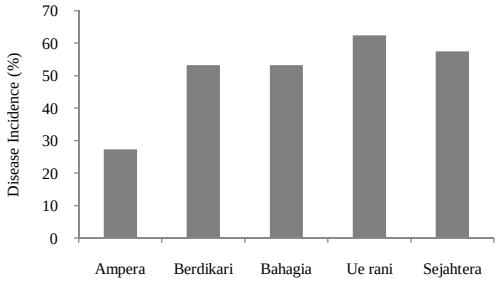

Figure 6. Vascular-streak dieback disease incidence extensive cocoa plantations in Central Sulawesi

The term of 'dieback' used to this disease to differentiated from the rot or wilt disease affected by Phytophthora (Mc Mahon and Purwantara, 2016).The causal agent decided as *Oncobasidium theobromae*, which belonged to the genus of Thanatephorus (Talbot and Keane, 1971). The next invention then changed the name *O. theobromae* to be *Thanatephorus theobromae* (Roberts, 1999). After phylogenetic analysis in ITS and LUS genes, the VSD pathogen then relocated to the paraphyletic genus in Ceratobasidium, and therefore the name changed to be *Ceratobasidium theobromae* (Samuels et al., 2012). Since that, the name of *C. theobromae* was agreed by scientist to be an appropriate name.

C.theobromae is an airborne pathogen, affected xylem infection, with a broad host range. The disease spread by basidiopores that released in the night and transferred by the wind to the susceptible tree. Climate condition such as high rainfall also an environmental factor that can help to distribute the basidiospores. Survival of the pathogen mostly in the xylem of the infected tree. However, it can also be saprophytic when the host is absence (Mc Mahon and Purwantara, 2016).

CONCLUSSIONS

This study figured out pod rot, canker, and VSD as still the severe problem in cacao plantations in Central Sulawesi, VSD disease was the most devastating disease compared to other diseases. This finding has provided baseline data for practical management advice in controlling the diseases.

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