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An investigation of species associated with stem canker of cacao in Sulawesi under climate change

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INTRODUCTION

- Cocoa (Theobroma cacao L) is a plantation crop that has high economic value and is an important commodity in international trade.
- Several countries are trying to increase cocoa production to supply the world's cocoa needs, such as Ivory Coast which supplies 39.8% with a production of 1.5 million tons/year, Ghana supplying 19.6% and Indonesia 8.1% (ICCO : 2017).
- Cocoa production in Indonesia has decreased significantly in the last decade. One of the factors behind decreasing cocoa production is the presence of pests and diseases. Indonesia was once the world's third major cocoa producer, but it has now dropped to six after Brazil (Parawansa 2020; ICCO., 2020).
- Previously,Ivory Coast and Ghana In 2014, the area of cocoa plantations in Indonesia was 1,774,303.97 ha with a production of 777,500 tons around 90% was cultivated by smallholders, particularly in Sulawesi, producing 500 million tons annually and constituting 60% of Indonesia's cocoa area (Directorate General of Plantations, 2015)
- Phytophthora palmiivora is a pathogen that can attack all parts of the plant and its symptoms can be found on the leaves, fruit, stems of cocoa (Parawansa, A.K., 2020; McMahon, 2016). Symptoms of the diseases caused by palmivora can be found on the leaves, fruit, and stems of cocoa, causing anthracnose, fruit rot and canker.

METHODOLOGY

Time and place of the research
This research was conducted for 5 months from July 2020 to November 2020. The research was carried out in 2 stages, namely in the field to take samples, which came from small holder gardens in East Luwu after a period of flooding and in the laboratory located at Muslim University in Makassar.

Materials and tools
The following procedures were included in implementation of the research

Sampling in the field

Harvesting of cocoa stems from community plantations in Bangun Jaya Village, Kec. Tomoni Kab. East Luwu. Samples were taken from diseased plants, from lesions in cocoa stems. Furthermore, the samples were analyzed in the laboratory

Isolation of the fungus on cocoa plants

Four cocoa clones that showed stem canker symptoms were used in this study. M01, MCC 02, Sulawesi 1 and Sulawesi 2 cacao clones were propagated by side-grafting on rootstock trees on smallholder plantations in flooded areas. To isolate diseased stem samples, we cut into the bark and excise a section. The same procedure was followed for healthy stems. We plated the samples onto PDA or V8 media. After isolation, we incubated them in sterile conditions. Following obtaining pure cultures, we observed them using a reference book under a microscope.

Propagation of Fungal Isolates

After 4-7 days the mycelium that grew from the cut parts of the plant stem was transferred to a new medium, until a pure culture was obtained and incubated again at room temperature for one week.
Purification of fungal isolates was carried out to determine the various types of fungi that grow on the stems of cocoa plants, to facilitate observation or identification, and to facilitate the naming of the obtained fungi.

Identification of Fungal Isolates

The surface sterilization procedure has been modified from Rodriques (1994) on the cocoa plant stem. The cocoa plant stems were thoroughly rinsed with running water. After cutting the cocoa plant stems into 1-2 cm pieces, isolation was conducted under laminar airflow. Plant parts were cut aseptically under sterile conditions under laminar airflow. For surface sterilization, pieces were immersed in 70% alcohol, followed by sterile water, then dried on sterile filter paper. Following that, they were plated on PDA media, and incubated at room temperature for four to seven days.

RESULTS

Table 1. Cacao stem clones infected with stem cancer, Phytopthora palmivora

No	Klon	Total of Isolation	Type	
			P. palmivora	*Rhizoctonia* sp
1.	M01	30	+	+
2.	MCC 02	30	+	-
3.	Sulawesi 1	30	+	-
4.	Sulawesi 2	30	+	-

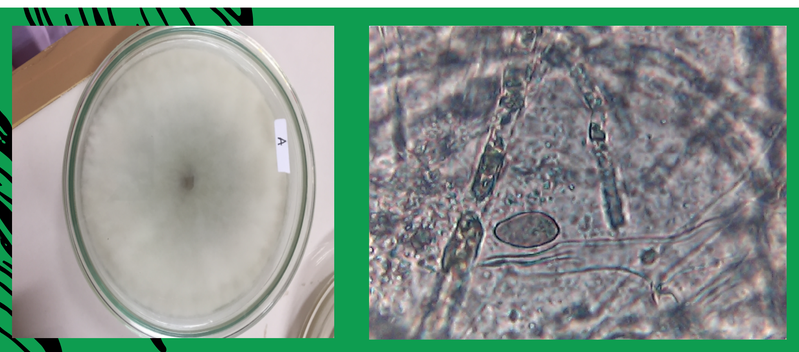

Figure 1. The morphology of Phytophthora palmivora was isolated from each of the clones M01, MCC 02, Sulawesi 1 and Sulawesi 2 at the age of 8 days, (a) fungal colonies, (b) conidia, (c) hyphae (d) and (e) spora of Phytopthora palmivora (microscopic observation 100×)

DISCUSSION

At the identification stage, Phytophthora palmivora was found in all tested clones (M01, MCC02, Sulawesi 1 and Sulawesi 2) on stems that indicated the presence of stem canker symptoms. The pathogen, P. palmivora has morphological characteristics with round and slightly oval sporangia (McMahon, 2016). In general, sporangia are ovoid or pear-shaped, with one clear papilla, many are globose and there are also some isolates that have obpyriform and ellipsoid shapes with sporangia size 53-61 X 32-42 m. Furthermore, the pear-shaped (ovoid) sporangia have clear papillae, are caduceus (easily separated from sporangiophores) with short stalks.

According to Barnett and hunter (1998), among others, the mycelium is clear in some species and dark in others, the mycelium cells are usually long, the septa on the branches are formed from the main body, do not have conidia and other reproductive cells, have sclerotia that are light or dark in color. brown to black. Samuel and Keane (2012) added that Rhizoctonia has a hyphae branching arrangement that is perpendicular or almost perpendicular, has dolipore septa, no clamp connection, and hyphae constriction occurs near the branching point.
Rhizoctonia is a soil fungus, acts as a parasite and can also become a saprotroph. In the absence of rice plants, this fungus can infect other plants.
There are various environmental conditions that place plants at high risk of infection because these pathogens prefer wet climates to infect them
Pathogenic fungi can infect through wounds, settle and develop in the vascular bundles. After the vascular tissue dies and the air is moist, the fungus forms purplish-white spores on infected roots. The spread of spores can be through wind, water, and agricultural tools.