Identification of main fungal disease from hydroponic melon in greenhouse

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Abstract. Hydroponic melon is a method of cultivating melons and grown in a greenhouse. The melon cultivation has problems, namely plant diseases, even in a closed greenhouse. The melon plant disease caused huge losses in melon cultivation until the melon plants died. The purpose of this descriptive study was to identify the cause of the melon plant disease. Samples of sick melon plants were taken and grown on PDA media in the laboratory. The fungus that grows is identified based on the literature. The identification results showed that the main disease causing hydroponic melon plants in the greenhouse was the fungus *Fusarium oxysporum* f.sp. *melonis*. The fungi have crescent-shaped macroconidia with 1-3 septa, hyaline, thick walls, and form chlamydospores that are spherical in intercalary and hyaline.

1. Introduction

Melon is one of the important horticultural crops belonging to Cucurbitaceae family in the world especially in tropical country because it contains several important compounds for human health [19]. Fleshy fruit structure is one of the main factors that determine consumer preference. Melon began to be cultivated by farmers both in open land or in greenhouses. This is because the need for melons by consumers has not been fulfilled. Melon production in Indonesia is still low at 129,147 tons in 2021 with the largest melon grower in Indonesia located in the province of East Java [4]. Melon production decreased by 6.54% compared to melon production in 2020 of 138,177 tons. The average consumption of Indonesian people for fruits in 2020 is 88.56 grams/capita/day, a decrease of 1.4 percent compared to 2019.

Some of the diseases found in melon cultivation include angular leaf spots [3], powdery mildew [6], and Fusarium wilt [5]. Melon losses due to the main disease become increase [22]. Melons grown in greenhouses also get disease attacks even though they are planted in closed spaces. The losses caused

by plant diseases in melon cultivation in greenhouses are quite large, especially plant diseases caused by soil-borne pathogens. Even melon plant diseases can cause plant death [20, 2].

Several measures to control melon plant diseases have been carried out, especially by applying chemical pesticides [1]. Other control methods that can be applied include planting disease-resistant cultivars, warm water treatment, garden and plant sanitation, and biological control [12,17]. However, appropriate control techniques are needed as long as the cause of the disease is known or identified [10]. Knowledge of the causes of melon plant diseases, especially those grown in greenhouses, is very important to know, so that appropriate control measures can be taken. Therefore, a descriptive study was conducted with the aim of knowing and identifying the causes of disease in hydroponic melon plants in the greenhouse.

2. Materials and Methods

Descriptive research was conducted by taking purposive random sampling of hydroponic melon plants with symptoms of disease and the surrounding soil, which were grown hydroponically in a greenhouse, Flos Hidroganik, Bansari Village, Bansari District, Temanggung Regency, Central Java Province, at an altitude of 1,000 m above sea level.

Preparation of samples

Samples of diseased melon plants were taken from the stems, leaves, and roots of melon plants. The sample is then put into a paper bag and labeled, ready to be taken to the laboratory. Soil samples were taken from around sick melon plants at random as much as 0.5 kg per sample and put in a plastic bag and labeled.

Working with the samples

Samples of diseased plant parts were then washed with running water, drained on filter paper, then the surface was sterilized with 70% alcohol and rinsed with sterile water several times to remove excess alcohol. The sample was then sliced into small pieces measuring 0.5 cm by including the diseased and healthy parts. Next, the samples were placed on PDA media in Petri dishes aseptically and incubated at room temperature for 5-7 days [20].

The soil sample was weighed as much as 1 g and dissolved in 9 mL of sterile water in a test tube, then homogenized and 1 drop was taken and placed on PDA media in a Petri dish and leveled with L glass. The samples were incubated at room temperature for 5-7 days.

The fungal colonies that grew were then purified by growing them on new PDA media for further identification. Fungal colonies were also grown on inclined PDA media in test tubes to be stored for further activities.

Identification

Identification was done by taking the fungal colonies that grow and placing them on the glass object after it had been dripped with water and covered with a cover glass. Then observed under a microscope at low magnification. Observations were made on conidia or spores formed and then compared with the literature [7, 23].

3. Result and discussion

3.1. *Result and discussion*

Hydroponic melon cultivation in a greenhouse shows symptoms of disease and even causes plant death (Figure 1). Symptoms of the disease are in the form of necrotic spots on the stem, starting from the base of the stem and spreading to the scion, followed by yellowing of the leaves (Figure 1a), and finally the leaves turn brown (Figure 1b), wilt and die (Figure 1c).

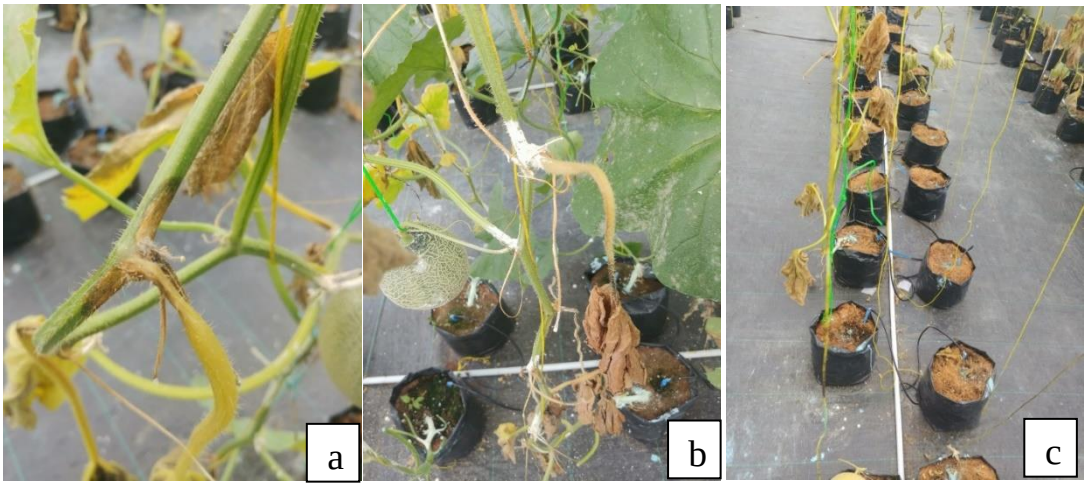

Figure 1. *Symptoms of hydroponic melon plant disease. Description: a. symptoms on stolons and leaf yellowing, b. leaves turn brown, and c. dead plant.*

Based on the observed hydroponic melon plant disease symptoms, these symptoms refer to the symptoms of Fusarium wilt disease. This is in accordance with the opinion that Fusarium wilt is characterized by loss of turgor pressure in the vine. The vines recover in the evening, but eventually die completely. Early symptoms often include a dull grey-green appearance of the leaves, followed by loss of turgor and wilting. After dying, the leaves turn yellow and eventually die. Wilting usually begins in older leaves and progresses to younger leaves. Early symptoms often appear when the plant begins to tangle, and wilting occurs on only one stolon, leaving the rest of the plant seemingly intact [9].

Symptoms of wilting in hydroponic melon plants start from the lower stolons to the top. This is the character of the attack of soil-borne fungi, which can live and survive in the soil for a long time [8]. The fungus infects melon plants through the roots and the fungus is carried into the greenhouse, among others, through the planting medium. The planting medium used is cocopeat. According to [16], isolated fungal pathogens grown on cocopeat medium to test their survivability on the medium have positive growth on cocopeat indicating that cocopeat is a suitable medium to host both pathogens.

The fungus penetrates the roots through the hyphae and colonizes the cortex by intercellular and intracellular growth. After reaching the vascular tissue, it spreads rapidly through xylem vessels, causing typical withering symptoms [15].

3.2. *Identification of the melon disease*

Based on the isolation results from the sample, it was found that the fungal colonies were white at the beginning of growth (Figure 2), then with increasing age the fungal colonies would become brownish. Colony growth was rapid. Colonies appeared like cotton fibers, white, aerial growth, and centered from the isolated source.

Colonies of *F. oxysporum* on PDA media were white and in accordance with the opinion of [7], who stated that colonies of *F. oxysporum* grew rapidly and the surface mycelium was abundant and bulging, white in color although generally purple or violet tinge. [11] stated that colonies of *F. oxysporum* f. sp. *melonis* is characterized by dense, white aerial mycelium that
is diffused into the agar.

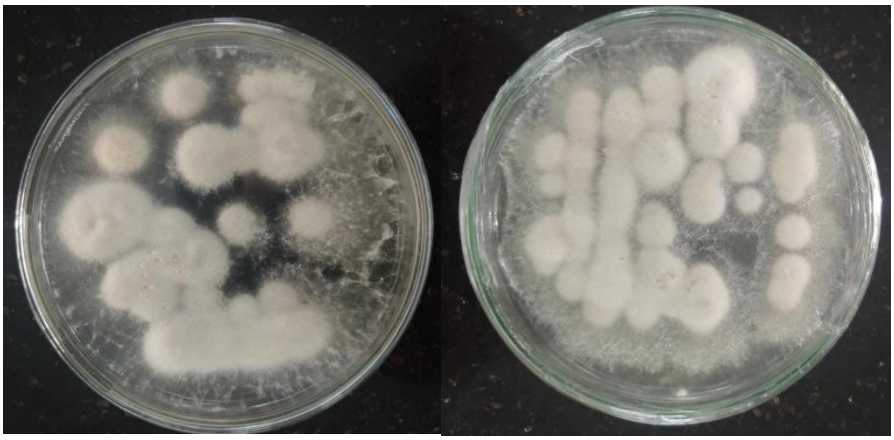

Figure 2. *Fusarium oxysporum colonies on PDA aged 5 days are white*.

Based on observations with a microscope, it appears that the shape of the dominant macroconidia was curved, with both pointed ends, thick walls, and 1-3 septa (Figure 3). In these observations, many macroconidia were found, while microconidia were not found, but microconidia were found formed at the tip of the hyphae short stalk. In addition, a round shape was also found which was a fungal chlamydospore, hyaline, smooth-walled.

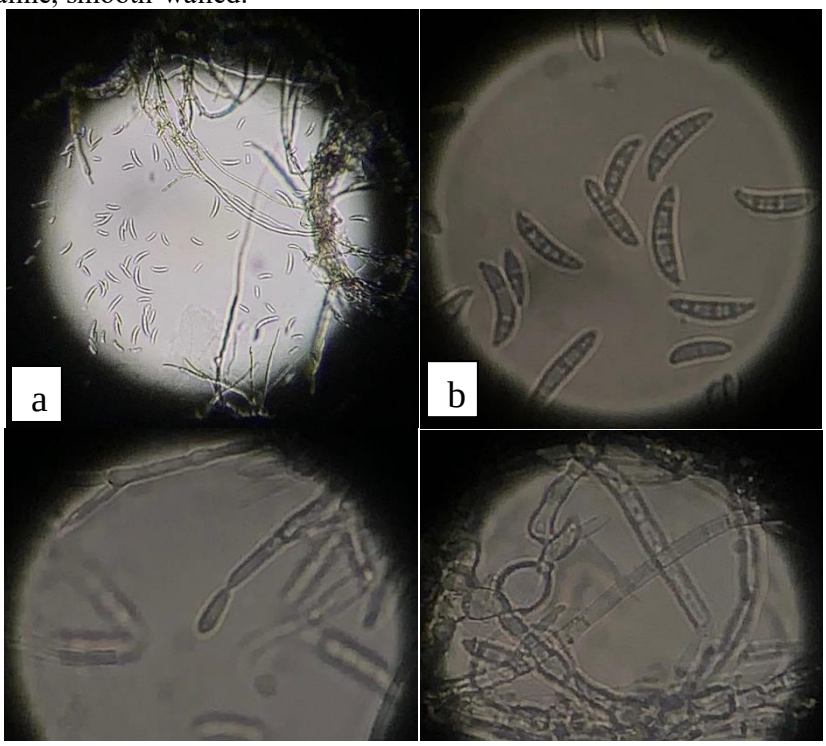

Figure 3. *Characteristics of microscopic morphology. Description: a. Macroconidia in group, b. septa macroconidia, c. growth of microconidia, and d. chlamydospores.*

This is in accordance with the opinion of [7, 23], that macroconidia are fusiform, slightly curved, pointed at both ends, with 3-5 septa. Furthermore, chlamydospores were formed intercalary or terminal in hyphae, often also on conidia, hyaline, smooth-walled or rough. The character refers to *F. oxysporum*. Identification based on morphological characters can be accepted and accounted for. The identification of the Fusarium species, using their morphological characteristics, was accurate [21]. Referring to the microscopic character and supported by colony growth, the fungal isolate that causes disease in melons is *F. oxysporum*. More precisely, *F. oxysporum* f. sp. *melonis* [14, 20].

According to [14, 20], *F. oxysporum* f. sp. *melonis* is the main pathogenic fungus that attacks melons, especially in greenhouses [20]. Supported by [18], that Fusarium wilt caused by *F. oxysporum* f. sp. *melonis* is a disease of melon plants in the greenhouse or in open land which is very detrimental. The fungus will colonize the xylem vessels and cause stem rot or stem rot symptoms.

4. Conclusion

The identification results showed that the main disease causing hydroponic melon plants in the greenhouse was the fungus *Fusarium oxysporum* f.sp. *melonis*. The fungi have crescent-shaped macroconidia with 1-3 septa, hyaline, thick walls, and form chlamydospores that are spherical in intercalary and hyaline.

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