Mycological Characterization Of White Pustule Symptom On *Ipomea Reptans* Poir Leaves In Bogor-Indonesia

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Abstract: *Ipomoea reptans* Poir. (Convolvulaceae) is one of the favorite vegetables consumed by Indonesian citizens. However, the plant is commonly infected by white pustule symptom of particular pathogen on it's leaves. The pustule known as white blister, is common disease in *I. reptans* Poir. leaves in Indonesia. Even so, till time, there was no microscopic description of this pathogen ever provided in previous reports in Indonesia. This study aimed to provide the biological information on the morphological and microscopic characteristics of the certain pathogen. The result revealed that the microorganism was *Albugo ipomeae-aquaticae* Sawada with brief characteristics in the following result.

Keywords: ***I. reptans*, Pustule, Albugo, Characterization, Indonesia**

Ipomoea reptans Poir. (Convolvulaceae) is commonly known as kangkong/kangkung which described as green leafy vegetable and can be found throughout region in Indonesia. It is believed that the plant to be originated from China. The plant is consider as weed in USA, whereas in South East Asia the particular plant is grown commercially (Austin 2007) and Indonesia is no exception. Kangkung is a high-value vegetable crop and known as common food eaten by all social groups in Indonesia. *I. reptans* provides huge source of vitamins, minerals, proteins, fibers, carotenes, and flavanoids with many health benefits (Rukmana, 1994; Manvar and Desai, 2013). Therefore, The Ministry of Agriculture of Indonesia decided to increase the production of these vegetables over the decade (BPS, 2017).

Parts of kangkong which commonly consumed are stems and leaves (Rukmana, 2007). However, these parts are often attacked by plant pathogens, especially the leaves. The regular symptom which mainly found are white pustule/blister. White pustule of kangkong is leaf and stem disease caused mostly by fungal pathogen. The disease is observed to be common and widespread on farms and easily found in local markets in Indonesia. Systemic infected plants of kangkong become unattractive and objectionable for market purposes (Austin 2007). The symptoms of the disease are indicated by the white or creamy-yellow pustules which can emerge on the leaves, stems or flowers, but

usually on the lower leaf surfaces (Riethmüller et al., 2002; Thines et al., 2008, 2009). The attacked parts may become thick and curl inwards. When the infection is acute, the size of the leaves decreases and the plant may become diminutived (Austin, 2007).

The agent of disease which related to white pustule symptom has been reported caused by the fungus *Albugo ipomeae-panduratae* (schw.) in Indonesia (Rukmana, 1994; Dibyantoro, 1996; Sunardi et al., 2013). Coupled with the bacteria, it is concerned that it could be a disease in humans for those who consume the foliar part of any crops infected by the pathogen (Ismail et al., 2016). However, till date, there was no microscopic description of this pathogen ever found in the form of scientific publications in Indonesia. Accordingly, this study aimed to provide the information on the morphological and microscopic characteristics of the particular pathogen in order to add insight and to be used as reference for the management of this plant disease in Indonesia.

MATERIAL AND METHOD

The study was conducted at Mycology Laboratory, Department of Biology, IPB University in May 2019. *I. reptans* Poir. used in this study were obtained from several local markets in Bogor. Pustules altogether with plant tissue were cut under stereo microscope and examine under light microscope using lactic acid. Like any blister/rust pathogen, the microorgaism can not be cultured in laboratory. Therefore, microscopic characterizations harboured were only based on fresh sample features: pustule descriptions, sporangiophore shape and colour, sporangia shape and wall thickness, and the oospores. Morphological identification was done reffering to 'a key to genus *Albugo*' (Choi and Priest, 1995).

RESULT AND DISCUSSION

The pustule on infected leaves of *I. reptans* were white to pale cream in colour (Fig 1; 2B) with darker appareance on the edge (Fig 3), 0.1-0.3 mm in diameter, erumpent, rounded to irregular in shape, found only on the abaxial side, and surrounded by reddish necrotic lesions (Fig 2C) which was in contrast to the healthy leaves (Fig 2A). Hyphae were coenocytyc, sporangiophore cylindrical or clavate (Fig 4B; 4D), 20-40 um x 10-15 um, straight to slightly curved, bearing the sporangia (Fig 4A) in a basipetal chain, hyaline, globose (Fig 4E) to square (Fig 4A), equal in thin wall, 15-20 um in diameter, and base rounded or subtruncate (Fig 4B; Fig 4D) in the plant's epidermal tissue (Fig 4F). Sporangiophore and sporangia usually were produced in the plant tissue (between mesophyl and epidermal layer), and then emerging out as pustule on the foliar surface (Webster and Weber, 2007). Sporangiophore are specialized hypha bearing sporangia, while sporangia are the structure which producing spores (Kirk et al., 2008). The Albugo spores are white powdery mass mixed in the pustule and then dispersed by the wind to find the new host (Webster and Weber, 2007).

Figure 1. Pustule symptom on infected leaves of *I. reptans*

Figure 2. Comparison of Healthy and Infected leaves of *I. reptans* : A. Adaxial and Abaxial appareance of healthy leavess; B. Abaxial part of infected leaves; C. Adaxial part with necrotic lesions.

Figure 3. Close up appareance of white pustule in *I. reptans* leaf

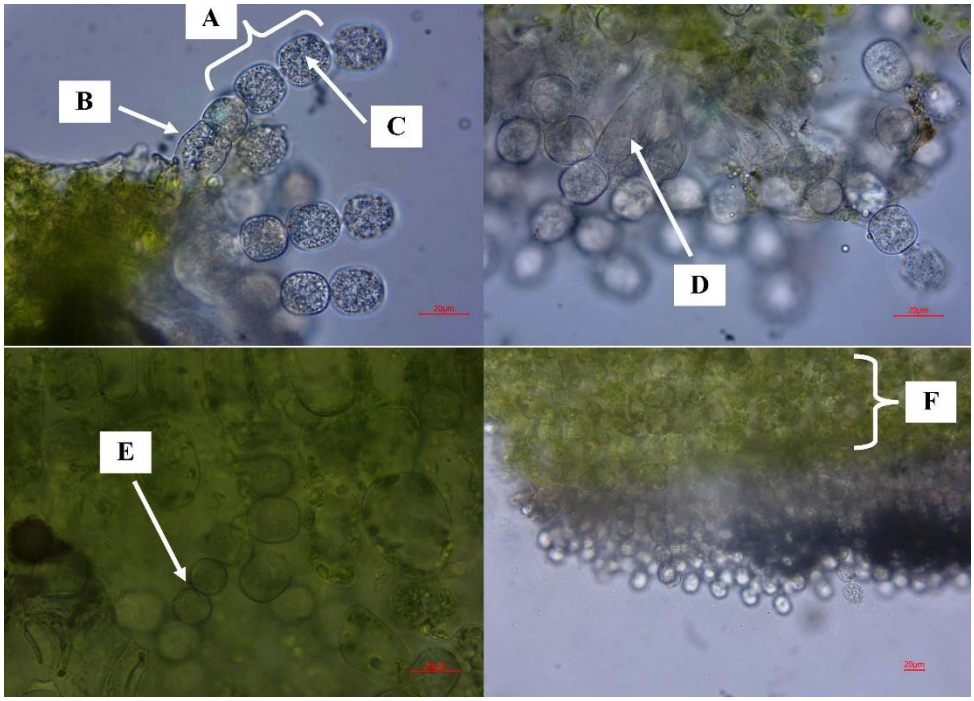

Figure 4. *Albugo ipomeae-aquaticae* Sawada sensu lato: A. Basipetal chain of sporangia; B & D: Sporangiphore; C: spores; E: Globose sporangia; F: Epidermal tissue of leaf. Bars : 20 um.

Identification was done using macroscopic and microscopic characters based on 'a key to genus *Albugo*' (Choi and Priest, 1995). The members of Albuginaceae are distinguished from related families by the formation of the asexual sporangia in basipetal chains. The number of spores produced were indefinite (Fig 4C). The identification revealed that the pathogen was *Albugo ipomeae-aquaticae*. Since Albugo is complex genus and DNA data was not obtain in this study, author consider that the isolate should be treated as *Albugo ipomeae-aquaticae* Sawada sensu lato for time being.

The family of Albuginaceae for decades known as the causal agents of white blister disease on various crops and wild plants (Riethmüller et al. 2002; Thines et al. 2008, 2009). Other researchers reported that the genus of Albugo is particularly one of the genera causing white pustule disease and parasitises in Convolvulaceae and Brassicaceae (Thines and Spring 2005; Thines and Voglmayr 2008; Choi et al., 2011). This organism causes specificly diseases in epigeal-ground plant tissues (Chakma et al., 2018). Albugo which known as obligate biotrophy of Oomycetes likely plays an important role in the persistence of asymptomatic endophytic in many crops (Ploch and Thines, 2011). May be this is one of the reasons why controlling this disease is quite difficult. Albugo infection vigorously suppresses host basic immunity and are unique compared to other microbial plant pathogens in enhancing host susceptibility to secondary infection (Cooper et al., 2008). *I. reptans* might agonized yield loss due to white blister caused by Albugo. It is appraised that the leaves infection can cause losses from 23-54.5% and 17-34 per cent (Vignesh et al., 2011). However, it is still unclear how this disease affected crops production in Indonesia.

In Indonesia, limited publications found regarding fungal community in *I. reptans* or *I. aquatica*. Wijaya et al. (2014) obtained 45 phylloplane fungus with 47 colonies were found and 11 unidentified fungus from leaves of *ipomea reptans* Poir. However, they did not find the genus of Albugo in their research. In addition, Ariyono et al. (2014) isolated and compared endophytic fungi from kangkong leaves from organic and conventional field. They reported that, there were 60 colonies of endophytic fungi were identified from organic field, consist of 11 genus with 47 species. Some publications have stated Albugo as disease agent in *I. reptans* leaves (Dibyantoro, 1996; Rukmana, 1994), yet without microscopic descriptions. Since the *I. reptans* is cosmopolitan and widespread through any province, which provides an excellent basis for food in indonesia (BPS, 2017), it is important to control the pathogen. As the initial step, we need to fully understand the biological characters of this particular microorganism. Here we provide those of the informations. To the best of our knowledge, this is the fisrt microscopic description of white pustule symptom caused by *A. ipomeae-aquaticae* Sawada sensu lato from kangkong leaves in Indonesia.

CONCLUSION

This study succesfully provided the morphological and microscopic characteristics of the pathogen from *I. reptans* Poir. leaves in Bogor-Indonesia. The result revealed that the isolate studied was Albugo. Author consider that the isolate should be treated as *Albugo ipomeae-aquaticae* Sawada sensu lato for time being.

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