

Identification of Disease and Efforts to Protect Natural Orchid Plants Against Virus Infection in the Liwa Botanical Garden

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ABSTRACT

Liwa Botanical Garden is one of the regional botanical gardens in Indonesia with the theme "Indonesian Ornamental Plants". Until now, disease infections are still a major obstacle in efforts to preserve and develop the potential of natural orchids. Based on previous research, it is known that some individual orchids exhibit symptoms of viral disease infections, namely mosaic, chlorotic, streak, and necrosis. This research was conducted to determine the identification of diseases and efforts to protect natural orchids against virus infections in the Liwa Botanical Garden through a collection of samples that showed symptoms of infection, analysis of disease symptoms, and analysis of the level of disease resistance. The results showed the response of natural orchids in the Liwa Botanical Garden to viral infections showed symptoms in the form of necrotic black and chlorotic patches, ie yellowing leaves on orchids *Coelogyne* sp., *Flickingeria* sp., *Calanthe* sp., *Trixsperrum centipeda*, *Bulbophyllum* sp. The type of orchid that shows the most symptoms is *Flickingeria* sp. a total of 8 samples. The type of natural orchid in the Liwa Botanical Garden which is most vulnerable to being infected with a virus is *Flickingeria* sp. with a disease intensity of 42%, while the most resistant orchids infected with a virus are *Coelogyne* sp. with an intensity of 15%. The results of this activity are expected to be basic information in efforts to protect plants against diseases to support the application of conservation of natural orchids in the Liwa Botanical Garden.

Key words: identification, virus infection, orchid virus, natural orchid, liwa botanical garden

INTRODUCTION

Liwa Botanical Garden is one of the regional botanical gardens in Indonesia with the theme "Indonesian Ornamental Plants". This botanical garden is located in Pekon Kubu Prabu, Liwa, West Lampung with an area of 86.68 ha. Liwa Botanical Garden was opened in 2017 under the auspices of the Forestry Service which is focused on the collection of Indonesian ornamental plants, one of which is natural orchids (Danang et al., 2015). Orchid is a plant that is very many types, especially the beauty of the flowers. The color varies from white, yellow, orange, flame red, dark red, pink, and other color combinations (Leni, 2009). According to botanists from 30 thousand species of natural orchids in the world, 5,000 of them are found in Indonesia (Rukmana, 2000).

Until now, infectious diseases are still a major obstacle in efforts to preserve and develop the potential of natural orchids (Muharram et al., 2013). Based on previous research (Mahfut et al., 2019) it is known that some individual orchids exhibit symptoms of viral disease infections, namely mosaic, chlorotic, streak, and necrosis. Mahfut et al. (2016) reported that orchid plants were able to be infected with more than 25 types of viruses. *Odontoglossum ringspot virus* (ORSV) and *Cymbidium mosaic virus* (CymMV) are the types of viruses that are reported to infect the most and have the widest spread in the world. Viral infections cause a decrease in plant vigor and flower quality resulting in economic losses (Mahfut et al., 2017). Based on this, it is necessary to conduct research related to "Identification of Disease and Efforts to Protect Natural Orchid Plants Against Virus Infection in the Liwa Botanical Garden" to determine the response of natural orchids to viral infections as well as the types of natural orchids that are most susceptible to virus infections in the Liwa Botanical Garden. The results of this activity are expected to be basic information in efforts to protect plants against diseases to support the application of conservation of natural orchids in the Liwa Botanical Garden.

MATERIALS AND METHODS

Sample Collection. Sample collection was carried out on orchid leaves in Liwa Botanical Garden which showed symptoms of being infected with a virus. All samples were tabulated and documented with photos.

Analysis of Disease Symptoms. This analysis is done by matching the sample documentation with the literature that has been previously reported. The literature used is Muharam et al., 2013; Mahfut and Daryono, 2014; Mahfut et al., 2017; Fery et al., 2018.

Disease Intensity Analysis. This stage is done to determine the severity of the disease (disease severity). Disease intensity is the proportion of infected hosts to the total observed surface area of the host. Calculation of disease intensity analysis is done using the method of Rahardjo and Suhardi (2008) and the scale of disease intensity refers to Mahfut et al. (2019).

Plant Resistance Level. Determination of the level of resistance of orchids to disease follows the method of Mahfut et al. (2019).

RESULTS AND DISCUSSION

Sample Collection

The sample collection phase was conducted from January 2nd week to February 2nd week 2020. Samples were randomly selected from orchid individuals who showed virus infection in the green house of the Liwa Botanical Garden. Based on the results of the collection obtained 16 samples of 5 types of orchids, namely *Coelogyne* sp., *Flickingeria* sp., *Calanthe* sp., *Trixspermum centipeda*, *Bulbophyllum* sp. The type of orchid that is most infected with the disease is *Flickingeria* sp. with a total of 8 samples. Overall data collection results conducted during street vendors are shown in **Table 1**.

Table 1. Collection of orchid leaf samples at Liwa Botanical Garden which shows a virus infection

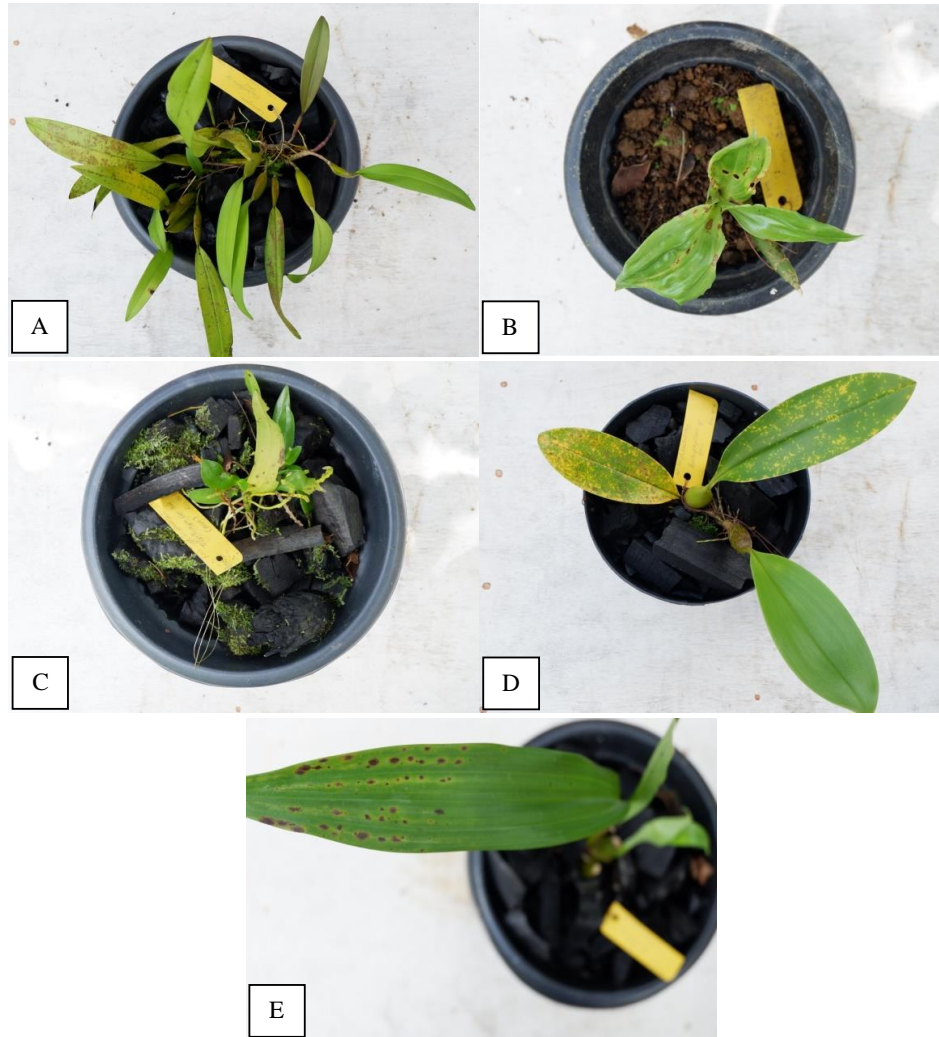
No	Species of Orchid	Number of Samples	Symptoms of Infection
1	<i>Coelogyne</i> sp.	2	Necrotic and chlorotic
2	<i>Flickingeria</i> sp.	8	Necrotic and streak
3	<i>Calanthe</i> sp.	2	Necrotic and chlorotic
4	<i>Trixspermum centipeda</i>	2	Mosaic
5	<i>Bulbophyllum</i> sp.	2	Necrotic and streak

The selection of sampling locations is based on previous research by Mahfut et al. (2019) who reported viral infection in the collection of natural orchids at Liwa Botanical Garden in August and December 2019. The types of infected orchids were *Calanthe*, *Cymbidium*, and *Dendrobium* with symptoms of necrosis, chlorotic and streak. Other studies have also reported ORSV infections in *Phalaenopsis amboinensis* (KRB2) and *Phalaenopsis amabilis* (KRB12) from Bogor Botanical Gardens, *Phalaenopsis amabilis* (KRP18) and *Dendrobium salacence* (KRP20) from Purwodadi Botanical Gardens, and *Phalaenopsis modesta* J. Sm. (KRBp5) from the Balikpapan Botanic Garden (Mahfut et al., 2017^b). ORSV can infect a variety of orchids including *Aranda* sp., *Dendrobium* sp., *Phalaenopsis* sp., and *Grammatophyllum* sp. Usually leaves arise in circles, lines, yellowish green or brown spots (Mahfut and Daryono, 2014). Furthermore Muharam et al. (2013) also reported the presence of CymMV virus infection in the orchid *Phalaenopsis* sp. and *Dendrobium* sp. in Java and Bali, there are symptoms of necrosis.

In this study, *Flickingeria* sp. be the type of orchid that is infected with the most viral diseases. This shows that this type of orchid is the host most susceptible to infection with pathogenic viral diseases. Next is *Coelogyne* sp., *Calanthe* sp., *Trixspermum centipede*, and *Bulbophyllum* sp.

Analysis of Disease Symptoms

89 Based on the analysis of disease symptoms, viral infections in orchid samples of *Coelogyne* sp., *Flickingeria*
90 sp., *Calanthe* sp., *Trixspermum centipeda*, *Bulbophyllum* sp. showing symptoms of viral infections that are
91 necrosis, streak, and chlorotic. Overall samples showing symptoms of viral infection are presented in **Fig. 1**.
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93 **Figure 1.** Viral infections on orchids: (A) *Flickingeria* sp., (B) *Calanthe* sp., (C) *Trixspermum centipeda*, (D)
94 *Bulbophyllum* sp., and (E) *Coelogyne* sp.
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97 On *Coelogyne* sp., showing symptoms of necrosis in the form of black patches on the leaves, which is
98 different from the orchid *Flickingeria* sp., *Calanthe* sp., and *Trixspermum centipeda* which have symptoms of
99 necrosis and chlorotic namely yellowing leaves. Whereas in *Bulbophyllum* sp. the symptoms shown are
100 chlorotic. Overall symptoms of viral diseases that infect natural orchids in the Liwa Botanical Garden are
101 presented in **Fig. 2**.
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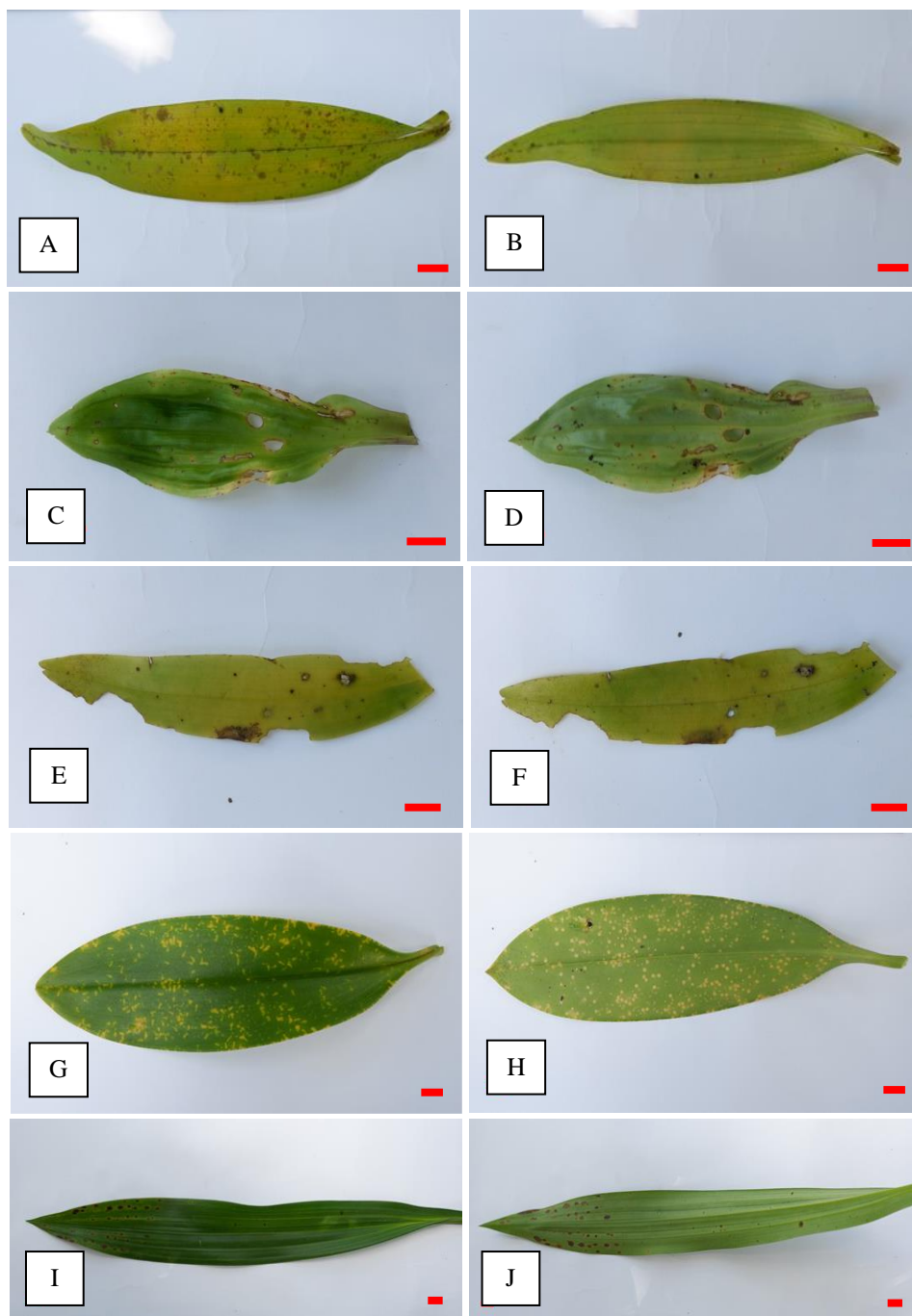


Figure 2. Symptoms of virus infection at Liwa Botanical Garden
 (A, B) : Necrotic and chlorotic on *Flickingeria* sp.
 (C, D) : Necrotic and streak on *Calanthe* sp.
 (E, F) : Necrotic and chlorotic on *Trixspermum centipeda*
 (G, H) : Mosaic on *Bulbophyllum* sp.
 (I, J) : Necrotic and streak on *Coelogyne* sp.
 (A, C, E, G, I): Top surface of the leaf, (B, D, F, H, J): Surface under the leaf. Bar: 1 cm

Disease Intensity

Disease intensity analysis results obtained as a percentage as shown in the **Table 2**.

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124 **Table 2.** Disease intensity analysis of virus infection at Liwa Botanical Garden

No.	Species of Orchid	Disease Intensity
1	<i>Coelogyne</i> sp.	15%
2	<i>Flickingeria</i> sp.	42%
3	<i>Calanthe</i> sp.	40%
4	<i>Trixspermum centipeda</i>	20%
5	<i>Bulbophyllum</i> sp.	26%

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127 Based on the analysis of the intensity of viral diseases in natural orchids in Liwa Botanical Garden the
 128 highest percentage was obtained in the orchid *Flickingeria* sp. with a percentage of 42%, this is because as
 129 many as 8 samples of a total of 15 leaves showed symptoms of the virus. Next is the orchid *Calanthe* sp. with a
 130 percentage of 40%, in the orchid *Bulbophyllum* sp. 26%, *Trixspermum centipeda* 20%, and *Coelogyne* sp. 15%.

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131 **Plant Resistance**

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132 The results of the analysis of the level of resistance to viral diseases in natural orchids in Liwa Botanical
 133 Garden are shown in **Table 3.**

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135 **Table 3.** Analysis of the level of plant resistance to viral infections on Liwa Botanical Garden

No.	Species of Orcid	Plant Resistance Level
1	<i>Coelogyne</i> sp.	Resistance
2	<i>Flickingeria</i> sp.	Susceptible
3	<i>Calanthe</i> sp.	Resistance
4	<i>Trixspermum centipeda</i>	Resistance
5	<i>Bulbophyllum</i> sp.	Resistance

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137 Based on the results of the analysis it can be seen that the orchid *Flickingeria* sp. has a vulnerable level of
 138 resilience because this type of orchid is the host most susceptible to infection with pathogenic viral diseases.
 139 Percentage obtained on the type of orchid *Flickingeria* sp. as much as 42%. Mahfut et al. (2019) explained that
 140 the susceptibility level is resistance level in orchids infected with the disease more than 40%.

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