

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

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ABSTRACT

Liwa Botanical Garden is located in West Lampung Regency which has an area of 86.6 hectares and is one of the conservation of ornamental plants that presents the flora of the Bukit Barisan Selatan National Park. One of the flagship collections of this botanical garden is a native orchid. Disease infection is still a major obstacle in the cultivation and development of native orchid potential at Liwa Botanical Garden. Based on the results of previous studies, it is known that several individual natural orchid collections from Liwa Botanical Garden showed symptoms of fungal disease infections. Disease infections can inhibit plant growth and resistance and reduce the aesthetic value periodically. Symptoms of infection include necrotic patches on the upper surface of the leaf. This research was conducted to determine the identification of diseases and efforts to protect natural orchids against fungal infections at Liwa Botanical Garden through a collection of samples that showed symptoms of infection, analysis of disease symptoms, and analysis of disease resistance levels. The results showed that the response of the natural orchid at Liwa Botanical Garden to fungal infections was to show symptoms of wilting in the leaves, namely in the orchids *Eria* sp., *Dendrobium* sp., and *Cymbidium* sp. turns black on the edge of the leaf, *Thrixspermum* sp. The type of orchid most commonly infected with fungus is *Cymbidium* sp. a total of 8 samples, and *Thrixspermum* sp. 3 samples, *Eria* sp. as many as 4 samples, *Dendrobium* sp. and *Calanthe triplicata* as many as 6 samples. The type of native orchid that is most susceptible to fungal infections is *Dendrobium* sp. and *Eria* sp. with disease intensity of 74.11% and 22.3%. 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 native orchids on Liwa Botanical Garden.

Key words: identification of diseases, fungal infections, orchid fungi, native orchids, liwa botanical garden

INTRODUCTION

Liwa Botanical Garden is located in Kubu Prah Village, Balik Bukit District, Liwa-West Lampung Regency. This botanical garden has an area of 86.6 hectares which is one of the conservation of ornamental plants that presents the rich flora of the Bukit Barisan Selatan National Park (Rosanti and widianjaya, 2018), one of which is natural orchids. The native orchid collection at the Liwa Botanical Garden was obtained from exploration and donation activities. Until November 2013 there were 384 exploration numbers and 41 donation numbers from the Bogor Botanical Gardens.

Disease infection is still a major obstacle in the cultivation and development of natural orchid potential at Liwa Botanical Garden. Based on the results of previous studies, it is known that several individual natural orchid collections from Liwa Botanical Garden showed symptoms of fungal disease infections. Disease infections can inhibit plant growth and resistance and reduce the aesthetic value periodically. Symptoms of infection include necrotic patches on the upper surface of the leaf (Mahfut et al., 2019). Plant diseases caused by fungi generally spread through the soil. The fungus can infect the root area and base of the stem, as a result the plant will experience wilting, seedling / sprout (damping-off), root rot, or root neck (Herlinda, 2006).

To facilitate the control of fungal diseases, an inventory of data is first carried out as basic information regarding the infection of the disease. Recognition of symptoms as an infection response is the first data in disease identification. The data is used to determine disease intensity and plant resistance and control. Based on the above it is necessary to conduct research activities related to the identification of diseases and efforts to protect natural orchid plants against fungal infections at Liwa Botanical Garden. The results of this study are

49 expected to be basic information in efforts to protect orchids to support the application of conservation at Liwa
50 Botanical Garden.

51 MATERIALS AND METHODS

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

54
55 **Analysis of Disease Symptoms.** This analysis is done by matching the sample documentation with the
56 literature that has been previously reported. The literature used is Muharam et al., 2013; Mahfut and Daryono,
57 2014; Mahfut et al., 2017; Fery et al., 2018.

58
59 **Disease Intensity Analysis.** This stage is done to determine the severity of the disease (disease severity).
60 Disease intensity is the proportion of infected hosts to the total observed surface area of the host. Calculation of
61 disease intensity analysis is done using the method of Rahardjo and Suhardi (2008) and the scale of disease
62 intensity refers to Mahfut et al. (2019).

63
64 **Plant Resistance Level.** Determination of the level of resistance of orchids to disease follows the method of
65 Mahfut et al. (2019).

66 RESULTS AND DISCUSSION

67 Sample Collection

68 The sample collection stage is conducted in the second week of January to the second week of February
69 2020. Samples are randomly selected from orchid individuals who show symptoms of fungal infection at the
70 Liwa Botanical Garden green house. Based on the collection results obtained 21 samples from 5 types of
71 orchids, i.e: *Eria* sp., *Thrixspermum* sp., *Cymbidium* sp., *Dendrobium* sp., *Calanthe triplicata*. The type of
72 orchid that is most infected with fungi is *Cymbidium* sp. as many as 8 samples. Furthermore orchid *Eria* sp. 4
73 samples, *Thrixspermum* sp. as many as 3 samples, while *Dendrobium* sp. and *Calanthe triplicata* with 6
74 samples. Overall data collection results are shown in **Table 1**.

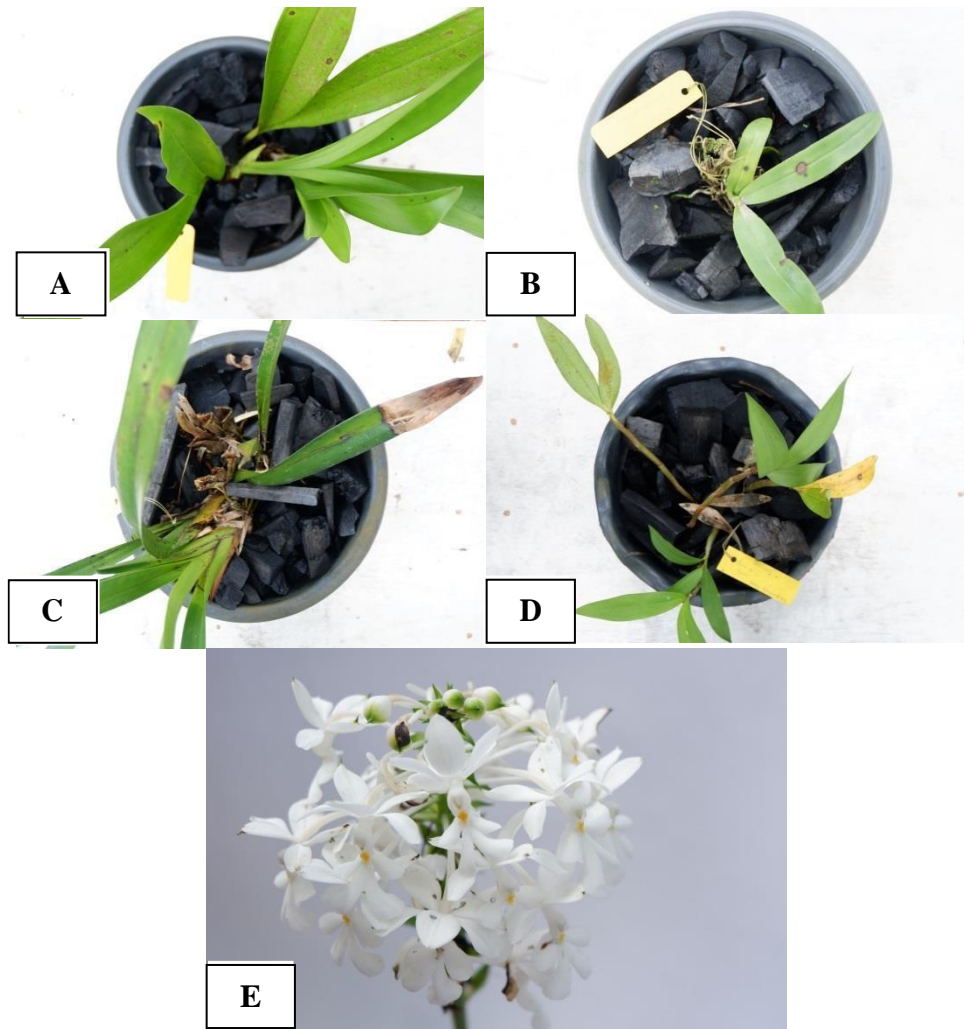
75
76 **Table 1.** Samples collection of native orchids at Liwa Botanical Garden which show symptoms of fungi
77 infection

No	Species of Orchid	Number of Samples	Symptoms of Infection
1	<i>Eria</i> sp.	4	Daun menjadi layu pada bagian tengah hingga ujung daun
2	<i>Cymbidium</i> sp.	8	Daun menjadi layu pada bagian tengah hingga ujungdaun
3	<i>Thrixspermum</i> sp.	3	Daun berubah menjadi hitam pada bagian pinggir daun
4	<i>Dendrobium</i> sp.	6	Seluruh bagian daun layu berwarna kuning
5	<i>Calanthe triplicata</i>	6	Terdapat bintik-bintik kecil berwarna hitam pada bagian kelopak bunga

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79 The selection of sampling locations is based on previous research (Mahfut et al., 2019) which reported a
80 fungal infection in the native orchid collection at Liwa Botanical Garden in August and December 2019. Types
81 of orchids infected with fungi are *Cymbidium* and *Corynborsis* with mixed virus symptoms, fungus, and
82 bacteria. In this study, *Cymbidium* sp. being the most orchid-infected type of orchid. This shows that this type
83 of orchid is the most vulnerable host infected with pathogenic fungi. Apart from that are orchids *Eria* sp.,
84 *Thrixspermum* sp., *Dendrobium* sp., *Calanthe triplicata*. Other studies also report the presence of fungal
85 infections with symptoms of wilting in 3 types of *Dendrobium stratiotes*, *Dendrobium moschatum*,
86 *Dendrobium concinnum*, and *Pteroceras unguiculatum* at Bogor Botanical Gardens (Anita, 2017). Devi (2018)
87 also reported infection with *Phalaenopsis* sp. in Lembang, West Bandung with symptoms of fungus spots.
88 Some research also shows that orchids in some locations are infected by fungus. Anita (2017) reports that on
89 *Dendrobium* sp. also showed a fairly severe fungal infection at Bogor Botanical Garden.

90 **Analysis of Disease Symptoms**

91 Based on the analysis of disease symptoms, orchid samples of *Eria* sp., *Thrixspermum* sp., *Cymbidium* sp.,
92 *Dendrobium* sp., And *Calanthe triplicata*. showing symptoms of fungal infections, namely leaves with black
93 spots on the edges, leaves withering and dry, there are black spots on the flowers. Overall symptoms of fungal
94 diseases infecting native orchids at Liwa Botanical Garden are showed on **Fig. 1**.



95 **Figure 1.** Symptoms of fungal infections on native orchids at Liwa Botanical Garden: (A) *Eria* sp. (B)
96 *Thrixspermum* sp. (C) *Cymbidium* sp. (D) *Dendrobium* sp. (E) *Calanthe triplicata*
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99 *Thrixspermum* sp. symptoms caused by the leaves turn black on the edge of the leaf, looks like a spot. In
100 *Dendrobium* sp. symptoms caused by all parts of the leaves withering yellow, the fungus that infects this orchid
101 is *Sclerotium rolfsii*. On *Eria* sp. and *Cymbidium* sp. have the same symptoms, namely the leaves become dry
102 brown there is the middle to the tip of the leaf. The fungus that infects this orchid is *Phytophthora palmivora*. In
103 contrast to *Calanthe triplicata* the symptoms caused by this orchid are black spots on the flower. This infecting
104 fungus is *Botrytis cinerea*. Whereas in *Calanthe triplicata* the infected part is a part of the flower. The
105 symptoms that arise are black spots on the flower petals.

106 The difference in symptoms caused by several factors, one of which is the type of orchid. Each type of
107 orchid shows a different character from one another. The habitat of the orchid plant influences the growth of
108 orchids such as the influence of sunlight, climate conditions, temperature, humidity and the availability of
109 nutrients that support the growth of orchids, and affect the quality and quantity of flowers produced (Darmono
110 2003). Overall symptoms of fungal diseases infecting natural orchids at Liwa Botanical Garden are showed on
111 **Fig. 2.**

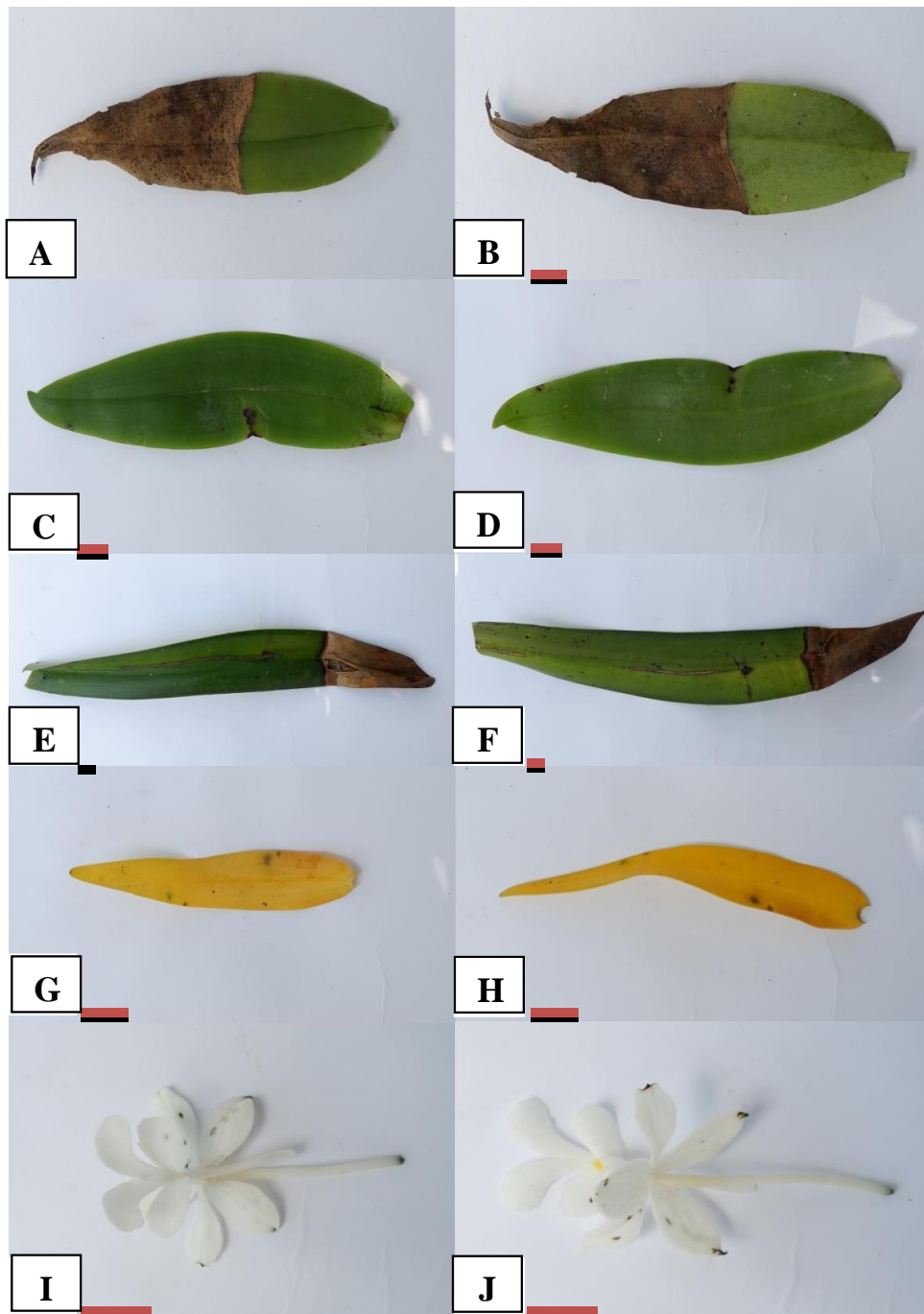


Figure 2. Samples collection of symptoms of fungal infections on naive orchids at Liwa Botanical Garden:
 (A, B) : Wilting leaf on *Eria* sp.
 (C, D) : Wilting leaf on *Thrixspermum* sp.
 (E, F) : Wilting leaf on *Cymbidium* sp.
 (G, H) : Wilting leaf on *Dendrobium* sp.
 (I, J) : Wilting leaf on *Calanthe triplicata*
 ((A, C, E, G, I): Top surface of the leaf and flower, (B, D, F, H, J): Surface under the leaf and flower. Bar: 1 cm

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Disease Intensity

The results of analysis of disease intensity of fungal diseases on native orchids at Liwa Botanical Garden, obtained the percentage of intensity as showed at **Table 2.**

126 **Table 2.** Analysis of fungal infection on native orchids at Liwa Botanical Garden

No.	Species of Orchid	Disease Intensity
1	<i>Eria</i> sp.	22,3%
2	<i>Cymbidium</i> sp.	3,63%
3	<i>Thrixspermum</i> sp.	3%
4	<i>Dendrobium</i> sp.	74,11%
5	<i>Calanthe triplicata</i>	12,63%

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128 *Dendrobium* sp. has the highest disease intensity with a fairly high percentage of disease events at 74.11%,
 129 with a total of 6 samples from a total of 17 leaves showing symptoms of fungal infections. In the orchid *Eria* sp.
 130 a total of 4 samples showed symptoms of fungal infections and the percentage of disease events was *Eria* sp.
 131 22.3%, but the intensity of the disease in this orchid is smaller when compared with *Cybidium* sp. The lower
 132 intensity of the disease on *Eria* sp. this is caused by the total number of leaves in one plant and the scale of
 133 infection categories in the leaves so that the comparison of *Dendrobium* sp. and *Eria* sp. is different. Unlike on
 134 *Dendrobium* sp. and *Eria* sp. which shows the percentage of disease intensity is quite high, because it has an
 135 intensity value above 20% compared to *Calanthe triplicata*, *Cymbidium* sp., *Thrixspermum* sp.

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137 **Plant Resistance**

138 The results of the analysis of the level of resistance to fungal diseases in native orchids in Liwa Botanical
 139 Garden are showed on **Table 3.**

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141 **Table 3.** Analysis of the level of plant resistance to fungal infections in the Liwa Botanical Garden

No.	Species of Orcid	Plant Resistance Level
1	<i>Eria</i> sp.	Resistance
2	<i>Cymbidium</i> sp.	Resistance
3	<i>Thrixspermum</i> sp.	Resistance
4	<i>Dendrobium</i> sp.	Susceptible
5	<i>Calanthe triplicata</i>	Resistance

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143 On *Dendrobium* sp. has a resistance level that is vulnerable because it has an incidence of more than 40%,
 144 while other orchids have a rather resistant level.

145

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 147 collaboration program with Universitas Lampung.

148

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