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To cite this article: Mahfut *et al* 2020 *J. Phys.: Conf. Ser.* **1641** 012098

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Identification of Disease and Efforts to Protect Native Orchid Plants Against Bacteria Infection in Liwa Botanical Garden

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Abstract. Liwa Botanical Garden is located in West Lampung Regency and is one of the conservation of ornamental plants that presents the rich flora of the Bukit Barisan Selatan National Park. One of the flagship collections of this botanical garden is a natural orchid. 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 several individual orchid collections from Liwa Botanical Garden show symptoms of bacterial infection. This pathogen will infect orchids and cause soft rot disease. This research was conducted to determine the identification of diseases and efforts to protect natural orchids against bacterial infections in the 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 orchids of Liwa Botanical Garden to bacterial infections was to show symptoms of soft rot disease, i.e *Bulbophyllum* sp., *Dendrobium crumenatum*, *Dendrobium montanum*, *Pholidota* sp., and *Vanilla* sp. The type of orchid that shows the most symptoms of bacterial infection is *Vanilla* sp. 11 samples, and *Pholidota* sp. and *Dendrobium crumenatum* with 3 samples each. The type of orchid that shows the most symptoms is *Flickingeria* sp. a total of 8 samples. The natural type of the Liwa Botanical Garden which is most susceptible to bacterial infections is *Pholidota* sp. and *Vanilla* sp. with disease intensity of 10% and 7.7%. 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 Liwa Botanical Garden.

1. Introduction

Liwa Botanical Garden is located in Pekon Kubu Perahu Village, Balik Bukit District, Liwa City, West Lampung Regency. This botanical garden with the concept of Indonesian Ornamental Plants has become one of the conservation of ornamental plants that presents the rich flora of the Bukit



Barisan Selatan National Park [17], one of which is a natural orchid. The natural orchid collection at the Liwa Botanical Garden was obtained from exploration and donation activities. As of November 2013, there were 384 numbers of exploration results and 41 numbers of donations from the Bogor Botanical Gardens [1;18]. Natural orchids are orchids that can grow naturally in nature without human assistance. However, the presence of natural orchids in their natural habitat (forest) has been reported to be greatly reduced. This is caused by several factors, including excessive exploration and forest destruction. In addition, disease infection is still a major obstacle in the cultivation and development of native orchid potential [6;7;8;9;10;11;12;13;14;15].

Based on previous research [12], it is known that several individual orchid collections in the Liwa Botanical Garden show symptoms of being infected disease, include against bacteria. This pathogen will infect orchids and cause soft rot disease. The spread of bacteria can occur through the media of water, soil, contact between healthy and diseased plants, and contamination of equipment for vegetative propagation and harvesting flowers. To facilitate bacterial control, data inventory is first carried out as preliminary information about 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, plant resistance, and disease control efforts. Based on this, the research on "Identification of Disease and Efforts to Protect Native Orchid Plants Against Bacterial Infection in Liwa Botanical Garden" is very necessary. The results of this study are expected to be fundamental data in efforts to protect orchids to support the application of conservation of natural orchids in the Liwa Botanical Garden. In addition, the results of this study provide a good communication medium between researchers and managers of the Liwa Botanical Garden in their efforts to control disease.

2. Materials and Methods

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

2.2. 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 [5;12].

2.3. 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 [16] and the scale of disease intensity refers to [12].

2.4. Plant Resistance Level. Determination of the level of resistance of orchids to disease follows the method of [12].

3. Results and Discussion

3.1. Sample Collection

The sample collection stage is carried out in the second week of January to the second week of February 2020. Samples are randomly selected from individual orchids showing symptoms of bacterial infection at the Liwa Botanical Garden green house. Based on the collection results

obtained 21 samples from 5 types of orchids, i.e. *Bulbophyllum* sp., *Dendrobium crumenatum*, *Dendrobium montanum*, *Pholidota* sp., and *Vanilla* sp. The type of orchid that is most infected with bacteria is *Vanilla* sp. as many as 11 samples. Furthermore, *Pholidota* sp. and *Dendrobium crumenatum* for 3 samples each. Overall data collection results are shown in Table 1.

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

No	Species of Orchid	Number of Samples	Symptoms of Infection
1	<i>Bulbophyllum</i> sp.	2	Soft rot on the edge of the leaf
2	<i>Dendrobium crumenatum</i>	3	Soft rot on the middle of the leaf
3	<i>Dendrobium montanum</i>	2	Soft rot on the middle of the leaf
4	<i>Pholidota</i> sp.	3	Soft rot on the middle and edge of the leaf
5	<i>Vanilla</i> sp.	11	Soft rot on the edge of the leaf

The selection of sampling locations was based on previous research [12] which reported bacterial infections in the natural orchid collection at Liwa Botanical Garden in August and December 2019. The type of orchid infected with bacteria was *Calanthe* sp. and *Flickingeria* sp. with symptoms of a mixture of viruses, fungi and bacteria. Several other studies also reported a bacterial infection with symptoms of soft rot in the orchid *Phalaenopsis* sp. at Ridho Nursery, Lembang, West Java; *Onchidium* sp. at Mr. Huang nursery, Bogor, West Java; *Paphiopedilum* sp. at the Global Orchid nursery, Lembang, West Java [3], *Grammatophyllum*, *Dendrobium*, and *Catleya* sp. in Yogyakarta [5].

In this study, *Vanilla* sp. be the type of orchid that is infected with the most bacteria. This shows that this type of orchid is the most vulnerable host infected with pathogenic bacteria. In addition to the orchids are *Pholidota* sp., *Dendrobium crumenatum*, *Dendrobium montanum*, and *Bulbophyllum* sp. [5] reported that the orchid *Dendrobium* sp. also showed a fairly severe bacterial infection in Yogyakarta.

3.2. Analysis of Disease Symptoms

Based on the analysis of disease symptoms, *Vanilla* sp., *Pholidota* sp., *Dendrobium crumenatum*, *Dendrobium montanum*, and *Bulbophyllum* sp. showing symptoms of bacterial infection that is rotten disease characterized by leaves rot, runny, and cause a foul odor. Overall symptoms of a bacterial disease infecting natural orchids in the Liwa Botanical Garden are presented in Figure 1.

Bacterial infections on samples *Bulbophyllum* sp., *Dendrobium crumenatum*, *Dendrobium montanum*, and *Pholidota* sp., cause the formation of watery, cold-colored rot areas that resemble clear plastic. In contrast to sample *Bulbophyllum* sp., *Dendrobium crumenatum*, and *Dendrobium montanum* which have more than one spot on the leaf, orchids *Pholidota* sp. only has one wound area but with a large enough area. On *Pholidota* sp. also shows the wound area that has begun to cause the formation of holes in the leaves.

Symptoms of bacterial infection on sample *Vanilla* sp. very different when compared with the other four samples. But the symptoms of the infection are very similar when compared with the literature. Bacterial infection of *Vanilla* sp. causing the formation of a soft, watery brownish wound area. In addition to causing the formation of wound areas, bacterial infections in this type of orchid also cause some parts of the leaves to turn yellow.

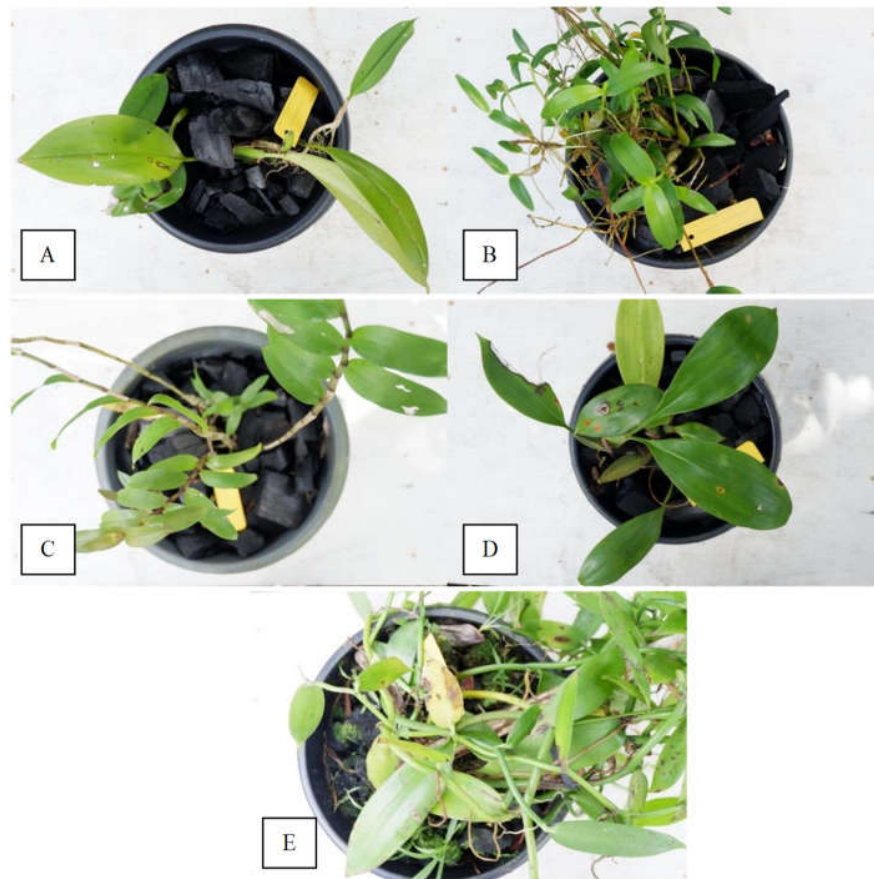


Figure 1. Symptoms of bacterial infection in orchids: (A) *Bulbophyllum* sp., (B) *Dendrobium crumenatum*, (C) *Dendrobium montanum*, (D) *Pholidota* sp., and (E) *Vanilla* sp.

The difference in symptoms that arise in the entire collection of this sample can be caused by several factors, including: the types of bacteria that infect the orchids are different, or the types of bacteria that infect the orchids are the same but the response of each species to bacterial infections are different [3]. The difference in these symptoms is not a problem if the plant protection measures taken are to use a bactericide as in this study [4]. However, if the protective measures applied are to use antagonistic microbes, it is necessary to further identify the type of bacteria that infects orchids. This is done because antagonistic microbes work specifically with certain pathogenic bacteria. In other words, if the pathogenic bacteria that infect the orchid are different, the antagonistic microbes used will be different [2]. Overall symptoms of a bacterial disease infecting natural orchids at Liwa Botanical Garden are showed on Figure 2.

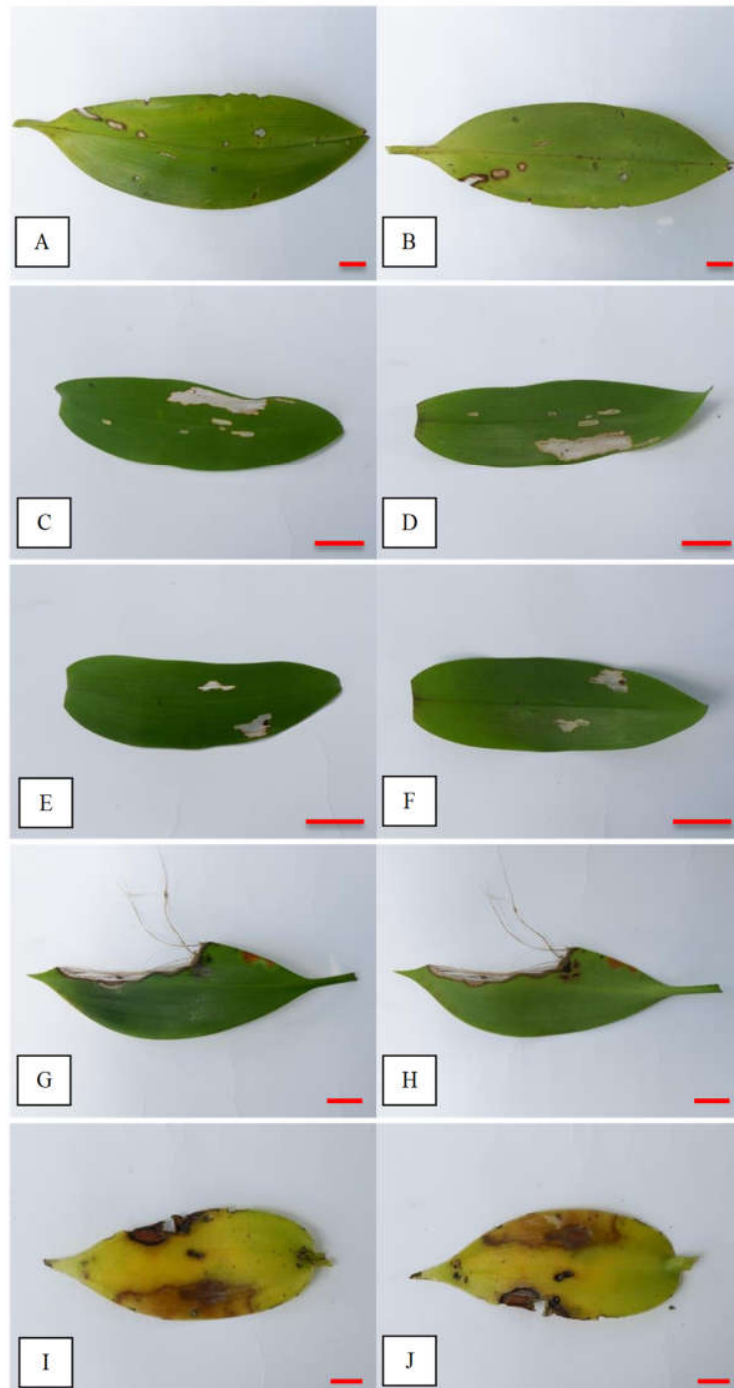


Figure 2. Collection of samples of bacterial infection symptoms at Liwa Botanical Garden:
(A, B) : Soft rot disease in orchid leaves *Bulbophyllum* sp.

- (C, D) : Soft rot disease in orchid leaves *Dendrobium crumenatum*
 (E, F) : Soft rot disease in orchid leaves anggrek *Dendrobium montanum*
 (G, H) : Soft rot disease in orchid leaves anggrek *Pholidota* sp.
 (I, J) : Soft rot disease in orchid leaves anggrek *Vanilla* sp.
 (A, C, E, G, I): Top surface of the leaf, (B, D, F, H, J): Surface under the leaf. Bar: 1 cm.

3.3. Disease Intensity

The results of the analysis of the intensity of bacterial diseases on natural orchids at Liwa Botanical Garden, obtained the percentage of intensity as shown in the Table 2.

Table 2. Analysis of bacterial infection on native orchids at Liwa Botanical Garden

No	Species of Orchid	Disease Intensity
1	<i>Bulbophyllum</i> sp.	1,6%
2	<i>Dendrobium crumenatum</i>	1,39%
3	<i>Dendrobium montanum</i>	0,54%
4	<i>Pholidota</i> sp.	10%
5	<i>Vanilla</i> sp.	7,7%

Pholidota sp. has the highest disease intensity. This is caused by several factors, including: the percentage of disease events is quite high at 30%, and as many as 3 samples from a total of 9 leaves show symptoms of bacterial infection. On 11 samples of *Vanilla* sp. samples showed symptoms of bacterial infection and the percentage of disease was 35%, but the intensity of the disease in this orchid was smaller when compared with *Pholidota* sp. Lower intensity of disease on *Vanilla* sp. this is caused by the total number of leaves in one plant that is 50 leaves. So that the ratio of the number of diseased and healthy leaves in this orchid is lower when compared with *Pholidota* sp. The lower the total ratio of the number of diseased and healthy leaves and the lower percentage of disease events will cause the results of the analysis of disease intensity to be lower [16]. In contrast to *Pholidota* sp. and *Vanilla* sp. which shows the percentage of disease intensity is quite high, on *Bulbophyllum* sp., *Dendrobium crumenatum*, and *Dendrobium montanum* show a very low percentage of intensity that is less than 2%.

3.4. Plant Resistance

Based on analysis resistance level that has been done, the results obtained as showed on Table 3.

Table 3. Analysis of resistance level to bacterial infection on native orchids in Liwa Botanical Garden

No	Species of Orchid	Plant Resistance
1	<i>Bulbophyllum</i> sp.	Resistance
2	<i>Dendrobium crumenatum</i>	Resistance
3	<i>Dendrobium montanum</i>	Resistance
4	<i>Pholidota</i> sp.	Resistance
5	<i>Vanilla</i> sp.	Resistance

Overall the sample has a rather resistant level of resistance because it has a disease incidence of less than 40%. [12] explain that the level of resistance is somewhat resistant is the level of resistance in orchids infected with the disease but the incidence of the disease is not more than 40%. This shows that the overall collection of natural orchid samples on Liwa Botanical Garden is capable of being infected by pathogens but a small portion of the cells supports the growth and development of pathogens so that they cause less disease.

Acknowledgments

Authors wishing to acknowledge from Liwa Botanical Garden who facilitated the research. This activity is a continuation of the collaboration program with Universitas Lampung

References

- [1] Adi MC, Yulika R, Nugraha I and Virditha UA 2019 *Buku Saku Kebun Raya Liwa* (Badan Penelitian dan Pengembangan Kabupaten Lampung Barat/UPTD Pengelola Kebun Raya Liwa) pp 1-41
- [2] Djatnika I, Hanudin W, Nuryani dan Silvia E 2011 *Kemangkusan Formula Jenis Bakteri Antagonis terhadap Intensitas Serangan Penyakit Busuk Lunak (*Pectobacterium carotovorum* pv. *Carotovorum*) pada Anggrek *Phalaenopsis** (Laporan Hasil Penelitian Badai Penelitian Tanaman Hias Tahun Anggaran 2010)
- [3] Hanudin and Rahardjo IB 2012 *Prosiding Seminar Nasional Anggrek* (Balai Penelitian Tanaman Hias/Indonesia)
- [4] Huang TC 2008 *The Occurrence and Control of Fungi and Bacterial Orchid Disease* (Taichung Branch Office/ Bureau of Animal and Plant Health Inspection and Quarantine)
- [5] Joko T, Kiswanti D, Subandiyah S and Hanudin 2011 *Proc. Internasional Seminar on Natural Resources, Climate Change, and Food Security in Developing Countries* (Surabaya/ Indonesia) pp: 255–265
- [6] Kumalawati AD, Abdullah S, Daryono BS and Mahfut 2011 *Proc. International Conference on Biological Science* (Yogyakarta/Indonesia) pp 54
- [7] Mahfut and Daryono BS 2014 Deteksi Odontoglossum ringspot virus (ORSV) Terhadap Anggrek Alam di Hutan Wonosadi, Gunung Kidul *Biogenesis* **2** 101-108
- [8] Mahfut, Joko T and Daryono BS 2016^a Molecular Characterization Molecular of Odontoglossum ringspot virus (ORSV) in Jawa and Bali, Indonesia *Asian Journal of Plant Pathology* **10** 9-14
- [9] Mahfut, Daryono BS, Joko T and Somowiyarjo S 2016^b Survei Odontoglossum ringspot virus (ORSV) yang Menginfeksi Anggrek Alam Tropis di Indonesia *Jurnal Perlindungan Tanaman Indonesia* **20** 1-6
- [10] Mahfut, Daryono BS and Somowiyarjo S 2017^a Deteksi Odontoglossum ringspot virus (ORSV) yang Menginfeksi Anggrek Asli Koleksi Kebun Raya di Indonesia *Jurnal Fitopatologi Indonesia* **13** 1-8
- [11] Mahfut, Daryono BS and Somowiyarjo S 2017^b *Prosiding Seminar Nasional Pengendalian Penyakit Pada Tanaman Pertanian Ramah Lingkungan II Perhimpunan Fitopatologi Indonesia Komisariat Daerah Yogyakarta, Solo, dan Semarang* (Yogyakarta/Indonesia) pp 354-360
- [12] Mahfut, Daryono BS Indrianto A and Somowiyarjo S 2019^a *Proc. International Conference on Science and Technology* (Makassar/Indonesia) pp 1-8
- [13] Mahfut, Wahyuningsih S and Handayani TT 2019^b *Konservasi Anggrek Alam di Kebun Raya Liwa*. (Universitas Lampung/Indonesia) pp 1-15
- [14] Mahfut 2020 *Prosiding Seminar Nasional Biodiversitas Indonesia* (UIN Alauddin Makassar/Indonesia). pp 1-6
- [15] Mahfut, Indrianto A, Somowiyarjo S and Daryono BS 2020 Molecular phylogeny of orchids mycorrhiza isolated from native tropical orchids in Indonesia *Malaysian Journal of Microbiology* **16** 68-72
- [16] Rahardjo IB and Suhardi 2008 Insidensi dan Intensitas Serangan Penyakit Karat Putih pada Beberapa Klon Krisan *Jurnal Holtikultura* **18** 312- 318

- [17] Rosanti D and Widianjaya RR 2018 Morfologi Orchidaceae di Kebun Raya Liwa Kabupaten Lampung Barat Provinsi Lampung *Sainmatika* **15** 84-89
- [18] Solihah SM 2015 Koleksi, Status, dan Potensi Anggrek di Kebun Raya Liwa *Warta Kebun Raya* **13** 14-23