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Ceratorhiza Induction towards ORSV Infection on Viability of *Phalaenopsis* and *Dendrobium*

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ABSTRACT

Orchids have a high level of biodiversity, such as *Dendrobium* and *Phalaenopsis*, which are epiphytes. *Dendrobium* can adapt to the condition of where it lives while *Phalaenopsis* can grow in highlands and depends on sunlight and humidity. Virus infection has become one of the obstacles in cultivating *Dendrobium* and *Phalaenopsis*. Efforts to increase fitness and control in *Dendrobium* and *Phalaenopsis* cultivation can be done by inducing the plant's fitness using a mycorrhiza, such as Ceratorhiza. A mycorrhiza is a form of mutualism between fungi and the plant's root. This research is aimed to give information related to the utilization of Cerathoriza for inducing orchids to suppress *Odontoglossum ringspot virus* (ORSV) infection, giving it better growth. The research was done in February-March 2021 at Botany Laboratory University of Lampung. A completely randomized factorial design was used on two factors, kind of orchid and mycorrhiza treatment (M), virus (V), and mycorrhiza virus (MV). Variables examined in this research are the amount of living and dead roots and leaves. Data obtained is homogenized using Levene's test and continued by ANOVA with the significance level of 5% and further testing using Tukey's test with the significance level of 5%. From this research, it is known that interaction between *Phalaenopsis* and *Dendrobium* exists during virus and mycorrhiza administration. It is concluded that *Phalaenopsis anabilis* is more vulnerable than *Dendrobium discolor*.

Keywords: *ceratorhiza*, *dendrobium*, ORSV, *phalaenopsis*

ABSTRAK

Anggrek merupakan salah satu tumbuhan yang memiliki keanekargaman sangat tinggi diantaranya *Dendrobium* dan *Phaleonopsis* yang merupakan anggrek epifit. Anggrek *Dendrobium* adalah salah satu anggrek yang mampu beradaptasi dengan kondisi tempat tumbuh anggrek. *Phalenopsis* merupakan anggrek epifit yang dapat tumbuh di daerah ketinggian dan membutuhkan cahaya serta kelembaban. Kendala dalam budidaya anggrek *Dendrobium* dan *Phaleonopsis* salah satunya karena adanya infeksi virus. Upaya peningkatan ketahanan dan pengendalian budidaya anggrek *Dendrobium* dan *Phaleonopsis* dapat dilakakukan dengan menginduksi ketahanan tanaman menggunakan mikoriza *Ceratorhiza*. Mikoriza merupakan suatu bentuk simbiosis mutualistik antara jamur dan akar tanaman. Tujuan dari penelitian ini dapat memberikan informasi mengenai pemanfaatan mikoriza *Ceratorhiza* untuk menginduksi tanaman anggrek agar dapat menahan infeksi virus *Odontoglossum ringspot virus* (ORSV), sehingga pertumbuhannya lebih baik. Waktu dan tempat penelitian dilakukan pada bulan Februari-Maret 2021 di Laboratorium Botani Universitas Lampung. Pada penelitian ini menggunakan Metode rancangan acak lengkap faktorial (RALF) yang terdiri dari dua faktor, yaitu jenis anggrek dan perlakuan mikoriza (M), virus (V), dan mikoriza virus (MV). Variabel

yang diamati pada penelitian ini adalah jumlah akar yang hidup dan mati, jumlah daun yang hidup dan mati. Data yang diperoleh dihomogenkan dengan menggunakan uji Levene kemudian dianalisis ragam pada taraf nyata 5% menggunakan ANOVA dan uji lanjut dengan Tukey pada taraf nyata 5%. Hasil penelitian menunjukkan bahwa jenis anggrek *Phalaenopsis amabilis* lebih rentan dibandingkan *Dendrobium discolor* pada perlakuan mikoriza (M), virus (V), dan mikoriza virus (MV). Terdapat interaksi antara *Phalaenopsis* dan *Dendrobium* pada variabel jumlah daun pada perlakuan mikoriza (M) dan virus (V).

Kata Kunci: *ceratorhiza, dendrobium, ORSV, phalaenopsis*

INTRODUCTION

Orchids is one of the biggest family in Indonesia (Soetopo, 2009). It is widely-spread and can be found in tropical forests in West Sumatera, Java, Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua (Rukmana, 2000). It is categorized into two based on the way of living, namely terrestrial and epiphyte. Terrestrial orchids are orchids that grow and develop on land (Dina and Soetopo, 2019) while epiphyte orchids are orchids that live on host plants but are not parasites. They depend on their hosts. The loss of orchids' host plants will significantly ruin orchids' life cycle (Ambari, 2016). Population of orchids in their natural habitat has been decreasing due to deforestation and forest over-exploitation (Johanis et al., 2001). This condition has led to the efforts of cultivation.

Phalaenopsis and *Dendrobium* are two of the most cultivated orchids (Yudistira *et al*., 2011). Unfortunately, virus infection has become one of the biggest challenges in orchids' cultivation and potential development (Kumalawati et al., 2011). Odontoglossum ringspot virus (ORSV) infects most orchids. Based on previous research by Mahfut (2016), symtomps caused by ORSV include mosaic, streak, chlorotic, and necrosis. Orchids protection measures can be done by genetic recombination resulting ORSV resistant orchids. Therefore, a mycorrhiza, such as *Cerathoriza* sp., is used as it is eco-friendlier and more effective.

Mycorrhiza is a mutualistic symbiosis between fungi and root. Plants obtain nutrients absorbed by fungi while fungi obtain nutrients resulted from assimilations done by plants. Mycorrhiza infected the root system of the plant hosts, producing hyphae intensively. *Cerathoriza*'s role as a biofertilizer can help the plant's growth and development in increasing root length, root amount, leaf amount, and leaf width (Brundrett, 2008). *Cerathoriza* as biocontrol can decrease virus infection levels on plants. Orchids have different resistance levels towards virus infection. Orchids' resistance increases as root amount and root length have increased after *Cerathoriza* induction. This research is done to find out the effectiveness of *Cerathoriza* induction towards *Phalaenopsis* and *Dendrobium* and their root viability after infected by ORSV.

According to previous studies, it was reported that the results of Ceratorhiza induction on orchids were known to be effective in inhibiting pathogens (Mahfut, 2019). The results of the study also reported that the early stages of *Ceratorhiza* induction will cause rotting in roots. The best time for *Ceratorhiza* inoculation is on the third and fourth day. It can be concluded that the faster *Ceratorhiza* contact with the orchids, the higher its ability to absorb nutrients and enhance growth (Mahfut *et al.,* 2016).

MATERIALS AND METHOD

Completely randomized factorial design was used on two factors. The first factor was the orchid type used, *Phalaenopsis amabilis* and *Dendrobium discolor* while the second factor was mycorrhiza induction (M), virus inoculation (V), and mycorrhiza induction and virus inoculation (MV), resulting in 6 treatments. Each treatment combination was repeated four times, resulting in 24 experimental units. Each experimental unit was a cup consists of growing media, one orchid plant (*Phalaenopsis amabilis* or *Dendrobium discolor)* based on treatment combination given. Variables examined are mycorrhiza effectiveness, leaf length, leaf width, leaf amount, root length, and root amount. Positive controls for *Phalaenopsis amabilis* and *Dendrobium discolor*, which are not included in the research design, also exists.

Tools used in this research were petri dish, beaker measuring glass 100 ml and 500 ml, mortar and pestel, pen, label, gloves, tissue, and camera. Materials used in this research were bottled seedlings of *Phalaenopsis amabilis* and *Dendrobium discolor*, moss sterile media, Potato Dextrose Agar media, Ceratorhiza sp., inoculum of *Odontoglossum ringspot virus* (ORSV), karborondum, phosphate buffer, water, alcohol.

This research was done through five steps below.

1. Acclimatization
   Bottled orchids are grown in the greenhouse for 2 months. After acclimatization, orchid treatment was done until 3-4 leaves have grown.
2. *Cerathoriza* inoculation
   Cerathoriza inoculation was done by growing *Cerathoriza* isolates on PDA that had been added by chloramphenicol. Isolates on petri dish was taken ± 0.5 cm and was put on the media through three spotting. Incubation was done at room temperature for 5-7 days. Isolates rejuvenation was done on 8-10 petri dishes.
3. ORSV inoculation
   ORSV inoculation towards planlet was done through sample, an ORSV infected tobacco. Tobacco leaves was ground and added with phosphate buffer with the ratio of 1:10 (m/v). Phosphate buffer was used to break down the cells, releasing the virus inside. Inoculation towards the orchid was done by rubbing carborundrum evenly, slowly, and manually by finger or cotton bud based on the vein (Calvo et al., 2020). Planlets were replanted on the media and symtomps, including necrosis, chlorosis, mosaic, leaf malformation, streak yellowing, and curling leaf, were examined during incubation time until they appear (15-30 days).
4. Examination on mycorrhiza effectiveness
   Examination on mycorrhiza effectiveness was done on the acclimated *Phalaenopsis amabilis* and *Dendrobium discolour*. Rejuvenation on *Cerathoriza* was done in 3 days and inoculation was done on the first until the fourth day. The examination was done in 30 days.
5. Examination on root viability
   Root viability examination was done by examining root length growth and root amount.

RESULTS AND DISCUSSION

Result

Mycorrhiza Effectiveness

The results of mycorrhiza inoculation performed for up to 4 days showed that hyphae enveloped the plant roots. The inoculation period indicates the thickness of the hyphae covering the plant. Myculation inclusions of *Phalaenopsis amabilis* and *Dendrobium discolor*

orchids are shown in Figure 1. The efficacy of *Ceratorhiza* performed by observing orchid root growth for post-inoculation survival is shown in Table 1.

Figure 1. Inoculation of *Ceratorhiza* on orchids (A) *Phalaenopsis amabilis* and (B) *Dendrobium discolor*.

Table 1. The number of orchid roots *Phalaenopsis* and *Dendrobium*

Orchid kind	Incubation time (Days)	Sunday				
		0	**1**	**2**	**3**	**4**
Phalaenopsis	1	7	7	7	7	7
	2	6	5	5	5	1
	3	5	4	4	4	4
	4	5	5	5	2	2
Dendrobium	1	10	10	9	8	0
	2	12	12	12	9	0
	3	10	10	9	6	6
	4	9	8	8	9	9

Based on the observations, there was a significant difference between the effectiveness of mycorrhiza and the incubation time. More effective results were obtained on the third day. The results are shown in Table 1 and Figure 2.

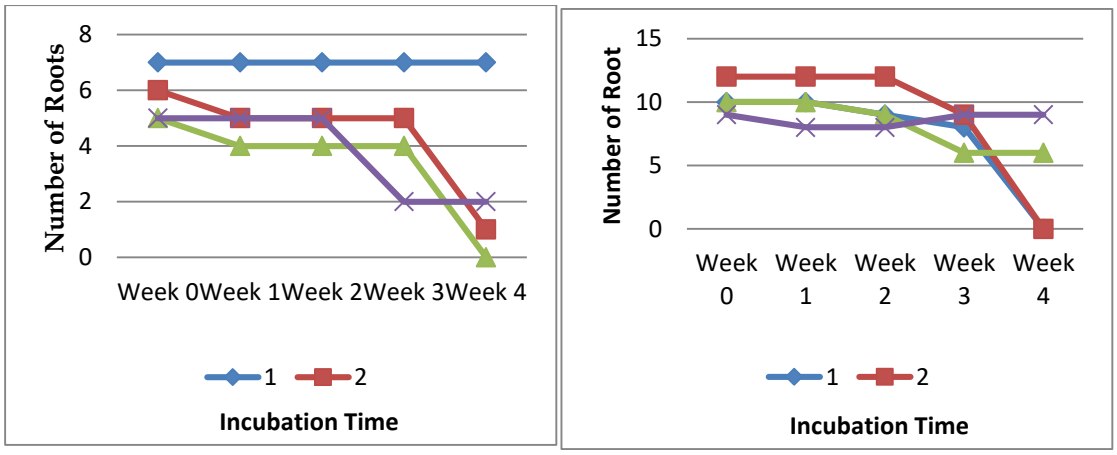

Figure 2. Mycorrhizal efficacy and its effect on the number roots

Based on the data above, there is no difference between *Phalaenopsis amabilis* and *Dendrobium discolor*. On the third day of incubation, both orchids showed their presence against

mycorrhiza. This may occur because mycorrhiza absorption has reached its maximum limit on the third day until it decreases by the 4th week.

After the mycorrhiza efficacy test was performed, observation was done from week 0 to week 5 with parameters namely, leaf length, leaf width, leaf number, root length, and root number shown in Figure 6-9. The results of the analysis using the ANOVA method are shown in Table 2-3.

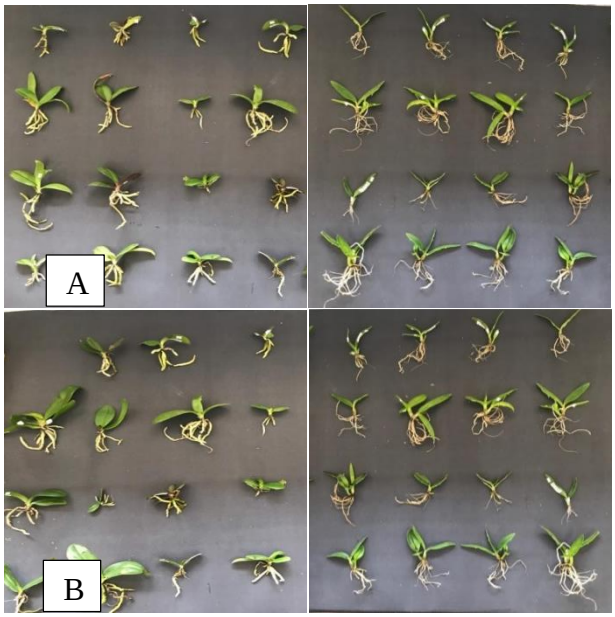

Figure 3. Development of small plants Phalaenopsis amabilis (left) and Dendrobium discolor (right) from mycorrhizal virus inoculation (MV) (A) week 0 (B) week 4.

Root Length

The initial stage of analyzing the root length observation data performed data homogeneity using the Levene test at 5%stage. The test results showed that the diversity of orchid samples were homogeneous. Further, the analysis was continued using ANOVA test, which showed that mycorrhiza (M), virus (V), and mycorrhizal virus (MV) inoculations on orchids gave significantly different results. The analysis was continued using the Tukey test at the 5% real level shown in Table 2. While the interaction between the two samples is seen on the interaction curve of Figure 6.

Based on the Tukey's test, there was a significant difference from the first factor that is shon in Figure 4. The second factors, mycorrhiza treatment, viruses, and mycorrhiza virus is not visible, this is because in the 0th week of mycorrhiza administration treatment is done after 0 week root length calculation and the result of mycorrhiza administration can be seen in week 1. While in the combination of first and second factor treatment (interaction) is also not visible.

At week 1, it can be seen that in the first factor, *Phalaenopsis amabilis* and *Dendrobium discolor* orchid types statistically did not show significant differences explained by Figure 4. In the second factor, treatment of mycorrhiza (M), virus (V), and MV mycorrhiza virus) have not been seen, this is because in the first week only mycorrhiza treatment is performed. Virus administration was performed after root length calculations for the first week and results were only seen in the 2nd week. Whereas in the combination of first and second factor treatment

(interaction) it was not visible, because at week 1 it was only visible for mycorrhiza treatment and could not be compared with other treatments.

Table 2. Tukey root length test in combination treatment of *Phalaenopsis amabilis* and *Dendrobium discolor* orchids by giving Mycorrhizae, Virus, and Mycorrhizae Virus at 0-5 weeks of age.

Sunday-	Factor B = Species	Factor A = Treatment			Marginal mean	K
		M	V	MV		
0	*Phalaenopsis*	3.45a ± 0.79	3.85a ± 0.58	2.76a ± 0.32	3.35a	3.66
	Dendrobium	3.61a ± 0.34	4.57a ± 0.38	4.80a ± 0.25	4.32b	4.64
	Marginal mean	3.53a	4.21a	3.78a		
	HSD Cell [0.05] = 2.17 ; Columns[0.05] = 1.23 ; Rows[0.05] = 0.83					
1	*Phalaenopsis*	3.37a ± 0.92	3.81a ± 0.28	2.42a ± 0.36	3.2a	3.65
	Dendrobium	3.51a ± 0.32	4.45a ± 0.15	4.59a ± 0.16	4.18a	4.66
	Marginal mean	3.44a	4.13a	3.50a		
	HSD Cell[0.05] = 2.02 ; Columns[0.05] = 1.14 ; Rows[0.05] = 0.77					
2	*Phalaenopsis*	2.88 ± 1.17	3.57 ± 0.47	2.43 ± 0.33	2.96a	3.45
	Dendrobium	3.41 ± 0.16	4.27 ± 0.25	4.63 ± 0.13	4.10a	4.01
	Marginal mean	3.14a	3.92a	3.53a		
	HSD Cell [0.05] = 2.47 ; Columns[0.05] = 1.4 ; Rows[0.05] = 0.94					
3	*Phalaenopsis*	2.74 ± 1.03	3.59 ± 0.53	2.19 ± 0.47	2.84a	3.16
	Dendrobium	2.87 ± 0.29	4.37 ± 0.27	4.63 ± 0.2	3.95a	3.63
	Marginal mean	2.80b	3.98a	3.41a		
	HSD Cell [0.05] = 2.44 ; Columns[0.05] = 1.39 ; Rows[0.05] = 0.93					
4	*Phalaenopsis*	2.74 ± 1.03	3.20 ± 0.54	2.18 ± 0.46	2.70a	3.20
	Dendrobium	2.39 ± 0.7	3.46 ± 0.1	4.27 ± 0.35	3.37a	2.82
	Marginal mean	2.56a	3.33a	3.22a		
	HSD Cell [0.05] = 2.72 ; Columns[0.05] = 1.54 ; Rows[0.05] = 1.04					
5	*Phalaenopsis*	2.70 ± 1.05	3.22 ± 0.53	2.21 ± 0.47	2.71a	3.21
	Dendrobium	2.03 ± 0.75	3.48 ± 0.1	4.28 ± 0.34	3.26a	2.83
	Marginal mean	2.36a	3.35a	3.24a		
	HSD Cell [0.05] = 2.78 ; Columns[0.05] = 1.58 ; Rows[0.05] = 1.06					

From week 2 to week 5, it can be seen that in the first factor, the orchid varieties *Phalaenopsis amabilis* and *Dendrobium discolor* statistically did not show significant differences explained by Figure 4.In the second factor, mycorrhiza (M) treatment, virus (V), and viral mycorrhiza (MV) did not show significant differences described in Figure 5. Whereas in the combination of the first and second factors the treatment (interaction) showed insignificant results, described in Figure 6.

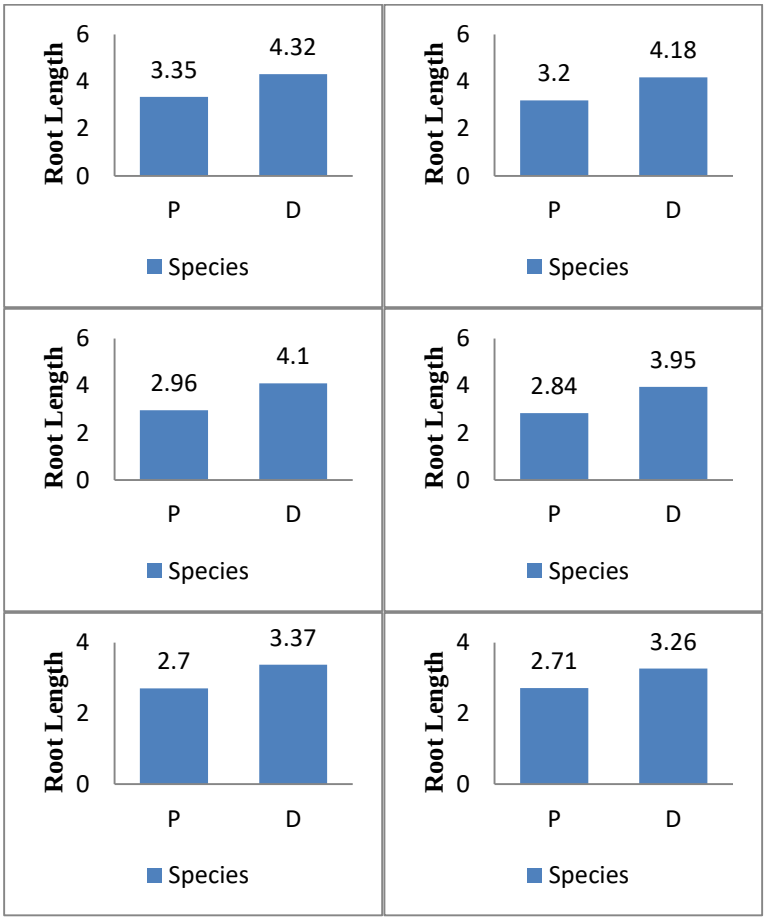

Figure 4. Comparative diagram of root length for Phalaenopsis amabilis and Dendrobium discolor

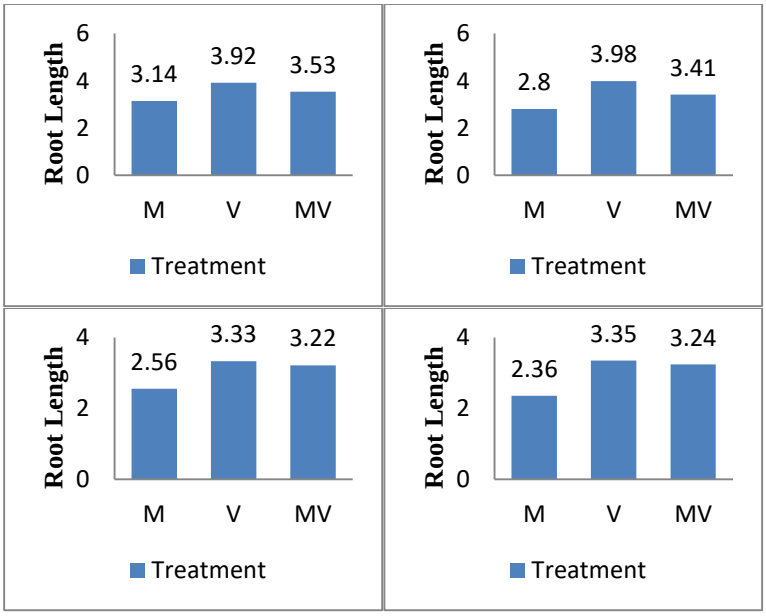

Figure 5. Comparative diagram of root length against the treatment of Phalaenopsis amabilis and Dendrobium discolor

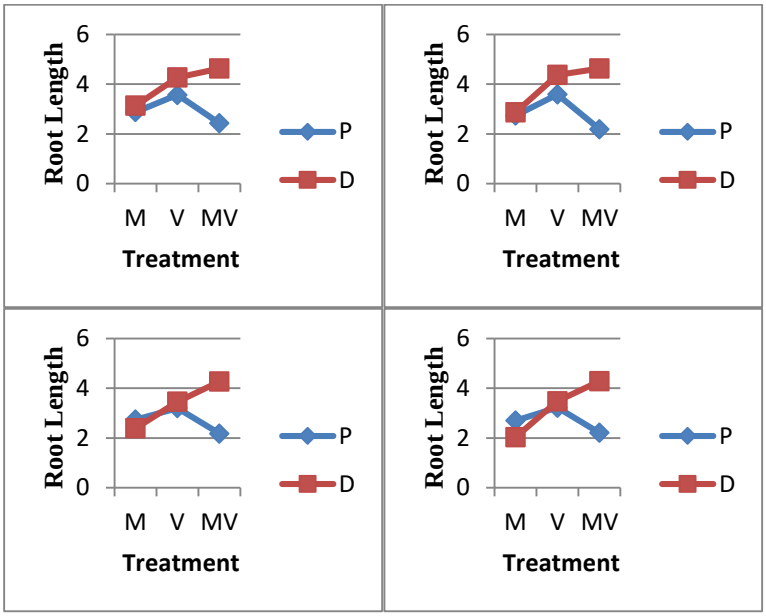

Figure 6. Interaction of Root Length with Mycorrhizae, Viruses, and Viral Mycorrhizae

Number of Roots

The initial stage of data analysis, observation of the number of roots, perform data homogeneity using Levene test at 5%stage. The test results showed that the diversity of samples on orchids was homogeneous. The analysis was continued using ANOVA test, which showed that mycorrhizal (M), virus (V), and mycorrizhal virus (MV) inoculations on orchids gave significantly different results. The analysis was continued using the Tukey test at the actual level of 5% as shown in Table 3. While the interaction between the two samples is seen on the interaction curve of Figure 9.

Based on the Tukey test at the actual level of 5% conducted (Table 3), it can be seen that on the first factor, *Phalaenopsis amabilis* and *Dendrobium discolor* orchids types statistically showed significant differences explained in Figure 7. factors, mycorrhiza treatment, virus, and mycorrhiza did not can be seen, this is because in week 0 mycorrhiza administration treatment is done after counting the number of roots in week 0 and the result of mycorrhiza administration can be seen in week 1. While in the combination of first and second factor treatment (interaction) is also not visible.

At week 1, it can be seen that in the first factor, Phalaenopsis amabilis and Dendrobium discolor orchid types statistically did not show significant differences explained by Figure 7. In the second factor, treatment of mycorrhizal (M), virus (V), and mycorrhizal virus (MV) has not been seen, this is because in the first week only mycorrhizal treatment is done. Virus administration was performed after the calculation of the number of roots in the 1st week and the results were only visible in the 2nd week. Whereas in the combination of first and second factor treatment (interaction) it was not visible, because at week 1 it was only visible for mycorrhizal treatment and could not be compared with other treatments.

From week 2 to week 5, it can be seen that on the first factor, the orchid types *Phalaenopsis amabilis* and *Dendrobium discolor* statistically did not show significant differences explained by Figure 7. In the second factor, mycorrhiza (M), virus (V) treatment, and viral mycorrhiza (MV) did not show the significant differences described in Figure 8. Although the treatment

combination of the first and second factors (interactions) showed insignificant results, it was explained in Figure 9.

Table 3. Total Root Tuky Test in combination treatment of Phalaenopsis amabilis and Dendrobium discolored orchids by administering Mycorrhiza Virus, Virus, Mycorrhizae at the age of 0-5 weeks

Sunday -	Factor B = Species	Factor A = Treatment			Marginal mean	K
		M	V	MV		
0	*Phalaenopsis*	5.25a ± 1.18	5.75a ± 0.75	5.75a ± 0.63	5.58a	5.25
	Dendrobium	6.5a ± 1.66	7.75a ± 0.48	8.75a ± 0.63	7.66a	8
	Marginal mean	5.87a	6.75a	7.25a		
	HSD Cell [0.05] = 4.4 ; Columns[0.05] = 2.5 ; Rows[0.05] = 1.68					
1	Anggrek *Phalaenopsis*	4.75a ± 1.31	6a ± 0.91	5.75a ± 0.48	5.5a	6.5
	Dendrobium	6.25a ± 1.55	7.75a ± 0.48	8a ± 0.41	7.33b	8.5
	Marginal mean	5.5a	6.87a	6.87a		
	HSD Cell[0.05] = 4.35 ; Columns[0.05] = 2.47 ; Rows[0.05] = 1.66					
2	*Phalaenopsis*	4.75a ± 1.31	6.5a ± 0.65	6a ± 0.71	5.75a	6.5
	Dendrobium	7a ± 1.87	8.25a ± 0.63	8.25a ± 0.75	7.83b	8
	Marginal mean	5.87a	7.37a	7.12a		
	HSD Cell [0.05] = 4.9 ; Columns[0.05] = 2.78 ; Rows[0.05] = 1.87					
3	*Phalaenopsis*	5a ± 1.47	6.5a ± 0.65	6a ± 0.71	5.83a	7.5
	Dendrobium	7.75a ± 1.65	8.25a ± 0.63	8.25a ± 0.85	8.08b	8.25
	Marginal mean	6.37a	7.37a	7.12a		
	HSD Cell [0.05] = 4.85 ; Columns[0.05] = 2.75 ; Rows[0.05] = 1.85					
4	*Phalaenopsis*	5a ± 1.47	6.5a ± 0.65	6a ± 0.71	5.83a	7
	Dendrobium	6.75a ± 2.02	7,25a ± 0.48	7.5a ± 0.65	7.16a	6.5
	Marginal mean	5.87a	6.87a	6.75a		
	HSD Cell [0.05] = 5.14 ; Columns[0.05] = 2.91 ; Rows[0.05] = 1.96					
5	*Phalaenopsis*	5.25a ± 1.38	6.5a ± 0.65	6a ± 0.71	5.91a	7
	Dendrobium	7a ± 1.78	7.25a ± 0.48	7.5a ± 0.65	7.25a	6
	Marginal mean	6.12a	6.87a	6.75a		
	HSD Cell [0.05] = 4.74 ; Columns[0.05] = 2.69 ; Rows[0.05] = 1.8					

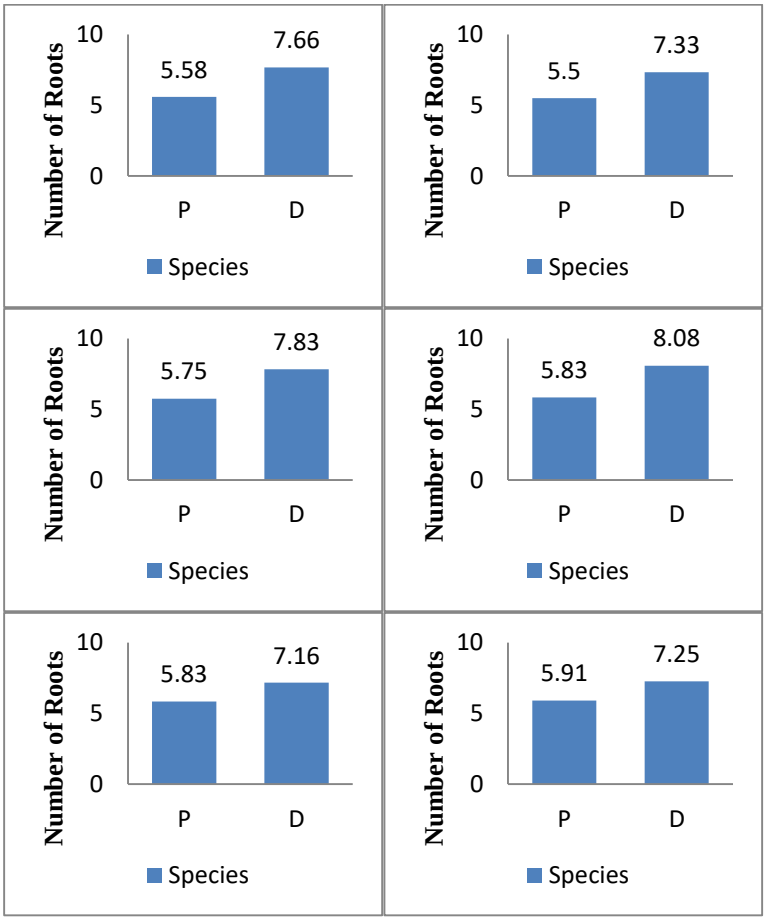

Figure 7. Comparative diagram of the number of roots of Phalaenopsis amabilis and Dendrobium discolor orchids.

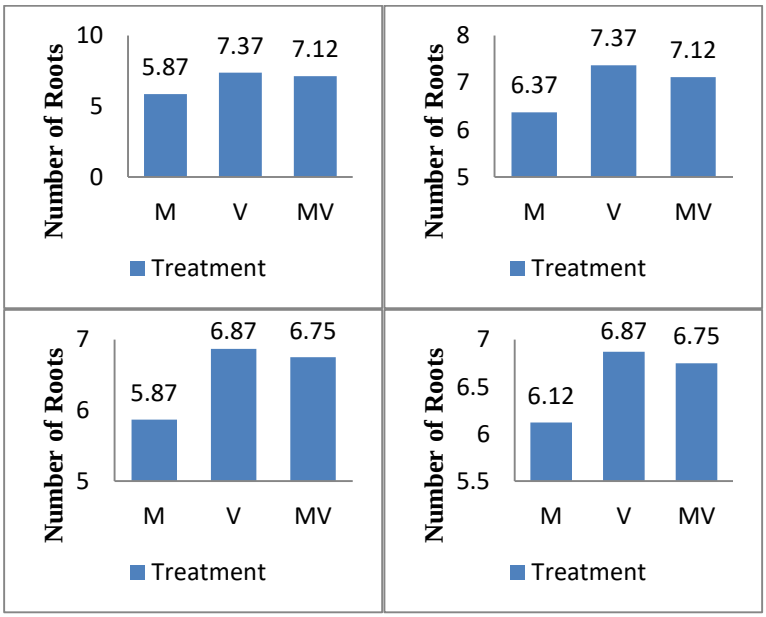

Figure 8. Comparative diagram of the number of treatment roots of Phalaenopsis amabilis and Dendrobium discolor orchids

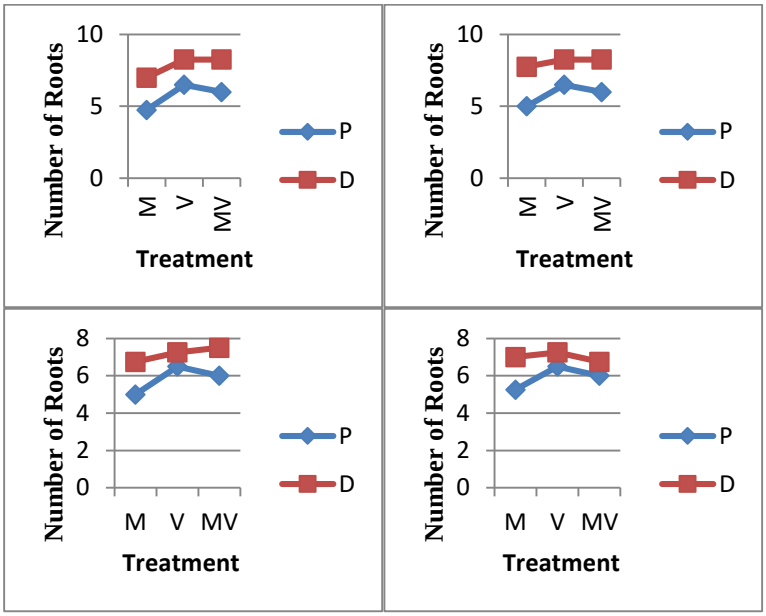

Figure 9. Graph of Number of Root Interactions Against Mycorrhizae Viruses, Viruses, and Mycorrhizae

Discussion

The research was conducted with observation for 4 weeks. The parameters observed were mycorrizhal efficacy test, leaf length, leaf width, number of leaves, root length, and number of roots on *Phalaenopsis amabilis* and *Dendrobium discolor* orchids. *Phalaenopsis* and *Dendrobium* orchids have been inoculated with *Ceratorhiza* and viruses. Khaterine (2016) explained that live orchids are associated with endophytic fungi. Mycorrhiza treatment can help improve the soil structure around the plant and can increase the length, width, and number of leaves as well as increase the length and number of roots. Meanwhile, viral treatment was used to see the resistance of mycorrhizas inoculated in orchids. In previous research by Lakani (2015), it is explained that the resistance of orchid plants can be seen on inoculated and uninoculated leaves.

Effectiveness of Mycorrhizae

Ceratorhiza efficacy test results on Phalaenopsis and Dendrobium were performed by observing growth and survival skills. Based on observations it is known that *Ceratorhiza* inoculation is most effective on the 3rd day. At the 3rd and 4th week observations the efficacy of *Ceratorhiza* showed mortality. Until the entire data was used only up to the second week of observation. This was done to avoid biased data if the entire observational data was applied up to the 4th week. Observations made from week 0 to week 2 could answer questions about the effectiveness of *Ceratorhiza* inoculation. This is supported by previous research by Mahfut (2020) who explained that mycorrhiza of *Trichoderma* and *Ceratorhiza* types showed that the best inoculation time was found on the 3rd and 4th day of inoculation.

The effectiveness of *Ceratoriza* can also be seen in the increase in the number of roots and leaves. *Ceratorhiza* treatment can increase the absorption of nutrients to enhance plant growth. Mahfut (2019) explained that induction of mycorrhiza types Ceratorhiza and *Trichoderma* can be used as *biofertilizers*. *Ceratorhiza* treatment on the 3rd and 4th day had more effect on the increased root volume. This is supported by a previous study by Mahfut (2019) who explained that *Ceratorhiza* has an influence on the number of dead roots compared to *Trichoderma* inoculation.

Ceratorhiza mycorrhizae can assist orchids in their growth and life cycle. Mahfut (2019) explains that *Ceratorhiza* mycorrhizae can infect the roots of orchid plants and produce intensive hyphae and can increase plant capacity. At week 3 and week 4 mycorrhiza inoculation the number of roots decreased, this may be due to environmental factors. According to a previous study by Kurnia (2019) regarding mycorrhiza characteristics, it was said that soil type is a factor that affects the types of mycorrhizae. Other factors that can affect plant growth are temperature, light, water, nutrients, and soil.

Root Length

Based on the data obtained from the analysis results of week 0 to week 5 on the root length variable, there was no significant difference. From week 1 to week 5, the number of leaves has decreased. This is due to treatment of mycorrhiza (M), virus (V), and mycorrhiza virus (MV), giving the virus causing damage to the leaves. If with *Phalaenopsis* control (3.38) (K); (2.96) (P) and *Dendrobium* (3.76) (K); (3.86) (P) on treatment showed higher outcomes than control. However, if viewed based on the type between the two orchids, Dendrobium better maintain the long growth of its roots compared to *Phalaenopsis*.

Mycorrhiza inoculated at the roots play a role in the growth and development of orchids for survival. Decreased root length growth can be caused by poor physiological processes. This is reinforced by the study of Lakit (2000) who explained that plant growth is a network of plant physiological processes in forming complex organ units with the addition of plant weight and size.

Mycorrhiza inoculated at the roots play a role in the growth and development of orchids for survival. Decreased root length growth can be caused by poor physiological processes. This is reinforced by the study of Lakitan (2000) who explained that plant growth is a network of plant physiological processes in forming complex organ units with the addition of plant weight and size.

Number of Roots

Based on the data obtained from the results of the analysis of week 0 to week 5 on the number of variable causes there was no significant difference. From week 1 to week 5, the number of leaf decreased. If with *Phalaenopsis* control 6.62 (K); 5.73 (P) and *Dendrobium* 7.54 (K); 7.55 (P) is similar to the root length variable indicating that *Phalaenopsis* treatment showed lower results compared to controls. Whereas in *Dendrobium*, when compared with control, the treatment showed higher results. This is due to treatment of mycorrhiza (M), virus (V), and mycorrhiza virus (MV), giving the virus causing leaf damages. However, if viewed based on the type between the two orchids, Dendrobium better maintains the long growth of its roots compared to Phalaenopsis.

Rianti (2017) explained that the number of plant roots indicates how wide the plant's reach is to absorb nutrients and nutrients in mycorrhiza (M) treatment, indicating that the ability of orchids to form roots is because they already have leaflets. This is supported by Bey et al., (2006), who explained that radicles will turn into roots with the help of auxin processed by leaves.

CONCLUSION

Cerathoriza induction can increase the effectiveness of *Phalaenopsis amabilis* and *Dendrobium discolor* with 3 days of incubation. Root viability drops in *Phalaenopsis amabilis* with the root

length of 2.96 cm and root amount of 5.73, while rises in *Dendrobium discolor* with the root length of 3.86 cm and root amount of 7.55.

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