ISSN 2808-3229
Journal of Biodiversity and Biotechnology. 1(2), 50–54,
2021 URL: https://jurnal.uns.ac.id/jbb/article/view/56352
doi: http://dx.doi.org/10.20961/jbb.v1i2.56352

The Effect of *Rhizoctonia* Mycorrhizae Application on *Dendrobium nandia anindhita* Seedling

Soelistijono, R.[1]*, Aprilliyan K., [2], Daryanti[1]

[1)]Faculty of Agricultural, Tunas Pembangunan University. Jl. Balekambang Number 1, Manahan, Surakarta (57139). Telp. +62-081-328-334-903,
[2)] Graduates School of the Faculty of Agriculture, Tunas Pembangunan University

**Corresponding author: sulistyo.utp@gmail.com*

Abstract

Dendrobium nandia anindhita orchid is a favored hybrid of orchid because it flowers easyly and has high variety of flower colors. The aim of this study was to determine the effect of the application of *Rhizoctonia* mycorrhizaee on seedling *Dendrobium* hybrid orchids. It is expected that the seedling will have the characteristics of the *Dendrobium* orchid species. The research was carried out in a green house and laboratory of the Faculty of Agriculture, Tunas Pembangunan University. The design used was a completely randomized design with one variable and 25 seedling samples each. The results showed: (1) Microscopically, *Rhizoctonia* mycorrhizaee had the following characteristics: Fungal hyphae growing on PDA media were white, branches of *Rhizoctonia* mycorrhizaee hyphae formed elbows and had septa; (2) The application treatment of *Rhizoctonia* mycorrhizaee (M) had a significant effect on the parameters of plant height, number of leaves, number of roots, root length and plant fresh weight, treatment (M) had no significant effect on parameters of leaf length; (3) Morphological observations showed that the orchid plants that were applied to *Rhizcotonia* mycorrhizae had greener leaf colors, more leaves, and longer roots than those without *Rhizcotonia* mycorrhizae.

Keywords: *Dendrobium nandia anindhita seedling; Rhizoctonia* mycorrhizae; peloton;

Cite this as: SoelistijonoR., Aprilliyan K., Daryanti. (2021). The Effect of Rhizoctonia Mycorrhizae Application on *Dendrobium nandia anindhita* Seedling. Journal of Biodiversity and Biotechnology. 1(2), 50–54. doi: http://dx.doi.org/10.20961/jbb.v1i2.56352.

Introduction

Orchid (*Orchidaceae*) is an ornamental plant hich is in great demand by the community. The *Dendrobium nandia anindhita* orchid (Figure 1) is an epiphytic *Dendrobium* hybrid with a strong pseudobulb, up to 2 m long and up to 5 m in its natural environment, its leaves are distic (*distichous*), lanceolate, with a width of up to 12 cm and a length of up to 20 cm long, has a skin-like texture (*coriaceous*). It has racemose flowers of 30 - 55 cm long, with 4.5 cm to 5.5 cm in diameter, oval sepals, pale-yellow petals on the white labellum and shades of yellow. *Dendrobium* hybrid growth is slow, so special care is needed to stimulate the growth of the orchid. The utilization of appropriate planting media and biological fertilizers in the form of soil microbes such as *Rhizoctonia* mycorrhizae are efforts that can be done to stimulate the growth and flowering of orchids (1).

Source: www.orchidroots.com

Figure 1. Dendrobium nandia anindhita flower

The working principle of *Rhizoctonia* mycorrhizae is to infect the root system of the

host plant and produce hyphae intensively and hence, increase the capacity for nutrient absorption. *Rhizoctonia* mycorrhizae itself can produce hormones such as auxins, cytokinins, gibberellins, and growth regulators such as vitamins to their host plants so that they can spur faster and maximize plant growth. *Rhizoctonia* mycorrhizae requires roots to complete its life cycle (2). In plants other than orchids, *Rhizoctonia* spp. will become a phatogen, but when *Rhizoctonia* spp is associated with orchid roots it will form a mutually beneficial symbiosis (3). *Rhizoctonia* mycorrhizae is capable of symbiosis with orchid root tissue and forms hyphae that attach to the root cortex tissue. The association of *Rhizoctonia* mycorrhizae with orchid plants occurs when the embryo forms roots and shoots known as the protocorm (4). After the protocorm develops into a perfect plant known as a plantlet, the hyphae network of *Rhizoctonia* mycorrhizae will be in the cortex of the orchid root to form a peloton (5). Peloton plays a role in providing nutrients that are needed by orchids during the seedling period. This study aims to determine the effect of *Rhizoctonia* mycorrhiza on orchid *Dendrobium nandia anindhita* seedling growth.

Material and Methods

This research was carried out at the Greenhouse of the Faculty of Agriculture, Universitas Tunas Pembangunan Surakarta with an altitude of 105 meters above the sea level starting from July 2020 to March 2021. The materials used in this study were: *Dendrobium* hybrid seedling (*Dendrobium nandia anindhita*), *Rhizoctonia* mycorrhizae, mos (dry moss) growing media and liquid PD media. The the seedlings are allowed to grow for 6 months, then transferred to pots. Then each pot was sprayed with liquid PD media that had been given *Rhizoctonia* mycorrhizae inoculum. This research was carried out using the CRD (Completely Randomized Design) with one treatment factor, namely the application of *Rhizoctonia* mycorrhizae (M1) and without the application of *Rhizoctonia* mycorrhizae (M0). Observational data from each parameter in each observation were analyzed with 5% and 1% ANOVA (Analisyts of Varians). If there are significantly different or very significantly different values, then proceed with DMRT (Duncan's Multiple Range Test) with a level of 5% to find out any differences between treatments.

Results and Discussion

Observations showed that the hyphae that developed from *Rhizoctonia* mycorrhizae isolates were white (Figure 2 A). The results of these observations are in accordance with the research of (6); whom found that of 670 isolates of *Rhizoctonia* spp., 168 were light brown to brown and 502 were white. Meanwhile, according to the results of research by (7), seven isolates of *Rhizoctonia* mycorrhizae isolated from the orchid species *Sphatoglottis plicata* from various places in Thailand showed white colonies, this was also strengthened by the opinion of (8) who stated that the colonies of *Rhizoctonia* mycorrhizae were different depending on each group (isolates grouping).

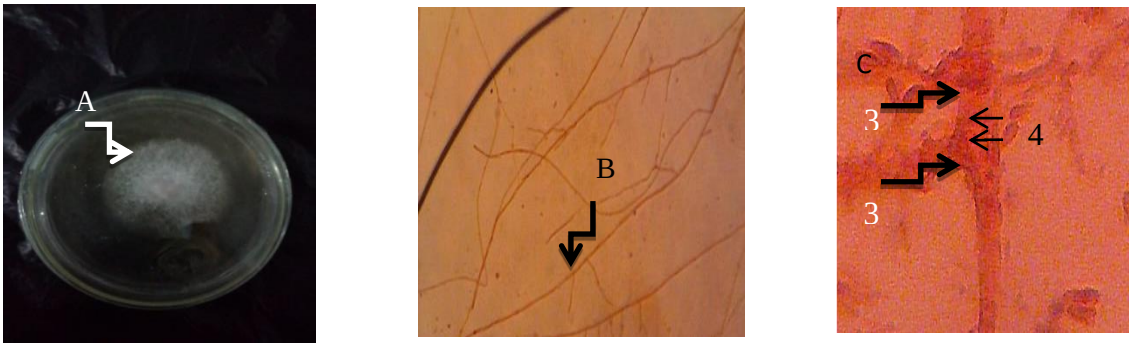

Figure 2. (A) *Rhizoctonia* mycorrhizael colonies, (B) Branching hyphae, (C) Septa and cell nucleus. Description: (1) *Rhizoctonia* mycorrhizael hyphae (2) Branching hyphae (3) Septa/hyphae partition (4) Cell nucleus/binucleate.

Microscopic observations showed that the isolates had hyphae that had septa between the hyphae which were brownish in color and formed right angles at the branches (Figure 2B). This is in accordance with the opinion of (9) who stated that hyphal branching in

Rhizoctonia mycorrhizae forms angled angles and the hyphae pigment is brownish. In addition to the presence of elbow branching in fungal hyphae and brownish hyphae, there are also other characteristics, namely two cell nuclei in each septum. This is in accordance with the opinion (7) who stated that most of the isolates of *Rhizoctonia* mycorrhizae sp. isolated from orchid roots only had two nuclei in each hyphal septum (Fig. 6 C), and only the binucleate group functioned as mycorrhizal, while most of the multinucleate were pathogenic (2).

Table 1. Summary results of the effect of the application of Rhizoctonia mycorrhizae and the watering interval on the seedling growth of Dendrobium violaceoflavens Hybrid orchids

No	Parameter	Michorhizae aplication (M)	Mark	
			Highest	Lowest
1	Plant height (cm)	*	6,94 (M1)	5,02 (M0)
2	Leaf lenght (cm)	ns	3,68 (M1)	3,32 (M0)
3	Number of leaves (sheet)	**	4,60 (M1)	2,20 (M0)
4	Number of roots (fruits)	*	9,40 (M1)	5,40 (M0)
5	Roots lenght (cm)	*	5,04 (M1)	3,58 (M0)
6	Plant fresh weight (g)	*	4,92 (M1)	2,72 (M0)

Description:
ns : No significant
* : Significnt
** : Very significant

The treatment had a significant effect on the parameters of plant height, root number, root length and plant fresh weight and on the number of leaves parameters showed results that had a very significant effect, but did not significantly affect leaf length parameters. The plant height parameter showed that the application of M1 with the highest value of 6.77 cm and M0 with the lowest value of 5.91 cm was significantly different in the plant height parameter. This is in accordance with the opinion of (10) suggesting that *Rhizoctonia* mycorrhizae is capable of symbiosis with orchid roots and plays a role in providing nutrients that are needed by these orchids in the seedling process. This is reinforced by data on plant height which increases every week 1 to week 8 observations (Figure 3).

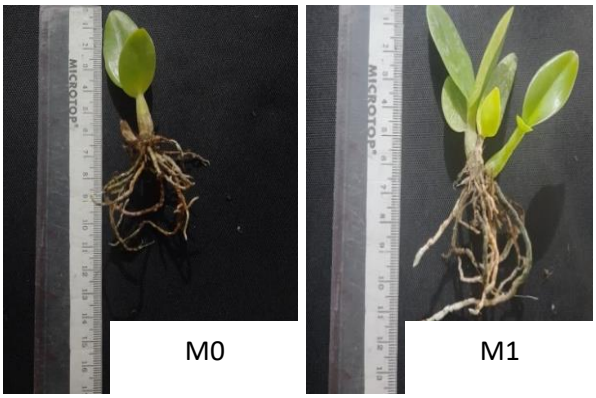

Figure 3. The relationship between the height of the orchid *Dendrobium nandia anindhita* without the application of *Rhizoctonia* mycorrhizae (M0) and with the application of *Rhizoctonia* mycorrhizae (M1)

Figure 3 above shows the results of plant height growth starting from week one to week eight. In the M1 treatment plant growth was better than the M0 treatment where the difference started to occur at the fourth to eighth week of observation.

Based on the results of the DMRT 5% test in table 1, it shows that the parameter of the number of leaves in the M0 treatment with

the lowest value of 2.70 which was significantly different from the M1 treatment with the highest value of 4.20. This is in accordance with the opinion of (11) in the effect of providing nutrients on the growth of orchid plants. And this shows the ability of *Rhizoctonia* mycorrhizae to provide organic material in the process of plant photosynthesis. (12) suggests that the provision of nutrients can increase plant growth in an amount that is in accordance with plant needs. Adequate nutritional needs of orchid plants will increase the growth of the number of leaves. Observation of plant morphology with treatment without application (M0) and with application of *Rhizoctonia* mycorrhizae (M1) (Figure 4).

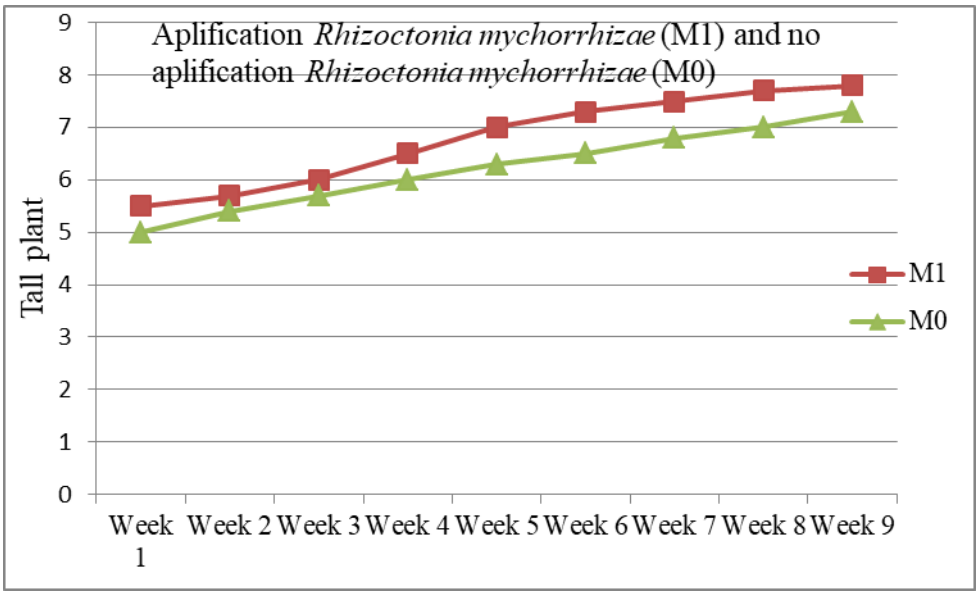

Figure 4. Comparison of morphological appearance of Dendrobium nandia anindhita seedling without Rhizoctonia mycorrhizael application and Rhizoctonia mycorrhizae application.

From the morphological observations, it appears that in the M1 treatment was differed in leaf color and number of leaves. Orchid plants treated with M1 had greener leaves, more leaves, and longer roots than those with M0 treatment. To determine the association between *Rhizoctonia* mycorrhizae and *Dendrobium nandia anindhita*, the peloton structure was observed in the roots (Figure 5).

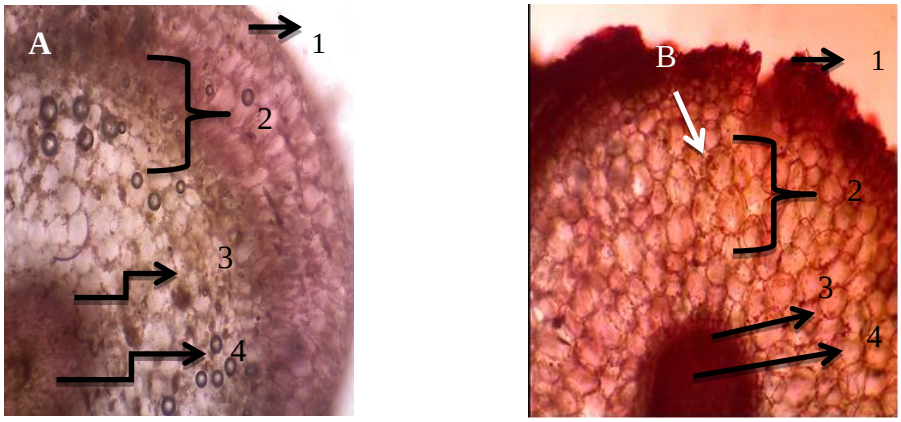

Figure 5. (A): Cross section of roots without peloton in M0 treatment with 10X magnification. (B): Root cross section in M1 treatment with 10X magnification Description:(1) Root epidermis tissue (2) Root cortex (3) Central cylinder (4) Root endodermis peloton.

Rhizoctonia mycorrhiza hyphae on orchid roots have the ability to penetrate into the root cortex tissue and form a dense coiled clump called peloton (10). The peloton structure is formed due to the presence of *Rhizoctonia* mycorrhizae which is able to enter the root tissue and form coils, this structure is a characteristic of the orchid *Rhizoctonia*

mycorrhizael fungus (5). *Rhizoctonia* mycorrhizae can increase the absorption of water, nutrients and can protect plants from pathogenic fungi and bacteria on the roots.

Conclusion

From the results of the research that has been carried out, it can be concluded as follows:

The application treatment of *Rhizoctonia* mycorrhizae (M) had a significant effect on the parameters of plant height, number of leaves, number of roots, root length and plant fresh weight, but there was no significant effect on leaf length parameters. Morphological observations showed that the orchid plants that were subjected to *Rhizcotonia* mycorrhizae application had greener leaf colors, more number of leaves, and longer roots than those without Rhizcotonia mycorrhizae.

References

1. Suradinata, Y.R., A. Nuraini. dan A. Setiadi. Pengaruh kombinasi media tanam dan konsentrasi pupuk daun terhadap pertumbuhan tanaman anggrek Dendrobium sp. pada tahap aklimatisasi. J Agrivigor. 2012; 11(2):104-116.
2. Sneh B, Burpee L & Ogoshi A. *Identification of Rhizoctonia* sp. APSPress. St. Paul. Minnesota;1991.
3. Chou, L. C. & Chang, D. C. N. Growth Responses, Enzyme Activities, and Component Changes as Influenced by *Rhizoctonia* Orchid Mycorrhizae on *Anoectochilus formosanus* Hayata, Botanical Studies. 2007; 48: 445-451.
4. Haryuni, H., & Dewi, T. S. K. The effects of dose *Rhizoctonia* binucleat (BNR) and phosphorus to nitrate reductase activity (NRA) and chlorophyll of vanilla seedling (Vanilla planifolia andrews). Biosaintifika: Journal of Biology & Biology Education. 2016; 8(2): 141-147.
5. Smith, S.E. dan Read, D.J. *Mycorrhizael Symbiosis*,3rd Edition. Academic Press. New York; 2008. p. 805.
6. Hyakumachi, M., Priyatmojo A., Kubota M., and Fukui, H. New Anastomosis Group,AG-T and AG-U,of Binucleate *Rhizoctonia* spp.Causing Root and Stem Rot of Cut-Flower and Miniatur Roses. Phytopatology. 2005; 95:784-792.
7. Athipunyakom, P. and Manoch, L. Isolation and identification of mycorrhizael fungi form eleven terrestrial orchids [Internet]. 2008. Available from: https://www.thaiscience.info/Article%20for%20ThaiScience/Article/5/10002942.pdf.
8. Soelistijono, Achmadi Priyatmojo, Endang Semiarti dan Christanti Sumardiyono. Characterization of pathogenic *Rhizoctonia* sp.and mycorrhizal *Rhizoctonia* Isolates on Terrestrial orchid plant Spathoglottis plicata. Biota. 2011; 16 (2): 372.
9. Agrios, G.N. *Plant Pathology* 4th ed. Academic Press. New York. 2005. p. 922.
10. Senthilkumar S., et al.. Morfological and structural feature of mycorrizal roots of *Spathoglottis plicata* and *Dendrobium* species. PHYTA. 2001; (5).
11. Yusuf Yusnaeni dan Ari Indrianto. Pengaruh Medium Pupuk Organik Cair (POC) Terhadap Karakter Morfologi Dan Jumlah Tunas Protokorm Anggrek Vanda Limbata Blume X Vanda Tricolor Lindl. J Bionature. 2014; (17)1: 14-23.
12. Lawalata, J. Pemberian Kombinasi ZPT terhadap Regenerasi Gloxinia Secara *In vitro*. J ExpLifeSci. 2011; 1(2).