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THE EFFECTIVENESS OF MONOSODIUM GLUTAMATE AND TYPES OF PLANTING MEDIA ON THE GROWTH OF ORCHID PLANT (*Dendrobium* sp) IN ACCLIMATIZATION PHASE

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ABSTRACT

The need for orchids in Indonesia is still great, including *Dendrobium sp* orchid that has become popular. However, constraint in the propagation of orchids is that its very slow growth at the acclimatization stage so that an alternative whose ingredients are easily obtained at an affordable price is needed to stimulate vegetative growth of orchid planlets. One effort to stimulate orchid growth is to use a combination of planting media such as fern, husk charcoal, wood shavings, and the use of Monosodium Glutamate (MSG) as a fertilizer supplement in the growth of orchid plantlets at the acclimatization phase. This study aims to determine the effect of the type of planting media and the application of Monosodium Glutamate (MSG) and its interaction on the growth of *Dendribium sp* at the acclimatization phase. The method used was a 2-factor randomized block design (RAK). The first factor was the type of planting media, namely ferns, husk charcoal, wood shavings, ferns + husk charcoal, ferns + wood shavings, ferns + husk charcoal + wood shavings. The second factor was dose of Monosodium glutamate, which was without MSG, 2.5 grams/liter of water and 5.0 grams/liter of water. The results showed that the dose of Monosodium glutamate did not give a significant response to the growth of orchids plantlet, while the combination of fern + charcoal growing media could increase the vegetative growth of *Dendrobium sp* at the acclimatization phase.

Keywords: *Monosodium Glutamat, Planting Medium, Acclimatization, Dendrobium Orchid*

INTRODUCTION

Indonesia has extraordinary biodiversity. Orchids is one type estimated to be around more than 600 genera, and 25,000 orchid species spread across the Indonesian territory, namely Kalimantan (1,400 species), Sumatra (1,126 species), Java (769 species), Sulawesi (500 species), Maluku (369 species), and Nusa Tenggara (200 species) (Clintonboni, 2012). From the past until now, foreigners have been targeting the genetic resources of Indonesian orchids for various purposes such as religious ceremonies, ornaments, room decorations, and artistic plants during the current pandemic. It is, therefore, necessary to develop orchid plants including *Dendrobium sp* which is very popular.

The Central Bureau of Statistics (2019) noted that the domestic market demand for orchids was also still high at 18,608,657 stalks and in South Sulawesi

with 30,575 stalks. Orchid *Dendrobium sp* is one of the three largest genera in the *Orchidaceae* spreading in various habitats (Qiu et al., 2015). Taxonomy of *Dendrobium sp* orchids according to Dyah (2015) is Kingdom: Plantae, Division: Spermathophyta, Subdivision: Angiospermae, Class: Lilioside, Order: Orchidales, Family: Orchiddaceae, Genus: Dendrobium, Species: Dendrobium sp. There are several contributing factors to the decreased production of orchids. One of the factors is seed factor obtained from the separation of young plants from mother plant (Keiki) so that the quality, quantity and continuity of production are not guaranteed. One of the efforts in obtaining seeds and multiplying orchid seeds is developed using tissue culture techniques (In vitro). Tissue culture is a plant propagation technique by isolating parts of plants, then placing them on media containing elements such as minerals, sugars, vitamins and growth regulators (Heriansyah, 2020).

Heriansyah (2019) reports that the success of an in vitro study depends on proper nutrition, growth regulators, sterile tissue culture room from bacteria and fungi, and availability of aseptic in the tissue culture to avoid contamination that can reduce the productivity of the tissue culture. In the acclimatization stage, the transfer of seeds from an aseptic environment in bottles to a non-aseptic environment has a potential problem because plantlets or seeds that are kept in sterile conditions with optimal environment (temperature and humidity) are very vulnerable to the external environment. This is a critical stage for plantlets where the plantlets will experience physiological changes due to new environmental factors. According to Romodhon (2017), plantlets produced during in vitro culture can have an abnormality in terms of morphology, anatomy, and physiology.

One essential environmental factor to be considered at the stage of plantlet acclimatization and orchid seedling enlargement is the planting medium. Growing media for seed is a new environment in the acclimatization process. A good growing medium for orchids must meet the requirements, including not rapidly decaying and decomposing, not being a source of disease for plants, having good aeration and drainage smoothly, being able to bind water and mineral nutrients optimally, and being able to maintain humidity around the root. Planting media is important as it supports plants, retains moisture, provides nutrients, and aeration of roots (Kaveriamma, 2019).

Selection of the appropriate planting media for orchids is needed to produce good growth and optimal flowering. Fern is one of the best media for *Dendrobium sp*. Using high porosity media supports root growth, but it is at risk of experiencing water shortages more quickly. Growing media commonly used for orchid plants vary, including charcoal, ferns, broken bricks, tiles, coconut fiber, and moss (Royani and Prihastanti, 2015). The use of the media depends on the environmental conditions where the orchid is cultivated. On the other hand, using media with low porosity can inhibit root growth even though the water holding capacity may be better than light media (Ari et al., 2016).

The provision of nutrients in orchid plants is generally given through the leaves. Leaf fertilizers are nutrient elements given through the leaves by spraying or watering the leaves so that they can be absorbed directly to meet the needs for growth and development (Sutedjo, 2010). In the vegetative growth phase, tissue-cultured orchids need nutrients that are rich in nitrogen and low in phosphate (P) and potassium (K) so that these orchid plants need supplements and fertilizers to support their growth (Kabir et al, 2012). One of the nitrogen-rich supplements as an

alternative to fertilizer that can be given to support orchid growth is Monosodium Glutamate (MSG). MSG can stimulate the growth and production of mustard or Pak Coy plants (Novi, 2016) and peanuts (Gresinta, 2015). Monosodium glutamate (COOH-CH2NH2-(CH2)-COONaH2O) which is often called vetsin is the sodium salt of glutamic acid. Glutamic acid is an amino acid that is one of the important components needed by the body. MSG is made through a fermentation process from molasses by bacteria (Brevibacterium Lactofermentum). In this fermentation process, glutamic acid will first be produced. Glutamic acid formed from this fermentation process is then added with soda (Sodium Carbonate) so that Monosodium Glutamate (MSG) will be formed. MSG is an alternative fertilizer supplement that is easily obtained and the price is affordable.

This study was conducted to determine the effect of the type of planting medium and the application of MSG and its interaction on the growth of Dendrobium sp orchids at the acclimatization phase.

MATERIALS AND METHODS

This research was conducted at the Laboratory and Green House of Agriculture and Fisheries Office of Makassar City from December 2020 to February 2021. The materials used in this study were *Dendrobum sp* orchid plantlets aged 4 months from in vitro culture, newsprint, ferns, husk charcoal, shavings wood, brick, steroform, MSG and dithane. While the tools used were writing utensils, tweezers, hand sprayer, clay pot (top diameter 10 cm, bottom 8 cm, and height 8 cm), basin, brush, tape measure, / ruler, clear insulation, scalpel, hook wire, electric scales and labels. The method used was a randomized block design (RAK) with 2 factors so that 18 treatment combinations were obtained, namely Fern + No MSG; Fern+MSG 2.5 g/liter of water; Fern+ MSG 5.0 g/liter of water; Husk charcoal+ MSG 2.5 g/liter of water; Husk charcoal+MSG 2.5 g/liter of water; Husk charcoal+MSG+ 5.0 g/liter water; Wood shavings+No MSG; Wood shavings+MSG 2.5 g/lt water; Wood shavings+MSG 5.0 g/lt water; Fern+Husk Charcoal+No MSG; Fern+Husk Charcoal+MSG 2.5 g/liter of water; Fern+Husk Charcoal+MSG 5.0 g/liter of water; Fern+Wood shavings+No MSG; Fern+Wood shavings+MSG 2.5 g/liter of water; Fern+Shavings+MSG 5.0 g/liter of water; Fern+Husk charcoal+Wood shavings+No MSG; Fern+Husk Charcoal+Wood shavings+MSG 2.5 g/liter of water; Fern+Husk Charcoal+Wood shavings+MSG 5.0 g/liter of water. Each treatment combination was repeated 3 times so that there were 54 experimental units and each treatment had 5 plants in each pot, so there were 270 plants.

The stages of implementing the research are as follows:

Soaking the planting media, namely ferns, husk charcoal and wood shavings in a solution of Fungisida Dithane 45. The solution is then poured in each of the pots provided with a size of 2 cm from the mouth of the pot for each treatment. The next stage is setting up a place (in this case is a green house) that has a sunlight intensity of 35-45%, a night temperature of 18-240C, an altitude of ± 2 meters above sea level, humidity is 60-85% and having good aeration/air circulation. The acclimatization process was conducted by removing the seeds/plantlets from tissue culture from the bottle at a temperature of 27-290C. When removing the seeds from the bottle, the base of the stem (Pseudo buld) which was previously filled with water makes it easier to remove the seeds. After the bottle is filled with water, the seedlings are removed from the bottle by using a wire or the like to pull the roots in the bottle.

Washing and draining the seeds are conducted so that fungi and bacteria that can harm the seeds do not grow. When washing process, it suggested not to try to hurt any part of the plant because it can cause infection. The washed seeds were then dipped in a 0.1% fungicide solution and grouped according to size and size on hygroscopic newsprint and previously measured plant height, number of leaves, and root length.

Plantlets were carefully planted without causing injury to the roots and stems and got labeled. Each pot consisting of 5 plants was then placed in a greenhouse/acclimatization

room.

Maintenance is carried out by watering using a propeller/sprinkler in the greenhouse in the morning and evening. Application of giving MSG is once a week according to a certain dose with a volume of 30 ml per pot.

RESULT AND DISCUSION

Percentage of success of acclimatization (%)

Based on the results of the 0.05 BNJ test, it showed that the treatment of fern + husk charcoal (M4) planting media gave the best effect on acclimatization success (93%), whereas the lowest percentage of success was single husk charcoal media (M2) (69%).

Table 1. Average percentage (%) of orchid plantlet acclimatization success.

Type of Planting Medium	Doses of Monosodium Glutamat (gram/liter of water)			**Average**
	(Control)	**(2,5)**	**(5,0)**	
M1:Fern	80,0	73,33	80,00	77,78[a]
M2: Husk Charcoal	66,67	66,67	73,33	68,89[b]
M3: Wood Shavings	73,33	100,00	100,00	91,11[a]
M4: Fern+Husk Charcoal	86,67	93,33	100,00	93,33[a]
M5:Fern+Wood Shavings	80,00	80,00	73,33	80,00[a]
M6: Fern+Husk Charcoal	80,00	86,67	73,33	80,00 73,33
Average	**78,89**	**83,33**	**83,33**	
NP. UJBNJ taraf 5%				**20,33**

Note: Numbers followed by letters that are not the same means that they are very significantly different at the 5% level

The treatment was successful because the mixture of fern + husk charcoal media is sufficient to supply the nutrients needed by plants. In addition, fern media has good water binding capacity, aeration, drainage, slow decays, but this configuration contains nutrients (Febrizawati, et. al., 2014).

The percentage of success on single medium husk charcoal (M2) is 69%. The fact is that husk charcoal media has a weakness; it is not strong enough to store water, and the porosity is weak so that the condition of the growing media is not humid and can cause plantlets to dry, pale, and even die. The single husk charcoal media are less inherent to the roots and lighter so that the plantlets are less upright in receiving sunlight. The function of growing media for an orchid is not only as a water provider and nutrients but also as a place for roots to attach and a place for plants to stand (Widiastoety, 2017).

Besides, external factors that can determine the success of acclimatization include light intensity, temperature, water, and humidity. It has been known that the light intensity required for the acclimatization stage ranges from 40% to 50%. A protective barrier such as Paranet is, therefore, needed to shade and protect the acclimatized orchid plants from direct sunshine. Research conducted by Sudartini et al. (2020) reported that the intensity of sunlight in a screen house using a net density of 65% during the day ranged from 52.9 to 2164.6 FC and gave the percentage of Dendrobium sp hybrid orchid plant life during acclimatization to the treatment without a hood application from 93% to 100%, while in treatment with the hood application was 100%.

Plant height (cm)

Based on the results of the 0.05 BNJ test (see Table 2) and (see Figure 1), it shows that the treatment of fern growing media type + husk charcoal + MSG

supplement dose of 5.00 grams/liter (M4P2) gave the best effect on plant height. It shows that there was an interaction between the treatment of growing media and the administration of MSG on *Dendrobium sp* orchids, which was 6.17 cm, but significantly different from the treatment of fern + husk charcoal + wood shavings + no MSG (M5P0) growing media with a value of 4.54 cm. Research conducted by Setiari and Nurchayati 2019 showed that the application of MSG solution could increase the length of orchid leaf higher than those plants without MSG spraying. This is because the addition of 2.5 grams/liter and 5.00 grams/liter of MSG by spraying can stimulate the growth of *Dendrobium sp* orchid plant height because glutamate contained in MSG is an amino acid. Amino acids help plant grow during young (shoots) to stimulate more leaves, in addition to providing resistance to pests and diseases. MSG also contains elements of hydrogen ions when mixed with water to produce gas needed for root and stem growth (Pujiansyah et. al, 2018). The results of research conducted by Agitaria et. al, 2020 showed that MSG had a significant effect on the growth of stem diameter, number, and height of cayenne pepper plants. Meanwhile, the treatment of ferns + wood shavings + no MSG (M5P0) with a plant height of 4.54 cm was the lowest due to the lack of nutrients, especially Nitrogen which plays a very important role in plant vegetative growth.

Availability of nitrogen is needed for plants because nitrogen is a constituent of proteins that play a role in plant metabolic processes. In addition, nitrogen acts as a constituent of chlorophyll which is very important in the process of photosynthesis that produce carbohydrate. These carbohydrates will be broken down into the energy needed to growth and plant development.

Table 2. The Average Growth of Plantlet Height of Orchid Plants in the Acclimatization Stage

Treatment combination	average (cm)
Husk Charcoal + Fern + MSG 5.00 gram/liter water	6.17[a]
Husk charcoal + MSG 5.00 gram/liter water	5.86[ab]
Paksi + No MSG	5.64[abc]
Paksi + MSG 2.50 gram/liter of water	5.63[abc]
Husk charcoal + Fern + MSG 2.50 gram/liter water	5.55[abc]
Husk charcoal + MSG 2.50 gram/liter water	5.52[abc]
Wood shavings + MSG 2.50 grams/liter of water	5.47[abc]
Fern + Husk charcoal + Wood shavings + No MSG	5.46[abc]
Paksi+ Wood shavings + MSG 5.00 gram/liter of water	5.40[abc]
Wood shavings + MSG 5.00 gram/liter of water	5.35[abc]
Husk charcoal + No MSG	5.31[abc]
Fern + husk charcoal + wood shavings + MSG 2.50 grams/liter of water	5.31[abc]
Wood shavings + No MSG	5.28[abc]
Husk charcoal + Fern + No MSG	5.28[abc]
Fern + wood shavings + MSG 2.50 grams/liter of water	5.21[abc]
Fern + MSG 5.00 gram/liter water	4.95[bc]
Fern + husk charcoal + wood shavings + MSG 5.00 gram/liter water	4.58[c]
Fern + Wood shavings + No MSG	4.54[c]
NP.UJBNJ level 5%	1.19

Note: numbers followed by letters that are not the same means that they are very significantly different at the 5% level of UJBNJ.

Figure 1. Performance of plant height growth with 12

Leaf area (cm2), Root Length (cm) and Wet Weight (grams)

The results of the 0.05 BNJ test (see Table 3) showed that the treatment of fern + husk charcoal (M4) planting media gave the best effect on leaf area of 3.69 cm^2, the highest root length was 5.07 cm and the heaviest wet weight was 0.79 grams. However, it was not significantly different from other planting media treatments, namely (M1), (M2), (M3), (M5) and (M6). Fern + husk charcoal combination is very good at providing a growth response of orchid. The combination of fern + husk charcoal as growing media is very good for growth response of leaf area, root length and wet weight. It is suspected in this case that mixtures of ferns have good criteria for orchid plant growth. The fern has capacity in: binding water, storing water well, having good aeration and drainage, weathering slowly. It also contains elements of nutrients needed for orchid plants (Widiastoety, 2017).

The ability of fern+husk charcoal combination is that it can bind and absorb water resulting in fern's flexibility to absorb liquid MSG supplements which are sprayed and can add nutrient contents that exist in media and can help orchid vegetative growth (Marlina et al., 2017). The use of fern media can increase plant growth like plant stems. The nature of the fern root that is advantageous is to have enough nutrient content, then development orchid root can also grow freely where media ferns also have pretty good air cavities. Combination media ferns + husk charcoal have advantages; that is, it is not easily weathered so it can absorb the nutrients it contains over a long time. While husk charcoal media in combination with fern media has advantages such as its porous, light, not dirty, and enough to hold water. Husk charcoal of rice contains SiO2 (52%), C(31%), K (0.3%), N (0.18%) and calcium (0.14%). Besides, it also contains other elements such as Fe2O3, K2O, MgO, CaO, and Cu in small amounts as well as several types of organic matter. The content of high silicate in rice husk charcoal can be profitable for plants, for it makes plants being resistant to pests and diseases as a result of the presence of tissue hardening. Husk charcoal can also be used to increase potassium levels in the land (Septiani, 2012). In this case, most of the nutrients that plants needed were supplied by growing media. Then, the nutrients will be absorbed by roots and used for plant physiological processes. Meanwhile, on a wood shavings treatment, Dendrobium sp orchid growth tends to decrease. This is because wood shavings have good aeration and drainage, but poor water retention, and poor Nitrogen elements. Therefore, the process of weathering become slow because sawdust contains compounds that are difficult to decompose properly such as cellulose, lignin, and hemicelluloses so that the supply of minerals and food ingredients to plant organs does not achieve a maximum level which is in turn cause plant to grow slowly and not having good root function in nutrient absorption resulting in a decrease of growth leaves of orchid plants (Noor, 2011).

Table. 3 Average Effect of Leaf Area, Root Length and Wet Weight on Plantlets of Dendrobium sp Orchid Plant

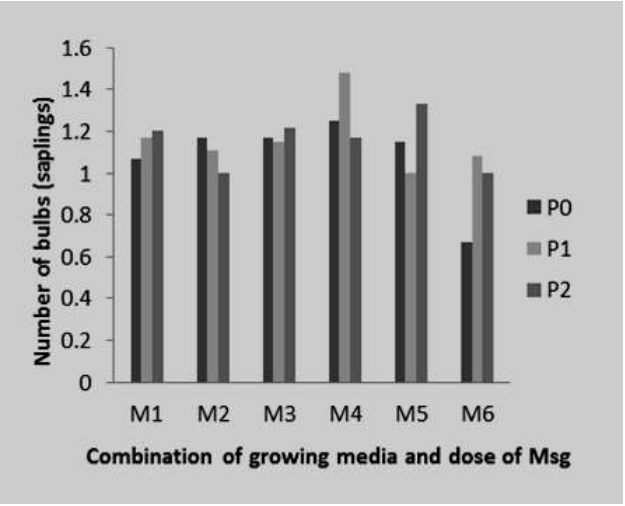
Type of Growing Media	Average Leaf Area, Root Length, and Wet Weight		
	Leaf Area (cm^2)	Root Length (cm)	wet Weight
M1: Fern	1,88[b]	3,49[c]	0,55[bc]
M2: Husk Charcoal	2,85[ab]	3,68[bc]	0,68[ab]
M3: Wood Shavings	2,27[ab]	4,78[ab]	0,61[abc]
M4: Fern+Husk Charcoal	3,69[a]	5,07[a]	0,79[a]
M5: Fern+Wood Shavings	1,69[b]	3,78[bc]	0,46[c]
M6: Fern+Husk Charcoal	1,44[b]	3,55[c]	0,47[c]
NP.UJBNJ taraf 5%	**1,57**	**1,12**	**0,20**

Note: numbers followed by letters that are not the same means that they are very significantly different at the 5% level of UJBNJ

Figure 2. Orchid root performance age 12 MST with various types of media

Number of Bulbs (saplings) and Number of Leaves (strands)

The results of observations of the number of bulbs (see Figure 3) and Dendrobium sp orchids showed that different types of growing media and MSG doses and interactions of the two did not have a significant effect. It was suspected that the dose of MSG treatment used in increasing the number of bulbs (saplings) was not appropriate so that it did not respond to the growth and development of orchid plants. In this case the nitrogen supplement given through MSG was less available so that the function and role of nitrogen in stimulating cell division and cell enlargement was not fulfilled. Nitrogen can directly participate in chlorophyll itself and stimulate cell division for plant growth. Nitrogen has also been reported to positively affect nutrient absorption and promote increased shoot growth (Chrysargyris et al., 2016). In this case, it is suspected that apart from internal factors, external factors also play a very important role in physiological processes and biochemical reactions that occur in plants such as macro and micro nutrients and also the availability of good media for plant growth such as the formation of bulbs and other vegetative growth.



Gambar 3 The average number of bulb plantlets of orchid plants aged 12 MST

CONCLUSION

From the results of the study that has been conducted, it can be concluded that the interaction of fern media + husk charcoal and MSG dose of 5.00 grams/liter of water had a good effect on plant height and has no significant effect on root length, wet weight, number of bulbs and plantlet area of *Dendrobium sp* orchids at the acclimatization stage.

The dose of MSG supplement did not affect all growth (increase in plant height, root length, wet weight, number of bulbs and leaf area) of *Dendrobium sp* orchid plantlets at the acclimatization stage.

The type of fern growing media + husk charcoal could give a better effect on the growth (plant height, root length, wet weight) of *Dendrobium sp* orchid plantlets at the acclimatization stage.

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