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Growth and Potential of Goat Weed (*Ageratum conyzoides* L.) as Host Plant for Propagation of Mycorrhiza Fungi

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Abstract

This research was conducted in the net house Sindang Kasih of village, District of West Ranomeeto, Regency of South Konawe, Province of Southeast Sulawesi and Laboratory of the Faculty of Forestry and Environmental Sciences Halu Oleo University Kendari, Indonesia. This study aims to assess the growth and potential of *Ageratum conyzoides* as host plant propagation of mycorrhiza fungi. This research is compiled using a Completely Design Block (CDB) with five treatments *i.e.*: without mycorrhiza fungi polybag^{-1} (A_0), 10 g mycorrhiza fungi polybag^{-1} (A_1), 20 g mycorrhiza fungi polybag^{-1} (A_2), 30 gmycorrhiza fungi polybag^{-1} (A_3), and 40 g mycorrhiza fungi polybag^{-1} (A_4). Each treatment was repeated 3 times in order to obtain the amount of 15 experimental units. The observed variables in this study were the stem of diameter, the leaves number of weed, the leaves area of weed, the number of seed stalk, seed number, seed weight and percentage of mycorrhiza fungi infection on weed rootings. The results showed that all doses treatment of mycorrhiza fungi inoculated was affected on growth of *A. conyzoides*.

Keywords

Mycorrhiza Fungi, *Ageratum conyzoides*, Host Plant, Propagation

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1. Introduction

The presence of weeds in crop areas can affect crop yields both in quantity and in quality. This occurs because of the competition that led to the growth of cultivated plants become stunted and reduce crop yields. One type of weed found growing on the plant area is *A. conizoides.* According to [1], *A. conyzoides* is not included in the group of noxious weed, but when grown on cropland can reduce crop production significantly. On the other hand, the presence of weeds in the area of crop cultivation can be useful for microorganisms associated with the roots of plants and weeds [2].

One of the microorganisms found associated with roots of weeds is mycorrhiza fungi. Results of research by Halim [2], show that the roots of *A. conizoides* plant found are mycorrhiza fungi such as *Glomus* sp., *Gigaspora* sp. and *Acalauspora* sp. Percentage of mycorrhiza fungi infection on roots of *A. conyzoides* is 60% [3]. Thus, the mycorrhiza fungi that have been applied in the field as a biological fertilizer are expected to live and thrive in rooting of *A. conizoides* plant and other plants or weeds, so the next planting season is not necessary to the application of mycorrhiza fungi. Therefore, this study aimed to assess the growth of weeds and its potential as host plants for mycorrhiza fungi propagation in the net house.

2. Methodology

2.1. Place

This research was conducted in the net house Sindang Kasih of village, District of West Ranomeeto, Regency of South Konawe, Province of Southeast Sulawesi and Laboratory of the Faculty of Forestry and Environmental ScienceHalu Oleo University Kendari, Indonesia.

2.2. Materials and Tools

The materials used in this study were water, soil, mycorrhiza fungi, seed of *A. conizoides*, polybag (size 40 cm × 50 cm), aquades, 30% sucrose, Acero Formalin Alcohol (FAA), 10% KOH solution, a solution of hydrogen 10% alkaline peroxide (H_2O_2), a solution of HCl 1%, dyes carbolfuchin 0.05%, lactogliserol, and paper labels. The tools used were tillage tools, verniercaliper, machetes, meter, digital camera, analytical balance, binocular microscope, glass measuring, petridish, pipettes, scissors, and stationery.

2.3. Research Design

This research is compiled using a completely design block (CDB) with five treatments *i.e.*: without mycorrhiza fungi polybag^{-1} (A_0), 10 g mycorrhiza fungi polybag^{-1} (A_1), 20 g mycorrhiza fungi polybag^{-1} (A_2), 30 g mycorrhiza fungi polybag^{-1} (A_3), 40 g mycorrhiza fungi polybag^{-1} (A_4), each treatment was repeated 3 times in order to obtain the amount of 15 experimental units.

2.4. Procedure

1) Preparation of planting medium. The soil used in this study came from the farmer's garden that was taken by the composite, then mixed evenly, sterilized using furnace oven heated on the stove for 60 minutes, cooled and then charged as much as 10 kg polybag^{-1}. Before planting, then each polybag which already contain watered soil to keep it moist.

2) Seding weeds and fungi mycorrhizae inoculation. The seeds of *A. conyzoides* first planted, transferred to a polybag at 30 days after sowing (height of weeds as much as 2 cm, leaf number of weed as much as 6 sheets). Mycorrhiza fungi inoculation is done concurrently with the removal of weeds from the nursery into a polybag. The location of mycorrhiza fungi is under weed seedlings [2].

3) Maintenance of weeds, weed maintenance includes fertilization and watering. Acording [2], the type of fertilizer used is 25% N, 7% P_2O_5 and 7% K_2O. Dose of fertilizer at planting time is 0.60 g polybag^{-1}. Type of fer-

tilizer given to the second and third stage is urea (46% N) at a dose of 0.10 g polybag^{-1}. Fertilizing the second stage at the age of 25 - 30 days after planting (DAP), while the third stage fertilization is done at the age of 40 - 45 DAP.

4) Harvest weed seeds, weed seeds that are old are harvested along the stems. The characteristics of weed seeds that are old are the tip of seed color change from white to brown, black seeds and easy to separate between the seeds with other seeds.

2.5. Observation of Variables

The variables were observed in this study include:

1) The weed height; plant and weed height is measured from the base of the stem to the tip of the highest leaves by using ammeter at the age of 7, 14, 21, 28, 35 and 42 days after planting (DAP).

2) The stem of diameter; stem diameter were measured using calipers at the age of 7, 14, 28, 35 and 42 DAP. The measurements were made approximately 15 cm from the ground.

3) The leaf number of weed; measured at the age of 7, 14, 21, 28, 35 and 42 DAP.

4) The leaf area of weed; measured at the age of 7, 14, 21, 28, 35 and 42 DAP.

5) The number of seed stalk, seed number and seed weight.

6) The percentage of mycorrhiza fungi infection on weed rootings; precededs with staining roots. The steps in staining roots are as follows: a) washing the roots with water, b) saving the FAA for fixation prior to painting, c) soaking in 10% KOH and heat with an autoclave for 15 - 20 minutes at 121˚C, d) washing with distilled water 3 times, e) soaking in hydrogen peroxide outsmart 10% (H_2O_2), f) washing with distilled water 3 times, g) soaking with HCl 1%, h) wasting HCl without washed with distilled water, i) soaking in carbon fuch in with concentration of 0.05% w/v in lactogliserol and heat at 90˚C for several hours or in an autoclave at 121˚C for 15 minutes, j) removing the paint and soak the roots in lactogliserol, and k) observing the roots sample using a microscope (Brundrett, 2004) in [3]. The Observations were carried outusinga dissecting microscopeata magnification of 40 times. Furthermore, mycorrhiza fungi infection was calculated by using the formula proposed by Brianand Schults (1980) in [3]:

$$IP = \frac{r_1}{r_1 + r_2} \times 100\% .$$

Note:

IP = the percentage of mycorrhiza fungi infection.

r_1 = the number of root infected examples.

r_2 = the number of root not infected examples.

2.6. Data Analysis

Dataofeach variable were observed were analyzed by variance of analysis. If the F count is greater than the F table, then continued with Duncan Range Multiple Test (DRMT) at 95% confidence level.

3. Result and Discussion

3.1. The Weed Height

The results showed that mycorrhiza fungi inoculation is not real effect on the weed height at the age of 7, 14 and 21 DAP. The average of weed height at 7 - 42 DAP Showed at **Table 1**.

Table 1 shows that at age 7 DAP weed highest on treatment of 10 g mycorrhiza fungi polybag^{-1} (A_1) that, at 14 DAP on treatment of 20 g mycorrhiza fungi polybag^{-1} (A_2), at 21 DAP on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3), at 28 DAP on treatment of 10 g mycorrhiza fungi polybag^{-1} (A_1) and treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3), at 35 DAP on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3), at 42 DAP on treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4). The variation of weed highest for all treatment as indicator that's mycorrhiza fungi can increasing the weed growth although the mycorrhiza fungi are not yet optimum symbiosis with the roots of weed plants. [4], declare that the symbiosis between mycorrhiza fungi to the roots of plants occurring optimum helps plants absorb nutrients. Mycorrhiza fungi able to increase the absorption of nutrients, particularly phosphate and several other nutrients such as Cu and Zn [5]-[7]. Cu element plays a role in the

Table 1. Average of weed height (cm) at 7 - 42 DAP.

Treatment	Age of weed (DAP)					
	7	14	21	28	35	42
Without mycorrhiza fungi polybag^{-1} (A_0)	3.13^{a}	5.10^{b}	7.80^{b}	13.07^{a}	14.73^{b}	18.27^{c}
10 g mycorrhiza fungi polybag^{-1} (A_1)	3.80^{a}	5.00^{ab}	8.30^{ab}	13.70^{a}	15.60^{a}	18.50^{abc}
20 g mycorrhiza fungi polybag^{-1} (A_2)	3.70^{a}	5.73^{a}	8.37^{ab}	13.53^{a}	15.43^{ab}	18.57^{ab}
30 g mycorrhiza fungi polybag^{-1} (A_3)	3.37^{a}	5.30^{ab}	8.67^{a}	13.70^{a}	15.84^{a}	18.43^{c}
40 g mycorrhiza fungi polybag^{-1} (A_4)	3.60^{a}	5.67^{ab}	8.57^{a}	13.57^{a}	15.83^{a}	18.77^{a}
DRMT 95%	2 = 0.764	2 = 0.545	2 = 0.655	2 = 0.418	2 = 0.727	2 = 0.280
	3 = 0.796	3 = 0.568	3 = 0.683	3 = 0.436	3 = 0.757	3 = 0.292
	4 = 0.814	4 = 0.580	4 = 0.698	4 = 0.446	4 = 0.775	4 = 0.299
	5 = 0.825	5 = 0.588	5 = 0.707	5 = 0.452	5 = 0.785	5 = 0.303

Note: The numbers are followed by the same letters in the same column, no significant based DRMT 95%.

transport of electrons in the process of photosynthesis, whereas Zn is needed in the metabolic process and as a cofactor in the process fosfodieterase [8]. Nutrients are used by plants to form carbohydrates in the photosynthesis process which will be fused with the material inorganic materials forming protoplasm at the growing point of the stem (meristem tissue), so that the plant increase in height [9].

3.2. The Leaf Number of Weed

The results showed that mycorrhiza fungi is not real effect on the leaf number at the age of 7, 14, 21, 28 and 35 DAP. The average of leaf number of weed at 7 - 42 DAP shown in **Table 2**.

Table 2 shows that the leaf number of weeds highest at 7 DAP on treatment of 10 g mycorrhiza fungi polybag^{-1} (A_1) and treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at 14 DAP on treatment of 10 g mycorrhiza fungi polybag^{-1} (A_1) and treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at 21 DAP on treatment without mycorrhiza fungi polybag^{-1} (A_0) and treatment of 10 gmycorrhiza fungi polybag^{-1} (A_1), at 28 DAPon treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3), at 35 DAP on treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at 42 DAP on treatment of 10 g mycorrhiza fungi polybag^{-1} (A_1) and treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3). Variation difference in the leaf number in each treatment showed that mycorrhiza fungi can help weed absorb nutrient elements which in turn can affect the quantity of the nutrient phosphorus is absorbed by weeds. Acording to [10], that mycorrhiza fungi inoculation at various doses can increase phosphorus uptake for *A. conyzoides*, and increase nutrient Nitrogen uptake by plant roots [11].

3.3. The Leaf Area of Weed

The results showed that mycorrhiza fungi inoculation is not significant effect on leaf area at 7 - 42 DAP. The average of leaf area of weed at 7 - 42 DAP shown in **Table 3**.

Table 3 shows that the highest leaf area of weeds at 7 DAP obtained in treatment of 20 g mycorrhiza fungi polybag^{-1} (A_2), at 14 DAP on treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at 21 DAP on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3), at 28 DAP on treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at 35 DAP on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3), at age 42 DAP on treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4). [6], states that the mycorrhiza fungi have the ability to help the process of photosynthesis through root exudates in soil that has been infected metabolites that could provide opportunities zinc. Metabolites of zinc is poses absorption of zinc in the soil until the process of spending the sink through the stomata is causing more of photosynthesis move to the roots which can further stimulate the activity of photosynthesis through the stomata opening, ion transfer and setting the amount of chlorophyll in the leaves. [12], declare that's speed photosynthesis activity has to do with the amount of nutrients absorbed by plants after infection and high organic-C contained in the soil causing plants that have been infected by Mycorrhiza fungi can affect the number of leaves.

Table 2. Average of leaf number of weed at 7 - 42 DAP.

Treatment	Age of weed (DAP)					
	7	14	21	28	35	42
Without mycorrhiza fungi polybag^{-1} (A_0)	3.33^{a}	4.00^{a}	5.33^{a}	5.67^{ab}	7.67^{a}	8.00^{b}
10 g mycorrhiza fungi polybag^{-1} (A_1)	4.67^{a}	5.00^{a}	5.33^{a}	5.67^{ab}	7.33^{a}	11.33^{a}
20 g mycorrhiza fungi polybag^{-1} (A_2)	4.33^{a}	4.33^{a}	4.00^{a}	5.33^{b}	7.67^{a}	10.33^{a}
30 g mycorrhiza fungi polybag^{-1} (A_3)	4.33^{a}	4.67^{a}	5.00^{a}	6.67^{a}	9.00^{a}	11.33^{a}
40 g mycorrhiza fungi polybag^{-1} (A_4)	4.67^{a}	5.00^{a}	5.00^{a}	6.33^{ab}	9.33^{a}	10.67^{a}
DRMT 95%	2 = 1.458	2 = 1.140	2 = 1.191	2 = 1.191	2 = 2.618	2 = 2.201
	3 = 1.520	3 = 1.188	3 = 1.241	3 = 1.241	3 = 2.728	3 = 2.294
	4 = 1.554	4 = 1.215	4 = 1.269	4 = 1.269	4 = 2.790	4 = 2.346
	5 = 1.575	5 = 1.231	5 = 1.286	5 = 1.286	5 = 2.827	5 = 2.377

Note: The numbers are followed by the same letters in the same column, no significant based DRMT 95%.

Table 3. Average of leaf area of weed (cm) at 7 - 42 DAP.

Treatment	Age of weed					
	7	14	21	28	35	42
Without mycorrhiza fungi polybag^{-1} (A_0)	2.53^{b}	3.60^{a}	5.23^{a}	7.43^{a}	8.13^{a}	9.17^{b}
10 g mycorrhiza fungi polybag^{-1} (A_1)	3.67^{ab}	4.43^{a}	6.10^{a}	9.00^{a}	9.37^{a}	13.07^{a}
20 g mycorrhiza fungi polybag^{-1} (A_2)	4.07^{a}	4.37^{a}	6.80^{a}	8.40^{a}	10.97^{a}	12.57^{a}
30 g mycorrhiza fungi polybag^{-1} (A_3)	4.03^{a}	4.57^{a}	7.23^{a}	9.40^{a}	11.20^{a}	12.37^{a}
40 g mycorrhiza fungi polybag^{-1} (A_4)	3.27^{ab}	4.93^{a}	6.90^{a}	10.77^{a}	10.80^{a}	13.30^{a}
UJBD 95%	2 = 1.183	2 = 1.424	2 = 2.209	2 = 3.218	2 = 3.386	2 = 4.414
	3 = 1.232	3 = 1.484	3 = 2.302	3 = 3.353	3 = 3.529	3 = 4.599
	4 = 1.260	4 = 1.517	4 = 2.354	4 = 3.429	4 = 3.608	4 = 4.703
	5 = 1.277	5 = 1.537	5 = 2.386	5 = 3.475	5 = 3.656	5 = 4.766

Note: The numbers are followed by the same letters in the same column, no significant based DRMT 95%.

3.4. The Stem Diameter of Weed

The result showed that Mycorrhiza fungi inoculation significant effect on stems diameter of weed at age 35 - 42 DAP. The average of stem diameter of weed at 7 - 42 DAP shown in **Table 4**.

Table 4 shows that the highest stem diameter of weed at 7 DAP was obtained on treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at 14 and 21 DAP on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3) and 40 g mycorrhiza fungi polybag^{-1} (A_4). The observation at the 28 DAP the highest stem diameter of weed obtained on treatment of 10 g mycorrhiza fungi polybag^{-1} (A_1), on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3) and treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4), at the 35 and 42 DAP on treatment of 30 g mycorrhiza fungi polybag^{-1} (A_3). The result of research shows that mycorrhiza fungi significantly effectly on the stem diameter of weed at 35 DAP and 42 DAP. That is because at the root mycorrhiza fungi infection has been active in helping the absorption of nutrients in the soil. As a result of these activities led to weeds are more effective in absorbing nutrients will then produce plant growth regulators such as auxin and gibberellins which can stimulate the growth of plants. The compounds in the root exudates were infected by mycorrhiza fungi causing growing influence on plant stems [13].

3.5. Number of Seed Stalk, Seed Number and Seed Weight

The results showed that the average number of weed seeds stalk and seed number was highest in the treatment of

10 g mycorrhiza fungi polybag^{-1} (A_1) as such as 516.67 stalks and 73,970.00 seeds. The average weight of the heaviest weed seeds in 1000 occurred in the treatment of 40 g mycorrhiza fungi polybag^{-1} (A_4) as such as 0.16 g. The average total seeds weight plant^{-1} was highest in control as such as 10.69 g. The number of seed stalk, seed number and seed weight of *A. conyzoides* shown in **Table 5**.

Mycorrhiza fungi inoculation could increase the average number of seeds stalk, the average number of seeds, and the average weight of weed seeds. This relates to the percentage level of mycorrhiza fungi infection in the roots of weeds. Mycorrhiza fungi infection in the roots of weeds will trigger high absorption of nutrients so that weeds can thrive [14]. [15] suggested that mycorrhiza fungi can symbiotically with plant roots and through its external hyphae were able to increase nutrient uptake Phosfor are immobilized on the ground. The high uptake P can directly influence fotosintat or sink in seed [16].

3.6. The Percentage of Mycorrhiza Fungi Infection on Weed Rootings

The results showed that the percentage of mycorrhiza fungi infection at the roots of weeds was highest in the treatment of 40 g mycorrhiza fungi polybag^{-1} (M_4) as sucs as 56.67% which is significantly different from the control, but not significant with other treatments. This is supported by the results of research [10], that the percentage of mycorrhiza fungi infection in the weeds as such as 23.33% to 60.00%. The average percentage of mycorrhiza fungi infection in rooting weeds can be seen in **Table 6**.

The results showed that mycorrhiza fungi infection at the roots of weeds is characterized by the presence of hyphae and vesicles (**Figure 1**). Vesicles shape oval, round or oval which serves as a food reserve. Fungi are branching hyphae and serves as a food reserve exchange between mycorrhiza fungi with their host plants. This structure begins to form 2 - 3 days after infection, starting with the lateral penetration of hyphae branch formed

Table 4. Average of stem diameter of weed (cm) at 7 - 42 DAP.

Treatment	Weed age (DAP)					
	7	14	21	28	35	42
Without mycorrhiza fungi polybag^{-1} (A_0)	0.13^a	0.13^a	0.13^a	0.17^a	0.17^b	0.20^c
10 g mycorrhiza fungi polybag^{-1} (A_1)	0.10^a	0.10^a	0.17^a	0.23^a	0.27^a	0.33^{ab}
20 g mycorrhiza fungi polybag^{-1} (A_2)	0.10^a	0.13^a	0.17^a	0.20^a	0.27^a	0.37^a
30 g mycorrhiza fungi polybag^{-1} (A_3)	0.10^a	0.17^a	0.20^a	0.23^a	0.33^a	0.40^a
40 g mycorrhiza fungi polybag^{-1} (A_4)	0.17^a	0.17^a	0.20^a	0.23^a	0.27^a	0.27^{bc}
DRMT95%	2 = 0.069	2 = 0.069	2 = 0.069	2 = 0.097	2 = 0.088	2 = 0.011
	3 = 0.088	3 = 0.077	3 = 0.073	3 = 0.101	3 = 0.091	3 = 0.096
	4 = 0.010	4 = 0.011	4 = 0.074	4 = 0.104	4 = 0.010	4 = 0.097
	5 = 0.011	5 = 0.011	5 = 0.074	5 = 0.105	5 = 0.095	5 = 0.098

Note: The numbers are followed by the same letters in the same column, no significant based DRMT 95%.

Table 5. Number of seed stalk, seed number and seed weight of *A. conyzoides*.

Treatment	Observation variable			
	Number of seed stalk	Seed number	Seed weight for 1000 (g)	Total seed weight Plant^{-1} (g)
Without mycorrhiza fungi polybag^{-1} (A_0)	497.67	71,241.33	0.14	10.69
10 g mycorrhiza fungi polybag^{-1} (A_1)	516.67	73,970.00	0.12	9.02
20 g mycorrhiza fungi polybag^{-1} (A_2)	252.67	36,198.33	0.17	5.43
30 g mycorrhiza fungi polybag^{-1} (A_3)	379.67	54,392.33	0.14	8.16
40 g mycorrhiza fungi polybag^{-1} (A_4)	476.33	68,205.67	0.16	10.23

by extracellular and intracellular hyphae into the host cell wall. Vesicle is an oval or round-shaped structure, containing a liquid fat, which serves as a food storage organ. External and internal hyphae appear separately marked with a different shape. [17], stating that the network of hyphae of mycorrhiza fungi into the root cortex cells and form a distinctive oval structure called vesicles and hyphae branching system called arbuscular. Vesiclesformated begin with the development of hyphae denser cytoplasm, multinucleate and contain particles of lipid and glycogen. The cytoplasm becomes more solid through condensation, and organelles increasingly difficult to distinguish in line with lipid accumulation during maturation [18]. This is because the roots of weeds quicker association with mycorrhiza fungi that cause root easily absorb the phosphorous and mycorrhiza fungi would otherwise obtain root exudates of the roots of weeds as an energy source [7]. While the rootings of weeds that's were not infected by mycorrhiza fungi do not appear to have vesicles and hyphae (**Figure 2**).

Table 6. Average of percentage of mycorrhiza fungi infection (%) on weed rootings.

Treatment	Percentage of mycorrhiza fungi infection	DRMT 95%
Without mycorrhiza fungi polybag^{-1} (A_0)	0.00^{b}	2 = 14.98
10 g mycorrhiza fungi polybag^{-1} (A_1)	50.00^{a}	3 = 15.61
20 g mycorrhiza fungi polybag^{-1} (A_2)	53.33^{a}	4 = 15.97
30 g mycorrhiza fungi polybag^{-1} (A_3)	53.33^{a}	5 = 16.18
40 g mycorrhiza fungi polybag^{-1} (A_4)	56.67^{a}	

Note: The numbers are followed by the same letters in the same column, no significant based DRMT 95%.

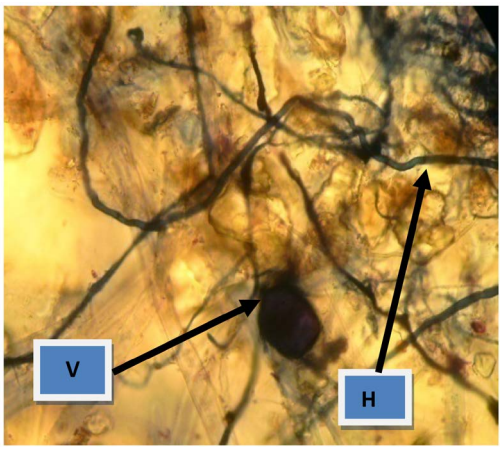

Figure 1. Form of Vesicles (V) and Hyphae (H) mycorrhiza fungi on the roots of *A. conyzoides* on 40× magnification.

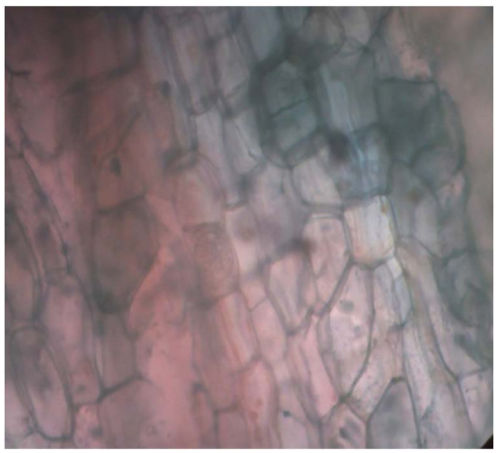

Figure 2. Form of the roots of *A. conyzoides* not infected by mycorrhiza fungi on 40× magnification.

4. Conclusion

Based on the result of research including the growth of weeds and the percentage of mycorrhiza fungi infection in the roots of weeds, it can be concluded that the *A. conyzoides* has the potential as host plants for propagation mycorrhiza fungi. The main indicators used to use weed as propagation of mycorrhiza fungi are an infection of mycorrhiza fungi on roots of weeds.

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References

[1] Halim (2010) Pengelolaan Gulma. Biologi, Klasifikasi dan Sistem Pengendalian. Unpad Press, Bandung.

[2] Halim (2009) The Role of Endomycorrhiza Indigenous of *Imperata cylindrica* (L.) Beauvand *Eupatorium odorata* (L.) in Weed and Corn Competitive. Graduate Dissertation of Padjadjaran University Bandung. (No Published)

[3] Halim, Rembon, F.S., Kandari, A.M., Resman and Sani, A. (2014) Characteristics of Indigenous Mycorrhiza of Weeds on Marginal Dry Land in South Konawe, Indonesia. *Journal of International of Agriculture, Forestry and Fisheries*, **3**, 459-463.

[4] Smith, S.E. and Read, D.J. (1997) Mycorrhiza Symbiosis. 2nd Edition, Academiz Press, Harcourt Brace & Company Publisher, London.

[5] Brundrett, M. (2006) Mycorrhizae Mutualistic Plant Fungus Symbioses. http://www.mycorrhiza.ag.utk.edu

[6] McGonigle, T.P.M. and Miller, M.H. (1993) Mycorrhiza Development and Phosphorus Absorption in Maize under Conventional and Reduce Tillage. *Soil Science Society of America Journal*, **57**.

[7] Juge, C., Samson, J., Bestien, C., Vierheilig, H., Coughlan, A. and Pieche, Y. (2002) Breaking Dormancy in Spores of the Arbuscular Mycorrhiza Fungus Glomusintraradies. A Critical Cold Storage Period. *Journal of Mycorrhiza*, **12**, 37-42. http://dx.doi.org/10.1007/s00572-001-0151-8

[8] Alloway, B.J. (2009) Soil Factors Associated with Zinc Deficiency in Crops and Humans. *Environmental Geochemistry and Health*, **31**, 537-548. http://dx.doi.org/10.1007/s10653-009-9255-4

[9] Sheng, K. (2007) Effects of Copper on the Photosynthesis and Oxidative Metabolism of Amaranthustricolor Seedling. *Agricultural Sciences in China*, **6**, 1182-1192. http://dx.doi.org/10.1016/S1671-2927(07)60162-X

[10] Halim (2012) The Role of Indigenous Mycorrhiza on Maize and *Ageratum conyzoides* L. Competitiv Index. *Berkala-Penelitian Agronomi*, **1**, 86-92.

[11] Xie, X., Weng, B., Cai, B., Dong, Y. and Yan, C. (2014) Effects of Arbuscular Mycorrhiza Inoculation and Phosphorus Supply on the Growth and Nutrient Uptake of Kandeliaobovata (Sheue, Liu & Yong) Seedlings Inautoclaved Soil. *Applied Soil Ecology*, **75**, 162-171. http://dx.doi.org/10.1016/j.apsoil.2013.11.009

[12] Lehmann, A., Veresoglou, S.D., Leifheit, E.F. and Rillig, M.C. (2014) Arbuscular Mycorrhizal Influence on Zinc Nutrition in Crop Plants—A Meta-Analysis. *Soil Biology & Biochemistry*, **69**, 123-131. http://dx.doi.org/10.1016/j.soilbio.2013.11.001

[13] Delvian (2006) Koleksi Isolat Cendawan Mikoriza Arbuskula Asal Hutan Pantai. Jurusan Kehutanan Fakultas Pertanian Universitas Sumatera Utara. http://www.library.usu.ac.id/download/fp/06005280.pdf

[14] Halim (2015) Fungi Mikoriza, Gulmadan Produktivitas Tanaman Jagung di Lahan Marginal. Unhalu Press, Kendari.

[15] Wilarso, S. (1990) Peranan Endomikorizadalam Kehidupan. Kerjasamaantara PAU Bioteknologi Institut Pertanian Bogordengan PAU Bioteknologi Universitas Gadjah Mada. Jogyakarta.

[16] Preston, S. (2007) Alternative Soil Amendements. NCAT Agriculture Specialist. National Suistanable Agriculture Information Service. ATTRA Publication. Melalui. http://www.attra.ncat.org/attra-pub/PDF/altsoil.pdf

[17] Feronika, A. (2003) Mikoriza: Peran, Prospekdan Kendalanya. Fakultas Pertanian. Universitas Gadjah Mada. Yogyakarta.

[18] Schreiner, R.P. and Koide, R.T. (1993) Mustards, Mustard Oil and Mycorrhizas. New Phytol. http://dx.doi.org/10.1111/j.1469-8137.1993.tb04536.x