Acclimatization of Micro Shoot-tip Cutting Red Palestine Fig on Several Planting Media Compositions

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Abstract. Acclimatization is a critical stage in plant micropropagation. Many plantlets resulting from tissue culture cannot survive when acclimatized. External environmental conditions will affect the ability of acclimatized plants to survive. Apart from climatic conditions (temperature and sun intensity), the type of media and its composition of the planting media can also influence the ability of plantlets to survive and grow. This research aims to: 1) see effect of media planting composition on acclimatization of fig micro shoot-tip cutting, and 2) find the best composition of acclimatization media treament for the success and growth of acclimatized fig from micro shoot-tip cutting. The research was carried out using a Randomized Block Design with 7 treatments, and each treatment was repeated 4 times. Each experimental unit was planted with 6 cuttings of fig plants resulting from in vitro multiplication. The data were subjected to analysis of variance, and differences between acts were tested with Tukey Test at the 5% level. The results showed: 1) The media planting composition were success to influence acclimatization of fig micro shoot-tip cutting, 2) The best composition of acclimatization media treament for the success and growth of fig micro shoot-tip cutting is top soil+cocopeat, and 3) The highest percentage of survival rate on fig micro shoot-tip cutting acclimatization (75%) obtained on top soil+cocopeat media followed by top soil media (45%).

Keywords: Fig, Micro shoot-tip, Acclimatization, Media Compositions

INTRODUCTION

The fig plant is a plant that produces fruit which is rich in the nutrients P, K, Ca, Mg and Fe [1] and has many health benefits because it contains anti-fungal, anti-worm, anti-oxidant and anti-carcinogenic [2]. Conventional propagation of fig plants can be done by grafting or cuttings. Meanwhile, propagation of fig plants in large quantities can be done using tissue culture techniques. The success of plant propagation using tissue culture is very dependent on the final stage of propagation, namely acclimatization.

Plantlet acclimatization is the stage of adapting plantlets from the in vitro environment to the ex vitro environment. This stage can be said to be a critical stage because plantlets resulting from tissue culture are produced under controlled conditions (low light intensity, high humidity, aseptic, with media equipped with an energy source). This condition can cause plantlets to have several deficiencies, such as abnormal stomata opening/closing function which affects water absorption, weak roots and low photosynthesis rates, reduced/absent wax coating on plantlet leaves in response to reduced humidity during hardening off, and tissue. vessels may not develop properly [3], [4].

This situation makes plantlets sensitive to high light intensity, slow growth, and susceptible to microorganisms/diseases. The extreme environmental conditions in ex vitro cause some plantlets not survive, wither and die. In order for plantlets to survive, a good plantlet acclimatization method is needed, and also observed appropriate environmental conditions (microclimate and planting media) so that a high percentage of conversion of plantlets into seeds can be obtained.

Besides from climatic conditions (temperature and light intensity), the type of media and composition of the planting media can also influence the ability of plantlets to survive and grow. Soil planting media mixed with cocopeat/charcoal husks/husks can improve the pores of the planting media and the ability of the media to hold water. [5]. This will affected the humidity of the plant media and the humidity around the acclimatized plantlets, which ultimately can affect the adaptation of the seedlings in their ability to survive. Therefore, in this research, we would like to try several media compositions that can provide high success in acclimatization fig plantlets to become seeds.

METHODS

The plant source used as planting material was micro shoot-tip cuttings from fig plantlets which were ready to acclimate (Figure 1). The shoot-tip were cut off from planlet in laminar air flow. Afterwards the shoot-tip cuttings are soaked using a fungicide and bactericide solution with concentration 2 $g.l^{-1}$ for 15 minutes, then air-dried for 15 minutes. The shoot-tip cutting was planted on each treatment media with small pot and its covered with transparent plastic.

The research was carried out using a Randomized Block Design with 7 treatments, and each treatment was repeated 4 times. Each experimental unit consisted of 6 polybags, each containing 1 shoot-tip, so there are 28 experimental units. The level of treatment that used in this research was presented on Table 1.1. Observational data from each variable (percentage of survival rate, plant height, number of leaves, leaf width and root length) was analyzed for diversity using ANOVA, and if there were significant differences between treatment, Tukey test was used to compare between all treatment's average at the 5% significance level.

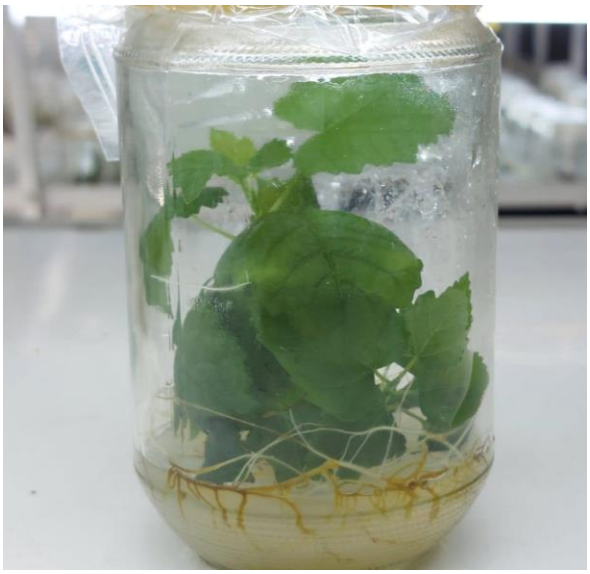

Figure 1. Red Palestine Fig planlet which used as source planting material

Table 1. Composition of acclimatization media treament

No.	Planting Media Composition
1	Cocopeat (M1)
2	Husk Charcoal (M2)
3	Husk (M3)
4	Top Soil (M4)
5	Top Soil + Cocopeat (M5)
6	Top Soil + Husk Charcoal (M6)
7	Top Soil + Husk (M7)

RESULTS AND DISCUSSION

Fig planlets were produced from previous research[6]. Micro shoot-tip cuttings from these planlets were cut off then ready to acclimate. A week after planting, before the plastic cover was opened, shoots planted on husk media showed symptoms of wilting on the leaves, followed by shoots planted on husk charcoal media. After the plastic cover was opened, the shoots still showed the same symptoms, especially on shoots planted on husk or charcoal media. Two weeks later, the shoots that were unable to adapt to the new environment began to appear and died three weeks after planting. Based on Figure 2 both charcoal husk and husk media cause shoot death which begins from wilting of the leaves on the shoots, especially the broad leaves. The results showed that the percentage of shoots that could adapted and grown was very dependent on its composition of media during acclimatization process (Table 2).

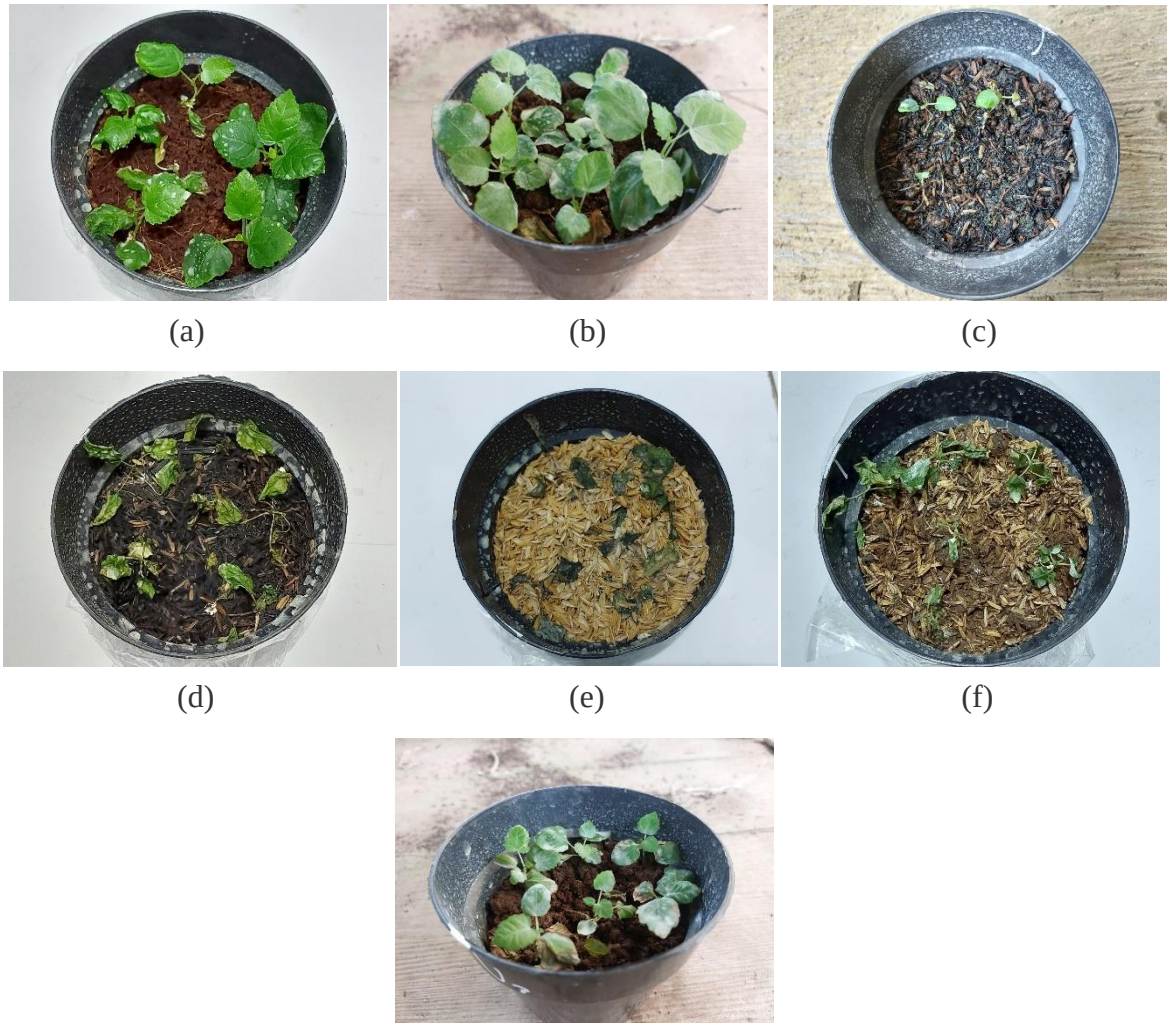

Figure 2. Visualization of Red Palestine Fig 2 weeks afer azcclimatization on each media treatment. a. cocopeat. b. top soil + cocopeat. c. husk charcoal. d. top soil + husk charcoal. e. husk. f. top soil + husk. g. top soil + husk.

Table 2. Survival ratio and growth rate of micro shoots in the different acclimatization media

Treatment	Survival Ratio (%)	Height of shoot (cm)	Number of Leaves	Width of Leaves (cm)	Length of Roots (cm)
Cocopeat (M1)	37.5	18.49 b	12.07 ab	6.71 a	18.40 a
Husk Charcoal (M2)	0	0 d	0 d	0 b	0 c
Husk (M3)	0	0 d	0 d	0 b	0 c
Top Soil (M4)	45.8	20.3 b	9.51 bc	6.43 a	17.90 ab
Top Soil + Cocopeat (M5)	75	21.85 a	13.81 a	7.31 a	15.20 b
Top Soil + Husk Charcoal (M6)	20.8	9.70 c	8.35 c	6.22 a	17.10 ab
Top Soil + Husk (M7)	8.3	0 d	0 d	0 b	0 c

The highest survival ratio on acclimatization was found in top soil + cocopeat media (75%) followed by top soil media (45.8%). The death of shoots planted on charcoal husk or husk is thought to be because the ability of both media to hold water is very low so that the humidity in the micro environment of the shoots is low. Top soil and cocopeat media or its combination were capable of holding water, so its not prone to dryness.

From table 2 it can be seen that the Top Soil + Cocopeat media treatment gave the best results on all observation variables. Meanwhile, shoots planted in charcoal or husk media, or combined with soil, do not provide good growth and even cause shoot death. This shows that apart from the structure of the media, the ability of the media to hold water and the nutrients provided will greatly determine the success of acclimatization and growth of the upper shoots. Supporting media conditions are thought to influence root growth which will ultimately determine the ability to absorb nutrients which ultimately influences plant growth. Plant performance 2 months after acclimatization can be seen in Figure 3.

The use of soil and cocopeat media can provide good growth space for the roots. The roots formed from tissue culture are not yet able to function perfectly in terms of absorbing water, nutrients and supporting the plant body. The use of cocopeat is able to provide porosity for root penetration, so that the roots can easily grow and develop so they can function well. So the use of cocopeat alone is able to provide better rooting conditions compared to soil + cocopeat (Figure 4).

However, the ability of cocopeat to withstand the availability of nutrients for plant canopy growth is very low, this is related to the porousity of cocopeat [7], so it requires other media to support this process. Soil has high aeration, has high nutrient absorption capacity, is able to hold the root area and support plants well. So that plant canopy growth in the combination of soil and cocopeat media is better compared to other treatments (Figure 5). Several research results regarding acclimatization show that the planting medium that is able to provide the best growth results is the planting medium combined with soil for fig plants [8], [9], [10], [11], [12], Indian Sandalwood[13], Pomegranate[14], Red Banana [15], *Passiflora foetida*[16], and Dragon Fruit[17]. Although the use of cocopeat often provides the best results in the acclimatization process for strawberry [18], stevia[19] Yellow Fig [20], dan Brown Turkey Fig [21], however, for the Red Palestine fig variety, the use of cocopeat alone was not able to provide stable growth space.

(a) (b)

Figure 3. Red Palestine fig performance after 2 months on acclimatization. a. cocopeat media. b. topsoil + cocopeat media

(a)

(b)

Figure 4. Rooting section on different media. a. cocopeat. b. topsoil + cocopeat

CONCLUSIONS

The results showed: 1) The media planting composition were success to influence acclimatization of fig micro shoot-tip cutting, 2) The best composition of acclimatization media treament for the success and growth of fig micro shoot-tip cutting is top soil+cocopeat, and 3) The highest percentage of survival rate on fig micro shoot-tip cutting acclimatization (75%) obtained on top soil+cocopeat media followed by top soil media (45%).

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