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Root induction and acclimatization of *in vitro* plantlets of *Artocarpus altilis*

Induksi perakaran dan aklimatisasi tanaman *Artocarpus altilis* secara in vitro

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Abstrak. *Noorrohmah S, Imelda M. 2015. Induksi perakaran dan aklimatisasi tanaman* Artocarpus altilis *secara in vitro. Pros Sem Nas Masy Biodiv Indon 1: 1896-1899.* Sukun merupakan salah satu tanaman kehutanan yang mengandung karbohidrat yang tinggi. Pada beberapa wilayah tertentu, tanaman ini mampu sebagai alternatif makanan pokok ketika persediaan makanan utama tersebut terbatas. Kegiatan penelitian dan pengembagan tanaman sukun melalui teknik pembibitan konvensional sudah banyak dilakukan namun penyediaan bibit sukun masih terbatas. Oleh karena itu perlu dikembangkan teknik perbanyakan melalui kultur jaringa Teknik kultur jaringan telah diakui keunggulannya karena mampu menghasilkan bibit dalam jumlah banyak, seragam, dan relatif singkat. Tahapan kritis dalam kegiatan perbanyakan dengan teknik kultur jaringan adalah pada tahapan aklimatisasi planlet. Penelitian ini bertujuan untuk mengetahui respon tanaman sukun dalam pembentukan akar dengan ZPT IBA dan mendapatkan formulasi media yang tepat pada tahap aklimatisasi. Pada penelitian ini menggunakan sukun kultivar Bone. Penelitian ini terdiri dari dua tahap. Tahap pertama adalah induksi perakaran dengan media dasar MS dan ½ MS dengan tambahan (0.25; 0.50; 1.00) mg/L IBA. Tahap kedua yaitu aklimatisasi dengan komposisi media dasar kokopit + sekam bakar + pasir + tanah (4: 2: 2:3) dan dengan tambahan mikoriza. Plantlet yang digunakan adalah plantlet yang sudah berakar maupun yang belum berakar. Parameter yang diamati adalah jumlah akar dan panjang akar (in vitro) sedangkan pada saat aklimatisasi adalah daya hidup, jumlah akar, dan panjang akar. Hasil penelitian menunjukkan bahwa media dasar ½ MS dengan tambahan 0.50 mg/L IBA mampu meningkatkan jumlah akar sebesar 6.20 dengan panjang akar 5.04 cm. Hasil aklimatisasi di rumah kaca dengan tingkat keberhasilan 60%. Pemberian mikoriza pada tahap aklimatisasi mampu meningkatkan jumlah akar.

Kata kunci: *Artocarpus altilis*, induksi perakaran, aklimatisasi, mikoriza

Abstract. *Noorrohmah S, Imelda M. 2015. Root induction and acclimatization of in vitro plantlets of* Artocarpus altilis*. Pros Sem Nas Masy Biodiv Indon 1: 1896-1899.* Breadfruit is one of forest plants with a high level of carbohydrate. In a certain area, it becomes an alternative staple food when the main staple foods are scarce. The limited availability of seedling with conventional technology is the main obstacle to the development of breadfruit. Consequently, the multiplication of breadfruit was developed by tissue culture techniques. Tissue culture technology has the ability to produce seedling in a large quantity, with uniform growth rate and in relatively short time. The critical step of propagation by tissue culture techniques is the acclimatization of plantlets. This study aimed to determine the response of explants for root induction with IBA and get proper acclimatization medium for the growth of plantlets breadfruit. This research used Bone cultivar Breadfruit. The study consisted of two steps. The first step was root induction with strength half MS or MS and added IBA (0.25; 0.50; 1.00) mg/L. The second was acclimatization, plantlets were planted which containing cocopeat + carbonized rice hulls + sand + soil (4: 2: 2 :3) and cocopeat + carbonized rice hulls + sand + soil (4: 2: 2: 3) + mycorrhizae was used to plantlets without root. The parameters of in vitro observation were root number and root length while survival rate, root number and root length at acclimatization. The results showed that strength half MS + 0. 50 mg/L IBA increase root number 6.20 and root length 5.04 cm. Acclimatization was performed in the greenhouse with a rate of success 60%. Mycorrhizae increase root number at acclimatization step.

Keynotes: *Artocarpus altilis*, root induction, acclimatization, mycorrhizae

INTRODUCTION

Breadfruit is one of forest plants, which has a high content of carbohydrate. In certain area, it is an alternate staple food when the main staple foods are scarce. The high carbohydrate content of breadfruit may become substitute rice as a staple food. Moreover, rice production in Indonesia is not adequate to the needs of the Indonesia people. The import of rice should still be held every year. Thus, the breadfruit is a potential source of food supply in the future, especially in support of food diversity program. The main constraint of development of breadfruit is limitation of seedling availability. The propagation of breadfruit had been done conventionally as grafting and root cuttings. Seed production is important in the development of a type of plant. Tissue culture technique has ability in producing seedling in large quantity, in uniform growth rate and in a relative short time. Production of seedlings through tissue culture techniques required several steps. The first step was shoot multiplications. The

second step was elongation, the third rooting initiation, and the last was acclimatization. Each step needed combinations between growth regulator auxin and cytokine. In the shoot multiplication step, a growth regulator cytokine plays a larger role than auxin. On the contrary, the use of plant growth regulator auxin will induce root initiation. The purpose of this study is to obtain the most efficient techniques for breadfruit propagation.

MATERIALS AND METHODS

Rooting in vitro

To study the effective strength for rooting were pulse treated with different concentrations of IBA (0.25; 0.50; 1.00) mg/L and cultured on basic medium full strength MS and half strength MS (1/2 MS). The parameters measured were numbers and lengths of roots. The frequency of explants-producing root was scored 6 weeks after by analysis of variance (ANOVA) and Duncan advanced test.

Acclimatization

In vitro rooted plantlets with 3 to 5 cm length were washed carefully with water to remove traces of agar and then transferred to the boxes. Experiments were carried out by planting plantlets acclimatization breadfruit in media cocopeat + carbonized rice hulls + sand + soil (4: 2: 2 :3) and cocopeat + carbonized rice hulls + sand + soil (4: 2: 2: 3) + mycorrhizae was used to plantlets without root. Treatment consists of P1 = plantlets have been rooted, P2 = plantlets have not been rooted plantlets, P3 = plantlets have not been rooted + mycorrhizae. The boxes were covered with tight plastic covers to prevent desiccation and to avoid rapid changes in environment and acclimatized in the green house. During the hardening procedure, plastic covers were gradually perforated after 15 days. The measured parameters were percentage of survival rate, numbers and lengths of roots.

RESULTS AND DISCUSSION

Root establishment from in vitro shoots

The results of the ANOVA tested at 6 weeks showed that IBA significantly affected the number and length of roots. The highest number of roots are 6.20 per bottle on cultured half strength MS medium + (0.50 to 1.00) mg/L IBA. Addition of 0.50 mg/L IBA on half strength MS medium showed the highest root length response (Figure 1).

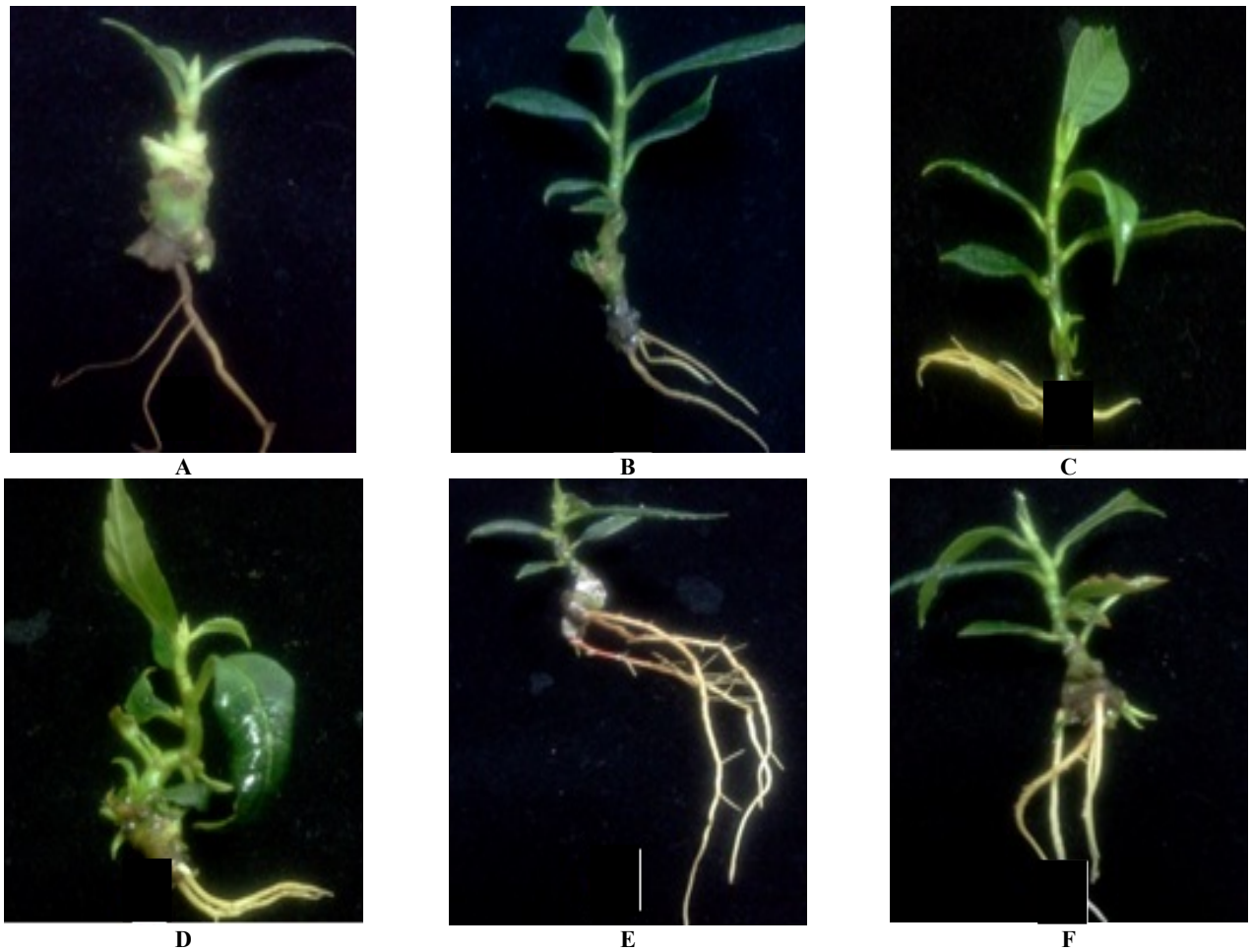

Figure 1. In vitro inducing root by using (0.25; 0.50; 1.00) mg/L IBA respectively on half strength MS (A-C) medium and full strength MS medium (D-F) after 6 weeks.

Table 1. Effect of IBA on numbers and lengths of roots at 6 weeks after

Treatments (mg/L)	Mean of root number	Mean of root length (cm)
MS + 0.25 IBA(A)	0,20^{c}	3,00^{b}
MS + 0.50 IBA(B)	4,20^{ab}	2,80^{b}
MS + 1.00 IBA(C)	1,80^{bc}	2,08^{b}
½ MS + 0.25 IBA (D)	0,20^{c}	3,00^{b}
½ MS + 0.50 IBA (E)	6,20^{a}	5,04^{a}
½ MS + 1.00 IBA (F)	6,20^{a}	3,40^{ab}

Note: *)Means followed by the same letter are not significantly different at p = 0.05

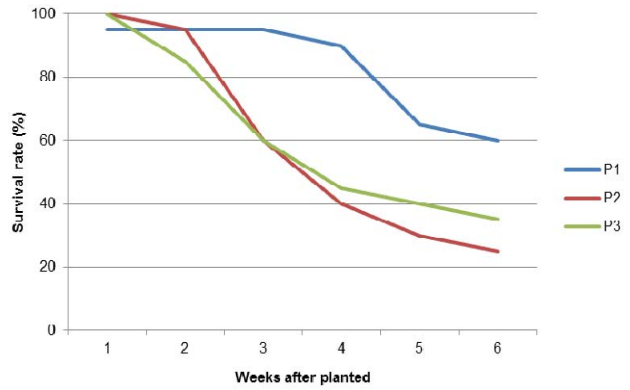

Figure 2. Effect of various treatments on acclimatization of in vitro plantlets of *Artocarpus altilis* (Parkinson) Fosberg after 6 weeks planted.

From the Duncan advanced test (DMRT), the effect of IBA showed that each treatment is not significantly different at the level of 5% of the number of roots and root length (Table 1).

This is consistent with statement George and Sherrington (1984) and Hobir et al. (1992) that if endogenous auxin ration in plant are equal with cytokinine, this condition will go straight to callus development; meanwhile if auxin ratio is higher than cytokinine, it tends to develop roots. Higher hormone contents will disturb development, toxicate or even kill plants (George et al. 2007).

Acclimatization

Acclimatization is a crucial step prior to transplantation of plants to the soil. The in vitro plantlets live in 100% relative humidity and they also depend on the medium for supply of sugar and other nutrients (Ahuja 1933). Plants are, therefore, allowed to grow on rooting medium for about 6 weeks after root initiation. During this phase the nutrients in the culture go on gradually depleting and plants become sturdy and easy to acclimatize in green house. For transferring the plants from *in vitro to ex vitro* environment used cocopeat + carbonized rice hulls + sand + soil (4: 2: 2 :3) medium. The highest survival percentage (Figure 2) was found in P1 (60%), P2 (25%), and P3 (35%).

Based on ANOVA test at 6 weeks after planting showed the effect of acclimation upon mycorrhizae significant effect (Figure 3) of the root number and no significant effect on the root length. Duncan advanced test results at p=0.05 showed that treatment P3 significantly

P1 **P2** **P3**

Figure 3. Effect of mycorrhizae in each treatment

Table 2.Effect of mycorrhizae on number and length of roots at 6 weeks after

Treatments	Mean of root number	Mean of root length (cm)
P1	8.67[b]	3.38[a]
P2	4.33[c]	3.95[a]
P3	14.67[a]	2.43[a]

Note: *) Means followed by the same letter are not significantly different at p = 0.05

effect of the root number if compared with P2 and moreover P1 which have been rooted (Table 2). Giving mycorrhizae showed no significant effect of the root length to each treatment.

One of the feasible means to increase P element in soil is by using Mycorrhizae. The mycorrhizae symbiosis with plant roots, growing external hives which are capable to increase P absorbtion from soil. This is consistent with statement that mycorrhizae can use P infected by soil particles (Smith and Read 1977).

In conclusion, the best medium to induce rooting in vitro is half strength MS medium + 0.50 mg/L IBA. The success of acclimatization in greenhouse achieved by 60% with medium + carbonized rice hulls cocopeat + sand + soil (4:2:2:3). Mycorrhizae able to increase rooting induction breadfruit plants in the field.

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