

Propagation of Valuable North Sumatera Benzoin Trees (*Styrax Sp*) Using Macrocutting Technique

A Susilowati^{1*}, K S Hartini¹, H H Rachmat², M Alvaroby¹

¹Faculty of Forestry, University of Sumatera Utara.Jl. Tridharma Ujung No 1. Kampus USU Medan20155

²Forest Research and Development Agency, Ministry of Environment and Forestry. Jl. Raya Gunung Batu. Bogor.16680

*arida_iswanto@yahoo.co.id

Abstract. Kemenyan known as Sumatran benzoin is North Sumatera local species that produce high valuable rosin and prospective export commodities. However, sustainability of Sumatran benzoin production has many constraints such as instability of resin production, lack information of propagation technique and traditional management system. Until now, comprehensive information for Sumatran benzoin propagation system still not determined yet. The objectives of this research were (1) to get information about propagation technique of Sumatran benzoin and its suitable growing medium and 2) to get information on adventitious root formation in Sumatran benzoin cuttings. Cutting materials (Toba benzoin and Durame benzoin) were originated from 1 year old seedling propagated by seed. Media used were combination of sand : rice husk (1:0 v/v; 1/1 v/v). Results showed that interaction between media and benzoin species significantly affected primer and secondary root length. While planting medium significantly improved secondary root length and number. Benzoin species significantly affected primary and secondary root length, and secondary root number.

1. Introduction

Kemenyan is North Sumatera local species that produced valuable resin and prospective export commodities [1]. Kemenyan known as rosin producer that is very valuable for their use in pharmaceutical, cosmetic, food preservatives and vernis [2]. Despite their potential commodities, kemenyan management is still using traditional technique, no exception for seedling propagation which still rely on natural regeneration [3], & [4]. Generative propagation also constrained due to recalcitrant seed character and mechanical dormancy that causing lower germination percentage and longer germination time (8-10 months for kemenyan toba and 2-3 months for kemenyan durame).

Due to the importance and economical value of this species, improving propagation technique play important role to sustainability of kemenyan production. Therefore vegetative propagation can be used as alternative of propagation technique. In Indonesia, the successful of vegetative propagation for improving quality of seedling and conservation rare species have been reported by some research i.e *D. cinereus*[5], *A. malaccensis*[6], *E. longifolia*[7] and Hopea [8].



Vegetative propagation techniques represent first step in tree species domestication [9] and offers opportunity of avoiding the problem of recalcitrant seeds [10]. Vegetatif propagation also facilitates the transference of genetic potential as well as the non additive variance of the parent to the new plant [11] and offers availability of superior individuals in a short period of time for large scale commercial plantation [12]. One of promising vegetative propagation technique here is macrocutting. Macrocutting is easier, cheaper, faster and offers more economical benefits compare to others [13]. Therefore research on macrocutting propagation of kemenyan were conducted to get information about propagation technique of Sumatran benzoin and its suitable growing medium.

2. Method

2.1. Materials

Cutting materials were originated from 1 year old kemenyan toba and durame seedling available at AekNauli Forest Research Agency, Pematang Siantar which fulfill stem health criteria. Medium used was sand and carbonized rice husk (1:0; 1:1 v/v in ratio). Propagator box, shading net, potray and cuttings scissors also used as tools for this research.

2.2. Methods and data analysis

Cutting experiment was carried out based on KOFFCO technique[14]. Cutting material were taken from ortotroph branches and cut 7-10 cm and immediately store in container water. Cutting then repeatedly washing use sterilized water. The cuttings were planting in prepared potray containing sterilized medium and replaced in propagator box according to the treatment. Propagator box then stored in green house with light intensity reduced to about 50 %. Watering was done twicedaily, preferably once in the morning before 10.00 a.m. andonce in the late afternoon after 4.00 p.m to ensure theseedlings receive enough water during theirinitial growing stage.

The factorial complete block design was used in setting the cuttings. Observation was done after 60 days from planting using parameter percentage of survival cuttings, rooted cuttings, primary and secondary root length, primary and secondary root number and length of shoot.

3. Result and Discussion

Root formation is critical and important phase to determined the succesfull of cuttings. Therefore its necessary to get suitable treatment for inducing quality root formation. The results obtained from this reseach were presented in Table 1. Interaction between media and benzoin species significantly affected primary and secondary root length, while medium significantly improved secondary root length and number. Kemenyan species significantly affecting primary and secondary root length, and secondary root number.

Table 1. The summary of analysis of variance for percentage of survival, rooting percentage, primary and secondary root length and number of primary and secondary root.

Source of variation	<i>P value</i>						
	Percentage of survival	Percentage of rooting	Shoot length	Primary length	Secondary root length	Primary root number	Secondary root number
Medium	0.580 ^{ns}	0.354 ^{ns}	0.381 ^{ns}	0.945 ^{ns}	0.002 ^{**}	0.860 ^{ns}	0.010 ^{**}
Species	0.580 ^{ns}	0.354 ^{ns}	0.080 ^{ns}	0.024 [*]	0.011 ^{**}	0.388 ^{ns}	0.002 ^{**}
Interaction	0.580 ^{ns}	0.354 ^{ns}	0.341 ^{ns}	0.465 ^{ns}	0.019 ^{**}	0.599 ^{ns}	0.299 ^{ns}

* = Significant at 5%; ns = not significant at 5% level of probability.

Until the end of observation (12 weeks), all cutting were healthy (Figure 1), grew well with greeny leaf with high survival percentage (91.7-100%). Kemenyan toba has the highest mean of survival percentage (100%) and all treatments showed high ability of rooting (91.7%). Rooting percentage resulted in this research was higher compared to previous research in kemenyan cuttings [4] using 4 month old seedling treated by IBA addition (83%) on KOFFCO technique. The higher capability of rooting without auxin exogen addition in our research indicated that the cutting material contain proper endogenous auxin, so that no need to adding exogen auxin. Physiologically, endogenous auxin play important role to convert carbohidrate pool to be soluble sugar which needed for cell division and enhancing the speed of sugar mobilization from leaf to the base of cuttings for induced root primordia.

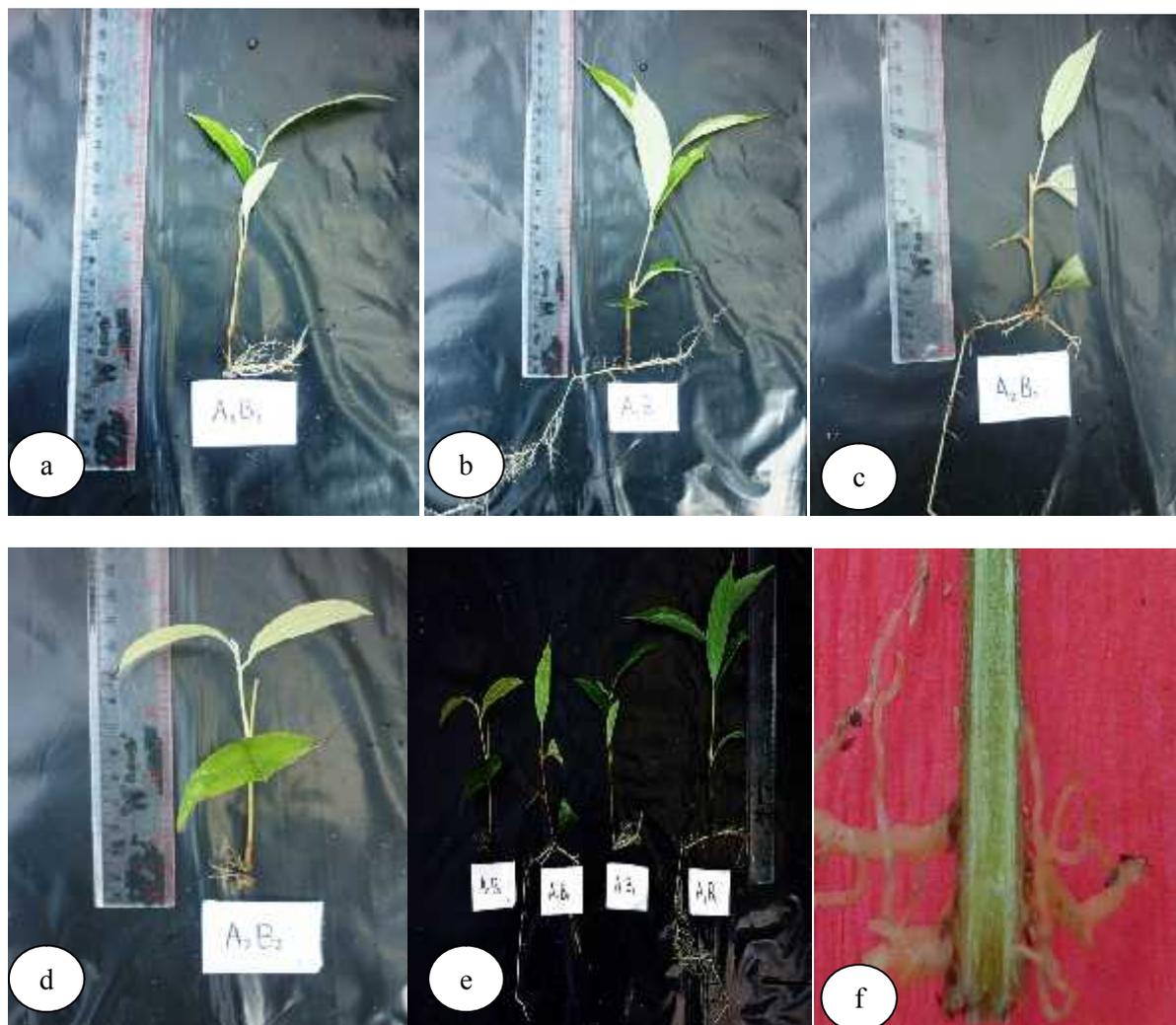


Figure 1. Result of cuttings experiment (a)Durame*sand medium, (b) Toba*sand medium, (c) Durame*sand:carbonized rice husk (1/1v/v), (d) Toba* sand:carbonized rice husk (1/1v/v), (e) performance of overall cuttings experiment, (f) adventitious root of kemenyan cuttings

Another indicators for the succesfully of cuttings were lenght and number of root formation. In this research, medium significantly improved secondary root length and number. Both of cutting species produce the highest mean of secondary root number when planting in sand:carbonized rice husk (1:1v/v) media. However, the use of pure sand media produce the highest mean of secondary root length. Previous research showed that type of media can have a major effect on the rooting and growth

capacity of cuttings [14]. The suitability of sand media and its combination for kemenyan also described by [15], they stated that kemenyan need porous, good oxygen diffusion and drainage media for growth.

Table 2. The summary of percentage of survival, rooting percentage, primary and secondary root length and number of primary and secondary root.

Parameters	Pure sand		Sand:carbonized rice husk (1:1v/v)	
	Durame	Toba	Durame	Toba
Percentage of survival (%)	91,67	91.67	91.67	100
Rootingpercentage (%)	91.67	91.67	91.67	91.67
Number of primary root	4.67	4.33	5.60	3.67
Number of secondary root	26.0	15.67	29.33	22.33
Primary root length (cm)	4.15	2.33	3.72	2.68
Secondary root length (cm)	2.44	0.80	0.43	0.34
Shoot length (cm)	8.17	5.83	8.10	7.33

Kemenyan durame produced the highest mean of primary and secondary root length and number in both of media treatment. It can be concluded that kemenyan durame have better rooting ability compared to kemenyan toba. Adventitious root formation of cuttings was complex process and affected by multiple factors i.e. genetic background, physiology of mother plant, auxin contain and plant metabolism [16]. Our histological observation using root specimen (Figure 1f) found that adventitious root formation on kemenyan originated from cell differentiation in wounded area near the cambium and phloem, followed by root primordia formation and root meristem formation.

4. Conclusion

Kemenyan can be propagated using macrocuttings technique and resulted high rooting ability (91,76%) without the addition of exogenous auxin. The successful of kemenyan cutting initiated by adventitious root formation through cell differentiation in wounded area near the cambium and phloem. Pure sand and combination sand:carbonized rice husk (1:1v/v) were suitable media for propagating kemenyan vegetatively because both media can produced higher number and length of root.

Acknowledgement

We would like to express our sincerely thanks to SEAMEO-BIOTROP for supporting our research fund with *Joint research grant*. My sincere appreciation also goes to BPK Aeknauli and farmer in North Tapanuli, for the access to their kemenyan forest and providing cuttings material as well as for technical assistance during fieldwork.

References

- [1] Iswanto AH et al 2016 J. Korean Wood Sci. Technol **44**(4):539-550
- [2] Pinyopusarerk K, Fisher M, Coppen JJW, Sroithongkham P, Kashio M, Costaz R, 2001. Monograph on Benzoine Food and Agriculture Organization of The United Nations Regional Office for Asia and Pasific
- [3] Kholibrina CR, Aswandi 2013. International Seminar Forests and Medical Plants for Better Human Welfare. Bogor
- [4] Putri KP, Danu 2014. Jurnal Penelitian Hutan Tanaman **11**(3): 141-147
- [5] Rahmat HH, Subiaktio A 2015. Pros Sem Nas Masy Biodiv Indon: **1**(3):560-564
- [6] Sumarna Y 2008 Info Hutan: **1** : 79-87

- [7] Susilowati A, Supriyanto, Siregar IZ, Subiakto A 2012. FORESTA Indonesian of Journal Forestry**I** (1): 25-29
- [8] Wulandari AS, Subiakto A, Revan R 2015 Jurnal Silviculture Tropika: **06** (3):190-195
- [9] Leakey RRB, Simons AJ 1998 Agrofor. Syst.**38**:165–176.
- [10] Gbadamosi AE, Oni O 2005 Journal of Arboriculture **31**(2)
- [11] Susilowati A, Siregar IZ, Supriyanto, Wahyudi I, Corryanti 2013 Biotropia 20(2)
- [12] Pandey A, Tamta S, Giri 2011 Int. J. Biodivers. Conserv.: **3**(4):142-146
- [13] Sarrou E, Therios I, Theriou KD 2014 Turk J. Bot **38**:298-231
- [14] Sakai C, Subiakto A, Nuroniah HS, Kamata N. 2002. J.ForRes, **7**:73-80.
- [15] Jayusman 2014 Mengenal pohon kemenyan (*Styrax* spp.) jenis dengan spektrum pemanfaatan luas yang belum dioptimalkan. IPB Press
- [16] Geiss, G., Gutierrez, L., & C. Bellini. 2009. Annu.Plant. Rev**37**: 127-156.