ASIAN JOURNAL OF PHARMACOGNOSY
Asian J. Pharmacogn 2(4):13-18

eISSN-0128-1119

Effect of a Misting System and Rooting Media of *Labisia pumila* Cuttings

Rozihawati Zahari[a]*, Nor Aini Ab. Shukor[a] and Norhayati Abdullah[b]

[a]*Laboratory of Sustainable Bioresource Management (BIOREM), Institute of Tropical Forestry and Tropical Product (INTROP) Universiti Putra Malaysia, Serdang, Malaysia.*
[b]*Department of Natural Product, Forest of Research Institute Malaysia (FRIM), Kepong, Selangor, Malaysia.*

Received June 3, 2018; accepted August 13, 2018; published online November 3, 2018

*For correspondence: rozihawatizahari@yahoo.com

ABSTRACT

Labisia pumila is one of the most popular and potent ingredients used in Malay traditional herbal. However, logging activities and forest encroachment reduced the productivity of *L. pumila* in natural stands. In addition, the species is slow growth and its scarcity of wildings in natural forests. Due to the problems, a study on *L. pumila* cuttings to examine the possibility of raising planting stocks was studied. The experiment was done at FRIM's nursery with a Split-Split Plot (SSPD) in a Randomized Complete Block Design (RCBD) involving two propagation systems (misting and non-misting), three rooting media (river sand, sawdust and 1:1 mixture of river sand and sawdust) and three plant parts (stem, petiole and leaf). Results indicated significant differences ($p \leq 0.05$) in all treatments with regards to their root and shoot development. Cuttings propagated in misting system produced better rooting ability (84%) than the non-mist system (72%). However, cuttings propagated in non-mist system showed better shoot growth (29%) than the ones raised in the misting system (20%). Cuttings grown in river sand produced higher root and shoot abilities (87% and 26%) than those raised on river sand and sawdust mix (1:1) (76% and 24%) and in sawdust (72% and 23%). Stem cuttings performed best compared to leaf and petiole cuttings. In conclusion, *L. pumila* var. *alata* stem cuttings could be possibly propagated vegetatively through rooting of cuttings with favorable treatments such those raised on river sand medium under the misting propagation system.

Keywords: Labisia pumila var *alata*; misting system; rooting media; cutting

ASIAN JOURNAL OF PHARMACOGNOSY
Asian J. Pharmacogn 2(4):13-18

eISSN-0128-1119

INTRODUCTION

Labisia pumila (Bl.) F. Vill & Naves belongs to Myrsinaceae family. This species can be found in tropical and subtropical regions including Indo China and Malaysia. The plant is a wild forest herb, which is commonly found in the lowland and hill forests of the Peninsular Malaysia at altitudes between 300 and 700 m above sea level (Sulaiman et al., 1992). The uses of this species in childbirth suggest the presence of phytochemicals that can cause smooth muscle contraction of the pregnant uterus to facilitate delivery or relaxation of the cervical smooth muscle to hasten delivery (Bowman and Rand, 1990). The demand for *L. pumila* from the forest areas is expected to increase based on current demand (Mohd Setafarzi, 2000). The supply of *L. pumila* and other medicinal plants for commercial purposes is dependent on natural forests, plantations, and imports (Mohd Azmi and Norini, 2000). The common trend shows that increased logging activities and encroachment of forest areas, cause tremendous decreased in *L. pumila* stockings from its natural stands. Besides, such a problem is also impeded by its poor slow growth and regeneration in the natural forests (Mohd Noh et al., 2002). The dependence on seeds as a source of planting material is also inadequate as seeds are difficult to obtain and even if available, they are in low number due to decreasing number of productive mother plants. In meeting the demand, it is necessary to find an alternative method of production to ensure regular supply of planting stock of this species and to offset the ever-increasing demand. Hence, vegetative propagation by cuttings can be one of the alternative methods to be used (Aminah, 1991a; Aminah et al., 1996). Vegetative propagation via cutting is the most appropriate technique for ensuring an adequate supply of planting stock (Kantarli, 1993). In order to gain successful results using vegetative propagation by cuttings, it would definitely require an extensive scientific research exploring on the optimum factors affecting rooting of cuttings. The findings of the study can also provide a basis for formulating suitable operational planting methods and systems for propagating this valuable indigenous herbal species. Thus, the objective of this study is to explore the possibility of propagation techniques through cuttings for mass production of *L. pumila*.

MATERIALS AND METHODS

L. pumila samples were collected from Belum Forest Reserve, Perak. The experiment was conducted in Institute Forest Research Malaysia (FRIM)'s nursery. Cuttings were assigned randomly into plots within a row (10 cuttings) and each receiving 40 cuttings of stem, leaf, and petiole. Each cutting was considered as an individual sample. Two types of propagation systems were used in this study; the mist and the non-mist. The plastic enclosure was also shaded with black plastic netting to provide 50% light intensity. The non-mist propagation bed was enclosed with transparent plastic then shaded with black plastic netting (50% light intensity). The average RH of the rooting bed (mist system) was 90%, and 80% for mist and non-mist system, while the average RH of the greenhouse was 73%. The average light intensity in mist and non-mist systems was 30 RLI (Relative Light Intensity) and 82.7 RLI in the greenhouse. The air temperature around the cuttings ranged from 25°C in the morning to 31°C in midday (for greenhouse). Three types of rooting media used in this study; sand, sawdust, and mixture of 1:1 v/v sawdust and sand. All media were sterilized prior to use. Cuttings of stem, petiole, and leaf of *L. pumila* were used in the experiment. The stem cuttings were utilized without leaf and the leaf was cut into two parts which first part included petiole and the second part is a marginal part. The leaf area from the apex of the cutting was maintained to 40 cm2 whereas, leave area of the petiole cutting from the base was maintained to 20 cm2. The diameter size of the stem cuttings was recorded (6 cm). The leaf area was measured using a leaf and petiole area meter (Delta-T series, Taiwan). Then the cuttings were treated immediately with Seradix 1, (0.1%, IBA)

ASIAN JOURNAL OF PHARMACOGNOSY
Asian J. Pharmacogn 2(4):13-18

eISSN-0128-1119

before being inserted into the rooting medium of the propagation bed. The experimental design used for this experiment is a Split-split Plot Design (SSPD) in a Randomised Complete Block Design (RCBD). The use of SSPD tends to improve the precision of the measurement on the effect of the subplot and the sub-subplot based on the main plot factor. RCBD was used in this study because the layout of the propagation bed was heterogeneous. The experiment was a 2 x 3 x 3 factorial experiment with four replications. There were two types of misting systems; mist and non-mist systems as the main plot, three media (sand, sawdust, and mixture of sand and sawdust) as the subplot. Treatments namely stem, petiole and leaf were randomly arranged into plots within a row. Data were analyzed using SAS software and interactions between the treatment factors were included in the analyses of variance (ANOVA). Duncan's range tests were used to compare the treatment means in the experiment.

RESULTS

Table 1 shows that there were significant differences ($p \leq 0.05$) in term of misting systems for all parameters, except shoot percentage. The rooting percentage of these cuttings in the misting system recorded 95% than the ones raised in non-misting (84%). In terms of media rooting, the river sand media recorded higher rooting percentage (94%), shooting percentage (31.60%), root length (3.64 cm), the total number of root and shoot was 1.27 compared to other rooting media.

Table 1. Means of root and shoot performance based on different treatments

Sources Of Variation	Levels	Rooting %	Shoot %	Root length	Total number of root	Total number of shoot
Misting	Mist	95.60^{a}	29.60^{a}	2.30^{b}	1.25^{b}	1.25^{b}
System	Non-mist	84.80^{b}	30.90^{a}	2.81^{a}	1.27^{a}	1.27^{a}
Media	River sand (R)	94.60^{a}	31.60^{a}	3.64^{a}	1.27^{a}	1.27^{a}
	Sawdust (S)	89.40^{ab}	28.20^{b}	1.67^{c}	1.24^{b}	1.24^{b}
	R:S (1:1 v/v)	87.90^{b}	30.80^{ab}	2.35^{b}	1.25^{b}	1.25^{b}
Plant	Stem	96.10^{a}	90.6^{a}	2.48^{b}	1.30^{a}	1.30^{a}
Parts	Petiole	86.40^{b}	0.00^{b}	2.28^{b}	1.23^{b}	1.23^{b}
	Leave	89.50^{b}	0.00^{b}	2.90^{a}	1.23^{b}	1.23^{b}

Note: Means with the same letters are not significantly different at 0.05 level of confidence (Duncan's Multiple Range Test).

The cutting taken from stem produced higher rooting percentage (96.10%), shoot percentage (90.60%), root length (2.48 cm), the total number of root and shoot was 1.30 compared to petiole and leaf cuttings. However, the petiole and leaf rooted cuttings no produce shoot number.

ASIAN JOURNAL OF PHARMACOGNOSY
Asian J. Pharmacogn 2(4):13-18

eISSN-0128-1119

DISCUSSION

Effect of misting systems: The rooting percentage of *L. pumila* cuttings raised in both misting systems, where cuttings raised in mist system performed better than cuttings raised in the non-mist system. This was because misting provides the necessary water which regulates the temperature and humidity in the mist system. Relative humidity in both propagator systems had the average RH of the rooting bed (mist system) was 90%, and 80% for non-mist system respectively in this study. However, Aminah (2003) reported that rooting ability in *Endospermum malaccense* did not show any difference between both misting systems. Tarit et al. (2011) reported that *Litsea monopetala* rooted cuttings in non-misting propagator were also showed maximum survival. The success of the mist system also depends on the condition under which they are used and significant water deficits can occur in both systems. According to Grange and Loach (1983) and Loach (1988b), successful propagation is dependent on the maintenance of suitable leaf temperature, irradiance and leaf-to-air vapor pressure deficit (VPD) for the metabolic processes involved in rooting. As rooting is dependent on water loss from cuttings and is primarily influenced by VPD, the quantification of VPD in different propagation environments is particularly useful (Grange and Loach, 1983). It has been noted in many studies that newly planted cuttings were sensitive to water deficit prior to rooting which in turn affects the physiological processes of cuttings and hence their rooting ability (Grange and Loach, 1983; Newton and Jones, 1993a; 1993b). Hence, intensive transpiration from leaves due to unfavorable environmental conditions such as an extreme temperature exceeding 35°C, excessive light intensity and water deficit must be avoided. Relative humidity of 80% or above should be maintained in the cutting beds to suppress transpiration (Zobel et al., 1983).

*Effect of media:*Overall, river sand medium exhibited the highest rooting and shoot percentage, total number of root and shoot, and root length compared to the mixture of sawdust and river sand and sawdust (Table 1). Successful results using sand as a medium have also been reported in some medicinal tree species such as *Prunus africana* (Tchoundjeu et al., 2002) and Allanblackia floribunda (Atangana et al., 2006). Aeration and water holding capacity could be one of the factors affecting the rooting ability of *L. pumila* cuttings in river sand medium. Since aeration and water holding capacity of the media are often negatively correlated, a balance between these must be achieved to ensure optimal rooting, which is mostly dependent upon whether the species is xeromorphic or hypomorphic (Loach, 1985). In the study, the cuttings produced less rooting with poor shoot grown in sawdust medium. The medium could be due to a fibrous medium that can absorb more water and is more compact than river sand. Thus, the high water availability in this medium contributes to excessive water which induces microbial activity that leads to disease infection which after causing cuttings to rot. The phenomenon has been supported by Mesen et al. (1997b) reporting that excess water availability in sawdust inhibited oxygen diffusion causing anoxia and reduced water absorption leading to the death of tissue.

Effect of plant part: Among plant parts used, stem cuttings gave the highest rooting and shoot percentage, total number of root and shoot, and root length followed by petiole and leaf (Table 1 and Figure 1). The results are also in agreement with previous work of Akuatulira et al. (2011) on vegetative propagation of medicinal plants, which stem cuttings also recorded the highest rooting percentage. The higher number and longer roots produced by stem cuttings could also be due to the presence of high free auxins, sugars, free phenols and other nutrients in the softwood stem cuttings (Agbo and Obi, 2007). As reported by Yeboah and Amoah (2009), plant substances such as sugars,

ASIAN JOURNAL OF PHARMACOGNOSY
Asian J. Pharmacogn 2(4):13-18

eISSN-0128-1119

auxins, and free phenols are responsible for root initiation and deactivation of indoleacetic acid (IAA) oxidases.

CONCLUSION

In conclusion, the results of this research have demonstrated that stem cuttings propagated in misting system produced better root percentage than the ones raised in the non-mist system. Cuttings grown in river sand produced higher root and shoot abilities than those raised on river sand and sawdust mix (1:1) and in sawdust.

DECLARATION OF CONFLICT OF INTEREST

We have no conflict of interest to declare.

REFERENCES

Akwatulira, F., Gwali, S., Segawa, P., Okullo, J.B.L., Tumwebaze, S.B., Mbwambo, J.R. Muchugi, A., 2011. Vegetative propagation of *Warburgia ugandensis* Sprague: An important medicinal tree species in eastern Africa. J Med. Plants Res. 5(30), 6615 – 6621.

Agbo, C.U. and Obi, I.U., 2007. Variability in propagation potentials of stem cuttings of different physiological ages of *Gongronema lotifolia* Benth. World J. Agri. Sci. 3 (5), 576 – 581.

Aminah, H., 1991a. A note on the rooting of *Shorea bracteolata* stem cuttings. J. Tropical For. Sci. 3,187 –188.

Aminah, H., Dick, J.M. and Grace, J., 1996. Vegetative propagation of *Shorea leprosula* Miq. by stem cuttings in non-mist and mist propagation systems. Commonwealth For. Rev. 75(**3**), 221-226.

Atangana, A.R., Tchoundjeu, Z., Asaah, E.K., Simons, E.K. and Khasa, D.P., 2006. Domestication *of Allanblackia floribunda*: Amenability to Vegetative propagation. J. For. Ecology and Manage. 237, 246-251.

Bowman, W.C. and Rand, M.J., 1990. Textbook of Pharmacology. Blackwell Scientific Publications, Great Britain. 2053 pp.

Eames, A.J. and Macdaniels L.H., 1987. An Introduction to Plant Anatomy (2 nd Edition). McGraw-Hill Book Company, Inc, London. 394 pp.

Grange, R.I. and Loach K., 1983. Environmental factors affecting water loss from leafy cuttings in different propagation systems. J. Horticulture Sci. 58, 1-7

Kantarli, M., 1993. Vegetative propagation of Dipeterocarps by cuttings in ASEAN – Canada Forest Tree Seed Centre. Handbook at Muak – Lek, Saraburi 81180, Thailand

Loach, K., 1985. Rooting cuttings in the relations to the propagation medium. Proc. Int. Plant Prop. Soc. 35, 472-485.

Loach, K., 1988. Controlling environmental conditions to improve adventitious rooting. In: Adventitious root formation in cuttings. In: Davis, T.D., Haissig, B.E. and Sankhla, N. (Eds.), Dioscorides Press, Oregon, USA, pp 248-273.

Mesen, F., Newton, A.C., Leakey, R.R.B., 1997b. The effects of propagation environment and foliar area on the rooting physiology of *Cordia alliodora* (Ruiz and Pavon) Oken cuttings. Trees 11, 404-411.

Mohd Jelani, B., Mohd Noh, J., Ahmad, N., 2000. Propagation and cultivation of potential herbal crops – to meet the need and demand of the industry. In *Proceeding Herbs an International Conference Exhibition,* 9-11 Nov. 1999. Malaysia Agricultural Research and Development Institute, Serdang, Selangor, Malaysia 2000. Pp. 64-67.

Mohd Noh, H.J., Mohd Jelani, B. and Mohd Akhir, A.H., 2002. Prestasi Pertumbuhan Empat Variati Kacip Fatimah Di Ladang Semaian Sungkai, Perak. In *Proceeding of the Seminar on Medicinal Plants and Aromatic Plants.* 20-21 August 2002, ed. Chang Y.S., Mastura, M. and Nurhanan, M. Y., Forest Research Institute Malaysia (FRIM), Kepong Kuala Lumpur, Malaysia 2004. pp. 25-27

Mohd Setafarzi, M.N., 2000. Status penggunaan herba oleh pengilang tempatan dan potensi penanaman di Malaysia. In *Proceeding of the Seminar Medicinal & Aromatic Plants.* 12-13 September, 1999, ed. Chang, Y. S., Mastura M., Vimala, S. and Zainon, A. S., Published by Forest Research Institute Malaysia (FRIM), Kepong, Malaysia 2002. pp 139-145.

Mohd Azmi, M. and Norini, H., 2000. Supply and demand of medicinal plants: A preliminary study in the northern states of peninsular Malaysia. *In Proceeding of the Seminar on Medicinal & Aromatic Plants.* 12-13 September 2000. ed. Chang Y. S., Mastura, M. Vimala, S. and Zainon A.S.. Forest Research Institute Malaysia (FRIM), Kepong, Selangor, Malaysia 2002. Pp. 16-25.

Newton, A.C., Jones, A.C., 1993a. Characterisation of microclimate in mist and non-mist propagation systems. J. Horticulture sci. 68, 421-431.

ASIAN JOURNAL OF PHARMACOGNOSY
Asian J. Pharmacogn 2(4):13-18

eISSN-0128-1119

Newton A.C., Jones A.C., 1993b. The water status or leafy cuttings of four tropical tree species in mist and non-mist propagation system. J. Horticulture Sci. 68, 653-663.

Qiang, S., Kiyotsugu, Y., Hitoshi, S., 2005. Internal Axial Light Conduction in the Stems and Roots of Herbaceous Plants. J. Exp. Botany 409,191-203.

Salisbury, F.B., Ross, C.W., 1992. Plant Physiology (4th ed.). Wadsworth Publishing Company Belmont, California.

Sulaiman, B., Mansor, M., Jaafar, A., 1992. "Some medicinal plants in mount Bubu, Perak". In *Proceeding in Medicinal Products from Tropical Rain Forest.* September 1991, ed. Shaari, K., Abd. Kadir, A. and Mohd. Ali, A. R., Forest Research Institute of Malaysia, Kepong, Malaysia. pp. 37-43.

Tarit, K.B., Mohammad, M.H., Mohammad, M., Mohammad, M. 2011. Vegetative propagation of *Litsea monopetala,* a wild tropical medicinal plant: Effects of indole-3-butyric acid (IBA) on stem cuttings. J. For. Research 22 (3), 409 – 416.

Tchoundjeu, Z., Avana, M.L., Leakey, R.R.B., Simons, A.J., Asaah, E., Duguma, B., Bell, J.M., 2002. Vegetative propagation of *Prunus africana*: effects of rooting medium auxin concentrations and leaf area. Agroforestry systems 54,183-192.

Yeboeh, J.S.T.L., Amoah, F.M. 2009. The rooting performance of shea (*Vitellaria paradoxa* C.F. Gaerth) cuttings leached in water and application of rooting hormone in different media. J. Plant Sci. 4(1),