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Lawsonia inermis (Lythraceae): A Native Plant as a Promising Landscape Plant

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ABSTRACT

This study is a successful effort undertaken to introduce *Lawsonia inermis* a native plant, to the landscape industry. It can be propagated by seeds. However, seeds are not available through the year. Therefore, the present study was conducted with the objective of identifying a suitable propagule and a media to propagate *L. inermis.* Flowering phenology, including animal visitors were observed and in the propagation experiment three maturity stages of stem cuttings viz. softwood, semi hardwood and hardwood were planted in two different media (sand, sand + coir dust 1:1). The layout of the experiment was Randomized completely Block Design. Twelve weeks after planting, root dry weight and root number were recorded. *Lawsnia inermis* attract insects and it produces attractive flowers. Tree architecture is also attractive and can fit in to a small space. Therefore, it can be used in urban landscaping and in plant borders. Softwood cuttings recorded highest rooting percentage (71 %) in sand medium. Root dry weight and number of roots produced significantly high in softwood grown in sand media. Therefore, it can be recommended as the potential propagule and the media to introduce *Lawsonia inermis* to the landscape industry in Sri Lanka.

KEYWORDS: Landscape, *Lawsonia inermis*, Native, Phenology, Propagation.

INTRODUCTION

Over the past decades there has been a high demand for exotic plants in the landscape industry. As a result, new plant species and varieties are regularly imported to the country by nursery growers. Some of these exotic plants have escaped from manmade landscapes and invaded in to natural areas and cause irreversible damage to local biodiversity. According to Wijesundara (2001), Royal Botanical Garden is responsible for introducing many exotic plants that have become invasive in Sri Lanka such as *Antigonan leptopus*, *Tithonia diversiftolia* and *Clidemia hirta*.

According to Knapp and Rice (1997), the growing knowledge of the threats caused by exotic species to native biodiversity has generated a great deal of interest in planting native species and restoring native plant habitats. Further, the transformation of resident native plant communities to other kind of landscapes will result from subdivision developments, resort planning and urbanization (Zadegan et al., 2008). This transformation, along with an interest in exotic species in developed landscapes, is becoming a major concern for environmentalists, conservationists and restoration ecologist (Baschak and Brown, 1995; McKinney, 2006).

One potential response to these concerns is to install more native plant species in either traditional or more naturalistic landscape designs providing the community with ecology-based solution to help, maintain or restore biological diversity (McHarg, 1969). Ecology –based design is a relatively new concept in landscape designing that incorporates the use of native plants in built landscapes (Hagstrom, 2006).

In recent years, landscape architects and concerned citizens have responded to the need for incorporating and using native plants in designed landscapes (Anon, 2007). However, the aesthetic qualities of native plants vary widely and are often quite different from exotic plants (Zadegan et al., 2008). But with careful selection, suitable native plants can be identified to introduce into the landscape industry. The diverse, floristic wealth of Sri Lanka could be exploited to introduce native plants to the landscape industry.

Landscaping with native plants can provide several benefits. According to Taylor (1988), native plants are less costly to maintain, they are resistant to pests and diseases and native plantings will give children a place to play where they can become aware of the working of the world around them. Each native plant species is a member of a community that includes other plants, animals and microorganisms and also native plants can provide children and adults with a tangible link to the past and these species rarely become invasive. Another dimension of native plants is their historical and cultural interest. Some plants play a significant role in native culture. Many species have reported value as food or medicine. Others have been used for cordage, textiles, dyestuff, or similar domestic purposes (Anon, 2009).

Lawsonia inermis commonly known as Marathondi (Sinhala) Marutani or Mailenanti (Tamil) or Henna (English) and belongs to the family Lythraceae. It is distributed in both wet and dry zones of Sri Lanka. It is naturally occurring in dry and desert regions especially near the sea coast (Anon, 2003). It can be considered as a tall shrub or small tree, growing up to 7 m. Leaves are opposite and acute. Flowers are small and fragrant, appeared in terminal large branches. Flowers are white in color and fruits are purplish green (Prajapati et al., 2003).

It produces important dye known since very ancient times, used for the hair, nails, teeth and also the tail and manes of horses. The flowers are used as a perfume (Verdcourt et al,. 1995). Extracts of *L. inermis* are also used to stain wood and to dye fabric and textiles. (Anon, 2007).

In the west and Middle East, *L.inermis* is used in hair shampoo, dyes, conditioners and rinses. *Lawsone innermis* dye products are mixed with indigo or other plant material to obtain a greater color range. *Lawsonia inermis* extract show anti bacterial, antifungal, and ultraviolet light screening activity. With the popularity of tattoos and the art of Mehendi were considered a safe, painless and non permanent alternative form of body ornamentation (Anon, 2007). Some medicinal properties were also recorded in the entire plant. The roots and leaves are said to be anthelmintic. The roots are used in the treatment of hysteria, nervous disorders and regarded as a specific for leprosy. The bark is given in the form of a decoction for jaundice, enlargement of the spleen and obstinate skin diseases. The leaves stimulate the growth of hair and the flowers are soporific. The flowers and fruits are reputed to have emmenagogue properties (Jayaweera, 1981).

In Sri Lanka either, internationally planted or naturally occurring *L.inermis* plants can be seen in home gardens. However, the scarcity of propagules is a major barrier to introduce this species to the landscape industry. Therefore, this study was conducted with the objective of identifying the best propagules and propagation media to propagate *L.inermis* cuttings and to investigate the flowering phenology.

MATERIALS AND METHODS

Field Survey

A field surveys was conducted in the Kurunegala district (Intermediate zone) and two natural populations were selected in Ibbagamuwa in Kurunegala area and Makandura area. Planting materials were collected from Makadura area for the propagation experiment and plants were observed in Ibbagamuwa to record phenology.

Flowering Phenology

Six plants were observed from March to May 2010 at one week intervals. When flower buds were present, 5 buds from each plant were tagged and observations were made daily throughout the flowering season to determine the time duration and frequency of flowering. Further, colour of the flowers and fruits were recorded using RHS (Royal Horticultural Society, 2001) colour chart. Animals visit to the flowers were also recorded.

Field Trial

The experiment was conducted at the Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila in Low country intermediate zone (IL_1).

Cuttings of 20 cm length were selected to represent three maturity stages viz softwood, semi hardwood and hardwood. Base of the cuttings were treated with a rooting hormone (0.3 % IBA) and Bordeaux mixture was applied on the top cut surface of the semi hardwood and hardwood cuttings before planting. The rooting media were pre moistened and the cuttings were planted 1-2 cm deep in punched polythene bags (8 cm x 6 cm, gauge 150) in two different potting mixtures namely sand and sand + Coir dust (1:1) and altogether six treatment combinations were used (Table 1). The treatments were factorialy combined in a Randomized Completely Block Design (RCBD) with three blocks. Twenty one cuttings were used in a single treatment per block and a total of 378 cuttings were used in the experiment.

Table 1. Details of maturity stage of cuttings and potting media used as treatment combinations

Treatments	Potting mixture	Maturity stage of cuttings
T1	Sand	Softwood
T2	Sand + Coir dust (1:1)	Softwood
T3	Sand	Semi hardwood
T4	Sand + Coir dust (1:1)	Semi hardwood
T5	Sand	Hardwood
T6	Sand + Coir dust (1:1)	Hardwood

The experiment was carried out inside a propagator covered with milk white polythene (gauge 500, relative humidity 90% and temperature 32 ^{0}C) in a net house (80% shade). Cuttings were irrigated once in three days intervals and fungicide (Bitertanol/1 ml/1 l) was applied as required. Twelve weeks after planting, percentage of rooting, root dry weight (oven dried at 80 ^{0}C for 48 hours) and number of roots

were recorded. The general liner model was used to analyze count data (SAS 1998).

RESULTS

Flowering phenology

Mass flowering was observed in *L. inermis* from February to March and flowering period extended up to May with low intensity in certain plants. However, in some plants mass flowering was recorded from June – July. During mass flowering 75 % of the canopy was covered with flowers. The inflorescence is an axillary or terminal panicles and 150 – 300 buds were recorded in a given panicle. However, these buds did not bloom simultaneously. Once the blooming was started, a panicle reached to full bloom stage (85 % flowering) in 5 days and flowering intensity reduced to 10 % and terminated after 7 days (Figure 1). Flower buds were rounded in shape and average times taken to reach the half bloom stage was 20 days and reached full bloom stage in 9 hours. Flowers remained at full bloom stage for 8 – 10 hours and started to senescence (Figure 2). Flowers started to bloom from 3.30 pm – 7.30 pm and reached half bloom stage from 12.30 am – 2.00 am in the following morning. The full bloom stage reached between 6.30 am to 9.30 am. The fragrance was present in slightly opened bud and it reached the maximum level at full bloom stage. It remained for another 2 days though the flowers reached its senescence stage (Figure 3).

Flowers belongs to the yellow group 4B while mature fruits are yellow green 144A and dried fruits are greyed orange 165A, (RHS Colour Chart, 2001). Flowers were visited by stingless honey bees, common bees and butterflies. Butterflies species were identified as *Mycalesis perseus typhlus* (Common bush brown) and *Ypthima ceylonica* (White four-ring).

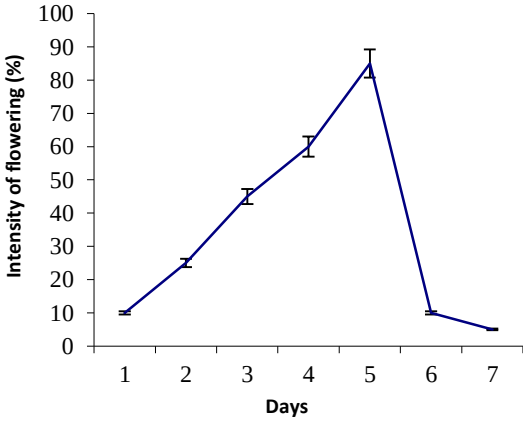

Figure 1 – Duration and intensity of flowering in a panicle of *L. inermis* during mass flowering period

Growth Performance of Cuttings

Rooting of Cuttings

Highest average rooting percentage was recorded in softwood cuttings (71 %) grown in sand media followed by softwood cutting grown in sand + coir dust media (44 %), (Figure 4).

Root Dry Weight

There was a significant effect of maturity stage of cuttings and potting media on root dry weight. (Table 2). However, there was no interaction between maturity stage of cuttings and potting media on root dry weight.

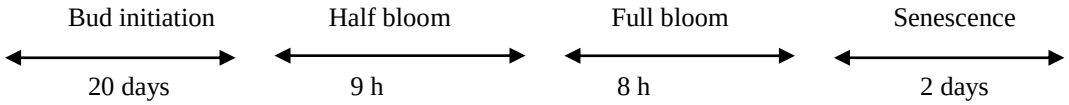

Figure 2. *L. inemis* from flower bud to senescence

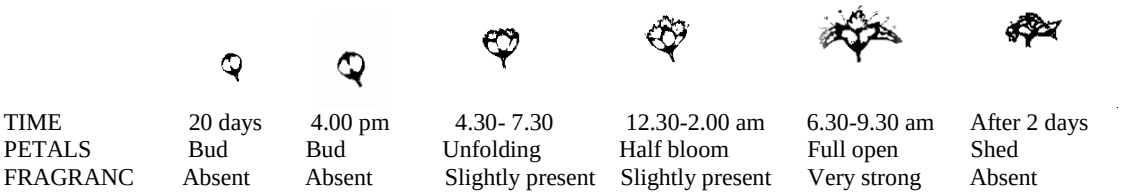

Figure 3. *Lawsonia inermis* from bud stage to senescence stage

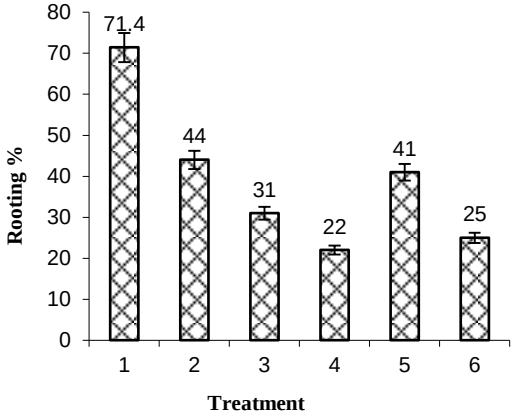

Figure 4. Rooting percentage of cuttings in different treatments

Softwood and hardwood cuttings recorded a significantly higher root dry weight (Table 3) when compared with semi hardwood. According to Table 4, root dry weight was significantly high in sand medium compared to sand + coir dust (1:1) medium.

Table 2. Effect of maturity stages of cuttings and potting media on root dry weight

Source	Probability
Maturity stage of cuttings	0.0007
Potting media	0.0006
R - square	0.1622
CV	101.51

Probability value < 0.05 – significantly different

Table 3. Mean root dry weights in different types of cutting

Maturity stage	Root dry Weight (g)
Softwood	0.01150[a]
Semi hardwood	0.0038[b]
Hardwood	0.0097[a]

Means in a column followed by the same letters are not significantly different at 0.05 level

Table 4. Mean root dry weight in different potting media

Potting media	Root dry weight (g)
Sand	0.0114[a]
Sand + Coir dust (1:1)	0.0058[b]

Means in a column followed by the same letters are not significantly different at 0.05 level

Table 5. Effect of maturity stages of cuttings and potting media on number of roots

Source	Chi-square	P-value
Block	4.66	0.0973
Cutting type	191.18	< 0.0001
Media	67.92	< 0.0001
Likelihood ratio		0.0004

Probability value < 0.05- significantly different

There was a significant effect of maturity stage of cuttings and potting media on number of roots and further, there is an interaction between maturity stage of cuttings and potting media on number of roots (Table 5).

According to contrast analysis, softwood-cuttings recorded significantly higher root number (8.4318) compared to semi hard wood (7.9716) and hardwood cuttings (7.2857), while there is no significant difference between semi hardwood and hardwood cuttings. (Table 6). Sand media recorded the highest root dry weight (0.0114). Therefore, it can be considered as the best medium.

Table 6. Contrast analysis of maturity stage of cutting and number of roots

Cutting type	Chi-square	p-value
Softwood vs. Semi hard wood	138.87	< 0.0001
Softwood vs. Hardwood	111.12	< 0.0001
Semi hardwood vs. Hard wood	2.12	0.1453

Probability value < 0.05-significantly different

DISCUSSION

Lawsonia inermis evolved and adapted to local conditions over thousands of years. It grows naturally in hot and dry climatic conditions in low fertile soils. Therefore, it can be introduced as a low maintenance landscape plant. Though *L. inermis* produce mass flowers only once within a year, tree architecture is attractive. It tolerate pruning and produce small leaves. It produces an open canopy. Therefore, it can be planted in a back of a border. Flowers attract butterflies and other insects. Hence, it can be used in wildlife gardening. Due to its narrow canopy it can also be introduced in urban landscaping to plant in a limited space. Combination of native and non- native plants in built landscapes will increase the consumer awareness of native plants and their interest in using them in the manmade landscapes.

According to the present study, softwood cuttings grown in sand medium recorded the highest rooting (71 %). Growth performances of cuttings (root dry weight and number of roots) also support the above observation. Therefore, softwood cuttings and sand medium can be recommended as potential propagule and medium to introduce this plant to the landscape industry. Studies conducted on other native plants such as *O. octandra* (Weerasinghe and Yakandawala, 2009) and *M. paniculata* (Welideniya and Yakandawala, 2006) also recommended soft wood cuttings as the best cutting type. Sand media was recommended as the best media for *O. octandra* and *M. paniculata*.

CONCLUSIONS

Lawsonia inermis is naturally occurring in soils with low fertility and low moisture levels. Therefore, it can be introduced as low maintenance landscape plant. *Lawsonia inermis* attract wild life. Therefore, this plant can be promoted in wild life gardening and can be used in plant borders. Softwood cuttings of 20 cm length grown in sand media recommended as the best cutting type and potting media to introduce this plant to the landscape industry.

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