

An Endangered Wild Plant *Humboldtia laurifolia* Vahl For Landscaping

P.R. UDARI, R.D.N. DEBARAWATTA and K. YAKANDAWALA

*Department of Horticulture and Landscape Gardening, Faculty of Agriculture and Plantation Management,
Wayamba University of Sri Lanka, Makandura, Gonawila (NWP)*

ABSTRACT

Humboldtia laurifolia is a wild plant native in to Sri Lanka. It attracts wildlife hence there is a possibility to introduce this plant into the landscape industry in Sri Lanka. However, a successful propagation technique is not available and seeds are rare and show dormancy. Therefore, the present study was conducted with the objectives of identifying a suitable propagule and a media to propagate *H. laurifolia* and to investigate the flowering phenology to determine the potential of this plant in wildlife gardening. Flowering phenology and animal visitors were observed and a propagation experiment was conducted. In *H. laurifolia*, mass flowering was observed in January and February and white to pinkish flowers are attractive; which attract butterflies, bees, stingless bee and ants. This plant can be considered as a difficult to root species as few cutting were survived. Softwood cuttings and sand medium recorded the highest survival rates. This plant is smaller in size hence it has a potential to introduce into urban landscaping to fit into smaller spaces. As this plant is categorized under the endangered group, promoting this plant in landscaping will be helpful in conservation efforts of this plant.

KEYWORDS: *Humboldtia laurifolia*, Landscaping, Native, Phenology, Propagation

INTRODUCTION

As a tropical country, Sri Lanka has ideal climatic conditions for the production of many flowering and foliage plants. In landscape industry, we widely use these ornamental plants for beautification as well as for functional purposes. The demand for these plants in landscape industry is increasing, as it is used in many places which include home gardens, public gardens and commercial establishments (Welideniya and Yakandawala, 2006).

Many varieties of exotic plants are used in landscape industry and at present most of these are imported from other countries (De Mel and Yakandawala, 2003). As a reason of being exotic, most of the introduced plants are unable to tolerate harsh conditions like unavailability of water, salinity, low fertility, high temperature and light (O'Brein, 1996).

Since native plants have evolved in Sri Lanka itself, they have a greater ability to adapt to Sri Lankan conditions when compared to exotic plants (O'Brein, 1996). These native plants can be used with a higher success rates as they can be grown under many adverse conditions found in tropical countries and these plants are evolved and adapted to local conditions over thousands of years. They are vigorous, hardy and able to tolerate many harsh conditions and further, these plants will not become invasive and affect the bio diversity and natural ecosystems (Senarathne and Yakandawala, 2004). They attract a wide variety of wildlife including mammals, birds, and butterflies (Klett, *et al.*, 2013). In recent

years, landscape architects and concerned citizens have responded to the need for incorporating and using native plants in designed landscapes (Anon, 2001).

Sri Lanka is one of the Biodiversity hot spots in the world. Island has high species richness including high endemic flora. Three thousand and four hundred flowering plants were recorded, of which over 24% is endemic to the island (Ashton *et al.*, 1997). Even though native plants have a greater potential to be used as ornamental plants, unavailability of knowledge of suitable propagules has kept these species in the dark (Konara and Yakandawala, 2005).

Humboldtia laurifolia Vahl is a tropical rainforest understory tree belongs to family Fabaceae and found in low land and upland forests of Sri Lanka. It is commonly known as Gal-Karanda or Ruan- Karanda in Sinhala. It is an ever green small tree, attaining a height less than 10 m. It possesses a compound leaf with 3-5 pairs of leaflets, ovate to ovate-oblong or lanceolate-oblong in shape and 4-15 cm long. Branches are zig zag in nature. Fruits puberulent or sub glabrous when young, glabrous at maturity, ellipsoid, compressed, 3-4 seeded (Verdcourt, 1990). According to Rudd *et al.*, (1991), this tree is native to Sri Lanka and India. However, Gunatilleke *et al.*, (2004) and Krombein *et al.*, (1999), suggest that *H. laurifolia* is endemic to Sri Lankan lowland rainforests.

Humboldtia laurifolia is one of the myrmecophyte species available in Sri Lanka that attracts insects to its domatia and this type

of interactions between ants and the plants can be classified as mutualistic symbiosis relationship (Krombein *et al.*, 1999). This is the host plant of *Jamides coruscans* (Ceylon cerulean butterfly) which is endemic to Sri Lanka (Anon, 2010). The wood of *H. laurifolia* has no commercial uses, but is sometimes collected for firewood. This is a most common understory tree species in Sinharaja World Heritage site. In addition to that this has been recorded in more than fifty forest reserves and state forests in Sri Lanka (Gunatilleke *et al.*, 2004). Further, this species has been categorized as an endangered species in the IUCN red list of threatened species (IUCN, 2013). This plant can be propagated through seeds. However, it shows a new kind of seed dormancy by considerable delay in emergence of the plumule following radical emergence (Jayasuriya *et al.*, 2010). However, sexually propagated plants take long time to produce flowers and seeds. Further, progeny will not be similar to parent plants (Weerasinghe and Yakandawala, 2009).

Under high rate of population increase and urbanization, space availability for landscaping is reduced. Particularly the size of home gardens is reduced (Samson and Samson, 1986). As a result, smaller compact trees have a higher demand in the horticultural trade. Therefore, *H. laurifolia* can be introduced to home gardens as a landscape tree. Hence, it is important to introduce a commercially viable method of propagation to popularize this plant in the landscape industry. The present study was conducted with the objectives of identifying the best cutting type and media to propagate *H. laurifolia* and to investigate the flowering phenology to determine the potential of this plant in wildlife gardening and urban landscaping.

MATERIALS AND METHODS

Field Survey

A field survey was conducted in the Kuliypitiya area to detect a natural population and *H. laurifolia* population was located in Galagedara forest reserve, Kuliypitiya (IL_{1a}). Planting materials for the propagation experiment were obtained from Galagedara forest.

Flowering Phenology

Hamboldtia laurifolia plant grown in the wildlife garden of the Faculty of Agriculture and Plantation Management, Wayamba University Sri Lanka was used to study the phenology. The plant was observed from January to April 2013. During the flowering season selected inflorescences were tagged and

observations were made daily to determine the time, duration and frequency of flowering. Further, number of flowers per inflorescence was also recorded. The colour of flush, flowers and fruits were recorded using RHS (Royal Horticultural Society, 2001) colour chart.

Flower Visitation

Floral visitors were observed during the study period from 6.00 am to 6.00 pm. Pollen releasing time was determined according to the visiting time of insects and observing pollens on its body.

Table 1. Maturity stages of cuttings and potting media used as treatment combinations

Treatment	Potting mixture	Maturity stage
T ₁	S	Soft wood
T ₂	S+C (1:1)	Semi hardwood
T ₃	S+C+T(1:1:1)	Hard wood
T ₄	S	Soft wood
T ₅	S+C(1:1)	Semi hardwood
T ₆	S+C+T(1:1:1)	Hardwood
T ₇	S	Soft wood
T ₈	S+C(1:1)	Semi hardwood
T ₉	S+C+T(1:1:1)	Hardwood

Note: S= Sand; C = Coir dust; T = Top soil

Propagation Experiment

The experiment was conducted at the Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (IL_{1a}) during the period of January to April 2013. Vigorously growing healthy planting materials were collected and 20 cm long cuttings were selected to represent three maturity stages *viz.* softwood, semi hardwood and hardwood (Table 1). Base of the cuttings were treated with a rooting hormone (0.3% IBA) and Bordeaux mixture was applied on the top cut surfaces of semi hardwood and hardwood cuttings before planting. The rooting media were pre moistened and cuttings were planted 1 - 2 cm deep in punched black polythene bags (8 cm × 6 cm, gauge 150) in three different potting mixtures namely Sand, Sand + Coir dust (1:1) and Sand + Coir dust + Top soil (1:1:1). Altogether nine treatment combinations were used (Table 1).

The treatments were factorially combined in a Randomized Completely Block Design (RCBD) with three blocks. Eighteen cuttings were used in a single treatment per block and a total of 486 cuttings were used in the

experiment. The experiment was carried out inside propagators covered with transparent polythene (gauge 500, relative humidity 85% and temperature 29°C) under natural shade. Cuttings were irrigated as required and a fungicide (Carbendazim 7 g / 10 L) was applied as required and a foliar fertilizer (Maxicrop-30 ml/12 L) was applied twice a week. Survival rate of sprouted cuttings were recorded 12 weeks after planting.

RESULTS AND DISCUSSION

Flowering Phenology

Continuous flowering was observed in *H. laurifolia* during the study period and mass flowering was observed in January and February. During mass flowering 75% of the canopy was covered with flowers. Flowering was started from the base of panicle and continued towards the top. The duration of an inflorescence is 10 days (± 2). Buds took 30 days to initiate blooming (Figure 1). Average time taken to reach half bloom stage to full bloom stage is about 3 hrs. Flowers remain at fully bloom stage for 12 hrs (± 2) and reached half bloom stage at 3.20 pm (± 0.2). The fully bloom stage reached at 4.30 pm (± 0.1) and remains for 12hrs (± 2). Pollen release initiated at 3.20 pm (± 0.2).

Flowers started to bloom at 1.20 pm. Fragrance was present in fully bloomed flowers and it remained until the following day. A flower took 3 days to complete senescence. Calyx of the flower is grayed red group 181C (RHS). Corolla belongs to the white group 155B and stigma is grayed red group 178. White is a cool colour which provides calm and quite effect to a landscape. Therefore, this plant can be used in monastic gardens and in theme garden designed as white gardens. In this plant continues flowering could be observed and flowers are contrast at night due to white in colour.

Flower Visitation

Animal species associated with the plant is given in Table 2. Stingless bee and ants carry pollen with them. Stingless bees were the most common visitor and two peak visitations (9.00 am and 4.00 pm) were observed (Figure 4). They were not visited during noon. *Humboldtia laurifolia* is the host plant of Ceylon cerulean butterfly and flowers attract another two species of butterflies. Therefore, this plant can be used in butterfly gardening.

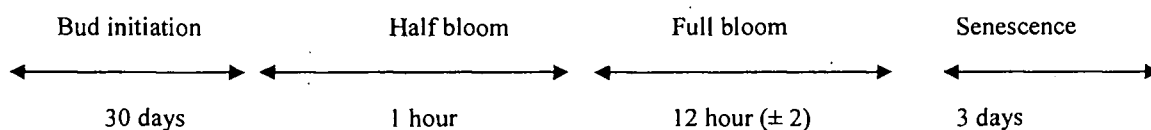


Figure 1. *Humboldtia laurifolia* from flower bud to senescence







TIME	30 days	1.00pm	1.20pm (± 0.1)	3.20pm (± 0.2)	4.30pm (± 0.1)	After 3 days
						
PEALS	Bud	Bud	Slightly Unfolding	Half bloom	Full bloom	Shed
FRAGRANCE	Absent	Absent	Absent	Slightly present	Strong	Absent
ANTHERS	Undehisced	Undehisced	Undehisced	Splitting from top	Fully split	Shriveled
POLLEN	Absent	Absent	Absent	Dispersing	Present	Absent

Figure 2. *Humboldtia laurifolia* from half bloom to senescence

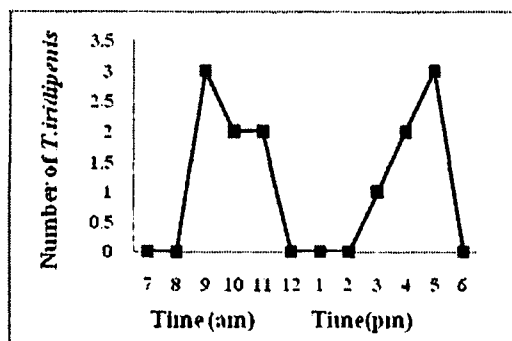


Figure 4. Floral visitation pattern of *T. iridipennis*

Table 2. Flower visitation time and animals

Scientific name	Common name	Visiting time
<i>Jamides coruscans</i>	Ceylon cerulean butterfly	Morning
<i>Parantika aglea</i>	Glassy tiger	Morning and afternoon
<i>Leptosia nina</i>	Psiche	Morning and afternoon
<i>Apis cerana</i>	Common bee	Morning
<i>Trigona iridipennis</i>	Stingless bee	Morning and afternoon
<i>Technomyrmex albipes</i>	Black ant	Full day

The plants have evolved numerous methods to domicile the ants and food supply throughout the year by producing nectaries found on the leaves, stipules and flower bud bracts. In *H. laurifolia*, when the internodes are not occupied by the ant's colonies it may be nested by solitary or sub-social wasps and bees, as well as other invertebrates (Krombein, et al., 1999). Most of the observed animals on this plant are predators of ants and bees. Further, caterpillars, snails, slugs, apes and monkeys fed on new flushes. Due to high attraction of wild life this plant can be recommended as a potential plant in wild life gardening.

Plant Characteristics

A sequence of colour changes were observed from young flush to mature flush (Table 3) and these changes are very much similar to the changes observed in *Amherstia nobilis* (Fabaceae), a popular shade tree. Tree architecture of *H. laurifolia* is attractive and its branches spread horizontally giving a compact effect to the landscape. Further, it attains a height of less than 10 m. Hence, it can be easily fit into a limited space. Therefore,

H. laurifolia can be recommended in urban landscaping. Further, by selective pruning, it can be incorporated in to mix borders.

Table 3. Sequence of colour change in flush

Stage	Colour
Young flush to mature stage	Grayed red Group 178C
	Grayed orange group B
	Grayed white group 196A
	Yellow green group N144D
Mature flush	Green group 135A

Propagation Experiment

According to the present study, low survival rates were recorded in all the three cutting types. However, the highest survival percentage was recorded in softwood cuttings (Figure 3) and in sand medium (Figure3). Roots were not initiated even after 12 weeks period of time in *H. laurifolia*. Therefore, it can be considered as a difficult to root species. However, during preliminary experiment softwood and semi hardwood cuttings produce roots. Seed production of this plant is rare, seasonal and a dormancy is present (Jayasuriya et al., 2010). Therefore, it is important to develop a suitable vegetative propagation technique. This plant is recognized as an endangered species (IUCN, 2013) in Sri Lanka. Therefore, it is important to develop a suitable propagation technique not only to introduce this plant in landscaping but also for conservation purposes. This plant is naturally occurring in wet, intermediate and dry zones of Sri Lanka and it can be promoted in landscaping in all the major climatic zones of the country.

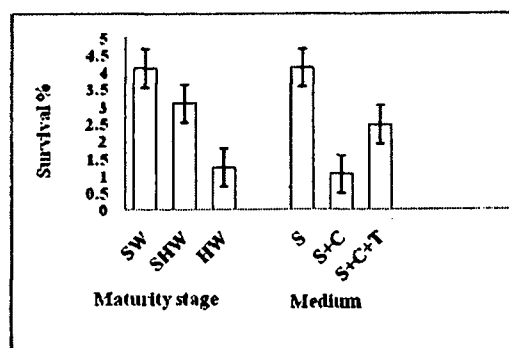


Figure 3. Survival rate at different maturity stages and media

Note: SW = Soft wood cuttings; SHW = Semi Hard Wood cuttings; HW = Hard Wood cuttings; S = Sand; C = Coir dust; T = Top soil

CONCLUSIONS

Humboldtia laurifolia is a difficult to root species and further studies are required to improve rooting. Softwood cutting and sand medium recorded the highest survival rates. This plant attracts different animals which include butterflies, bees, stingless bees and ants. Hence, this plant can be promoted in wildlife gardening. Due to the smaller size, this plant has a potential to introduce in urban landscaping to fit into smaller spaces. As this plant is categorized under the endangered group, promoting this plant in landscaping will be helpful in conservation efforts of this plant.

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