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Effect of light intensity and soil media on establishment and growth of *Curculigo latifolia* Dryand

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Abstract

Growth and survival percentage of *Curculigo latifolia* Dryand under different light intensity and various soil media was studied to work out suitable growing conditions for the species. Three light intensity (25, 50 and 100%) and soil media consisting topsoil, organic manure and sand as 1:1:1 (T1), 2:3:1 (T2) and 3:2:1 (T3) were used as treatments for planting *C. latifolia*. When multiplied by rhizomes, the survival rates in all treatments were 100%, however the leaf growth and number were influenced by light intensity and soil media. There were no significant differences of leaf growth between T1 and T3 under 50% light and T2 under 100 % light. However, in T2 under 25% light higher leaf number and in T1 (1:1:1) under 50% light higher plant height was observed. The species was successfully regenerated by rhizomes for the present study. The study revealed that light intensity has significant effect on plant height and leaf number of *C. latifolia*. Soil media influenced the height and leaf number with different effect under varying light intensities.

Key word: *Curculigo latifolia* Dryand, lemba, soil media, light intensity, leaf growth, plant height

Introduction

There are more than 20 species in family Hypoxidaceae, and *Curculigo* and *Hypoxis* are two main genera belonging to this family. The genus *Curculigo* is distributed in the tropical region of Africa and Asia rainforest's, especially, Malaysia and Singapore (Ismail *et al.,* 2010; Kocyan, 2007). *Curculigo latifolia* Dryand (Fig. 1) is common species and is locally known as lemba in Malaysia. It is not cultivated (Shaari, 2005) but found abundantly distributed in highlands areas (with 1500-2000 m altitude) and normally on slopes and forests, in Peninsular Malaysia. Leaf fibers are used for making the fishing net, rope and twines in Borneo and Malaysia. Use of an infusion of fresh shoots, leaves, and flowers can treat high fever. Flower and root concoctions are used to ease stomachache and frequent urination (Shaari, 2005). A rhizome poultice is applied externally to wounds for healing (Ahmad and Holdsworth, 1994). Extract of *C. latifolia* inhibits hepatitis B virus (Wiart, 2000). Leaves are simple and complete, ensiform, parallel-veined and sub glabrous. The petiole ascends to 2 meter long. The leafstalks are one-third of the length of the leaves. The stem consists of overlapping leaves. The Inflorescence directly rise from an underground stem (scape) with inferior ovary and contains six stamens. The flowers are trimerous, radially with small yellow flowers. The fruits are berry, black in colour and very sweet. Black ant and bee were identified as probable pollinators of *C. latifolia* visiting frequently between 0930 and 1000 hours (Ismail *et al.,* 2010). The flower anthesis starts at 0630 and flowers fully expand at 0930, exposing dehisced anthers and glistening stigma. Flowers last for a day and completely withered by 2000 hours. Previous studies on germination rate of *C. latifolia* seeds showed that seeds were unable to germinate on jiffy bags or germinating trays and blotter papers. *C. latifolia* is a monocotyledonous plant and the most proper vegetative propagules are corms and rhizomes (Ismail *et al.,* 2010).

Yamashita *et al.* (1990) reported the sweet taste and taste-modifying activity of curculin. The curculin is considered as a unique sweet protein occurring in the fruit of *C. latifolia,* which is 500 times sweeter than sucrose by weight, and can be expected as a new low-calorie sweetener (Faus, 2000; Kant, 2005; Masuda & Kitabatake, 2006) and can be used as a low calorie sweetener for diabetic or obese people (Surana *et al.,* 2006; Maznah *et al.,* 2010).

Considering the importance of *C. latifolia* in region (Malaysia), and unsuccessful cultivation attempts, standardization of optimum environmental parameters like light intensity and soil media is important. The main objective of this experiment was to study the effect of various light intensity and soil media on the growth of *C. latifolia* plants generated from rhizomes.

Materials and methods

Soil media: The black poly bags sized 30 x 15 cm were filled with three ratios of topsoil, organic manure and sand as 1:1:1 (T1), 2:3:1 (T2) and 3:2:1 (T3) as different treatments.

Light: Artificial shading condition/environment (25, 50 and 100% of light intensity) was achieved by using black plastic net to determine the light requirements for growth of *C. latifolia*.

Planting material: 150 plants with 20-25 cm height and 40 rhizomes segments, collected from Cameron and Genting highlands rainforests, were transplanted in black poly bags and were kept under artificially shaded area.

Data collection included plant survival, leaf number and plant height, recorded every two weeks for 4 months. Survival rates were monitored only in plants regenerated from rhizomes segments. The planted plantlets in three soil media were arranged in three blocks with 25, 50 100% light intensity. Each block consisted of three treatments and 36 plants and Randomized

Complete Block Design (RCBD) used in this study. For the equal sunrise exposure, all treatments were randomly arranged and were located in horizontal line facing the sunrise direction.

Results and discussion

All the planted rhizome segments survived and attained growth after 4 months with hundred percent survival, irrespective of soil media and light conditions. The favourable effect on leaf number and plant growth were observed at 50% light intensity. Under 50% light height, plant height in T1, T2 and T3 soil media, was recorded as 26.15, 23.92 and 19.63 cm, respectively. Height of plants in T1, T2 and T3 soil media under 25% light was recorded as 20.74, 24.06 and 17.97 cm, respectively. Plant height was low in the same soil media under 100% light. The growth of the plants was found to be significantly different under different light intensities and soil ratio.

Light quantity and quality affect ecosystem properties in general and plant performance in particular due to complex interactions with other environmental factors (Valladares, 2003). Considerable complexity and interspecific variation in the effects of shade on plant growth have been observed by researchers and it has been demonstrated that moderate shading can significantly enhance plant growth, particularly in species exhibiting limited morphological plasticity. They also suggested that the species under habitats, where shading tends to be limited, growth were most inhibited by exposed conditions and benefited most from shading, despite there being no nutrient or water stress (Semchenko *et al*., 2012). Low-light grown plants have frequently been shown to be more susceptible to photo inhibition than those grown under high light intensity (Long *et al.,* 1994; Fan *et al.,* 2013).

C. latifolia kept in 50% of light and planted on T1, T2 and T3 media recorded 24, 29 and 24 number of leaf, respectively. The leaf number under 25% light on the T2 soil media was 25 and only 9 leaves developed in 100% light. There was no significant difference in leaf number under T1 and T3 in 50% light and T2 in 25% light. In this study, the higher number of leaves were observed in T2 under 50% light and followed by 25% light in the same media. This result is in agreement with the observations made by Bradley (1998) and Butler (1963). The results also exhibit an interaction between soil ratio and light intensity for leaf number and height of *C. latifolia*.

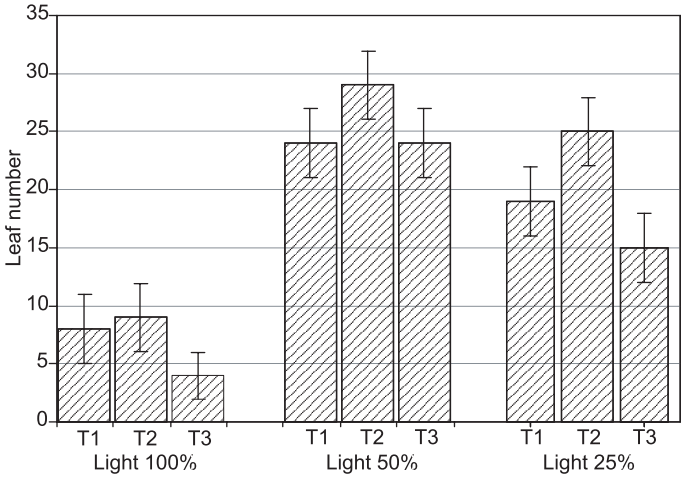

Fig. 1. Height of *C. latifolia* planted in different soil media and exposed to various percentages of sunlight

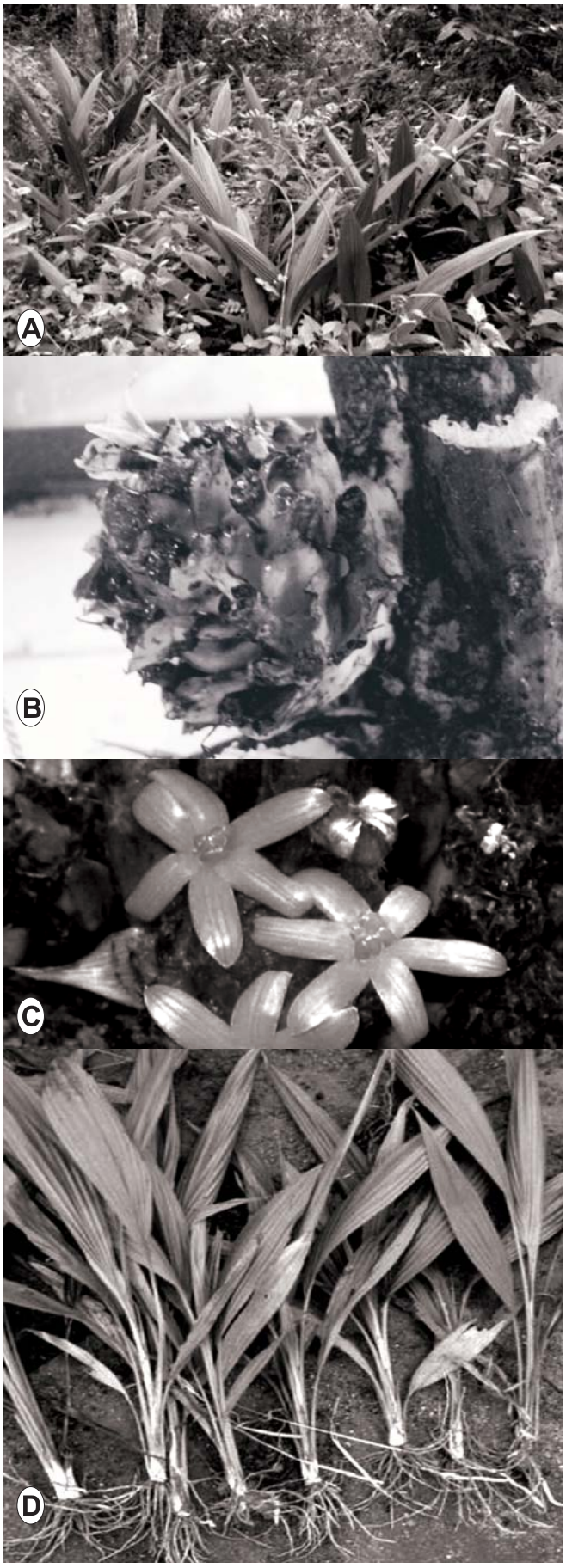

Fig. 1. A: *Curculigo latifolia* Dryand under forest conditions, B: Inflorescence, C: Flower, D: *C. latifolia* plants alongwith rhizomes used for experimentation.

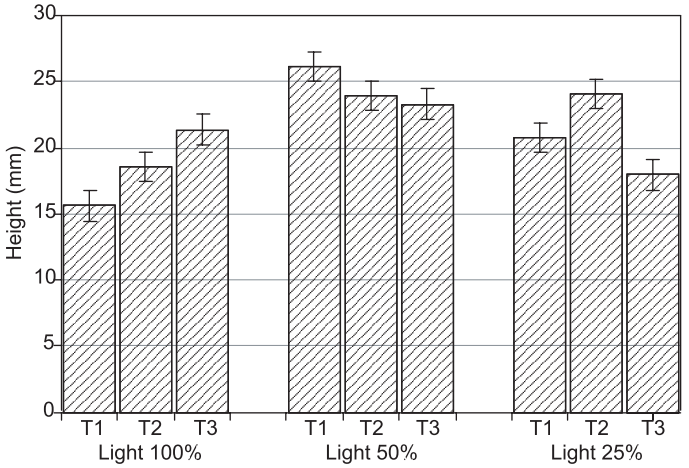

Fig. 2. The leaf number of *C. latifolia* planted in different soil media and exposed to various percentage of sunlight

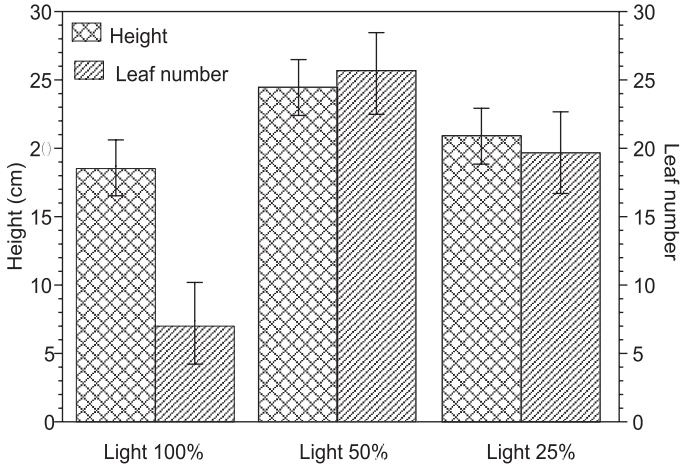

Fig. 3. Mean effect of light regime on leaf number of *C. latifolia* planted in different soil media

Our results substantiate views of Brink (2003) that the *Curculigo* spp. are shade-loving plants, thriving under partly shaded or sunless conditions. In the open field, it grew very slowly and the leaves remained small. *Curculigo* prefers fertile, well-drained soils, rich in organic matter. In Java, *C. capitulata* occurs in primary and secondary forest up to 2000 m altitude and *C. latifolia* (Marasi) in rain forest up to 1100 m altitude.

The study revealed that light intensity and soil media significantly influenced plant height and leaf number of *C. latifolia* and ultimately influenced the plant growth. Soil media consisting topsoil, organic manure and sand in the ratio of 2:3:1 and 50% light produced better growth. The species was successfully regenerated by rhizomes for cultivation. Therefore, shading of 50% through plastic net and soil media with topsoil, organic manure and sand as 2:3:1 can be included in package of practices for its cultivation.

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