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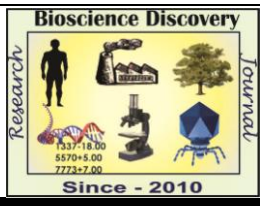

Seedling characteristics of some medicinal plants of Lamiaceae

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Abstract

Plants in their juvenile stage possess some important characters which are very important and promising from the taxonomic as well as evolutionary point of view. Seedling morphology of three species of Lamiaceae has been investigated on the basis of their germination pattern, position of cotyledon, hypocotyl, epicotyl, and paracotyledon and eophylls development. An artificial key has been constructed for easier identification of plants in their juvenile stage. Phenogram has been made by using UPGMA analysis to investigate the correlation between the investigated taxa.

INTRODUCTION

Seedling is a young and very important stage of plants lifecycle. It is very different from the mature plant and difficult to identify plants in seedling stage. Seedling morphological study is important as it helps in easier identification of plants in their juvenile stage. Various biotic and abiotic factors affect its establishment, so early identification helps in conservation of economically important plants.(Paria, 2014). Studies about the germination of species are important tools in solving taxonomical and phylogenetical questions and in the understanding of morphology using ontongeny (Martin *et al*., 2012). So an attempt has been made in this work to construct an artificial key for the identification of some medicinal plants of Lamiaceae in their juvenile form. Seedling morphology of four species of *Ocimum* L. (Lamiaceae) and its taxonomic significance has been studied by Singh (2012). Seedling morphology of endangered *Eremostachys superba* Royle ex Benth. (Lamiaceae) has been studied by Malik *et al.* (2014). Seedling morphology of *Anisomeles ovata* R.Br. (Lamiaceae) has been studied by Malik and Anand (2014). Earlier works from Tripura have documented different ethno medicinal plants used by different tribal community of the state (Deb, 1968; Singh *et al.*, 1997; Majumdar *et al.*, 2006; Majumdar and Datta, 2007; Das *et al.*, 2009; Shil and Choudhary, 2009; De *et al.*, 2010; Sen *et al.*, 2011; Deb *et al.*, 2012). Seedling morphology in Tripura has been studied by Roy and Datta (2014) no such study on seedling morphology of medicinal plants of Lamiaceae has been done in Tripura. Unweighted Pair Group Method with Arithmetic Mean is a bottom up hierarchical clustering method which is used in this study to draw the correlation among the investigated taxa.

MATERIALS AND METHODS

Study area: Tripura is a state in North-East India and considered as a biodiversity hotspot. It borders Bangladesh, Mizoram and Assam. Tripura is surrounded by Bangladesh on its north, south and west: the length of its international border is 856 km (84% of its total border) (http://tripura.gov.in/knowtripura).

The state lies between 22° 56' to 24° 32' North latitudes and 91° 09' to 92° 20' East longitudes with an aerial extent of 10,491.69 sq. km.

The mature seed and seedling specimens of *Hyptis suaveolens, Leucas aspera and Ocimum tenuiflorum* were collected from different localities of Tripura. The specimens were photographed and documented in the form of herbarium sheets. They were compared and identified with the help of seedling raised from identified seeds. At least eight to ten specimens of each growth form were studied from various habitats. Morphological observation and description of seedlings were done according to Duke (1965), Burger (1972), Bokdam (1977), Vogel (1980) and Paria (2014). Artificial keys were prepared for the identification of investigated taxa in juvenile stage. Phenogram were prepared based on UPGMA method in PAST software.

Diagnoses and key to identification of the investigated taxa

***Hyptis suaveolens* (L.) Poit. Vernacular Name:** Tokma, Tukkma.

Seedling Morphology Phanerocotylar, Epigeal, *Roots*: Tap, Elongating, Branched, Creamish White, Moderately woody, Root tip creamish white, *Hypocotyl*: Upper portion green and lower portion brown, Angular, Hairy, Elongating, Moderately woody, *Para cotyledon*: Petiolate, Glabrous, Angular, Exstipulate, Emarginate, Entire, Leaf base Truncate, Pinnate, Primary vein number 1, Venation not prominent, Soft, Green, Hairy, Opposite, Symmetrical, Orbicular, *Internode*:Upper part green and base brown, Moderately woody, Angular, Hairy, *Eophylls*: Simple, Soft, Stipulate, Petiolate, Angular, Hairy, Phyllotaxy: Opposite, Ovate, Leaf Base Truncate, Acute, Symmetric, Serrate, Pinnate, Primary Vein Number 1, Craspedodromous, Prominent, Glabrous. *Next leaves:* Simple, Soft, Stipulate, Petiolate, Angular, Hairy, Opposite and Decussate, Ovate, Cordate, other characters are more or less same as that of first two leaves except measurements. (**Plate.1a.).**

***Leucas aspera* (Willd.) Link Vernacular name:** Garundi, Ageusia

Seedling Morphology: Phanerocotylar, Epigeal, *Roots*: Tap, Elongating, Branched, White, Soft, Root Tip: Brownish white or cream color, *Hypocotyl*: Light green upper half and brownish green in lower half, Angular, Hairy, Short elongating, Soft, *Para cotyledon:* Sessile, Angular, Exstipulate, Emarginate, Entire, Leaf base Attenuate, Venation Pattern pinnate, Primary Vein Number 1, Venation not distinct, Soft, Green, Glabrous, Opposite, Symmetric, Ovate. *Internode* : Green, Soft, Angular, Hairy, *Eophylls***:** Simple, Soft, Exstipulate, Sessile, Terete, Opposite, Ovate, Leaf base Attenuate, Acute, Symmetric, Ciliate, Pinnate, Primary Vein Number 1, Eucamptodromous, Veins Prominent, Hairy, *Next leaves*: Simple, Elliptic, Soft, Sessile, Opposite Decussate, Elliptic, Attenuate, Acute, Symmetric, Ciliate, Pinnate, 1, Eucamptodromous, Prominent, Hairy, other characters are more or less same as that of first two leaves except measurements. (**Plate.1b.).**

***Ocimum tenuiflorum* L. Vernacular name:** Tulsi

Seedling Morphology: Phanerocotylar, Epigeal, *Roots*: Tap, Elongating, Branched, White, Soft, White, *Hypocotyl* : Green, Angular, Hairy, Reduced, Soft, *Para cotyledon*: Petiolate, Hairy, Angular, Exstipulate, Emarginate, Entire, Leaf Base Truncate, Venation Pattern not distinct, Soft , Green, Glabrous, Opposite, Symmetric, Ovate, *Internode*: Green, Soft, Angular, Hairy, *Eophylls*: Simple, Ovate, Soft , Petiolate, Opposite, Ovate, Cuneate, Obtuse, Symmetric, Entire, Pinnate, primary vein number 1, Eucamptodromous, venation pattern distinct Hairy. *Next leaves*: Simple, Soft, Petiolate, Angular, Hairy, Opposite and Decussate, Oblong, Cuneate, Obtuse, Symmetric, Serrate, Pinnate other characters are more or less same as that of first two leaves except measurements. (**Plate.1c.).**

Key to the investigated taxa:

1. Paracotyledon orbicular……*Hyptis suaveolens*
1. Paracotyledon ovate
2. Eophylls leaf apex acute……..*Leucas aspera*
2. Eophylls leaf apex obtuse …*Ocimum tenuiflorum*

RESULTS AND DISCUSSION

Seedling morphology of plants includes distinguished characters like germination pattern, nature of root, hypocotyl, shape, size, color, apex, base, margin of paracotyledon and eophylls. Roots of *Hyptis suaveolens, Leucas aspera, and Ocimum tenuiflorum* are elongating. Hypocotyl of *Hyptis suaveolens* is elongating, *Leucas aspera* is short elongating but of *Ocimum tenuiflorum*, it is reduced. Paracotyledon of *Leucas aspera and Ocimum tenuiflorum* are ovate and are different from orbicular paracotyledon of *Hyptis suaveolens.* Eophylls of *Hyptis suaveolens, Leucas aspera and Ocimum tenuiflorum* are simple, ovate, opposite. On the basis of all these seedling characters artificial key has been constructed for the easier identification of plants in their juvenile stage.

Plate 1. Seedling of (a) *Hyptis suaveolens* (b) *Leucas aspera* (c) *Ocimum tenuiflorum*

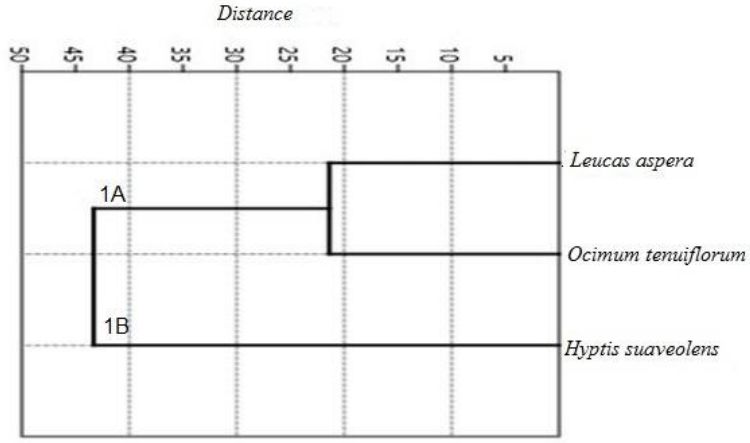

Figure.1. Phenogram of investigated taxa using UPGMA analysis.

A phenogram has been constructed using UPGMA method. Phenogram includes three taxa in two clusters. In cluster 1A two taxa *Leucas aspera* and *Ocimum tenuiflorum* are closely related and both have the paracotyledon leaf shape ovate. Cluster 1B comprises of *Hyptis suaveolens* which has paracotyledon leaf shape orbicular. Thus, the phenogram shows the correlation between the taxa and is helpful from the evolutionary point of view Figure.1.

Conclusion: Seedling characters of three species of Lamiaceae plant are related to each other and the artificial key is very useful for early identification and restoration of plants. Seedling morphological studies of medicinal plants help to restore the wild medicinal plants in very early stage of their life cycle. These types of study are very useful for safeguarding of biodiversity and also to draw the evolutionary relationship among medicinal plants.

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