

## Systematic studies of genus *Embelia* (Primulaceae) in India

### Introduction

Genus *Embelia*, a tropical woody liana was first described by Nicolaas Laurens Burman in 1768, with *Embelia ribes* Burm. f. as the type (Burman 1768). The total number of species worldwide is currently estimated between 130 (Ståhl & Anderberg 2004; Judd *et al.* 2007), 140 (Hu & Vidal 2004) and 150 (Mabberley, 2017). In revision of the Myrsinaceae in 1902 Mez reported 92 species of *Embelia*, divided into 8 subgenera, distributed in South-East Asia (mostly from Borneo and Java), India, China, Africa, Madagascar, Australia and Hawaii (Mez 1902); the genus is currently placed in the family Primulaceae which includes Maesaceae, Myrsinaceae and Theophrastaceae (APG 2009; Dubeanes *et al.* 2015). The exact number of species in India is ambiguous due to several taxonomic complexities resulting from high diversity and variation in floral forms observed within this genus. Twenty species of *Embelia* are reported from India, of which concentration of endemism is high in Peninsular India especially Western Ghats. Out of 20 species 10 species are known from Peninsular India, 7 species from Himalayan region, and 3 species from Andaman & Nicobar Island. Among the 18 species mentioned by C. B. Clarke (1882) under two subgenera *Euembelia* and *Rhynchostylis*. The subgenera are seldom used and could potentially be refined: from our area of study.

The last comprehensive revisionary work for the genus in India has been done by C. B. Clarke in 1882. After the revisionary work by C. B. Clarke a new combination *E. drupacea* (Dennst.) M. R. Almeida & S. M. Almeida (1993) from Western Ghats, Peninsular India and a new species *E. arunachalensis* R. K. Choudhary, R. C. Srivastava & A. K. Das (2009) from Eastern Himalaya were discovered. Other than above mentioned revisionary work, regional floristics workers have included the genus *Embelia* in their study. Except these treatments in regional floras and the century old work of Clarke (l.c.), the genus *Embelia* has taxonomically less studied in India. This has resulted in the gap of our knowledge and considerable confusion in the taxonomic delimitation of the group. For instance, *E. tsjeriam-cottam* is one of the widely distributed species which shows a lot of variation in vegetative and reproductive morphology, due to which it is considered as conspecific to *E. robusta* by Clarke (1882), Cooke (1904) and Gambel (1912). Similarly, *E. basaal* and *E. viridiflora* is considered to be distributed in Peninsular India, but the identity of the taxon is ambiguous and there is a dispute in understanding the distribution of *E. viridiflora*, *E. basaal* and *E. drupacea*. Moreover, most of the species included in the Clarke (1882) study is known only by its type collection. For example, *E. gardneriana* Wight (1848) an endemic taxon first described from Sispara, Kerala have not been collected later and were being included in various studies based on type collection. And the taxon *E. parviflora* is mostly confused with recently described and closely related species *E. arunachalensis*. Also, the lack of our understanding of the species boundaries has also resulted in gap of knowledge in the geographic distribution of the species in India. The seven species i.e., *E. amentacea*, *E. canescens*, *E. coriacea*, *E. floribunda*, *E. limpani*, *E. myrtillus* and *E. sessiliflora*, included in Clarke study from Eastern region are doubtful for its distribution to the country as they were reported from then regions of British India (Nepal, Burma, Mallaca Island, Java). These shows the necessity to revise and revisit the taxonomy, nomenclatural and distribution issues for the group.

A comprehensive systematic study has to be carried out to resolve the taxonomic complexities within the species of Indian *Embelia*. Hence the broad objective of this project is to carry out a systematic studies of the genus *Embelia* in India through studying its micro and macro-morphological characters, nomenclature and also to ascertain the geographic ranges to understand the distribution and IUCN status of species within this group.

## Objective

- Assessment of present distributional status of the genus *Embelia* in India.
- To carry out Systematic studies of the genus *Embelia* from India.
- Preparation of a comprehensive taxonomic account on species and infraspecific diversity of the genus in India.

## Materials and Methods

### Objective 1: *Assessment of present distributional status of the genus Embelia in India.*

1. A list of all the species of genus *Embelia* those recorded and described from India will be gathered along with their protologs. The specimens of all these species will be observed by consulting national and regional herbaria and the specimen deposited in international herbaria will be consulted digitally.
2. Periodical exploration trips will be conducted at different forest areas to locate the species of *Embelia* in India based on the protologs and specimens observed in the herbaria.
3. The type localities and areas with the higher richness of species from this group will be prioritized for sampling. These areas will be revisited as and when required to collect each species at flowering and fruiting stages.
4. Each species will be documented pictorially and important observations on flower and fruit morphology will be recorded while collecting the fresh material.
5. The collected specimens will be processed and standard protocol for making herbarium sheets for each species will be followed.
6. The collected species will be identified based on the protologs and the specimens will be subsequently deposited in national or international herbaria.

### Objective 2: *To carry out Systematic studies of the genus Embelia from India.*

1. Extensive field surveys will be conducted to collect the species from different parts of India, which includes the Western Ghats, as well as wet forests along the Eastern Ghats, Eastern and Western Himalayas and Andaman Nicobar Islands.
2. Each species will be documented pictorially and important observations on flower and fruit morphology will be recorded.
3. Along with phenological characters the ecology, population, geography and GPS data will be recorded.
4. The nomenclatural status of each species reported from India will be studied and evaluated.

### Objective 3: *Preparation of a comprehensive taxonomic account on species and infraspecific diversity of the genus in India.*

1. Detailed description, illustration, taxonomical classification and key preparations for the genus will be prepared.

## Expected outcome

As is evident from the literature reviewed, the Indian species of *Embelia* need to be taxonomically revised and re-evaluated based on comprehensive sampling across its distribution range within the country to understand – (i) Variation and taxonomic identity within the species (ii) Taxonomic boundaries between species and (iii) Distribution limits of their geographic ranges. Understanding the systematic of genus *Embelia* would shed light on a number of questions about its taxonomy, endemism, diversification and distribution. The study

also assesses and update nomenclature of each taxon and incline the publication of an illustrated taxonomic account of species and infraspecific diversity among the genus in India.

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