

## FB01

# Monotypic taxa, their taxonomic implications and conservation needs in Bangladesh

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**Abstract**—Monotypic taxa, represented by a single genus or a single species, are one of the important groups of plant that are interesting not only in floristics study, but also in phytogeography and phylogenetic studies. They need critical taxonomic evaluation and documentation, and also deserve special attention from the conservation point of view. Here we have reviewed the members of monotypic taxa, their distribution and representation in Bangladesh. About 139 genera of 47 families of flowering plants are monotypic in the angiospermic flora of the country. Among these families, 21 are also monotypic. The number of monotypic taxa should be increased, as the inventory and enumeration of plants of Bangladesh is far beyond the completion. Moreover, some of these monotypic taxa have not been collected again after their original collection. Monotypic taxa are, therefore, a challenging and stimulating groups that merits considerable further attention of both taxonomists as well as molecular and conservation biologists.

### INTRODUCTION

Bangladesh, the world largest deltaic region, lies in the northeastern part of South Asia between 20°34' and 26°38' North latitude and 88°01' and 92°41' East longitude [1]. The sub-tropical monsoon climate prevails throughout the country with high relative humidity and heavy rainfall during the rainy season. Despite its relatively small geographical area, Bangladesh is rich in both floral and faunal diversities evident in a varied range of ecosystems starting from the northern and eastern hills to the southern seas; most deciduous forests to the mangroves, and different agro-ecosystems spread over the wetlands, flood plains as well as the hills [2]. Biogeographically, the eastern part of Bangladesh falls within the Indo-Burma region which is one of the 25 recognized biodiversity hotspot areas of the world and supposed to have 7000 endemic plant species [3], [4]. The country as a whole is a transition between the Indo-Gangetic plains and the eastern Himalayas and in turn part of the Indo-Chinese sub region of the Oriental realm [2].

An estimated 5,700 species of angiosperms alone, including 68 woody legumes, 130 fiber yielding plants, 500 medicinal plants, 29 orchids, three species of gymnosperms and 1700 pteridophytes have been recorded from Bangladesh [5]. However, 106 species have been listed as endangered, around 100 species as threatened, and many others, specially the medicinal plant species are facing great pressure [6], [7]. Subsequently, Bangladesh has approximately 113 species of mammals, more than 628 species of birds (both passerine and non passerine), 126 species of reptiles, 22 species of amphibians, 708 species of marine and freshwater fish, 2493 species of insects, 19 species of mites, 164 species of algae (or seaweed) and 4

species of echinoderms with many others [8], [9]. Among them, a total of 40 species of inland mammals, 41 species of birds, 58 species of reptiles and 8 species of amphibians under various degrees of risks in the country [8]. Some of the major reasons behind the biodiversity depletion in Bangladesh are high population density, extreme poverty and unemployment, habitat destruction, degradation and fragmentation of land, over-exploitation and illegal collection, environmental pollution and degradation, natural calamities such as floods, cyclones, increase in soil salinity, etc. related to sea level rise and global climate changes, invasive alien species, etc. [9].

The term monotypic is self-explanatory. A family is said to be monotypic if represented by a single genus with single species. Similarly, a genus is monotypic when represented by the “type species” only. This terminology is used in descriptive taxonomy of both flora and fauna; however, in this review we have concentrated our discussion on the flora only. These are an unusual, but important groups of plant that are interesting not only in floristics study, but also in phytogeography and phylogenetic studies. They also need further taxonomic evaluation and documentation. In this review, we have collected information about their numbers, occurrences, habit-wise distribution and their representation in the country. This is a preliminary effort for listing the monotypic taxa of Bangladesh, which might be used as the baseline information source for the intensive field studies in future to locate the species in the wild, and collect relevant data to formulate appropriate conservation strategies for these plants.

### TAXONOMY AND GROWTH CHARACTERISTICS

About 139 genera of 47 families of the flowering plants are monotypic in the angiospermic flora of Bangladesh (Table 1). The complete list of these monotypic taxa has not been presented here due to space constrain, but will be available upon request to the corresponding author. Among the families studied, the Scrophulariaceae with 15 taxa can be considered the most dominant, followed by Menispermaceae (11), Asclepiadaceae (10), Convolvulaceae (9), since these four families together account for about one-third of the total number of monotypic taxa in the country [10]–[15]. Out of these 47 families, 21 families are also monotypic (Table 1).

An interesting aspect of the monotypic taxa is perhaps the dynamism associated with their habits and life cycles. In terms of habits, herbs (56) constitute the largest group and contribute about 41% to the total number of monotypic taxa

**Table 1.** Families with monotypic genera of Bangladesh

Family	Total genera	Monotypic genera
Scrophulariaceae	23	15
Menispermaceae	13	11
Asclepiadaceae	26	10
Convolvulaceae	15	9
Liliaceae	16	8
Solanaceae	13	7
Lauraceae	13	6
Commelinaceae	13	6
Annonaceae	15	5
Hydrocharitaceae	6	5
Periplocaceae	6	5
Combretaceae	6	4
Dipterocarpaceae	5	4
Nymphaeaceae	5	4
Rhizophoraceae	5	3
Aizoaceae	2	2
Burseraceae	2	2
Hydrocotylaceae	2	2
Linaceae	2	2
Loranthaceae	7	2
Arecaceae (Palmae)	incomplete	1
Bixaceae	1	1
Buddlejaceae	1	1
Burmanniaceae	1	1
Cannabidaceae	1	1
Caricaceae	1	1
Cassythaceae	1	1
Casuarinaceae	1	1
Costaceae	1	1
Dichapetalaceae	1	1
Hydrophyllaceae	1	1
Juncaceae	1	1
Martyniaceae	1	1
Molluginaceae	2	1
Peperomiaceae	1	1
Periplocaceae	incomplete	1
Phytolaccaceae	1	1
Plumbaginaceae	2	1
Pontederiaceae	2	1
Punicaceae	1	1
Ruppiaceae	1	1
Salicaceae	1	1
Sonneratiaceae	2	1
Sphenocleaceae	1	1
Stemonaceae	1	1
Zannichelliaceae	1	1
Zygophyllaceae	1	1
Total	224	139

(Table 2). Herbs are well-known amongst the most efficient colonizers of the plant community. The monotypic taxa could be variants of other common plants, but those that have migrated far from their original locales have further evolved and adapted to the new locales, and in the process have been identified as 'new' plant records with unique identifying features [16].

**Table 2.** Distribution of monotypic taxa according to habits in Bangladesh

Habit	No. of taxa	%
Herbs	56	40.29
Shrubs	27	19.42
Trees	22	15.83
Perennial herbs	19	13.67
Climbers	14	10.07
Parasite	1	0.72

In contrast to herbs, trees have the perennial life cycle, another parameter to consider with reference to monotypic status. Trees have been considered the dominant life forms in any forest and the number of trees in unit area primarily determines the denseness of the forest. Considering this and the fact that the trees have a long lifespan, is it possible that some of the monotypic trees are actually relics of past forests, where the other forest elements have declined due to ecological and anthropological causes? However, there are other trees listed that may have been introduced in the past, but have not spread, diversified or hybridized with native trees due to reproductive and post-mating barriers, and have thereby remained isolated as monotypic taxa.

#### DISTRIBUTION AND PHYTOGEOGRAPHY

Some of these monotypic taxa of Bangladesh are present and also monotypic in the flora of India. For example, the taxon *Anamirta cocculus* (L.) Wight & Arn. (Common name: Kakmari; Family: Menispermaceae) is monotypic both in flora of Bangladesh and India [16]. These may indicate to the common origin and close phytogeographical relationship between Bangladesh and India [2], [4]. *Anamirta cocculus* has a relatively wide phytogeographical distribution and can be found in Sri Lanka, Myanmar, Indonesia, Thailand to Malaysia along with Bangladesh and India. However, the monotypic taxa sometimes show unusual distribution patterns where considerable distances, including different continents or islands separate the provenances, and have raised many questions related to their disjunctive phytogeographical distribution. For example, *Trianthema portulacastrum* L. (Family: Aizoaceae) has been reported in Bangladesh, India, Malaysia, Indonesia, Philippines, South New Guinea, Western Asia, Africa and tropical America. Such a discontinuous distribution needs an explanation. Did these taxa migrate from or to Bangladesh? Has it been given a unique taxon nomenclature due to misidentification that makes it monotypic? If there is no taxonomic ambiguity in its identification, could these taxa have a migratory history that can be traced? Could it have migrated due to non-reproductive causes such as human, bird or animal intervention? There are many such questions that can be addressed. Thus, the monotypic taxa are also become as the best possible candidates for phytogeography studies [16].

#### CONSERVATION CONSIDERATIONS

The monotypic taxa deserve special attention from the conservation point of view, because they represent species which could be lost forever due to their related genomes of

these plants do not exist anywhere else in the world. For example, the palm species *Corypha taliera* Roxb. (Common name: Tali palm / Dhaka palm; Family: Arecaceae) has been considered as critically endangered; the last surviving individuals of the species in the whole world are not only limited to Bangladesh but are also restricted to small areas [17]. Therefore, it is essential to collate and document data about these, because these plants representing unique plant genetic resource that could be lost forever.

To conserve biodiversity, it is necessary not only to maximize the number of taxa that are saved today, but also to guarantee the maintenance of high levels of biological diversity in the future, and to achieve this, consideration of phylogeny is essential [18]. In phylogeny study, relationship between taxonomic and genetic diversity is clearly expressed by a phylogenetic tree. If we consider that each species was diverged genetically from its relatives by an amount roughly proportional to the time since they diverged from their common ancestor, then the branch lengths in a phylogenetic tree scaled to the observed genetic divergence between species would provide a quantitative measure of diversity within a clade. From this perspective, old, monotypic taxa often make relatively large contributions to diversity, and so should be accorded high priorities in conservation decisions [19].

#### DOCUMENTATION

The documentation of monotypic taxa has always been a problem for taxonomists. There are several factors like systematic disposition, phenotypic plasticity, incomplete floristic surveys or incomplete flora records, including fossils or endemism and isolation of the taxon or a combination of any or all of these factors that results in the recognition of taxa as monotypic [16]. Are there any possibilities of misidentification, 'new species syndrome' and other related issues responsible for the monotypic taxa? These and many other questions that have never been systematically addressed, make the study of the monotypic taxa interesting, challenging and important. The number of monotypic taxa in flora of Bangladesh should be increased, as many of the species-rich families viz., Asteraceae (Compositae), Fabaceae (Leguminosae), Poaceae (Gramineae), Cyperaceae, etc. have not been included in this review. In addition, the inventory and enumeration of plants of Bangladesh is far beyond completion. Hitherto, only 65 families of flowering plants have been well documented in 53 issues of the "Flora of Bangladesh" [10], [11]. And three other families were documented as research articles with different authorities [12] – [14]. It is also a matter of concern that some of the monotypic taxa have not been collected again after the original collection [10] and we are not sure about their physical existence in nature at present.

#### CONCLUDING REMARKS

One of the most important aspects of floristics in Bangladesh is the lack of reliable population estimates of the monotypic taxa. Therefore, intensive field studies are necessary to locate the species in the wild, and collect the relevant data. Although some efforts are ongoing to identify or ratify the threatened plants, and lists of

endangered or rare and threatened plants have been prepared, the work is much slower than the pace at which distribution status of the plants is changing due to ecological, anthropological and natural catastrophic factors. When the monotypic taxa show any promise of economic importance, their vulnerability is increased several fold [16]. Monotypic taxa are, therefore, a challenging and stimulating groups that merits considerable further attention of both taxonomists as well as molecular and conservation biologists.

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